

**INVASIVE ALIEN PLANTS AND RURAL LIVELIHOODS: A CASE OF GWANDA
DISTRICT, ZIMBABWE**

A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS OF THE DEGREE OF

DOCTOR OF PHILOSOPHY (PhD)

DEPARTMENT OF ECONOMICS AND ECONOMIC HISTORY

RHODES UNIVERSITY

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2016

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INVASIVE ALIEN PLANTS AND RURAL LIVELIHOODS: A CASE OF GWANDA DISTRICT, ZIMBABWE

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DEGREE: PhD

YEAR: 2016

Department: Economics and Economic History

Environment and Natural Resources Economics Focus Area (ENREFA)

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ABSTRACT

*Biodiversity is the cornerstone of ecosystem functioning and the realisation that most rural African community livelihoods are directly dependent on ecosystem goods and services warrants its conservation. Invasive alien plants threaten biodiversity and compromise the ecosystem's ability to provide goods and services for rural communities, thereby negatively affecting livelihood strategies. Information on IAPs is lacking in most African countries, thus, the livelihood effects of Invasive Alien Plants (IAPs) are not clearly understood. In Zimbabwe, *Cylindropuntia fulgida* var. *fulgida* (Cff) has invaded Gwanda district in the Matabeleland south province compromising local household capital assets that contribute to livelihood strategies and altering the ecosystem. This study exposed the rural worldview of the environment, the effect that Cff has on local livelihood strategies and the effectiveness environmental management institutions in rural Gwanda district. The study followed a post positivist paradigm. The impacts of IAPs on rural communities in Zimbabwe were analysed by looking at the livelihood stresses that arise because of Cff. The research used multi-stage sampling to select a representative sample of respondents. Primary data was collected using semi-structured questionnaires, group discussion and key informant guides. Furthermore, document analysis was conducted to collect secondary data. The data analysis process used Computer packages Microsoft Excel, SPSS and NVIVO. Results showed that livelihood benefits that species in the natural environment provide strongly influence environmental perceptions of rural African communities. Additionally, the study showed that Cff compromises the local ecosystem and reduces its ability to support the dominant livelihoods in the study area. The long-term result of such a situation in the absence of control is increased poverty and the failure to realise sustainable development. However, results indicated that IAPs could also improve the poverty situation of a community before they have reached the threshold points. It is therefore imperative to know the threshold points of an invasive plant in order to ascertain the efficient point to intervene. The study also showed that benefits of invasive plants accrue to different members of a society at different times (private/public). This knowledge allows the adoption of efficient and effective control strategies.*

KEY WORDS: *Cylindropuntia Fulgida* var. *Fulgida*, Livelihoods, Ecosystem services, Institutions, Gwanda

DECLARATION

I, Nqobizitha Dube, hereby declare that this thesis is a result of my research investigations and findings. All the work that was written by other authors and used in the thesis is fully acknowledged and a reference list is included. This work has not been previously submitted in part or entirety for degree purposes to any other university.

Submitted in fulfilment of the PhD in Economics degree at Rhodes University

Signature



Nqobizitha Dube

Date: 27 January 2016

DEDICATION

This thesis is dedicated to Douglas and Alice Mathanda Dube who are responsible for all I have become.

ACKNOWLEDGEMENTS

This thesis would not have been completed had it not been for the kind assistance of several people to whom I would like to extend my gratitude:

Firstly, I extend my sincere gratitude to my supervisors, Prof. Gavin Fraser and Prof. Jen Snowball. I will be forever indebted to you for your great mentorship. Your guidance, passion, patience and critical analysis of the multiple drafts that resulted in this thesis will be forever remembered. I would also like to acknowledge the financial support I received from the Environment and Natural Resources Economics Focus Area (ENREFA) through my supervisors (Profs. Gavin Fraser and Jen Snowball). May you continue to be abundantly blessed. Furthermore, I want to recognise the support (financial, social) I received from the Institute of Development Studies of the National University of Science and Technology in Zimbabwe where I was permanently employed and allowed to take study leave and pursue this doctoral programme.

To my other ENREFA colleagues (Juniours Marire, Samantha Munro, Brendan Martens, Marlon Chirara and Patricia Madigele), your honest critique of various sections of this thesis will always be remembered and cherished. I will also be forever in debt to the residents of Gwanda and key informants (particularly, Mrs Amukela Sidange and Councillor Maphosa) who gave the primary data that resulted in this thesis.

I am indebted to my family and friends. I want to express my sincere appreciation to Zinzile Kumalo, for your inspiration, practical and emotional support. I know you were denied the opportunity to spend quality time with me while carrying our son thank you for understanding. To my parents, thank you for making me the man I have become. To my ancestors, all the great people of Bukalanga, sons and daughters of Bango, Malindi, Muka, Mkupa and the supreme creator of all things, I thank you.

ACRONYMS

CARE	Cooperative for Assistance and Relief Everywhere
CBA	Convention on Biodiversity
Cff	Cylindropuntia fulgida var fulgida
EDQ	Environment Dependency Quartile
EMA	Environmental Management Agency
ESE	Ecosystem Services Economics
ESPA	Ecosystem Services for Poverty Alleviation
DFID	Department for International Development
FGD	Focus Group Discussion
GDDMP	Gwanda District Disaster Management Plan
IAP	Invasive Alien Plant
IAS	Invasive Alien Species
KII	Key Informant Interview
MEA	Millennium Ecosystem Assessment
MPP	Marginal Physical Product
MRP	Marginal Revenue Product
NIE	New Institutional Economics
PA	Poverty Alleviation
PCA	Principal Components Analysis
RBZ	Reserve Bank of Zimbabwe
RDC	Rural District Council
RDDC	Rural District Development Committee
SD	Sustainable Development
SADC	Southern African Development Community
SRL	Sustainable Rural Livelihoods
TEEB	The Economics of Ecosystems and Biodiversity
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
VIDCO	Village Development Committee
WADCO	Ward Development Committee
WCED	World Commission on Environment and Development
WfW	Working for Water
WIQ	Wealth and Income Quartile
EDQ	Environmental Dependency Quartile
ZIMSTATS	Zimbabwe National Statistical Office
ZRP	Zimbabwe Republic Police

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CHAPTER 1: INTRODUCTION

This chapter provides background information for the study, and presents the premises for formulating research questions and the main objectives of the research project. The study investigates the impact of invasive alien plant species on rural livelihoods in Zimbabwe using the case of *Cylindropuntia Fulgida var Fulgida* (Cff) in Gwanda district, Matabeleland South province.

1.1. BACKGROUND

According to Sala *et al.* (2000), invasive alien plants (IAPs) are one of the major causes of biodiversity loss on the globe. Furthermore, IAPs may alter ecosystems and compromise the ecosystem's ability to produce beneficial goods and services usually at a high socio-economic cost (Pimentel, Zuniga and Morrison, 2005; Mooney and Hobbs, 2000; Lovell and Stone, 2005). Ecosystem goods and services result from complex biodiversity dependent interactions implying that a reduction in species diversity may lead to ecosystem malfunction (Cardinale *et al.*, 2006; Hooper *et al.*, 2005; Schäfer, 2012).

The term biodiversity encompasses more than the genetic variation within species on the planet and its global importance cannot be over-emphasised (Mooney and Hobbs, 2000; Hooper *et al.*, 2005). Additionally, the historical roots of scholarly arguments regarding the value and symbiotic relationships that exist between biodiversity and life are well documented in literature (Costanza *et al.*, 1997; Sala *et al.*, 2000; Naeem, Loreau and Ichausti, 2002; Sachs *et al.*, 2009; Salles, 2012).

The significance of alien species in the environment and the possible risks associated with them has stimulated a considerable amount of debate around various related aspects such as conflict of interests (Shackleton, 2002, 2006; Armstrong, 1992), relevance of origin (Warren, 2011, 2007) and control methods (Higgins, 1996). Given the reliance on ecosystem goods and services for livelihoods and poverty alleviation in sub-Saharan Africa, the

minimisation of the negative effects of IAPs is evidently of paramount importance (Schrader, 2004; Mwebaze *et al.*, 2010; Egoh *et al.*, 2012).

Southern Africa has recorded a significant number of alien plant invasions in the recent past (Volchansky, Hoffmann and Zimmerman, 1999; Zimmermann and Klein, 2000; van Wilgen *et al.*, 2011). Academic research on the socio-economic aspects, however, has been limited. In Africa, the presence of IAPs compromises long-term ecosystem health and the production of environmental goods and services that contribute to sustainable livelihoods in the small-scale rural context (Shackleton *et al.*, 2011).

Sustainable livelihoods have been the subject of academic debate for a significant amount of time. From pioneering work by Chambers (1987), a number of scholars have engaged the subject of livelihoods in the academic arena (Chambers and Conway, 1992; Carney, 1998, Scoones, 1998; Moser, 1998; Bebbington, 1999; Park, Howden and Crimp, 2012). According to Egoh *et al.* (2012), although ecosystem services are important in supporting livelihoods both in developed and developing countries, human dependence on provisioning services is more pronounced in developing countries where poverty reigns and most people are reliant on natural resources for livelihood formulation. As such, given that more than half of the African population live in rural areas, alterations that inhibit the ability of ecosystems to produce goods and services may have dire consequences to African livelihoods (Barbier, 2010; Egoh *et al.*, 2012, Angelsen *et al.*, 2014).

Cholla fruit is the common name for *Cylindropuntia fulgida* var. *fulgida* (Cff) in its native North America. The plant Cff has invaded a number of southern African countries, including Zimbabwe (Klein and Zimmermann, Undated; Masocha, 2010). In Zimbabwe, the worst infestations have been documented in the Beitbridge and Gwanda Districts (Zimmermann and Klein, 2000; Mathenge *et al.*, 2009; Masocha, 2010). Cff spread from the Beitbridge border area into parts of neighbouring Gwanda District (Masocha, 2010). The Cff invasion of Gwanda district in the Matabeleland south province has compromised local rural livelihoods by altering the local ecosystem (Francis, 2012). Furthermore, Zimbabwe has seen limited research on IAPs and the aspects related to them (Maroyi, 2012).

1.2. THEORETICAL FRAMEWORK

This study analyses the Cff invasion of Gwanda district in the contexts of Ecosystem Services Economics (ESE), Sustainable Rural Livelihoods (SRL) and New Institutional Economics (NIE). These three frameworks incorporate concepts of poverty alleviation and sustainable development through the diversification of livelihoods and the cooperation of economic agents (Putnam, 1995; Scoones, 1998; Williamson, 2000; Egoh *et al.*, 2012).

1.2.1. Ecosystem Services Economics (ESE)

The Millennium Ecosystems Assessment (2005) project divided ecosystem goods and services (ES) into provisioning, regulatory and cultural services. In this study the abbreviation ES includes both ecosystem goods and services. Egoh *et al.* (2009) noted an intrinsic link between biodiversity and ES as the latter is dependent on the former. It is this link and the indispensable ES that have been used in campaigns for increasing resources channelled towards the management of biodiversity (Bookbinder *et al.*, 1998; Naughton-Treves, Holland and Brandon, 2005; Egoh *et al.*, 2009). Biodiversity conservation would lead to a boost in ES especially in communities where ecosystems directly support livelihoods (Naimir, 1990; Davies, 2002; Fabricius, 2004; Egoh *et al.*, 2012).

The economics of ecosystems is rooted in ecological and environmental economics (Gómez-Baggethun *et al.*, 2010). ESE considers amongst other things, the economic effects of harvesting of ES, the formulation of markets for ES, the payment for ES and the different methods used to value ES (Turpie, 2003; Moller and Ranke, 2006; Parks and Gowdy, 2013). The economic gains derived from utilising ES and the different methods used to measure the value of ES are the aspects of the ESE considered in this study.

1.2.2. Sustainable Rural Livelihoods Theory (SRL)

A livelihood strategy comprises capabilities, assets (natural, human, physical, financial, psychological and social) and activities required for survival (Chambers and Conway, 1992; Bebbington, 1999; Judge and Bono, 2001; Scoones, 2010). Scoones (1999) noted that a livelihood strategy's susceptibility to stresses determined its sustainability and ultimately, overall household vulnerability. A livelihood is sustainable when it can cope with shocks and stresses and maintain or enhance its capabilities and assets without undermining the natural resource base (Scoones, 1998). Assets that households have access to not only give them a

means of making a living, but also meaning to life and the ability to change the rules of access to capital (Bebbington, 1999).

Therefore, capitals/assets are foundation pillars of livelihoods development (Bebbington, 1999). Costanza *et al.* (1997) considered natural capital to be arguably the most significant. Its significance is most notable in poor rural African communities that depend directly on the natural environment for most of their livelihood strategies (Conway, 1985; Egoh *et al.*, 2012). Therefore, on the one hand, the failure of natural capital to regenerate sustainably due to issues such as the loss of biodiversity and IAPs may be a major livelihood stress factor, especially in rural Africa. On the other hand, the positive aspects of IAPs such as raw material provision may contribute to the livelihoods capital mix. This study, accordingly, makes use of the livelihood formulation concepts to determine the possible stresses or contributions of IAPs.

1.2.3. New Institutional Economics (NIE)

The shortcomings of neoclassical economics led scholars like Veblen, Commons and Schmoller to conclude that state activities were unavoidable and freedom of trade did not guarantee an increase in societal welfare (Joksow, 2004). These scholars (Veblen, Commons and Schmoller) are the faces of what has been termed the Old Institutionalists (Ankarloo, 2006). The shortcomings of old institutionalism, which included a lack of rigorous, systematic theoretical foundations and empirical analysis, were debatably addressed through the works of notable scholars like Ronald Coase, Douglas North and Oliver Williamson, who founded what has become known as New Institutional Economics (NIE). Contrary to old institutionalism, NIE was an attempt to incorporate a theory of institutions into mainstream economics through empirical analysis (Joksow, 2004).

Institutions and institutional frameworks in this study are analysed under the umbrella of NIE with the aim to relate the influence of institutional frameworks to rural livelihoods and the access to ES. In the discipline of economics, institutions are the humanly devised constraints and rules (informal and formal) that structure political, economic and social interaction for order and reduction of uncertainty in exchange (North, 1990). Institutions include amongst others, religion, culture, formal rules and laws, contracts and money (Williamson, 2000).

1.3. STATEMENT OF THE PROBLEM

Biodiversity is the cornerstone of ecosystem functioning and the realisation that most rural African community livelihoods are directly dependent on ecosystem goods and services warrants its conservation (Mwebaze *et al.*, 2010; Egoh *et al.*, 2012). Invasive alien plants threaten biodiversity by outcompeting and replacing other species. Furthermore, invasive alien plants compromise the ecosystem's ability to provide goods and services for rural communities, thereby negatively affecting livelihood strategies (Pimentel, Lach, Zuniga and Morrison, 2000; Pimentel, Zuniga and Morrison, 2005). Information on IAPs is lacking in most African countries, thus the livelihood effects of IAPs are not clearly understood (Nuñez and Pauchard, 2009). In Zimbabwe, *Cylindropuntia fulgida* var. *fulgida* (Cff) has invaded Gwanda district in the Matabeleland south province (Masocha, 2010) compromising local household capital assets that contribute to livelihood strategies and altering the ecosystem. Limited knowledge regarding IAPs in Zimbabwe has hampered Cff management efforts in Gwanda and prevailing institutional frameworks are failing to address the situation adequately. This study, therefore, intends to expose the rural view of the environment and IAPs, the effect that Cff has on local livelihood strategies and the effectiveness environmental management institutions in Gwanda.

1.4. RESEARCH GOALS AND SPECIFIC QUESTIONS

The general goal of the study was to determine the impact of the IAPs on rural livelihoods in Zimbabwe. To unpack the general goal, the specific questions the study seeks to answer are:

1. What are the local perceptions regarding invasive alien species and their management?
2. What are the major livelihood strategies in rural Gwanda?
3. Which livelihood strategies does the Cff invasion affect?
4. How effective are the Cff management institutions in rural Gwanda?

1.5. JUSTIFICATION OF THE STUDY

The contribution of natural capital to the overall reduction in poverty has resulted in a drive to understand more fully the contribution of components such as biodiversity and ecosystem goods and services (Shackleton, *et al.*, 2007). This drive has led to the formation of

organisations such as the Ecosystem Services for Poverty Alleviation (ESPA) Programme and the Consortium on Ecosystems and Poverty in Sub-Saharan Africa (CEPSA). Furthermore, research has shown that ecosystem services are essential in mitigating risk, livelihood strategy vulnerability and building resilience, especially amongst the rural poor (Egoh, 2012).

African rural societies have been characterised by dire poverty, stressed livelihoods and in an attempt to escape poverty, the sale of ecosystem goods and services has been widespread (WRI, 2000; Marshall, 2005). The degradation and loss of ecosystem services negatively affects the poor and vulnerable people disproportionately, hence, in the event of catastrophic biological invasions, the natural capital dependent poor become poorer as their access to ecosystem goods and services is constrained (MEA, 2005).

As harvesting of ecosystem goods and services is a component of household livelihood strategies (Bebbington, 1999; Park, Howden and Crimp, 2012), the Cff invasion of Gwanda district in the Matabeleland south province has the potential to compromise local household capitals that contribute to livelihood strategies through the alteration of the local ecosystem. Maroyi (2012) argued that knowledge regarding IAPs was limited in Zimbabwe, hence, the need for knowledge creation in order to augment management efforts of invaders such as Cff in Gwanda. Moreover, studies by Mapenza (2007) highlighted the lacunae of information regarding the effectiveness of local formal and informal environmental management institutional frameworks in Zimbabwe.

In light of the evident gaps in knowledge, this study intends to highlight the perceptions of IAPs, the effect that Cff has on local livelihood strategies and the effectiveness of environmental management institutions in Gwanda. This information contributes to the IAPs debate in Zimbabwe and creates a platform for addressing livelihood issues emanating from IAPs in rural Africa and the developing world at large.

1.6. METHODS PROCEDURES AND TECHNIQUES

The study followed a post positivist research paradigm, examining the relationship between theory and practice and drawing on new knowledge gathered from research to interrogate and augment theory. The impacts of IAPs on rural communities in Zimbabwe are analysed by looking at the livelihood stresses that arise because of Cff. A case study approach guided by secondary data (Masocha, 2010) is used.

1.6.1. Data collection

The research used multi-stage sampling to select a representative sample of respondents. The study used primary data collected from sampled households and key informants in relevant positions of authority. Relevant sources such as the Central Statistical Office, the Provincial Livestock Department and the Provincial Veterinary Office provided secondary data. Primary data from the households (through household head/representative) was collected using semi-structured questionnaires and group discussion guides while key informant interview guides were used to collect data from key individuals. Furthermore, a document analysis was conducted to collect secondary data.

1.6.2. Data analysis

Data was analysed under ESE, SRL and NIE to determine the livelihood impacts of Cff using both qualitative and quantitative techniques. Attributes, attitudes and contributions were used to analyse the overall perceptions towards IAPs. Principal Component Analysis (PCA) and descriptive statistics were used for quantitative analysis of the major livelihood strategies in the study area. The overall household activities were categorised while the average time spent on each activity per day and incomes realised were used as proxies to indicate the importance of the activity within overall household livelihood strategies. Regarding the livelihood effects of Cff, time and income spent on Cff related activities indicated the overall impact of Cff on a livelihood strategy. The major capital assets affected by Cff were recorded and ranked according to the rankings given by the households. The local environmental management institutions in Gwanda were presented on an institutional matrix and analysed using a Relevance, Effectiveness and Formulation (REF) scorecard. The data analysis process used Computer packages Microsoft Excel, SPSS and NVIVO.

1.7. OUTLINE OF THESIS

The study is comprised of eight chapters. After this introductory chapter, the second chapter presents the background IAP theory and discusses Cff, in particular. The chapter defines alien plants and discusses the multiple arguments associated with them, explains the Cff invasion of southern Africa and summarises the Zimbabwean situation.

The third chapter gives details of the theoretical framework of the study (ESE, SRL and NIE). Under NIE, emphasis is on the concepts of social capital and property rights based on Putnam

and Ostrom's conceptualisation respectively (Putnam, 1993; Ostrom, 2000), without neglecting contributions of the other social capital authors. The chapter also gives an overview of poverty alleviation strategies and sustainable development.

Chapter four provides an outline of alien plants and environmental management institutions in Zimbabwe. The chapter focuses on the study area and the villages that have been included in the case study. A general overview of Zimbabwe and Gwanda regarding the economy, geography and population is given. The chapter further offers a summary of the prominent organisations involved in environmental management in Zimbabwe.

The fifth chapter presents the methods used for collecting and analysing data. The chapter also presents a summary of the study population demographics. The study follows a mixed methods (qualitative and quantitative) approach in both data collection and analysis. A diverse assessment framework of analysis based on the research sub-questions is built in this chapter. The assembled framework uses concepts gathered from chapters two and three together with modifications that have been tailor made to suite the problem in question.

Chapter six gives a contextual analysis of the institutional environment in the study area while Chapter seven is devoted to the analysis and discussion of results based on the analysis framework assembled in chapter five. This chapter aims at presenting the different livelihood implications of alien plants in rural communities using the case of Cff in Gwanda. The chapter debates the findings in the light of information in chapters two and three with the aim of validating and adding to existing theory.

Chapter eight summarises the key arguments presented in the thesis and provides conclusions of the study. It offers answers to the research questions posed in chapter one. The chapter also offers recommendations and suggests areas that require future investigation within the alien plants and livelihoods discourse.

CHAPTER 2: INVASIVE ALIEN PLANTS AND ENVIRONMENTAL CONSERVATION

Debates revolving around invasive alien species have become widespread in environmental and natural resource economics (Rejmánek, 1989; Mooney and Hobbs, 2000; Anderson and Burkholder 2002; Carlton, 2009; van Wilgen *et al.*, 2008; Kotzé *et al.*, 2010). In addition, the increasing global recognition of the symbiotic relationship that exists between humans and the environment has made environmental conservation and management inescapable (Costanza, 1997; Klenner *et al.*, 2009).

In the spirit of environmental preservation and promoting sustainable development, questions regarding the effects that invasive alien vegetation has on environmental conservation surface (Hooper *et al.*, 2005; Convention on Biological Diversity, 2010).

This chapter discusses invasive alien vegetation in relation to environmental conservation. It commences by presenting the historical archives of invasive alien species research followed by socio-economic arguments that single out invasive alien species as a threat to the natural environment and human societies. Furthermore, the chapter discusses the spread, perceptions, uses and costs associated with alien species together with a brief summary on invasive alien species control. The chapter, finally, gives particular attention to the spread and management of *Cylindropuntia fulgida var fulgida* (Cff) in Zimbabwe.

2.1. INVASIVE ALIEN PLANTS

Carlton (1996) argued that there was a general acceptance of historical constant mobility of plants and animals across the earth that predated available literature. Therefore, the default view in species origin is to classify species without any obvious record of introduction as 'native' and those with records of deliberate or non-deliberate introductions as 'alien' (Carlton, 1996). From a similar standpoint, Selge, Fischer and van der Wal (2011) argued that non-nativeness of plant species was a controversial subject given that there was no rule that stipulated that any species should stay put. In this regard, non-nativeness is always considered with respect to a period in question as shown by Ellis (1993) who cited the closure

of the English Channel 7000 years ago as a reference point that divided the non-native and the native species. However, scholars have disputed this reference point in literature with some pointing to the Mesolithic Age, whereas others subscribe to the year 1492 when Christopher Columbus arrived in America (Nentwig, 2007).

Regarding the definition of invasive alien plants (IAPs), Colautti and MacIsaac (2004) argued that ecological ambiguity and tautology had ensnared the meaning of the term 'Invasive Alien Plant'. The ambiguity in definition has resulted in a lack of consensus amongst scholars and the subjective interpretation of many important terms associated with IAP theory such as invasive/transient/sleeper weeds (Selge, Fischer and van der Wal, 2011).

Humans have increasingly defined IAPs based on their interactions 'with' and perceptions 'of' the plant (Colautti and MacIsaac, 2004). Morton (1996) showed that human based definitions were associated with weaknesses such as, considering species a nuisance/weedy/invasive in areas where they have little or no impact simply because they were identified as a nuisance elsewhere.

These definition criticisms may seem merely semantic in nature at first glance; nonetheless, varied definitions can cloud theoretical issues, lump together different phenomena and split similar issues thereby making generalisation difficult or impossible (Colautti and MacIsaac, 2004). Thus, consensus in defining of IAPs would reduce confusion among researchers, facilitate generalisation and contribute towards a better understanding of the subject matter (Richardson *et al.*, 2000). In an attempt to bring consensus to defining IAPs, Richardson *et al.* (2000) recommended categories (Table 2.1) to define plants with respect to origin, invasiveness and plant-human interactions.

Despite the highlighted lack of consensus and the ambiguity of certain terms, this study uses the IAPs definition by Sharp, Larson and Green (2011: 2) that defined IAPs as "species that are not native to a particular region and aggressively compete with native species, are considered to be a major threat to biodiversity and ecosystems". The definition adopted by the study also emphasises on the concept of harm caused in line with the CBD (2010) that defined invasive alien plants are those that have been introduced, established, spread and caused harm. This amalgamated definition covers the majority of recommendations made by Richardson *et al.* (2000) in defining plant invasions.

Table 2. 1: Recommended terminology in plant invasion ecology

Category	Recommended Definition
Alien plants	Plant taxa in a certain area whose presence is due to intentional or unintentional introduction as a result of human activity (synonyms; exotic plants, non-native plants non-indigenous plants)
Casual Alien invaders	Alien plants that may flourish and even reproduce occasionally in an area, but which do not form self-replacing populations and rely on repeated introductions for persistence (Synonyms; Waifs, Transients and occasional escapes)
Naturalised plants	Alien plants that reproduce consistently and sustain populations over many life cycles without direct intervention by humans (or in spite of human intervention). They often recruit offspring freely usually close to adult plants and do not necessarily invade natural, semi-natural or human made ecosystems
Invasive plants	Naturalised plants that reproduce offspring often and in very large numbers at a considerable distance from the parent plant thus have the potential to spread over a considerable distance
Weeds	Plants (not necessarily alien) that grow in sites where they are not wanted and they usually have detectable economic and environmental effects. Environmental weeds are alien plant taxa that invade natural vegetation usually adversely affecting native biodiversity and ecosystem functioning
Transformers	A subset of invasive plants, which change the character, condition, form or nature of an ecosystem over a substantial area.

Source: Richardson *et al.* (2000)

2.1.1 Invasive alien plant theory

The subject of IAPs has continued to capture the attention of researchers across the academic divide. The major reasons for the attention are, amongst others, the growing realisation that human induced environmental degradation has reached unacceptable levels and that the

need to curtail degradation and to promote environmental conservation has received unanimous global support (TEEB, 2010; MEA, 2003). Sala *et al.* (2000) considered invasive alien plants to be one of the major causes of biodiversity loss on the globe. Likewise, Antonio and Vitousek (1992) considered land use alterations and biological invasions as major contributors to species extinction and subsequently, biodiversity loss. Once established, IAPs may reduce biodiversity and alter ecosystems usually at a high environmental and social cost (Mooney and Hobbs, 2000; Pimentel *et al.*, 2004; Lovell and Stone, 2005).

Early scholars realised that various traits such as shifts in community dominance, alteration of ecosystem processes and high competitiveness were associated with IAPs (D'Antonio and Vitousek, 1992; Elton, 1959; Greenway, 1967; Simberloff, 1981; Drake *et al.*, 1989; Ramakrishan and Vitousek, 1989). These three primary study areas formed the base of historical research in the environmental effects of IAPs.

In studies investigating the differences in invasive abilities of various species, Gordon (1998) considered successful invasive alien plants as those that exhibited the following characteristics:

- Effective reproductive and dispersal mechanisms;
- Superior competitiveness in comparison to indigenous species;
- Limited enemies in host ecosystem;
- Ability to occupy a vacant niche; and
- Capability of altering the site by either significantly changing resource availability or disturbance regimes or both.

Gordon's (1998) characteristics have received much attention in the literature as shown in Table 2.2. However, as time progressed, research related to the social impacts of IAPs began to emerge. The major areas of socio-impact, IAP research discussed in this chapter are:

- i. The modes of plant invasion,
- ii. The perceptions on invasive plants,
- iii. The socio-economic impacts of IAPs,
- iv. Implications for biodiversity,
- v. The uses of IAPs and
- vi. The management of IAPs

2.2. PLANT INVASIONS

Humans have introduced plants, animals, and other organisms around the world for millennia albeit at a relatively slow pace in comparison to modern times (Di Castri, 1990; Horan and Lupi, 2005). In recent times, the pace of the introductions has increased proportionately with world trade and faster travel technology (Horan and Lupi, 2005). According to Ruiz *et al.* (2006), commercial trade arguably propels rates of invasion due to the development of new source and recipient regions, trade routes and markets, as well as new products. Although species introductions use many routes and vectors as a path, the rising volume of air and ship transport is primary the driver of marine invasions (Lodge, 2006) and the spread of insect disease vectors (Tatem, Hay and Rogers, 2006). In the Great Lakes, for example, commercial shipping (usually via ballast water) was implicated in 60% of the new introductions of invasive alien species (Horan and Lupi, 2005). Therefore, the increasingly globalised world facilitates and intensifies the spread of invasive alien species in different global ecosystems (Meyerson and Mooney, 2007).

Table 2.2: Scholarly publications with respect to Gordon’s 1998 categories of successful invaders

	Characteristic under investigation	Scholarly publications
1	Effective reproductive and dispersal mechanisms	Carlton, 1996; Mooney and Hobbs, 2000; Kotzé <i>et al.</i> 2010
2	Superior competitiveness in comparison to indigenous species	Greenway, 1967; Bruce, Cameron, and Harcombe, 1995; Gandiwa and Kativu, 2009
3	Limited enemies in host ecosystem	Simberloff, 1981; Brown, 2005; Henderson, 2007.
4	Ability to occupy a vacant niche	Bazzaz, 1986; D’Antonio, and Vitousek. 1992; Rouget and Richardson, 2003
5	Capability of altering the site	Rejma’nek, 1989; Anderson and Burkholder 2002; Carlton, 2009; van Wilgen, <i>et al.</i> , 2008

In the light of the globalisation debate, global economic growth is thus considered a major factor in the spread of invasive species (Fofonoff *et al.*, 2003; Levine and D’Antonio, 2003; Taylor and Irwin, 2004; Cassey *et al.*, 2004). From this viewpoint, Taylor and Irwin (2004) showed that there was a correlation between major economic indicators and the spread of

IAPs in Canada. Furthermore, Dalmazzone (2002) found that socio-economic measures such as GDP/capita could explain the spread of alien plant species for 26 countries.

These contemporary activities and circumstances have made it almost impossible to manage the spread of alien species effectively across continents or the movement of species across different habitats within a region (McNeely, 1999; Normile, 2004). However, in light of modern day conditions, Meyerson and Mooney (2007) advocated global integration of site-specific ecological factors with trade analysis as a useful approach for preventing and managing plant invasions. Correspondingly, Drake and Lodge (2004) argued for the sharing of technologies in the prevention of invasions and a global synchronised information system on IAPs that provided the ability to forecast risk by identifying changing vectors, routes, and donor and recipient regions. Such approaches would allow for cost effective management of IAPs given the possibility of early detection through coordinated and synchronised monitoring networks (Rejma'nek, 2000; Papes and Peterson, 2003).

2.2.1. Predicting plant invasiveness

With (2002) considered the ability to understand the factors that regulate the spread of invasive species as an important goal of landscape ecology. Similarly, Zhu *et al.* (2007) argued that the ability to predict distribution patterns of invasive plants in regions outside their native range is fundamental to developing early detection systems and minimising the ecological impacts of biological invasions by alien plants.

According to Lonsdale (1999: 1524), "The degree to which an area is invaded by alien species is a function of:

- a. Ecosystem-level properties, including resistance to invasion and the degree of disturbance;
- b. Propagule pressure of the invasive species;
- c. The properties of the invasive species, such as invasion potential; and
- d. The properties of the individual native species themselves, such as their competitive ability".

In addition to the highlighted, human activities and information asymmetries are a major determinant (Horan and Lupi, 2005; Lodge 2006; Ruiz *et al.*, 2006).

Disturbance and ecosystem level properties

Belote *et al.* (2008) showed that invasion was dependent on the disturbance intensity and scale. Few species can colonise areas with high resident species diversity, because more species occupy more niches, and thus provide greater resistance to invasion (Elton 1959; Levine 2000, Naeem *et al.*, 2000, Kennedy *et al.*, 2002, Fargione and Tilman, 2005). Therefore, disturbance at both global and local scales is an important factor in facilitating species invasions (Sher and Hyatt, 1999; Mooney and Hobbs, 2000). However, some scholars have argued that environments that support higher native diversity within sites and at both small and large scales may also promote non-native diversity (Shea and Chesson, 2002).

Propagule pressure

Studies have suggested that the influence of various barriers to invasion diminishes when propagules swamp an environment (D'Antonio, Levine, and Thomsen, 2001; Rouget and Richardson, 2003). Propagules are materials used for the purposes of dispersing an organism. Propagule pressure (also termed introduction effort) is a composite measure of the quality, quantity and frequency of invading organisms (Lockwood, 2005; Groom, 2006).

Given that subsequent events and processes along the naturalisation-invasion continuum are all probabilistic rather than deterministic, the increased availability of propagules can thus be a fundamental driving force in the invasion (D'Antonio, Levine and Thomsen, 2001, Foster, 2001; Frenot *et al.*, 2001; Brown and Peet, 2003). Rouget and Richardson (2003) showed for three invasive tree species that models incorporating propagule pressure were markedly superior to those invoking only environmental parameters in explaining distribution patterns and abundance of invaders.

2.2.2. Sleeper weeds

Plant invasions may also be a result of sleeper weeds that have been defined as alien plants that have become naturalised in a region but not increased their population size exponentially (Cunningham *et al.*, 2004). They are usually present in a small area but have the potential to spread widely and have a major negative impact on the environment (Groves, 1999; Cunningham *et al.*, 2004). Grice and Ainsworth (2003) discussed six situations that could result in alien plant becoming sleeper weeds. These were:

- i. Restrictions caused by a narrow genetic base poorly adapted to the local environment,

- ii. Restrictions caused by limited suitable habitat,
- iii. Restrictions caused by limited opportunities for recruitment,
- iv. Restrictions caused by a low intrinsic population growth rate,
- v. Restrictions caused by the absence of mutual catalysts, and
- vi. Species wrongly perceived as not invasive.

2.2.3. Invasiveness prediction Models

The realisation that information of future plant invasions is vital has seen the development of various models that intend to predict the rates of spread of invasive plants (Austin, 2002; Anderson, Lew, and Peterson, 2003; Gillham *et al.*, 2004). Most of these models make use of a majority of the variables discussed thus far.

Predictive models allow for the development of early warning systems and precise insurance premiums for the risks of environmental degradation associated with invasive alien species (Tucker and Richardson, 1995; Genovesi and Shine, 2003; Nishida *et al.*, 2009; Randall *et al.*, 2008; Andreu and Vila, 2009; Crosti, Cascone, and Cipollaro, 2010). According to Meyerson and Mooney, (2007), the development of accurate models will lead to better management of invasive alien species and the environment at large.

2.3. INVASIVE ALIEN PLANT PERCEPTIONS

After a plant has become naturalised and invasive in a foreign ecosystem, it usually begins to capture the attention of society in general. Society consists of large numbers of individuals with different value systems, perceptions and goals. However, with respect to invasive alien species, Selge, Fischer and van der Wal, (2011) argued that society consisted of two groups of individuals, those who play a strong role in the generation of the discourse, i.e. scientists, and those who experience its practical application, i.e. the general public. When it comes to the second group of people in society, perceptions of, and attitudes towards, invasive non-native species are an important factor for social cohesion regarding the management of IAPs. Stakeholders' attitudes and behaviour towards the environment can lead to the success or failure of natural environment conservation initiatives (Kim, Borges, and Chon, 2006). Thus, Maloney and Ward (1973) viewed environmental problems as a resultant effect of maladaptive human behaviour and psychology.

In this regard, understanding the individual attitudes that shape environmental behaviour is of fundamental importance in the amelioration of environmental problems rooted in complexities of ecological behaviour (Milfont and Duckitt, 2010). Moreover, the multifarious interactions of people with the natural environment make it crucial to examine the link between environmental issues and people's perceptions of the environment (Gray, *et al.*, 2010). Research also suggests that natural environment attachments in individuals can lead to pro-environmental behaviour (Cheng and Monroe, 2012; Halpenny, 2010; Vaske and Kobrin, 2001). Similarly, Lee (2011) asserted that sustainable use of the environment increased when its users had positive attitudes about conservation of the natural environment.

It is therefore apparent that attitudes and perceptions can affect stakeholders' intent to engage in environmental conservation (Sirivongs and Tsuchiya, 2012). Milfont (2007) defined environmental attitudes as a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour. From a similar perspective, Schultz *et al.* (2004:31) defined environmental attitudes as "the collection of beliefs, affect, and regulate the behavioural intentions a person holds regarding environmentally related activities or issues".

In an attempt to structure environmental attitudes and perceptions, studies have suggested a structure with two higher order vertical dimensions (Preservation and Utilization) and multiple explanatory horizontal lower order dimensions (Milfont and Duckitt, 2004, 2006; Milfont and Gouveia, 2006; Wiseman and Bogner, 2003). In the higher order, preservation expresses the general belief that preserving nature in its original natural state and protecting it from human use and alteration is the priority. Utilisation, in contrast, expresses the general belief that it is right, appropriate and necessary to use and alter nature and all natural phenomena and species for human objectives. The broad vertical dimensions of preservation and utilisation are evident in other theoretical perspectives such as the spiritual and the instrumental views of people-environment relations (Stokols, 1990); the moral/altruistic and utilitarian values (Kaiser and Scheuthle, 2003); the ecocentric and the anthropocentric view of the environment (Thompson and Barton, 1994) and the self (Egoistic), other people (Altruistic), biosphere (Biospheric) perspective (Schultz, 2000; 2001).

Multiple techniques and measures that scholars have used to capture environmental attitudes derive the lower order dimensions. According to Himmelfarb (1993), attitudes are a latent construct and as such, cannot be observed directly but have to be inferred from overt responses. The techniques of attitude measurement can be broadly organised into direct self-reporting methods and implicit measurement techniques (Krosnick, Judd and Wittenbrink, 2005). These techniques include Kellet's (1996) classification of environmental values; the Ecology Scale (Maloney and Ward, 1973; Maloney, Ward, and Braucht, 1975); the Ecocentric and Anthropocentric Environmental Attitude Scales (Thompson & Barton, 1994); the Environmental Concern Scale (Weigel and Weigel, 1978); the Ecological World View Scale (Blaikie, 1992) and the New Environmental Paradigm (NEP) Scale (Dunlap and Van Liere, 1978; Dunlap, Van Liere, Mertig, and Jones, 2000). However, due to the nature of the study focus on the horizontal dimension will be limited to the New Environmental Paradigm (NEP) Scale and Kellet's (1996) classification of environmental values.

The NEP Scale measures an ecocentric system of beliefs (i.e. humans as just one component of nature) as opposed to an anthropocentric system of beliefs (i.e. humans as independent from, and superior to, other organisms in nature) (Bechtel *et al.*, 2006; Dunlap *et al.*, 2000). The revised NEP scale (Dunlap *et al.*, 2000) contains 15 balanced items designed to tap each of the opposing world-views of nature (Table 2.3).

Table 2.3: The NEP Scale

1	We are approaching the limit of the number of people the Earth can support
2	Humans have the right to modify the natural environment to suit their needs.
3	When humans interfere with nature it often produces disastrous consequences.
4	Human ingenuity will insure that we do not make the Earth unliveable.
5	Humans are seriously abusing the environment.
6	The Earth has plenty of natural resources if we just learn how to develop them.
7	Plants and animals have as much right as humans to exist.
8	The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9	Despite our special abilities, humans are still subject to the laws of nature.
10	The so-called "ecological crisis" facing humankind has been greatly exaggerated.
11	The Earth is like a spaceship with very limited room and resources.
12	Humans were meant to rule over the rest of nature.
13	The balance of nature is very delicate and easily upset.
14	Humans will eventually learn enough about how nature works to be able to control it.
15	If things continue on their present course, we will soon experience a major ecological catastrophe.

Source: Dunlap and Van Liere (1978).

Similar to the NEP horizontal dimensions are Kellert's (1996) nine perspectives of human affiliation to nature are shown in the Table 2.4.

Table 2.4: Environmental perceptions according to Kellert (1996)

ENVIRONMENTAL PERSPECTIVE	EXPLANATION
Utilitarian perspective	Valuing the environmental for the direct and indirect consumptive uses. Considers the physical benefits derived from nature for human existence
Naturalistic perspective	This aspect refers to the satisfaction derived from contact with nature. It covers the fascination, awe and wonder associated with intimate experiences with nature
Ecologistic-scientific perspective	This refers to valuing nature for the systematic urge to understand natural processes and functions
Aesthetic perspective	Valuing nature for its physical beauty
Symbolic perspective	This is the case where nature is valued for its ability to facilitate human thought and communication. Animate nature is considered a facilitator of cognition, human language and thought
Humanistic perspective	Valuing nature for the deep emotional attachment with some of its individual elements. This is usually directed at sentient matter such as animal or plant species
Moralistic value	This value refers to strong feelings of affinity, ethical responsibility and reverence of the natural world. This perspective often reflects the conviction of a fundamental spiritual meaning, order and harmony in nature.
Dominionistic perspective	Reflects the desire to master the natural world and has been at times characterised by waste, overexploitation and despoliation of the natural world. However, concepts such as the capacity to respond in the advent of an adversarial relationship with nature are also considered under this perspective
Negativistic perspective	This perspective characterises the sentiment of fearing nature and having antipathy towards it. This conviction is characterised by alienation, avoidance and even harming or destroying certain aspects of the natural world.

Source: Kellert (1996).

These aspects have been increasingly used to analyse human perceptions towards various plant and animal species (Kellert, 1981, 1991; Schüttler, Rozzi and Jax, 2011). These categories may be thought of as reflections of universal and functional expressions of the human perspective of nature (Kellert, 1996). The Biophilia hypothesis formed the foundation of

Kellert's (1996) classification. The Biophilia hypothesis states that humans have an inherent need to affiliate with nature and human personal fulfilment is dependent on our relationship with nature (Wilson, 1984). Based on the Biophilia hypothesis, Kellert (1996) asserted that nature influenced human material exploitation, emotions, aesthetic appreciation and spiritual perspectives.

In addition to the perspectives already discussed, age has been noted to be a significant determinant of environmental perspectives by several authors (Van Liere and Dunlap; 1980; Mohai and Twight, 1987; Mutalib, Fadzly and Foo, 2013). Mohai and Twight (1987) argued that as individuals age, they increase the accumulation of material and social resources; become more involved in religious, political economic and social subsystems ultimately shunning environmental conservation in favour of the status quo. Numerous studies conducted in developed western nations advance the argument that environmental issues have been generally viewed as a 'threat' to existing social order hence, younger generations are considered more open to the environmental issues than the older ones (Van Liere and Dunlap, 1980).

Other scholars found environmental concern to be positively associated with social class education and income (Van Liere and Dunlap, 1980; Mainieri *et al.*, 1997; Muhammadet *al.*, 2014; Yu, 2014). According to Inglehart (1990), this perspective is based on the fact that once people are more educated and have obtained their basic material and physical needs, they opt for more aesthetic aspects of human existence or 'quality of life' such as a better environment. At a macro scale, economists often link this view to the Environmental Kuznets Curve (EKC) that argued for a positive relationship between the levels of income and environmental concern in broader society (Grossman and Krueger, 1995).

The discussed perspectives thus far attempt to capture the general view of society regarding the environment. These perspectives, however, may be reduced to the two major higher-level dimensions previously discussed and as shown in the Table 2.5. Unfortunately, despite numerous measures of views discussed and investigated in various parts of the planet, very little is known about how the rural poor, particularly in Africa, conceptualise, live with, and respond to pressing environmental issues facing them (Ogunbode, 2013).

In the case of IAPs in rural Africa, the importance of perceptions, attitudes and ecological views is most evident in cases where public opposition causes delay or even cessation of

control efforts (Shackleton, 2007; Marshall *et al.*, 2011; McNeely, 2011). According to Fischer *et al.* (2011), this conflict of interests led to explicit calls from both science and policy for research on environmental perceptions in order to garner public support for environmentally beneficial IAP control programmes. Therefore, to foster public buy-in on policies regarding IAPs, there is a need to understand how the public formulates perceptions, attitudes and ecological views about plant species around them (Czech, Krausman and Borkhataria, 1998; Schlegel and Rupf, 2010, Fischer *et al.*, 2011).

2.4. THE SOCIO-ECONOMIC IMPACTS OF INVASIVE ALIEN PLANTS

Public perceptions of alien plants relate to the socio-economic effects that the plant has on the host community. A number of socio-economic impacts emanate directly from specific plant invasions; however, in this section the major effects of invasive alien plants discussed are those related to economics, public health, culture and international policy.

2.4.1. Economic impacts of IAPs

Invasive alien species may lead to economic losses in various sectors of the economy. These losses may take the form of low crop productivity, infrastructural damage, loss of livestock and mitigation costs (Pimentel *et al.*, 2001; Anderson *et al.*, 2004). Pimentel, Zuniga and Morrison, (2004) estimated the environmental costs associated with invasive alien species in the USA at US\$137 billion annually while van Wilgen and De Lange (2011) estimated them at US\$457 million (based on Working for Water costs) in South Africa.

From an alternative perspective, the presence of invasive alien plants may result in general economic benefits such as employment creation. The activities associated with the management and control of invasive alien plants usually require human labour thus stimulating employment and overall economic activity. An example of such a situation would be that of the Working for Water (WfW) programme in South Africa. According to Marais and Wannenburg (2008), the WfW programme is an extension of the Expanded Public Works Programme of the South African Government, aimed at the sustainable management of natural resources through the control and management of invasive alien plants while enhancing socio-economic empowerment in South Africa through the provision of employment.

Table 2.5: Relationship amongst methods of analysing environmental perceptions

KELLERT (1996)	THE NEP, DUNLAP AND VAN LIERE (1978)	HIGHER ORDER DIMENSIONS
<ul style="list-style-type: none"> i. Naturalistic perspective ii. Aesthetic perspective iii. Ecologistic –scientific perspective iv. Symbolic perspective v. Humanistic perspective 	<ul style="list-style-type: none"> i. We are approaching the limit of the number of people the Earth can support ii. When humans interfere with nature it often produces disastrous consequences. iii. Humans are seriously abusing the environment. iv. Despite our special abilities, humans are still subject to the laws of nature. v. If things continue on their present course, we will soon experience a major ecological catastrophe vi. The Earth is like a spaceship with very limited room and resources. 	<p>Preservation</p>
<ul style="list-style-type: none"> i. Utilitarian perspective ii. Dominionistic perspective iii. Negativistic perspective 	<ul style="list-style-type: none"> i. Humans have the right to modify the natural environment to suit their needs. ii. The Earth has plenty of natural resources if we just learn how to develop them. iii. The balance of nature is strong enough to cope with the impacts of modern industrial nations. iv. The so-called “ecological crisis” facing humankind has been greatly exaggerated. v. Humans were meant to rule over the rest of nature. vi. Humans will eventually learn enough about how nature works to be able to control it. vii. Human ingenuity will insure that we do not make the Earth unlivable 	<p>Utilisation</p>

2.4.2. Public health

The introduction of non-indigenous disease vectors present risks to public health, domestic and wild animal and indigenous plant populations. Invasive alien species may bring with them foreign pathogens or become hosts and vectors of certain pathogens. Mountfort and Cubitt (1985) portrayed this scenario using a case of bites from introduced rat species in India¹.

2.4.3. Cultural impacts of IAPs

From a traditional African perspective, the environment was managed and revered from a spiritual and religious point of view, in that plants had cultural connotations associated with them (Kwashirai, 2007; Mapenza, 2007). In Zimbabwe, for example, vegetation that grew in places where the rainmaking ceremonies were held was considered sacred and, according to custom, was not to be cut down or disturbed without the permission of the chief and local spirit medium (Mapenza, 2007). The presence of IAPs may undermine the survival of such sacred vegetation thereby compromising long-standing traditions. Using a case of northeastern Scotland, Selge, Fischer, and Van der Wal, (2011) showed that IAPs can have an impact on the appearance of a place and thereby the common practices associated with that place.

2.4.4. Policy implications of IAPs

International policies have been crafted to deal with the effects of invasive alien plants and act as super-ordinate institutions on which individual countries may base their domestic IAPs policies. First, varieties of international agreements such as the World Trade Organisation (WTO) Sanitary and Phytosanitary Agreement (SPS Agreement) have been included in global international trade and environmental policy agendas (Anderson *et al.*, 2004). Second, invasive species' issues are also being elevated onto the international agenda via the Convention on Biological Diversity (CBD), which urges countries to prevent the introduction of and to control or eradicate non-native species that threaten ecosystems, habitats, or species (CBD, 2010).

¹An estimated 20 000 cases were reported annually with an infection risk given that rats were major vectors for and carriers of more than 38 human and livestock diseases in India.

The International Plant Protection Convention (IPPC) was established as the international standard-setting body for conducting plant pest risk analysis for environmental hazards, explicitly to address risks to non-agronomic ecosystems (Anderson *et al.*, 2004). With specific reference to sea transport and the spread of IAPs, article 196 of the United Nations Convention on the Law of the Sea (UNCLOS) calls for measures to prevent, reduce, and control the intentional or accidental introduction of species, alien or new, which could cause significant and harmful changes to the marine environment (National Invasive Species Council (NISC), 2001).

2.5. IMPLICATIONS OF IAPS FOR BIODIVERSITY

IAPs also negatively affect global biodiversity often with dire consequences for food security and ecosystem resilience (Amend *et al.*, 2008; Dube, 2010). The term biodiversity encompasses not only the genetic variation within species but also biome distribution on the planet, numbers of species, their interaction, functional traits and the evenness of species distribution (CBD, 1992; Hooper *et al.*, 2005; Mooney 2002). The global importance of biodiversity cannot be over emphasised. The historical roots of scholarly arguments on the value and symbiotic relationships that exist between biodiversity and life have been summarised by Naeem, Loreau and Ichautsi (2002).

Biodiversity may be categorised into three major levels, which are ecosystem diversity, species diversity and genetic diversity (Atta-Krah *et al.*, 2004). Species diversity refers to the species units that may be counted and recorded by interested parties. Genetic diversity represents all of the genetically determined differences that occur between individuals of a species in the expression of a particular trait or set of traits (Atta-Krah *et al.*, 2004). Biodiversity is critical for ecosystem sustainability as it allows species to respond to changing environments and ensures long-term survival (System-wide Genetic Resources Programme (SGRP), 2000).

Biodiversity also contributes to sustainable food production, livelihoods and ecosystem health (Brush, 1995; Jackson *et al.*, 2005). The many studies that have shown the importance of agro-biodiversity, for both livelihood and conservation, highlight the prominence of biodiversity (Cromwell, Cooper and Mulvany, 2003; Jackson, Pascual and Hodgkin 2007; Jarvis, Padoch, and Cooper 2007; Amend *et al.*, 2008; Santilli, 2012). Thus, farmers use diversity amongst species for risk avoidance, increased food security, to boost profits and

improve land use patterns (Brush, 1995; Santilli, 2012). Therefore, Atta-Krah *et al.* (2004) argued that increased biodiversity begets stability based on the 'insurance' principle, that is, having a variety of species insures an ecosystem against a range of environmental upsets.

2.5.1. Economic valuation of biodiversity

Despite the numerous conservation efforts in different global biomes, little has been achieved due to the failure to economically recognise and value biodiversity and ecosystem goods and services (Costanza *et al.*, 1997; Sachs *et al.*, 2009; Salles, 2012). The value of biodiversity ranges from more tangible consumptive and non-consumptive use values through to the less tangible values such as option and existence values (Turpie, 2003). Economists and ecologists around the globe have developed various methods (travel cost method, hedonic pricing, benefit transfer, contingent valuation and choice experiments) and frameworks that attempt to give an explicit value to different facets of biodiversity (Costanza *et al.*, 1997; Millennium Ecosystem Assessment, 2005; Haines-Young *et al.*, 2007; Defra, 2010; TEEB, 2010). However, due to its public good nature and measurement complexity, biodiversity remains greatly undervalued by society (Turpie *et al.*, 2003; Costanza, 2012).

Despite the challenges in its evaluation, the estimation of biodiversity values in monetary terms helps to determine the optimal level of conservation and justify conservation actions at the public policy and decision-making level (Turpie, 2003). In spite of the noted value of biodiversity, Butchart *et al.* (2010) argued that global biodiversity was on the decline despite significant global conservation efforts.

2.5.2. Decline of global biodiversity

The world faces an unprecedented reduction of biodiversity that is occurring in virtually every ecosystem (Dirzo and Raven, 2003). Klenner *et al.* (2009) concurred, arguing that the loss of species had doubled in magnitude in recent time in all ecosystems. Human activities have been and are continuing to change the environment on local and global scales. Many of these alterations are leading to dramatic changes in the biotic structure and composition of ecological communities, either from the loss of species or from the introduction of exotic species (Hooper *et al.*, 2005; CBD, 2010). In addition, climate change and IAPs further exacerbate the decline of biodiversity (Mooney and Hobbs 2000; Pimentel *et al.*, 2000, 2004).

Biodiversity and human activity

Human demands for forest products or conversion of forests into agriculture or human settlements usually take priority over forest conservation (McNeely and Scherr, 2003). About 90% of the biodiversity in the tropics is located in human-dominated working landscapes (Garrity, 2004). When forests are modified due to commercial and human interests, ecosystem structure is simplified and biodiversity may be destroyed (McNeely and Scherr, 2003). With particular reference to agriculture, Sileshi *et al.* (2008) and Khumalo *et al.* (2012) argued that modern agriculture is currently one of the greatest threats to biodiversity as it introduces alien species that are both advantageous and detrimental to species diversity.

Biodiversity and climate change

Temperatures and moisture patterns influence the distributions of plants and animals. According to Chambers (2002), when the climate changes, species often die out in their present areas and colonise new areas. Thus, changes in climate affect biodiversity either directly or indirectly through a number of mechanisms that include range and abundance shifts, changes in phenology, physiology and behaviour (Compass Resource Management (CRM), 2007). Accordingly, as the climate changes in the future, there will be disruption of natural communities and extinction of populations and species (Beamish and Mahnken, 2001). Leadley *et al.* (2010) further suggested that climate change could surpass habitat destruction by human activity as the greatest global threat to biodiversity over the next few decades.

An analysis of potential future biome distributions due to climate change suggested that large portions of Amazonian rainforest could be replaced by tropical savannahs (Lapola, Oyama and Nobre, 2009). At higher altitudes and latitudes, alpine and boreal forests are expected to expand northwards and shift their tree lines upwards at the expense of low stature tundra and alpine communities (Alo and Wang, 2008). Increased temperature and decreased rainfall mean that some lakes, especially in Africa, could dry out (Campbell *et al.*, 2009). Oceans are predicted to warm and become more acidic, resulting in widespread degradation of tropical coral reefs (Hoegh-Guldberg *et al.*, 2007). Turpie *et al.* 2003 noted that sizeable loss of species in biomes such as Fynbos and Nama Karoo inevitably accompanied such changes. These implications of climate change for genetic and specific diversity have potentially negative

repercussions for ecosystem services and the livelihoods of ecosystem service dependent communities (Bellard *et al.*, 2012).

Biodiversity and IAPs

Pimentel (2004) and Didham *et al.* (2005) argued that IAPs posed a significant threat to global biodiversity and ecosystem functioning, stating that IAPs ranked as the second most serious threat to global biodiversity loss after direct habitat destruction. Invasive plants have a range of impacts that may reduce biodiversity which include interference with crop and pasture production, competition for light, water and nutrients, displacement of crops and pasture species through production of toxins that inhibit growth (allelopathy) of other plants, degradation and displacement of native habitats (Veblen *et al.*, 1992; Cherry *et al.*, 2001; Khumalo *et al.*, 2012). These noted negative effects of IAPs on biodiversity necessitate management of IAPs.

2.6. THE USES OF INVASIVE PLANTS

Notwithstanding the previously discussed negative effects associated with IAPs, alien plants are also associated with societal benefits that may necessitate their introduction to certain ecosystems. These benefits range from socio-economic to environmental benefits and require special analysis in the IAP debate. The major benefits discussed in this section are the commercial, livelihoods and environmental benefits of IAPs.

2.6.1. Commercial benefits of IAPs

Some plants that have become invasive overtime owe their continued existence to their perceived commercial value. An example would be the case of the Black wattle, which has become an invasive alien in South Africa. According to de Wit *et al.* (2001), Black wattle (native to Australia) was imported to South Africa and has become major input in the leather tanning industry which is valued at approximately \$552 million. Due to the perceived agro-forestry benefits, *Prosopis* species were also deliberately introduced in certain areas (Felker, 1998; Rodgers, 2000; Geesing, Al-Khawlani and Abba, 2004). The commercial benefits associated with *Prosopis* include its ability to support industries that create local employment and promote community development (Pasiiecznik *et al.*, 2001; Dube, 2010; Ancha, Abu and Omafufu, 2011).

2.6.2. Environmental value

Richardson and van Wilgen (2004) argued that the most damaging species are those that transformed ecosystems, affecting their ability to provide services such as water, soil maintenance, and nutrient cycling. Despite these arguments, other IAPs have significant benefits to the natural environment (Felker, 1998; Mutsambiwa, Ali and El-Tahir, 1998; Pasiiecznik *et al.*, 2001). An example of a tree with such attributes is *Prosopis*, which, according to Kaushik and Kumar (2003), is able to improve the soil in which it is growing by means of biological nitrogen fixation, leaf litter accumulation, loosening of a hard soil structure and stabilizing of loose sands. *Prosopis glandulosa* is also recognised for its ability to build up the soil carbon with an amount estimated to be 35-38 kg/ha/a thereby creating 'islands of fertility' on land with poor soils (Felker, 1998).

2.6.3. Livelihoods and IAPs

Scholars have reasoned that in rural communities, villagers make use of IAPs as part of their livelihood strategies (McGarry *et al.*, 2005; Siges *et al.*, 2005; de Neergaard *et al.*, 2005). Due to the livelihood value of IAPs, rural communities may begin to favour IAPs compared to indigenous species owing to factors such as ease of harvest, abundance or changes in tastes (Shackleton and Shackleton, 2004). Keirungi and Fabricius (2005) showed that the switch in preference might lead to the active cultivation of IAPs.

In this regard, Shackleton *et al.* (2007) argued that rural communities rarely understood the impact of IAPs, which were ultimately not factored into IAPs management programmes. Moreover, McGarry *et al.* (2005) claimed that the management of IAPs often considered costs from a national perspective negating the plant's impact on livelihoods and the needs of rural people on whose land the plant is growing. The common misconception is that the IAP's harmful impacts on the natural environment automatically translate into negative effects on human well-being (Shackleton *et al.*, 2007).

Shackleton *et al.* (2007) argued that livelihood benefits of IAPs are directly related to perceived benefits of the plant and the duration of the invasion. In this light, Shackleton *et al.* (2007) presented a framework that is indicative of the value of IAPs to local rural livelihood strategies.

The framework comprises four curves presented as trajectories through time beginning at the introduction of the alien plant deliberately or accidentally into an area (Figure 2.1). The first curve is one of increasing abundance of the plant with time; it follows a density-dependent logistical function (sigmoid shape) in the absence of any control mechanisms. The second curve depicts benefits (if there are any) accruing to local livelihoods from the plant. This will generally mirror the abundance curve given that the more abundant the plant, the greater the benefits. The third curve relates to the costs of the plant that compound as time and abundance progresses. The fourth curve illustrates livelihood vulnerabilities of the local people associated with the plant. Due to inherently vulnerable rural livelihoods, the vulnerability curves starts of at a high point and decreases as the benefits of the plant begin to offer new livelihood opportunities. However, as abundance of the plant increases, socio-economic costs increase and livelihoods become vulnerable once more.

In Figure 2.1, phase 1 represents the early stage of invasion represented by a low abundance of the plant. In this situation, the benefits (if any) are low, and direct, specifically for the reasons for which it was introduced, and probably accessed by only a small proportion of the community. There are no control attempts and ecological costs are still small. Livelihood assets and vulnerability are defined more by other livelihood strategies than by the plant.

In Phase 2, the abundance of the plant has increased, and continues to do so. If it has beneficial uses, the majority of the households have accessed them, and diversified their livelihoods. Widespread use of new opportunities and benefits offered by the plant reduces livelihood vulnerability. However, ecological costs are also on the rise and the effect that the cost will have on the benefit curve is dependent on an acceptable plant population that will allow the villagers to keep on benefiting. This is the threshold plant population.

Phase 3 is the one at which the costs eventually exceed the benefits, with the ratio becoming increasingly negative unless either the plant is controlled or new and significant benefits are identified. People face either (1) controlling the invasion, or (2) living with it resulting in impaired livelihood options and increased vulnerability. The final trajectories in Phase 3 will depend upon what intervention or strategies are adopted. If costs are not addressed then vulnerability will increase to levels above that experienced before the plant was introduced (Shackleton *et al.*, 2007). The shape of the curve is dependent on whether the species has a low or high threshold point (Yokomizo *et al.*, 2009; Shackleton *et al.*, 2007).

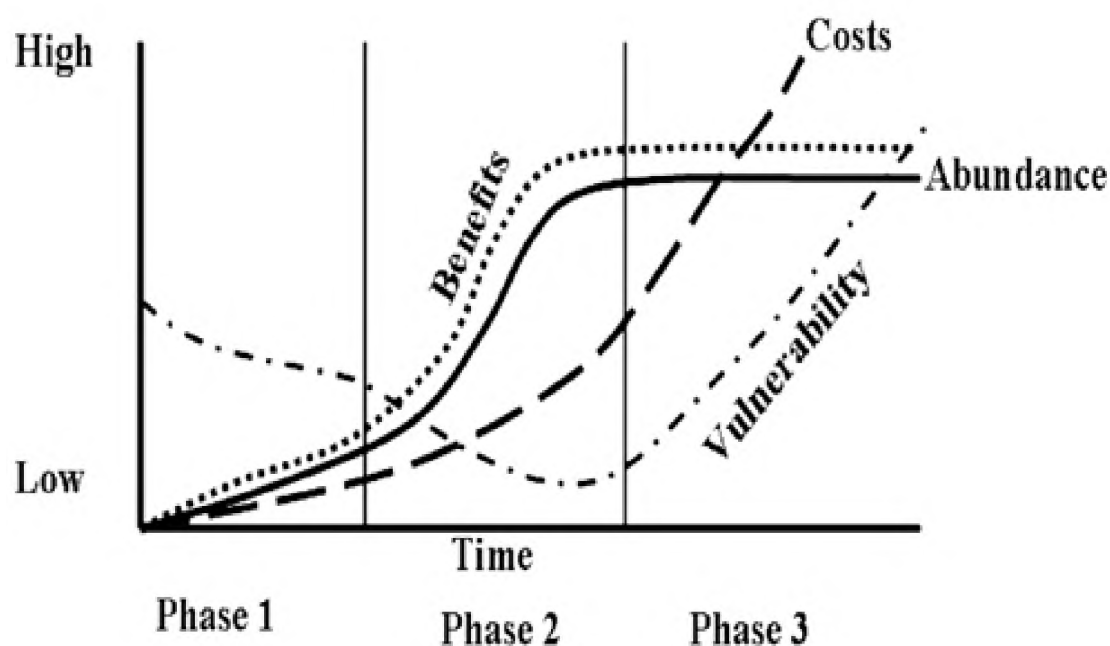


Figure 2.1: Impacts of IAS in rural livelihoods

Source: (Shackleton *et al.*, 2007).

Therefore, the presence of IAPs may compromise long-term ecosystem health but increase goods and services that boost livelihoods, especially in the small-scale rural context (Shackleton, Kirby and Gambiza, 2011). The idea of IAPs complementing livelihoods calls for management frameworks that will account for this aspect (Shackleton *et al.*, 2007). Studies have shown that IAPs are most beneficial when they are below their population threshold (de Wit *et al.*, 2001; Shackleton *et al.*, 2007; Yokomizo *et al.*, 2009). At this point, if the plant has beneficial attributes, they are sufficient to cover the demands of dependent communities. After the threshold point, the plant begins to increase community vulnerability as the costs of its presence begin to outweigh the benefits (Shackleton *et al.*, 2007). When costs are significantly higher than the benefits, community livelihood strategies are stressed, the need for control increases and capital assets are reshuffled at household level to deal with the IAP's strain. Therefore, perceived benefits and uses of IAPs may result in a conflict of interests between broad scale environmental managers and local communities.

2.7. THE CONTROL OF IAPs

For an IAP's control/management initiative to be successful, it has to take cognisance of aspects such as perceptions and uses of the plant at grassroots levels. According Hulme, (2006), when dealing with IAPs, the most cost-effective approach is prevention, followed by early detection and eradication. The major of IAP control methods are mechanical, chemical and biological control. Nonetheless, the choice of control method is dependent on the density of the invasion, inherent costs, environmental considerations and public interests (van Wilgen, Richardson, and Higgins, 2001).

2.7.1. Density impact curves

Information describing the relationship between the density of an invasive plant and benefits derived by communities is in limited supply, despite its importance in effective management of IAPs (Parker *et al.*, 1999; Taylor and Hastings, 2004; Whittle, Lenhart, and Gross, 2007). Optimal IAP management will depend on the relationship between density and overall impact of the plant on society. This relationship has been termed the 'density-impact curve' by Yokomizo *et al.* (2009). Misspecification of the density-impact curve causes unnecessary impact cost or wasted management effort (Whittle, Lenhart, and Gross, 2007).

Yokomizo *et al.* (2009) described IAPs as high and low threshold species. Invaders with high impact at low density are termed 'Low-threshold species' and are usually the worst invaders as their impact is apparent even at low density.

Thus, maximum management investment for low threshold species is optimal when the population densities are low otherwise economically inefficient at high populations. High-threshold species may not be noticeably apparent as problematic until they achieve high densities. Thus, large investments in management are not necessary unless populations are very high. Thus, the value of knowing the correct curve is particularly important for low-threshold populations at low density where eradication is more likely (Yokomizo *et al.*, 2009). Knowledge of the density-impact curve also allows policy makers to choose the most appropriate control method usually a choice between biological, mechanical and chemical control.

2.7.2. Mechanical control

According to van Wilgen, Richardson and Higgins (2001), mechanical control options include the physical felling or uprooting of plants using tools that include, amongst others, saws, slashes, axes and bulldozers. In some cases, their removal from the site is often in combination with burning. Mechanical control, which relies on each of the plants being identified and removed, is often costly in comparison to other control mechanisms given that it is highly labour intensive (van Wilgen and De Lange, 2012). Holmes *et al.* (2005) further argued that efforts directed at clearing IAPs often resulted in further disturbances, depending on the duration and the severity of the invasion. Therefore, there is a need for longer-term observations in the assessment of vegetation restoration in areas that have been disturbed by clearing of invasive species for incidences such as increased soil erosion (Cowling *et al.*, 1997; Holmes *et al.*, 2005).

2.7.3. Chemical control

Chemical control involves the use of herbicides and mycoherbicides. These are applied to prevent sprouting of cut stumps, or to kill seedlings (Lotter and Hoffmann, 1998). This mechanism may be cheaper than mechanical control and has the advantage that it specifically targets certain areas of the plant (van Wilgen, Richardson and Higgins, 2001). However, there are legitimate concerns over the use of herbicides in terms of potential environmental impacts. Hence, legislative hurdles usually constrain chemical control (Hobbs and Humphries, 1995).

2.7.4. Biological control

Biological control involves using species-specific insects or other invertebrates, and diseases, usually from the IAP's region of origin, to control the plants (van Wilgen, Richardson and Higgins, 2001). Most invasive alien plants are not invasive in their natural ranges and usually do not produce huge amounts of seed due to a host of co-evolved natural enemy organisms (Zimmermann and Naser, 1999). According to van Wilgen, Richardson and Higgins, (2001), some species, when exposed to a new region without the attendant enemies, grow more vigorously, produce many more seeds than in their native ranges, and become aggressive invaders. Thus, biological control aims to reduce the effects of this phenomenon, and to achieve a situation where the invasive alien plant becomes a non-invasive naturalised alien (van Wilgen, Richardson and Higgins, 2001).

Biological control is usually environmentally benign, leading to widespread acceptance and support from authorities and the public given successes such as the effective control of *Opuntia stricta* in South Africa (Volchansky, Hoffmann and Zimmerman (1999), Southern African Plant Invaders Atlas (SAPIA), 2011). However, some interest groups have expressed concern about the potentially negative effects on non-target plants, or on weeds that may have important commercial value (van Wilgen, Richardson and Higgins, 2001). The access to foreign agents is also dependent on international bureaucracy that may complicate the process of acquisition of required agents (Zimmermann and Naser, 1999).

According to SAPIA (2011), South Africa is one of the world leaders in the field of biological weed control. In South Africa, biological control agents have resulted in the complete control of 10 (21%) of the 48 plant species on which agents have become established, and in substantial levels of control in 18 (38%) of the cases (SAPIA, 2011).

2.8. ACADEMIC RESEARCH ON ALIEN INVASIVE PLANTS IN AFRICA

The previous sections have discussed socio-economic debates related to IAPs exposing the societal benefits and problems associated with IAPs. Despite the evidently growing body of literature, academic research in the area is lacking in most African countries (Pyšek *et al.*, 2008; Nuñez and Pauchard, 2009; Egoh *et al.*, 2012). Ironically, most natural ecosystems and biodiversity hotspots are located in developing countries while ecological research centres and scientists are mostly located in developed countries (Nuñez and Pauchard, 2009). This state of affairs consequently influences the amount of research on ecological topics such as biological invasions and their management strategies (Smith *et al.*, 2003; Nuñez and Pauchard, 2009).

Nuñez and Pauchard (2009) attributed this skewed relationship to the multiple competing socio-economic challenges facing the majority of African countries and low levels of industrialisation. Southern Africa, in particular, recorded a significant number of alien plant invasions in the recent past (Volchansky, Hoffmann and Zimmerman, 1999; Zimmermann and Klein, 2000; van Wilgen *et al.*, 2008). Academic research, however, is skewed towards the richer (South Africa, Mauritius, Kenya) and more industrialised nations on the continent, in accordance with arguments raised by Nuñez and Pauchard (2009). However, of late, other southern African countries have also contributed to the academic debate on IAPs, e.g.

Zimbabwe (Chikwenhere, 1996, 1997, 2000, 2001; Maroyi, 2012; Sithole, Zisadza-Gandiwa, and Gandiwa, 2012; Masocha, 2010) and Seychelles (Mwebaze *et al.*, 2010).

2.9. CYLINDROPUNTIA FULGIDA VAR. FULGIDA (CFF)

Cylindropuntia Fulgida var fulgida (Cff) is native to North America where it is commonly known as the chain-fruit *cholla* or the jumping *cholla* (pronounced “KOY-ya” meaning skull or head in Spanish) in its native home (Knuth, 2009). Klein and Zimmermann (Undated) described it as a branched, jointed cactus with long, dense, whitish spines. It belongs to the sub-family Opuntioideae, generally known as ‘*chollas*’. The plant grows naturally in the Sonora desert of Mexico and the southern USA (Klein and Zimmermann, Undated). Its stem segments are grey-green, eventually turning black and spiny (Knuth, 2009; Benson, 1982; Anderson, 2001).

According to Kent (2012), the segments are usually 6-23 cm long and 2-3.5 cm in circumference. The areoles under each group of spines are triangular, with 0-18 spines per group. Spines are up to 3.5 cm long. They are yellow, but get darker with age and flowers are pink to magenta (Kent, 2012). Fruits form long chains like teardrops attached to each other; each fruit is fleshy, green, nearly spineless, 2-5.5 cm long (Kent, 2012). *Chollas* have tiny groups of spines that detach easily and implant themselves into skin, causing immediate irritation (Knuth, 2009). Small portions of *chollas* routinely break off, littering the desert floor, attaching easily to passing victims, and growing new cacti wherever they end up (Kent, 2012). The plant is heat tolerant and thrives in arid areas with abundant sunlight and limited moisture (Turner, Bowers and Burgess, 1995).



Figure 2.2: *Cylindropuntia Fulgida var fulgida* in Sengezani village, Gwanda District, Zimbabwe.

2.9.1 Uses of Cff in its native environment

In the Sonoran Desert, Cff is hailed for its ability to provide extensive desert habitat for wildlife owing to its ability to reproduce vegetatively because of the rooting of its detached fruits and its cylindrical joints (Benson 1982; Turner *et al.*, 1995). According to Kane (2006), in South America, the root of the tree makes tea that soothes urinary tract infections and reduces the chances of developing kidney stones. The gum when dissolved in water also fights gastronomic inflammations, burns, rashes and other intestinal irritations (Kane, 2006). According to Oldfield (1997), the plant is also used to top walls in order to make the barrier more formidable. The plant is also a habitat for dye producing cochineal insects (Kane, 2006).

2.9.2. Cff invasion effects in non-native areas

Cff spreads steadily and forms dense infestations over large areas of land. It may negatively affect pastoral enterprises through livestock injury; reduction in land carrying capacity, grazing rangeland and difficulties in manoeuvring in infested areas (Greenfield and Nicholson, 2007; Mathenge *et al.*, 2009). Moreover, the plant can contaminate wool and cause damage to hides in the case of the wool and leather industries (Harvey, 2009). Furthermore, Cff

encroaches on natural vegetation, reducing the economic value of the land, biodiversity and the health of endemic species through competition (Harvey, 2009; Mathenge *et al.*, 2009). Cff infestations can also significantly degrade the aesthetic values of landscapes, affecting tourism use and values, especially in high visitation areas (Harvey, 2009). The plants also cause injury to people and wildlife (Masocha, 2010).

2.9.3. Historical aspects of Cff in southern African

Cff invaded South Africa and Zimbabwe with the worst infestations in Kimberley South Africa and on both sides of the Zimbabwe –South Africa border (Mathenge *et al.*, 2009). According to Zimmermann (1978), Cff was introduced to South Africa in the 1940s for ornamental purposes. Thereafter it spread steadily forming dense infestations over parts of South Africa such as the Free State, Northern Cape, Limpopo and Northwest provinces (Henderson & Zimmermann, 2003). The plant in due course inevitably spread from the Beitbridge border area into parts of neighbouring Gwanda District of Zimbabwe (Masocha, 2010). According to EMA (2012), approximately 1 465 hectares have been invaded in the Matabeleland south province of Zimbabwe.

Cff was initially incorrectly identified as *Opuntia Rosea DeCandolle* (Henderson and Zimmermann, 2003; Mathenge *et al.*, 2009; Masocha; 2010) and in Zimbabwe; it is still officially misidentified as Cactus Rosea (*Opuntia Fulgida*) (EMA, 2012). Rosea cactus (*Opuntia Rosea DC.*) was the name used for the densely spiny cactus invading plant in South Africa and it was through biological control initiatives that the error of incorrect identity was realised (Henderson and Zimmermann, 2003). Misidentification slowed biological control efforts, as the procured agents were not suitable for the plant. After studies by Mathenge *et al.* (2009), the plant was correctly identified as *Cylindropuntia fulgida var. fulgida* and was controlled using host specific cochineal insects in South Africa. Besides the ornamental uses observed by Zimmermann (1978) and protective barrier use observed by Francis (2012), very limited uses of Cff have been identified in southern Africa.

2.9.4. Control of Cff in southern Africa

In Zimbabwe, the Environmental Management Agency (EMA), the local community and NGOs have been involved in control initiatives (Sidange, pers. comm, 2011). The control has taken the form of mechanical control where the EMA provides affected villagers with tools to cut

down and burn the plant. According to Klein and Zimmermann (Undated), South Africa, since the late 1970s practiced herbicidal control of cactus using picloram. Additionally, South Africa actively practiced biological control of Cff using cochineal insects (Henderson and Zimmermann, 2003). October 2008 saw the first release of the cochineal biotype in South Africa near Douglas in the Northern Cape by WfW authorities (Klein and Zimmermann, Undated).

According to Klein and Zimmermann (Undated), the results of the biological control exercise were astounding and promised to rank amongst the best in all of South Africa. Nonetheless, the same may not be said for the Zimbabwean side where infestations have reached unbearable levels and are beginning to stress local livelihoods. (Klein and Zimmermann, Undated; Sidange, pers. comm, 2011).

2.9.5. Research on Cff related aspects

Considerable research related to alien species and particularly Cff has been conducted in South Africa (van Wilgen *et al.*, 1998; Koenig, 2009, Henderson and Zimmermann, 2003; Mathenge, 2009). Therefore, research output and experience put South Africa in a good position to combat the Cff invasion. Zimbabwe, on the other hand, has seen very limited research on IAPs particularly in Cff related aspects. In Zimbabwe, clarity is lacking regarding the effects of the invasion on local biodiversity, the local ecosystem and local livelihoods. The situation is also characterised by the lack of critical information and limited knowledge regarding the effectiveness of the environmental management institutions in Gwanda district and Zimbabwe at large.

2.10. CHAPTER SUMMARY

This chapter has shown that without adequate management IAPs may lead to losses that are detrimental to society and global ecosystems. The terms “invasive” and “alien” have also been revealed to bring ambiguity to the study area prompting the need to understand what the perceptions of the public are towards invasive alien plants. The perception is intricately dependent on the observer in question. If a plant has beneficial attributes used by local rural communities its control may be viewed as a success in the eyes of national environmental interests, yet it may be unpopular in the eyes of the host community. Thus, IAPs may have uses that augment local livelihoods and at the same time may have attributes that stress local

livelihoods. Therefore, plant thresholds and livelihoods in question must inform control and management options. The next chapter discusses the theoretical underpinnings used to frame the Cff effects on rural livelihoods.

CHAPTER 3: THEORETICAL FRAMEWORK: INVASIVE ALIEN PLANTS AND RURAL LIVELIHOODS

Discussions in the previous chapter have shown that invasive alien species despite their uses and contribution to rural livelihoods may out-compete native species and reduce local biodiversity (MEA, 2003; Shackleton *et al.*, 2007; TEEB, 2009). It therefore follows that controlling invasive alien vegetation may lead to conservation of indigenous biodiversity and sustainable ecosystem functioning. A healthy ecosystem supports poverty alleviation and achieving sustainable development (WCED, 1987; Costanza *et al.*, 1997; 2014; Costanza, 2012).

A healthy ecosystem is one that supports human activity through the provision of goods and services such as food, water, clean air and recycling (Costanza, 2012; Costanza *et al.*, 1997; MEA, 2005). Despite the critical role played by ecosystem services in supporting livelihoods in both developed and developing countries, human dependence on provisioning services is more commonly associated with developing countries where many people are poor and reliant on natural resources (Barbier, 2010; Egoh *et al.*, 2012; Angelsen *et al.*, 2014). The value of ecosystem goods and services (ES) in this study is analysed in the domain of Ecosystem Services Economics (ESE).

It has also been alleged that the harvesting of ecosystem goods and services is a significant component of household livelihood strategies (Bebbington, 1999; Park, Howden and Crimp, 2012; Angelsen *et al.*, 2014). The practice of harvesting ES from the environment to formulate livelihood strategies was termed access to natural capital (Scoones, 1998). The idea of combining different capitals in order to make a living is synonymous with all households on the globe (Bebbington, 1999; Costanza *et al.*, 2014). However, the proportions of those capitals and their ability to withstand change determine whether the household's livelihood strategy is sustainable and if the household is rich or poor. The access to different forms of

capital and the ability to manipulate the systems that govern the access to capital is usually dependent on the formal and the informal institutional frameworks that govern the functioning of a society (Scoones, 1998; Pretty, 2008). This research analyses the impact that Cff has on the formulation of rural livelihoods using the Sustainable Rural Livelihoods (SRL) approach. Subsequently, the study uses a New Institutional Economics (NIE) methodology to investigate the effect that formal and informal institutions have on the formulation of livelihoods in an environment invaded by Cff.

Healthy ecosystems are thought to bring about sustainability and allow ecosystem dependent communities sustainable access to natural capital thereby reducing stresses on livelihood strategies, sequentially alleviating poverty and promoting sustainable development (Costanza, 1997; Sunderlin *et al.*, 2005; Stump, 2010). The three theoretical frameworks (ESE, SLA and NIE) are relevant to the study, as they constitute the fundamental pillars of poverty alleviation and sustainable development, especially in rural Africa (Carter and May, 1999; Glasmeier and Farrigan, 2003; Vemuri and Costanza, 2006; Reid and Vogel, 2006).

The chapter commences by briefly discussing the theoretical foundations of Sustainable Development and Poverty Alleviation from a natural environment perspective. This is followed by an in-depth analysis of ESE and SRL approaches, their roots, progression and present day structures. Finally, the chapter discusses NIE, with a focus towards the effectiveness of formal and informal institutions that govern common pool resources.

3.1. SUSTAINABLE DEVELOPMENT (SD)

After decades of industrialisation and the two world wars, global environmental concerns triggered by amongst other things increased pollution, species extinction and depletion of non-renewable resources began to surface in the mid-1960s (Clark and Munn, 1986; Munn, 1992). These concerns ultimately led to the United Nations Conference on the Human Environment held in Stockholm in 1972. This conference was a major turning point in global environmental management and it resulted in the 1983 Gro Harlem Brundtland led commission on Environment and Development. This commission reflected on the escalating environmental crisis and devised a global remedial strategy (WCED, 1987). The remedial strategy produced has become known as the Brundtland Commission report titled "Our common future" (WCED, 1987; Munn, 1992).

The recommendations made by the Brundtland commission led to the United Nations Conference on Development and the Environment (UNCED) that was held in Rio de Janeiro, Brazil, June, 1992 (Munn, 1992). The Brazil conference was followed by the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa in 2002 and the Rio+20 earth summit held in Brazil in 2012. All these conferences were reflections of growing concerns resulting from depletion of the natural environment. The latter two particularly sought to reinforce commitments to sustainable development made in Rio de Janeiro, 1992 (Carr and Norman, 2008).

The Brundtland Commission report outlined several actions requiring global implementation in order to achieve 'Sustainable Development' and reverse environmental damage (Carr and Norman, 2008). The phrase 'Sustainable Development' though already used in the World Conservation Strategy (IUCN, 1980) was used again in the Brundtland Report (WCED, 1987). The Brundtland Commission defined sustainable development as development that met the needs of the present generation without compromising the ability of future generations to meet their needs (WCED, 1987). However, according to Munn (1992), the definition was vague requiring clarity as to whom the sustainability was aimed at, its purpose and conditions. In an attempt to clarify and unpack the definition, a number of scholarly approaches have been suggested to operationalise the concept of sustainable development (Grossman and Krueger, 1995; Bossel, 2001; Wallis, Graymore and Richards, 2011). These include:

- a) Indicators and indices that assess progress toward sustainable development (Bossel, 2001; IISD, 2008),
- b) The pillar models with interacting or interdependent dimensions (Wallis, Graymore and Richards, 2011),
- c) The Prism of Sustainable Development, which attempted to bring interdependency to pillar models (Spangenberg and Bonniot 1998, Valentin and Spangenberg 1999),
- d) The Prism approach was the MAIN prism by Kain (2000). This approach emphasised on four interacting dimensions (Kain, 2000),
- e) The egg of sustainability approach by the IDRC (1997); the basic orientors framework by Bossel (2001) and
- f) Human–Ecosystem-linked models that emphasised the ecological limits of an ecosystem (Wackernagel and Rees, 1996; Prescott-Allen, 2001).

From a human-ecosystem perspective, Grossman and Krueger (1995) explored sustainable development by investigating the relationship between the scale of economic activity and the quality of the environments of different countries. Grossman and Krueger (1995) observed that economic growth resulted in environmental deterioration in the short run and environmental protection in the long run as national incomes grew. This relationship has been plotted on an XY plain and is commonly referred to as the Environmental Kuznets Curve (EKC). According to Bertinelli, Strobl and Zou (2012), the relationship suggests that lower income regions are too poor to be highly interested in environmental protection and conservation. Conclusions reached by Egoh (2012) and Nuñez and Pauchard (2010) regarding the use and knowledge of ecosystem goods and services support Bertinelli, Strobl and Zou's (2012) conclusions. However, the interrelationship between economic progress, environmental management and individual well-being is a more complicated process, affecting both the quality and sustainability of the society as a whole (Jansson, 2013).

Extreme poverty that still affects the lives of a significant number of people in the developing world holds back progress towards sustainable development. In addition, soil degradation, pollution, over-harvesting, biodiversity loss, etc. continue to rage unabated, jeopardising productivity, especially in sub Saharan Africa (World Bank, 2010; Goosen, 2012). The Millennium Ecosystem Assessment (MEA) (2005) further emphasised the dependence of human society on the interactions of a complex web (socio-economic and environmental) for the provision of essentials such as clean air, water, food, and shelter. Thus, despite the sectors competing for funds in low-income economies and arguments, for instance, those presented in the Environmental Kuznets Curve theory, the connections between nature and achieving sustainable development cannot be over emphasised (Jansson, 2013).

3.2. THE NATURAL ENVIRONMENT AND POVERTY ALLEVIATION (PA)

The United Nations millennium goal number 'one' states that, by 2015, the world should have eradicated extreme poverty and hunger from the face of the earth. The goal aims at halving the proportion of people living on less than US\$1 per day, and those suffering from hunger, by 2015 (United Nations Millennium Declaration, 2000).

Poverty is very complex and multi-dimensional in both definition and form (Chambers, 1988; Kingdon and Knight 2003; Sunderlin *et al.*, 2004). The dimensions of poverty constitute

income, location and gender differences and access to aid amongst other dimensions. Shackleton *et al.* (2008b: 3) defined poverty, in its broadest sense as:

“The pronounced deprivation of well-being related to a lack of material income or consumption (the conventional measures of poverty), low levels of education and health, poor nutrition and low food security, high levels of vulnerability and exposure to risk, and a profound lack of opportunity to be heard”

In an attempt to clarify the meaning of poverty, Kingdon and Knight (2003) made use of the concept of human well-being as a major pillar of when considering poverty and as an alternative to the term poverty. Human well-being is multidimensional in comparison to poverty, which is usually defined using narrow parameters such as national income (Kingdon and Knight, 2003). A critical dimension of human well-being is that of vulnerability. According to Wiegiers *et al.* (2006), this concept encompasses the aspects that inhibit adequate and effective response to shocks and environmental changes. Therefore, despite the numerous determinants of well-being, the ability and speed of response is a determinant of poverty (Scoones, 1999). The UNEP/ISSD (2004) listed the determinants of well-being shown in Table 3.1.

The poverty datum line is one of the most common measures of poverty worldwide (Blignaut and de Wit, 2004). It centres on the amount of income required to meet minimum consumption requirements of a household (World Bank, 2010). Another common method is the income or GDP/capita measure, which divides total GDP of a nation by its population to determine how much of the national income each individual would get. These measures, however, have been criticised for their unrealistic nature as they fail to consider some fundamental aspects of the human society. These criticisms led to the development of alternative measures such as the Human Development Index (HDI) and the Human Poverty Index (HPI), that provide a more comprehensive picture of human well-being (Potter *et al.*, 2004; Willis, 2005).

Table 3.1: Determinants of well-being related to global Initiatives

Instrumental freedoms of capabilities approach (Sen 1999)	Millennium Ecosystem Assessment (MA 2005)	Human well-being, poverty and ecosystem services: Exploring the links (UNEP/IISD 2004)
<p>Participative freedom –ability to participate in decisions through such institutions as free speech and democratic elections</p> <p>Protective security - safety nets against adverse effects of disasters</p> <p>Economic facilities - ability to participate in trade and production</p> <p>Social opportunities - ability to access education and health services</p> <p>Transparency guarantees - culture of openness and trust</p>	<p>Material minimum for a good life (adequate livelihoods, sufficient food, shelter, access to goods)</p> <p>Health (strength, feeling well, access to clean air and water)</p> <p>Good social relations (social cohesion, mutual respect, ability to help others)</p> <p>Security (personal safety, secure resource access, security from disasters)</p> <p>Freedom and choice (opportunity to be able to achieve what an individual values doing and being)</p>	<p>Ability to be nourished</p> <p>Ability to be free from avoidable disease</p> <p>Ability to make a livelihood</p> <p>Ability to live in an environmentally safe shelter</p> <p>Ability to access adequate clean water</p> <p>Ability to have clean air</p> <p>Ability to have energy to keep warm and cook</p> <p>Ability to use traditional medicine</p> <p>Ability to continue using natural elements found in ecosystems for traditional spiritual and cultural purposes</p> <p>Ability to cope with extreme natural events</p> <p>Ability to make sustainable management decisions that respect natural resources and enable the achievement of a sustainable income stream</p>

Source: Shackleton, *et al.* (2008b).

Elaborating on the constituents of poverty, Pisupati (2006) noted that there was a vicious circle relationship between poverty and environmental degradation, whilst the former Indian Prime Minister Indira Gandhi described poverty as the worst kind of pollution (Pisupati, 2006). Despite the vicious circle relationship documented in Pisupati (2006), Howe *et al.* (2013) argued that poor documentation plagued the pathways between ecosystem services and poverty alleviation leading to causal relationships often inferred from correlative data. Furthermore, there is limited research in southern Africa that has explicitly examined the links between ecosystem services and poverty alleviation within the contextual framework of complex socio-ecological systems as prompted by the Millennium Ecosystems Analysis project (Shackleton, *et al.*, 2008b).

According to Shackleton, *et al.* (2008a), the high levels of spatial concurrence between regions rich in biodiversity and the majority of the world's rural poor (WRI, 2005), has made natural resource-based activities a viable option in addressing poverty in the developing world. Studies have shown that biodiversity and the natural capital all over the world adequately combine to contribute to the welfare of the world's poor (Felker, 1998; Godoy *et al.*, 2000; Belcher, Ruiz-Pe´rez, and Achdiawan, 2005). This aspect is evident in African rural societies that are characterised by dire poverty and stressed livelihoods. In an attempt to escape poverty, the rural poor begin to sell ecosystem goods and services (Arnold and Townson, 1998; WRI, 2005; Marshall and Newton, 2003).

As such, natural product markets make significant contributions to the rural household income requirements and their commercialisation is seen as an important potential vehicle for achieving poverty alleviation (Ndoye, Ruiz-Pe´rez, and Eyebe, 1997; Scherr, White, and Kaimowitz, 2004; Andrew and Masozera, 2010). Unfortunately, in spite of the importance of natural capital in developing countries, national development plans in many developing countries, especially those in sub Saharan Africa, do not fully capture its value to livelihoods (Nkem *et al.*, 2007).

Notwithstanding the lack of acknowledgement in the development plans of developing countries, the ability for natural capital to contribute towards the overall reduction in poverty has resulted in a drive to understand more fully the contribution biodiversity and natural product trade can make to this cause (Shackleton, *et al.*, 2008a). This drive has led to the Gaborone Declaration on natural capital accounting of 2012; the formation of organisations

such as the Ecosystem Services for Poverty Alleviation (ESPA) Programme and the Consortium on Ecosystems and Poverty in sub-Saharan Africa (CEPSA). The relationship between poverty alleviation and ecosystem goods and services was summarised by Pisupati (2006), as shown in Figure 3.1.

Evidently, ecosystem services are essential in mitigating risk, vulnerability and building resilience especially amongst the rural poor. The degradation and loss of ecosystem services negatively affect the poor and vulnerable people disproportionately and this loss may act as a significant barrier to reducing poverty (MEA, 2005). Thus, in the event of catastrophic biological invasions, the natural capital dependent poor become poorer as their access to ecosystem products is constrained. The Environmental Kuznets Curve showed that in the presence of poverty and deprivation, environmental concern is at its lowest. Therefore, from this viewpoint, poverty may contribute to a vicious cycle of unsustainable use of ecosystem goods and services.

3.3. ECOSYSTEM SERVICES ECONOMICS (ESE)

One of the reasons for the collapse of many ancient civilisations was the destruction of the environmental resources on which they depended (Diamond, 2005). If society is dependent on the natural environment for its smooth functioning and existence then it follows that there could be no society without the natural environment (Costanza *et al.*, 1997; MEA, 2005; Loreau *et al.*, 2006; Costanza *et al.*, 2014). This crucial role played by the environment has been explicitly debated in the recent past due to the realisation that human activities continually put a strain on the services of Mother Nature (TEEB, 2010). Development has traditionally been measured and linked to rapid economic growth disregarding the full role of environmental systems and their capacity to be replenished (Costanza *et al.*, 1997). According to the Secretariat of the Convention on Biological Diversity (CBD), planning techniques are needed to avoid a collapse of environmental systems leading to irreversible consequences for humanity and the rest of the planet (CBD, 2010).

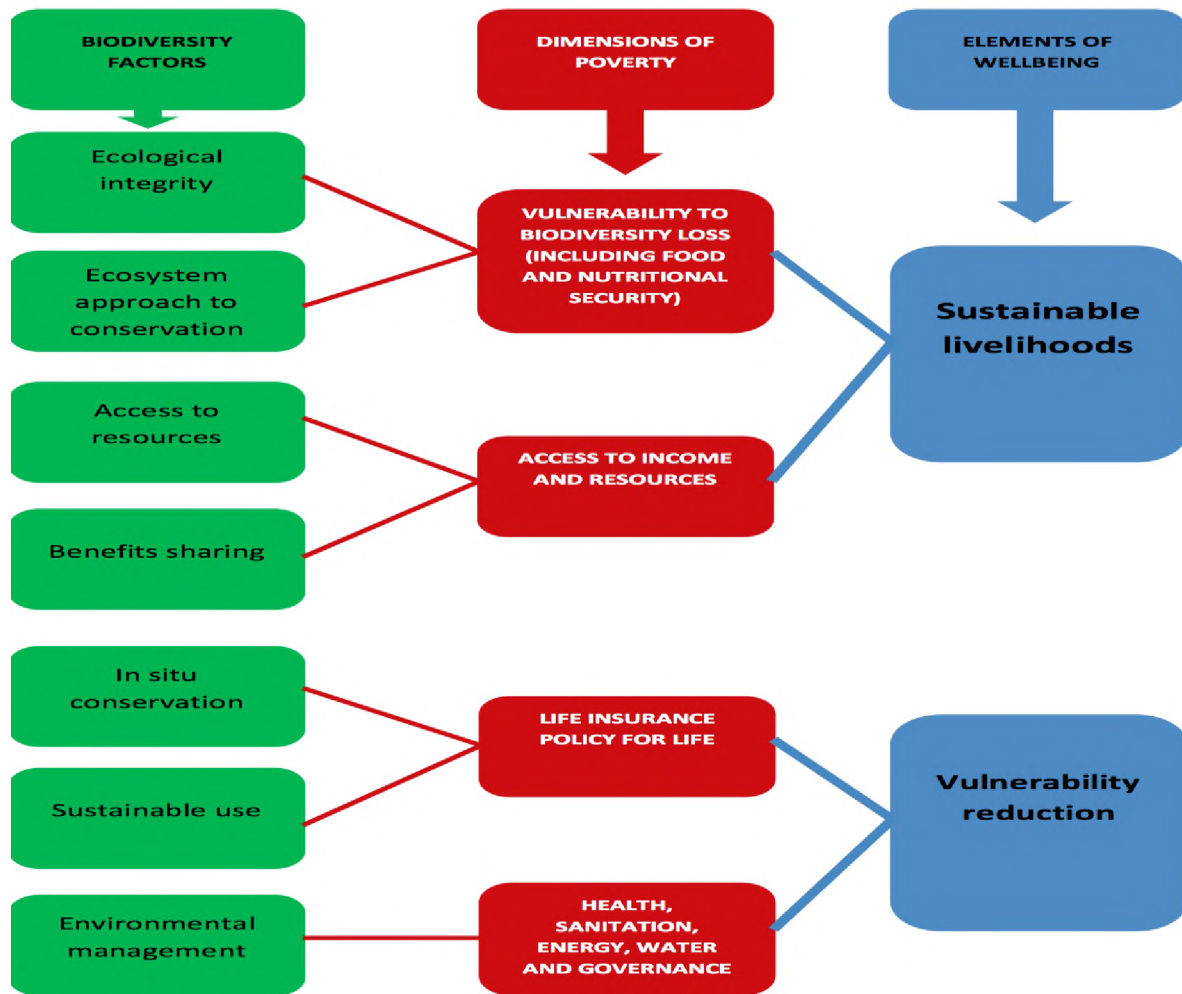


Figure 3.1: Biodiversity Links to the Dimensions of Poverty

Source: Pisupati (2006).

The smooth functioning of a web of inter-related parts known as ecosystems provides the services of Mother Nature. The CBD defined ecosystems as complex relationships between living organisms (biodiversity) and non-living matter, as well as the weather patterns that affect them (CBD, 2010). Ecosystems provide the numerous goods and services that allow society to function and these services have come to be collectively known as 'ecosystem goods and services' (ES) (Ehrlich and Ehrlich, 1981).

Ecosystems intricately relate to human social systems given that humans are part of the ecosystems (Duraiappah *et al.*, 2008; CBD, 2010). According to the CBD (2010), approximately 1.3 billion human beings draw their livelihoods from nature, 70% of world population relies on medicinal plants and the livelihoods of more than 3 billion people depend on marine and coastal biodiversity. Despite the observed importance of ES, statistics continue to point

towards ecosystem degradation as shown in Box 3.1. The Millennium Ecosystem Assessment project concurred estimating degradation and transformation of more than 60% of ecosystems worldwide (MEA, 2005). These pointers are more significant and disturbing in relation to a substantial part of the world's population in rural areas (especially in developing countries) that derive their livelihoods directly from local ecosystems (CBD, 2010; Egoh *et al.*, 2012).

Ecosystem goods and services are benefits obtained by people (passively or actively) from ecosystems (MEA, 2005; Fisher and Turner, 2008). The definition clearly indicates that the main area of interest in this study domain is the contribution that these natural systems make to human welfare rather than the many other equally significant scientific phenomena associated with the natural environment. From an economic perspective, ES goods include both the tangible (fibre, food, etc.,) and intangible (water purification, carbon sequestration, etc.,) ecosystem outputs.

Box 3.1: Summary of some documented ecosystem pressures to date

- Half of the world's wetlands have been lost in the past century;
- 80% of grasslands are suffering from soil degradation;
- 20% of dry lands are in the danger of becoming deserts;
- Current atmospheric emissions of CO₂ are nearly four times the total emissions in 1950;
- The tropical forest estate is shrinking at about 5% per decade, adding 3 billion tons of CO₂ to the atmosphere each year and contributing to major loss of biodiversity;
- A new global study concludes that 90% of all large fishes have disappeared from the world's oceans in the past half century, the devastating result of industrial fishing;
- About 20 to 120 million people live in areas affected by desertification;
- Inland water species have declined by 50%;
- Marine and terrestrial species have declined by approximately 30%;
- 23% of mammals and 25% of conifers are currently threatened with extinction;
- The status of bird species has deteriorated over the last two decades with 12% now threatened with extinction;
- 32% of amphibians are categorized as threatened with extinction.

Source: CBD (2010).

In economic theory, the precise valuation of environmental goods and services is difficult because in most case markets for them do not exist. Hence, there is need to make use of alternative evaluation techniques that have been developing over time (Kanninen 2006; Pagiola, Ritter and Bishop, 2004).

The concept of value is different from price when analysing ES. Regarding most tangible economic goods such as timber, the price paid for timber approximates the value. However, in cases where individuals derive value from driving through the undisturbed countryside, the valuation may be high, while the absence of a market for such a good makes pricing impossible.

In an attempt to categorise ES, Bateman *et al.* (2010) differentiated ecological assets, final ecosystem services, goods and benefits as shown in Table 3.2. Similarly, the MEA (2005) divided ecosystem services into provisioning, regulatory, cultural and supporting services. Provisioning services include the provision of goods such as food, fresh water, and wood. Regulatory services include the regulation of climate, disease and water quality. Cultural services include aesthetic, spiritual and recreational values associated with ecosystems. Supporting services include nutrient cycling and soil formation. These services in turn result in an increase in human welfare as shown in Figure 3.2, which summarises the categories of ecosystem services and their relation with the welfare of human societies. Despite having gained worldwide acclaim, the MEA ecosystem classification has been criticised for its failure to distinguish categories that are services in their own right from processes for achieving services (Boyd and Banzhaf, 2006; Kroeger and Casey, 2007).

Table 3.2: Categorisation of ecosystem services

ECOSYSTEM SERVICE CATEGORY	EXPLANATION
Ecological assets	The stocks of potential services which the ecosystem may provide
Final ecosystem services	The last items in the chain of ecosystem functions, which are the raw materials in the production of industrial goods
Goods	Ecosystem tangible products with direct use values
Benefits	The change in human well-being generated by a good

Source: Bateman *et al.* (2010)

The study of ecosystems has been characterised by a spectrum with natural scientists on one end and economists on the other end. Examining the development trail of interest in ecosystem services, Costanza *et al.* (1997) argued that the early 1990s were characterised by specialised research in specific themes and sub themes usually aimed at solving problems

related to particular funders. However, there has been a growing realisation that most global problems are multi-faceted and required integrated approaches in order to tackle them more effectively (Klein, 2000; Rafols and Meyer, 2010; Costanza and Kubiszewski, 2012a). According to Costanza and Kubiszewski (2012), modern scholarship especially in ecosystem studies necessitates working across traditional disciplinary lines due to improved information access through technology. Therefore, it is of paramount importance to develop new ways of understanding the structure of multi, inter, and trans-disciplinary scholarship, perhaps discarding disciplinary boundaries altogether (Costanza and Kubiszewski, 2012b).

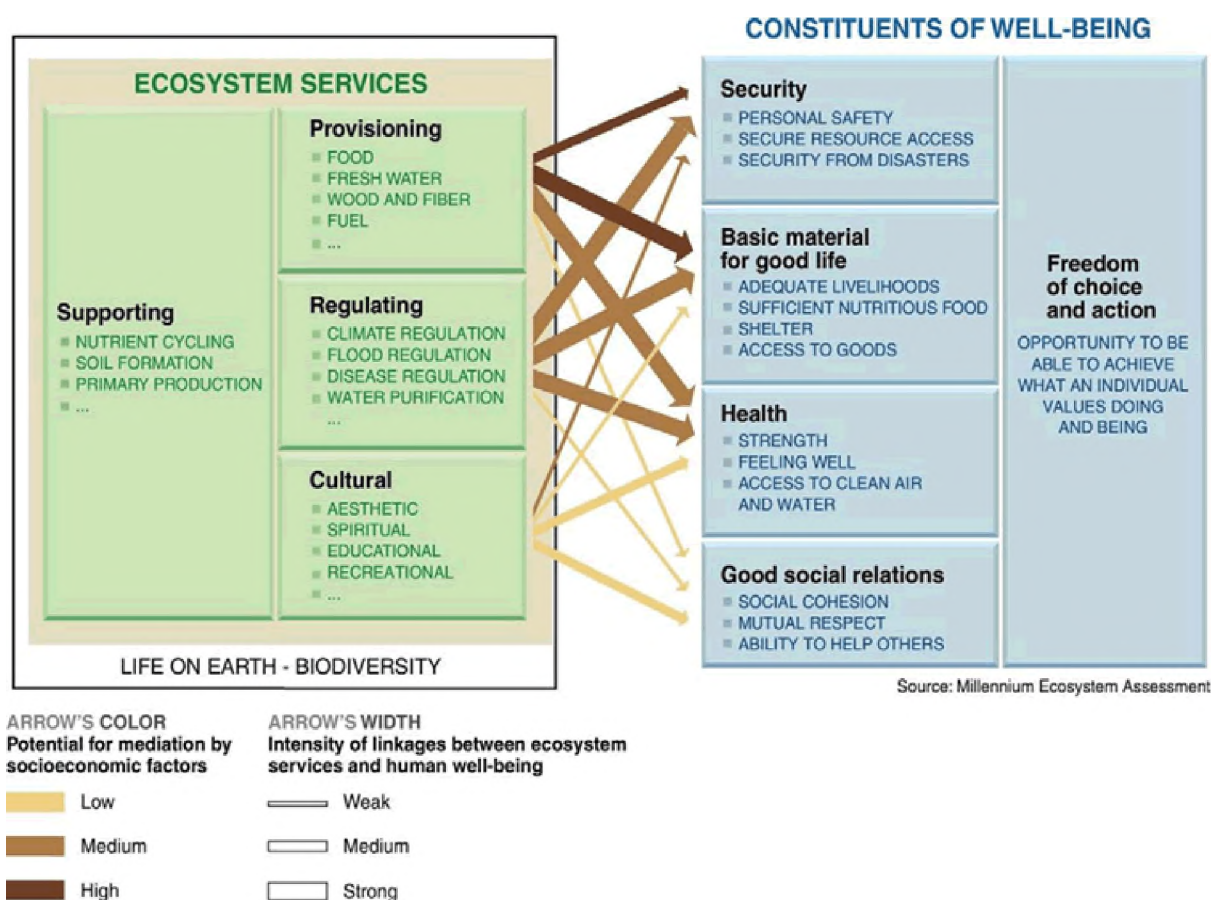
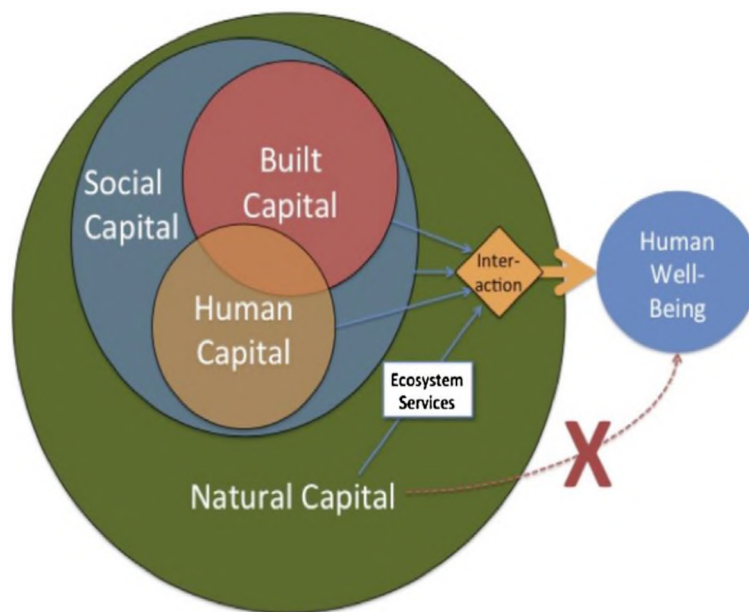


Figure 3.2: Categories of ecosystem services and their influence on human well-being

Source: MEA (2005).

According to Costanza *et al.* (2014), the widespread recognition of ecosystem services has reframed the relationship between humans and the rest of nature. A better understanding of the role of ecosystem services emphasises the value of natural capital in wealth, well-being and sustainability (Costanza *et al.*, 2014). Figure 3.3 shows that sustaining and enhancing

human well-being requires a balance of all of assets (individual people, society, the built economy, and ecosystems).



Interaction between built, social, human and natural capital required to produce human well-being. Built and human capital (the economy) is embedded in society that is embedded in the rest of nature. Ecosystem services are the relative contribution of natural capital to human well-being, and do not flow directly. It is therefore essential to adopt a broad, trans-disciplinary perspective in order to address ecosystem services.

Figure 3.3: Interaction of capitals for human well-being

Source: Costanza *et al.*, (2014)

The realisation that sustainable management of ecosystems is beneficial for human growth and development has seen the formation of a number of national and international institutions that aim at developing techniques and other institutions to effectively manage ecosystems. These institutions include, amongst others, the MEA project, the Economics of Ecosystems and Biodiversity Project (TEEB), the Ecosystem Services Partnership (ESP) and the development of the Journal of Ecosystem Services in 2012 that intended to stimulate academic debate around the subject.

Currently, a number of multi-linked areas are present in the field of ecosystem services economics. However, as this section delves deeper into the ecosystem services debate, the discussion will focus on certain specific areas. These areas are a historical background to the field, issues of ecosystem valuation and mapping; the relationship between ecosystem services, poverty, sustainable development and IAPs; the debates emerging in this relatively infant field of study and, finally, the major promising future research themes in the field.

3.3.1. History of ecosystem services in economic theory

The origin of ecosystem services in economic literature has to be considered under multiple headings that point to what are today understood as ecosystem services. This is necessitated by the fact that the term 'ecosystem services' is relatively new and focusing on it while searching for related literature in history would result in major omissions (Gómez-Baggethun *et al.*, 2010). Therefore, terms such as land, nature's gifts, and ecosystem functions cast a wider net in the chronicling of ecosystem services economics literature. This subdivision covers the physiocratic age, classical economics age, the neoclassical economics age, the environmentalist age, the ecological age and finally the emergence of ecosystem services economics.

Physiocratic age

The term Physiocrat originates in the Greek language meaning 'Government of Nature'. In ancient Greece, natural environmental concerns were at hand as shown by Plato's and Pliny the Elder's descriptions on the effects of deforestation causing soil erosion, drying springs and compromising rainfall in 400 BC (Daily, 1997; Andréassian, 2004; Gómez-Baggethun *et al.*, 2010).

The physiocratic age encompasses the ideologies that were present in the ancient world up until the time of economists who lived in the second half of the 18th century (Gómez-Baggethun *et al.*, 2010). The dominant belief in this period was that nations derived wealth solely from the value of land (Rothbard, 1995). At this point, land was the ultimate resource and the major measure of wealth as it defined nations, places and was the source or matter from whence all wealth came (Cantillon, 1755). Rothbard (1995) argued that the emergence of literature in this school of thought could be traced to France and that most of the theory was centred on agricultural land use. Consequently, labour in this era was mostly associated with agricultural productivity (Cantillon, 1775). Major philosophers in this age included François Quesnay, Anne-Robert-Jacques Turgot and Richard Cantillon.

Classical economics age

The classical economic age followed the physiocratic age and its major philosophers included Adam Smith, David Ricardo and Karl Marx, amongst others. According to Crocker (1999), one of the major issues in relation to natural resources in classical economics was the absence of

a price tag to the services rendered. Say (1829) further amplified this point of view arguing that nature's services were costless gifts from God. However, despite the zero prices, land remained a separate factor in the production function alongside the ever-growing importance of labour during the classical economic age (Blaug, 1964; Gómez-Baggethun *et al.*, 2012).

George (1881) captured the value of land in the classical economics claiming that land was necessary for all production as it was the standing-place, the workshop and the storehouse of labour. He considered land the only means by which the human being could obtain access to the material universe or utilise its powers and concluded that without land man could not exist (George, 1881). Correspondingly, Karl Marx considered value to emerge from the combination of labour and nature arguing that labour was not the source of all wealth but nature was, given that labour was a manifestation of the power of nature (Marx, 1887). Ricardo's law on diminishing returns and Malthus' concerns regarding population growth further reveal assertions on the value of land in classical economics (Turner, Pearce, and Bateman, 1994).

However, with the progression of time, classical economists emphasised labour more as the major production factor. This was evidently portrayed in Adam Smith's 1776 influential book *The Wealth of Nations*, which stated in the introduction that the wealth of a particular society resulted from the amount of labour it embodied (Smith, 1909). Furthermore, the 19th century saw unprecedented industrialisation and technological progress that resulted in the growth of a capitalist society that emphasised capital accumulation inevitably leading to an increase in the appeal of capital as a factor of production in comparison to land (Schumpeter, 1955). The pursuit of capital consequently led nature losing the distinct analytical treatment it had previously received to labour and capital as the ultimate sources of wealth generation (Daly and Cobb, 1989).

Neoclassical economics age

Neoclassical economics' major focus was that of exchange value that was rooted in the market price of commodities. Notable authors during this period include Alfred Marshall, Vilfredo Pareto, Knut Wicksell, John Maynard Keynes and Joseph Stiglitz, amongst others. During this period, the tools to put market prices on nature were virtually non-existent; thus, it lost its position in the production function (Gómez-Baggethun *et al.*, 2010). Hubacek and van der Bergh (2006) concurred that by the second half of the 20th century, environmental

resources and the benefits of nature had completely disappeared from the production function and the shift from land and other natural inputs to capital and labour alone was completed.

In this era, the notion of substituting capital became very common, as shown in Solow's growth model, where land is absent from the production function under the assumption that it could be substituted by manufactured capital (Solow, 1956). Nonetheless, the emergence of market externalities redirected efforts beyond the parameters of exchange value as shown through sustainability concerns raised by the likes of Gray, Ramsey, Ise and Hotelling between the 1910s and the 1930s (Martínez-Alier, 1987).

The Environmentalist age

According to Gómez-Baggethun *et al.* (2010), this era is located in the second half of the 20th century and saw specialised economic sub-disciplines begin to address shortcomings of standard economic science in its analysis of environmental problems. Major scholars who made theoretical contributions in this period included; Clawson (1959); Coase (1964); Ridker and Henning (1967); Krutilla (1967); von Bertalanffy (1968); Hardin (1968) Georgescu-Roegen (1971); Odum (1971); Daly (1977) and Kapp (1983), amongst others.

Market failure and the neglect of environmental contributions (which in most cases resembled public goods) beleaguered pure neoclassical economics (Daly, 1977). This restricted the neoclassical economists to those services of nature that could have a price placed on them meaning that there was a continuous undervaluation of nature's products and ultimately, unsustainable use (Costanza *et al.*, 1997). The problems alluded to earlier saw the development of the environmental economics school of thought, which developed various monetary valuation techniques, intended to capture nature's contribution and overall wealth creation (Gómez-Baggethun *et al.*, 2010). Conversely, Ridker and Henning (1967) noted that these valuation techniques typically relied on related marketed goods and services as proxies.

Ecological economics

This school of economic thought is a direct result of the environmentalist wave of literature; hence, the two are a reflection of each other (Turner, Pearce and Bateman, 1994). According to Gómez-Baggethun *et al.* (2009), environmental and ecological economics overlap in the

use of specific techniques to measure sustainability, evaluate policies and assist decision-making. Nonetheless, environmental economics operated mainly within the framework of neoclassical economics (perfect information and margins) while ecological economics challenged and interrogated unrealistic neoclassical assumptions that were not practical in a real world where most systems are interlinked and dynamic (Daly, 1977; Noorgard, 1994). Ecological economics, through rigorous debate about the systematic functions of the planet, has resulted in the isolation of systems in nature that support human life and ultimately the birth of economic theory and debate that analysed those systems.

Economics of ecosystems

According to Costanza and Kubiszewski (2012), the last three decades have seen a plethora of literature that stressed societal dependence on natural ecosystems, sometimes referred to as ecosystem goods and services. A series of contributions started referring to the functions of nature in relation to their services to human societies (King, 1966; Helliwell, 1969; Odum and Odum, 1972; Braat, van der Ploeg and Bouma, 1979). Schumacher (1973) used the concept of natural capital that stimulated further explanations by other authors who referred to ecosystems, ecological services, environmental goods, or nature's services. However, Ehrlich and Ehrlich (1981) introduced the concept of ecosystem services. Prominent authors in this emerging field included, amongst others, Ehrlich, de Groot, Costanza, Daily, Fisher and Pagiola.

According to Perrings *et al.* (1995), the Beijer Institute's Biodiversity Program in the early 1990s brought ecosystem services to light in the academic research arena. Research priorities identified in this program were later addressed in a number of future publications (Perrings *et al.*, 1995; Gómez-Baggethun *et al.*, 2010). At the turn of the millennium, the concept of ecosystems services slowly found its way into the policy circles of national governments and global organisations. This period saw the adoption of the 'Ecosystem Approach' by the UNEP, CBD, the Global Biodiversity Assessment and the MEA, amongst others. Despite the growing importance of the study area, research by Costanza and Kubiszewski (2012) indicated a lack of related programmes and projects pioneered by developing countries, especially those in sub-Saharan Africa.

Research on the monetary value of ecosystem services has grown as shown by the design of market-based instruments to create economic incentives for conservation (Gómez-

Baggethun *et al.*, 2010). These instruments are utilitarian in nature as they are based on the utility derived from ecosystem services (Jack, Kousky and Sims, 2008). The emerging instruments are the creation of markets for ecosystem services and payment for ecosystem services (Landell-Mills and Porras, 2002; Bayon, 2004; Wunder, Engel and Pagiola, 2008).

These instruments frame ecosystem functions from a utilitarian perspective in order to increase public interest in biodiversity conservation (Costanza *et al.*, 1997). However, to make the instruments effective, Gómez-Baggethun *et al.* (2010) argued they must be accompanied by institutional structures for ecosystem services, appropriation and exchange. The theoretical grounds on which Gómez-Baggethun's *et al.*'s (2010) argument is hinged are found in classical institutional literature, arguing for the need to establish well-defined property rights to facilitate efficient market regulation of environmental goods and services (Coase, 1960; Hardin, 1968; Ostrom, 1990, 2000; Vatn, 2005).

3.3.2. Measuring the value of ecosystem goods and services

The notion of measurement makes the subliminal assumption of 'presence' given that one cannot measure something that is absent. Therefore, to measure value in economics, the assumption is that a good or service exists and certain parameters govern it (Blignaut and de Wit, 2004). It should be noted that without the ability and intelligence to compare forms of creation then the concept of value might not exist, as all things would be the same (Tolle, 2005).

Value has long been linked to exchange or use (Parks and Gowdy, 2013). However, the use value paradox arose in the classical economics age and perplexed classical philosophers who observed that objects such as rare stones had a limited use value in life but a very high exchange value whereas life essentials like water had very high use values but low exchange value (Schumpeter, 1955; Parks and Gowdy, 2013). Galiani (1751) attempted to solve this problem by suggesting that price was a function of individual satisfaction and scarcity. This analysis may be linked to the realisation that humanity had an insatiable appetite for more that was also accompanied by the need to be unique and have what others could not have (Tolle, 2005).

This combination of what some scholars have termed greed, diversity of wants and the appeal of scarcity led to the concept of marginal utility that is the maximisation of utility presented

by Schumpeter as a resolution to the use-exchange value paradox (Schumpeter, 1955). After the utility maximisation theory, it became apparent that commodities could be exchanged for money in societies where markets existed for them. Money as a medium of exchange and a measure of value was then used to obtain the different commodities that maximise utility (Hunt, 2002).

The need to value environmental resources emanated from the realisation that their absence was a barrier to economic growth and utility maximisation (Dasgupta and Heal, 1974). The explicit valuation of natural services would include work done by, *inter alia*, Hotelling (1931) on non-renewable resources and Gordon (1954) on fisheries. In the case of modern ecosystem services arguments, the valuing of ecosystem services in commercial markets has influenced policy decisions in their favour (MEA, 2005; TEEB, 2010). Costanza *et al.* (1997) argued that failure to pay special attention to the valuation of ecosystem services could ultimately compromise the sustainability of humans in the biosphere.

Major valuation techniques in economic theory and researchers who have used them are summarised in the Table 3.3. Bockstael and McConnell (1993), however, reasoned that most of these attempts were highly neoclassical in nature as they used privately consumed market goods, which are weakly complementary to the public goods as environmental proxies.

Using some of the methods summarised in the Table 3.3, Costanza *et al.* (1997) estimated the annual value of global ecosystem services at between US\$16–54 trillion, with an estimated global average of US\$33 trillion. De Groot *et al.* (2012) revised the valuation methods used by Costanza *et al.* (1997) and came up with a valuation of \$124.8 trillion/yr for global ecosystems. Based on improved methods used by de Groot *et al.* (2012), Costanza *et al.* (2014) showed that global land use changes between 1997 and 2011 had resulted in a loss of ecosystem services ranging from \$4.3 and \$20.2 trillion/yr, with large losses (\$10.9 trillion/yr) in marine systems due to coral reef degradation.

Table 3.3: Ecosystem services evaluation methods

Valuation approach	Examples of methodologies	Published research
Market price approaches	Market prices	Le Roux and Nahman, 2005; Turpie, Heydenrych, and Lamberth, 2003
Market cost approaches	Replacement cost method Damage cost avoided method Production function method	Moller and Ranke, 2006; Amaza, Bila, and Iheanacho, 2006
Revealed preference methods	Hedonic pricing method Travel cost method	Clawson, 1959; Hanley, Wright and Koop, 2002
Stated preference methods	Contingent evaluation method Choice modelling	Kramer and Mercer, 1997; Turpie, 2003
Participatory approaches to valuation	Deliberate valuation method	Alvarez-Farizo and Hanley, 2006; Spash, 2008
Value transfer	Value transfer method	Niemeyer and Spash, 2001; Sagoff, 1998; Spash, 2008

Source: Christie *et al.* (2012)

According to Christie *et al.* (2012), the paper (Costanza *et al.*, 1997) attracted a lot interest, which was both positive and negative in orientation. Norgaard and Bode (1998: 37) questioned the usefulness of global valuation exercises saying, “now that we know the exchange value of the earth, we wondered with whom we might exchange it and what we might be able to do with the money”. However, In spite of theoretical controversies and gaps, environmental valuation studies have had great policy relevance and generally have been well received (MEA, 2005; TEEB, 2010; Christie *et al.*, 2012).

Because of the development of valuation tools for ecosystem services, markets and payments for these services have also emerged. Payment for Ecosystem Services (PES) deals result when organisations take an active interest in addressing particular environmental issues (UNEP, 2008; Wunder, 2005; Schomers and Matzdorf, 2013). These schemes provide an income for ecosystem management initiatives and promote sustainable ecosystem management (UNEP, 2008). PES arrangements include public payment schemes to private landowners to maintain or enhance ecosystem services and formal markets with open trading between buyers and sellers.

An example of such an initiative would be the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism initiated in 2007 by those party to the United Nations Framework Convention on Climate Change (UNFCCC). This mechanism is rooted in the Kyoto Protocol regarding carbon emissions and proposes to pay developing countries to manage tropical forest ecosystems in order to improve carbon sequestration thereby reducing the amount of carbon in the atmosphere (May *et al.*, 2004; Chatterjee, 2009).

3.3.3. Mapping Ecosystem Services

The mapping of ecosystem services involves determining ecosystem location and type. This exercise is beneficial as it assists in environmental planning and management (Heal *et al.*, 2005; Troy and Wilson, 2006). According to Maes *et al.* (2012), maps are useful in problem identification and can be used as a communication tool amongst a variety of stakeholders. Maps also allow the visualisation of locations where valuable ecosystem services are produced or used and explain the relevance of ecosystem services to the public in their territory (Maes *et al.*, 2012). Additionally, the spatial mapping of ecosystems allows the visualisation of different landscapes and economically relevant aspects associated with them (Bateman *et al.*, 1999; Egoth *et al.*, 2008).

The growing realisation of the importance of ecosystem mapping has resulted in the establishment of mapping groups around the globe. An example of such a group would be the Mapping and Assessment of Ecosystems and their Services working group (WG-MAES) in the European Union whose objective is to map major European ecosystems, their services and the major beneficiaries (Maes *et al.*, 2012).

3.3.4. Ecosystem Services and IAPs

The impacts of invasive species on ecosystem services have attracted worldwide attention in relation to their general environmental effects and resultant socio-economic losses (Pejchar and Mooney, 2009). As discussed in Chapter 2, invasive alien plants may lead to economic (monetary losses), environmental (alteration of ecosystem structure and function) and social losses (reductions in quality of life, cultural heritage and recreational opportunities). Despite this realisation, Charles and Dukes (2007) asserted that the effect of IAPs on ecosystem services is still lacking in literature.

A number of academic endeavours and assessments of the different effects of IAPs on ES do not fully factor in the effects that the alteration of certain ecosystem services has on various societal spheres, due to their subjective nature and the difficulties associated with quantifying this component (Charles and Dukes, 2007). Even with the paucity in literature, studies on ecosystem processes negatively affected by invasive species continue (Turpie *et al.*, 2003; Levine and D'Antonio, 2003; Beekey, McCabe and Marsden, 2004; Zhu, *et al.*, 2006; Hogan *et al.*, 2007).

The structure and functions of ecosystems allow the production of services and the overall maintenance of ecosystems. Invasive species alter the production, maintenance, and quality of services by a variety of mechanisms, which include species extinctions, community structure alterations, alteration of natural cycles and energy, exploitative competition, and alteration of disturbance regimes such as fire and soil erosion (Rejma'nek, 1989; Mack and D'Antonio 1998; Charles and Dukes, 2007). These alterations are not without a cost as shown in the Table 3.4 that summarises major ecosystem services affected by IAPs and the approximate monetary costs.

Therefore, the need to understand the ES-IAP relationship is of paramount importance and cannot be ignored. This was further buttressed by Pejchar and Mooney (2009: 497) who likened the impacts of IAPs to an 'invisible tax' on ecosystem services that is rarely included in decision-making.

3.3.5. Ecosystem Services, Sustainability and Poverty alleviation

Traditional neoclassical economics, considered manufactured capital and natural capital as substitutes (Solow, 1986). This argument is what has been termed the weak sustainability approach, which is in direct contrast with the ecologists' strong sustainability approach that considers natural and manufactured capital as compliments rather than substitutes (Costanza and Daly, 1992; Bateman *et al.*, 2011). The sustainable harvesting of ecosystem services is a major component of sustainable development (Costanza *et al.*, 1997; MEA, 2005; TEEB, 2010). In recognition of this aspect, a number of arguments that relate to sustainability have developed in ESE.

Table 3.4: Ecosystem services affected by IAPs and the approximate monetary costs

IAP	Location	Ecosystem service altered	Monetary impact (USD)	Reference
Acacia <i>melanoxylon</i> (blackwood), Acacia <i>cyclops</i> (<i>rooikrans</i>), Eucalyptus spp. (gum trees) and other woody shrubs and trees	Cape Floristic Region, South Africa (<i>fynbos</i>)	Food (sour figs, honey-bush tea), fibre (thatching reed, timber), ornamental resources (flowers, greens, ferns), medicine, essential oils (<i>buchu</i>)	-2,852,984	Turpie <i>et al.</i> (2003)
		Water (mountain catchments)	-67,836,059	
		Pollination (bee keeping)	-27,783,728	
		Ecotourism	-830,683	
		Fuel (<i>Acacia cyclops</i> As firewood)	+2,799,492	

Source: Charles and Dukes, 2007.

Sustainability arguments in relation to ES have seen the inclusion of discounting when dealing with ES. This process is based on the argument that receiving now is better than receiving in the future, thus ES are assigned shadow values that encapsulate within them conceptions of the impact of changes on the stock of natural assets (Stern, 2007; Bateman *et al.*, 2011).

Similarly, in an attempt to address the sustainability concerns, Mäler, (2008) considered ecosystem resilience as an asset that determined the ability of an ecosystem to withstand stresses and shocks so as to continue providing services. The ecological resilience of an ecosystem therefore is treated as a stock with a distinct asset value that can appreciate or depreciate in time (Mäler, 2008; Bateman *et al.*, 2011).

Safe minimum standards (SMS) have also been considered as a way to ensure the sustainable harvesting of ES (Bishop 1978). According to Bateman *et al.* (2011), in the SMS approach, conventional economic decision-making prevails unless a threshold ES threat is identified at which point environmental conservation is mandatory unless the costs of achieving it are ridiculously high.

With regard to poverty, unsustainable harvesting of ES arguably results in their depletion and their depletion may ultimately result in increased poverty for societies dependent on

ecosystem services for their livelihoods (Egoh *et al.*, 2012). The rural poor are most vulnerable to unsustainable harvesting of ES and any attempts that aim at poverty reduction in these parts of the world such as the Sustainable Development Goals (SDGs) should prioritise the sustainable harvesting of the ES (ESPA, 2012).

3.3.6. Debates emerging in ESE

The previous sections have shown that the services of nature are inherently complex in production and existence. Analysing them and studying them using the basic economic model has resulted in murmurs in the academic background given that the neoclassical economic model is based on an individual making a purely economic decision at a given point in time (Gowdy, 2004; 2005; Redford and Adams, 2009).

A number of scholars have become convinced that neoclassical welfare economics has reached its limit and the time has come to consider other schools of thought such as Behavioural Economics, Non-Linear Complexity Theory, Post-Keynesian Economics, Green Keynesian Economics and Neuro Economics (Bowles and Gintis, 2000; Davis, 2006; Quiggin, 2010; Christie *et al.*, 2012; Harris, 2013). Ecosystem services economics has therefore come under criticism for various reasons discussed as follows.

The basic economic model is generally an extremely narrow context, especially when dealing with environmental services, policies and sustainable harvesting. Complexities involved in predicting the future of ES and possible changes that may occur exacerbate this narrow approach. Furthermore, some scholars argue that the utilitarian framing of nature is counterproductive and against the fundamentals of conservation of nature in the long run (Rees, 1998; Martínez-Alier, 2002; Robertson, 2004).

The complexities of nature are also considered to be of a much higher order compared to modern understanding, thus any attempt to come up with valuations will be dogged by lack of critical information that underpins the provision of the ES in question (McCauley, 2006; Soma, 2006; Spash, 2008). To make matters worse, the valuation of social benefits, which include mental well-being, ethical, religious, spiritual and cultural values, may prove to be impossible (UNEP, 1999). Monetary valuation information may also be misleading to policy makers, as prices do not give information on the link of the ES to communities and location (Toman, 1998). Moreover, according to Parks and Gowdy (2013), the economic value of

ecosystem services does not necessarily capture values such as ecological sustainability and distributional fairness.

In the case of ES markets, Schomers and Matzdorf (2013) argued that the inherent lack of knowledge leads to the underestimation of the value of ES and, hence, their overuse. Redford and Adams (2009) also expressed concern at the speed at which markets for ecosystem services and the payment mechanisms were being adopted without much critical discussion across the spectrum of conservation and policy debate. Discounting of ES in the future has also been criticised given that it is not possible to justify a discount rate using present knowledge (Stern, 2007; Parks and Gowdy, 2013).

In this light, Redford and Adams (2009) summarised four major problems that could be associated with the payment of ecosystem services schemes. Firstly, in a world of relentless pursuit of economic logic, there is a real risk that economic arguments about services valued by humans will override and outweigh non-economic justifications for conservation. Secondly, the definition of ES is based on ES that are beneficial to humans, thus this aspect of the definition may result in detrimental effects and long-term survival of the non-human parts of the ecosystems. Certain aspects of ecosystems not regarded as part of the ES function may be disregarded. Thirdly, experience has shown that scarcity results in ownership and control of resources, therefore, as ecosystem services become scarce and valuable, people will compete to gain control over flows of services and the ecosystems that provide them. This will have serious welfare implications on the most vulnerable in society. Finally, markets change, appear and disappear but this may not be the case for the components of ES thus, where markets do exist, the value of the services may differ from places without those markets (Redford and Adams, 2009).

3.3.7. Emerging areas of future research in ESE

As a discipline still in its infancy, the pillars of ESE are yet to be fully defined. A number of areas, however, are emerging as research areas that will most likely shape the discipline as it progresses. The mapping of ecosystem services is still at a relatively introductory level. Maes *et al.* (2012) gave an introduction to and an overview of the challenges associated with this process. Significant scholarly debate and research is still required in order to make use of the immense opportunities related to ecosystem mapping (Braat and De Groot, 2012). The potential of mapping was also recognised at the 10th Conference of Parties in Nagoya, Japan.

Despite the numerous quantification methodologies subsequently discussed, there is still the need to further link the complex functioning of ecosystems with general concepts of value (De Groot *et al.*, 2010; Muller and Burkhard, 2012). Time aspects are also emerging in the ESE debate given that natural restoration time may run into decades for wetlands and grasslands and hundreds of years for forests (De Groot *et al.*, 2010).

In summary, Braat and De Groot (2012) discussed four major areas whose development through research and academic debate would be crucial for ESE as a discipline. Firstly, there is a requirement for specialists in legal and institutional dimensions of societal development to address issues around sustainable management of natural capital and ecosystem services. These legal requirements may translate into a new World Trade Organisation, World Bank and International Monetary Fund, based on the ecological economics of the future, instead of the neoclassical economics of the past. Secondly, there is need to develop transparent systems of national accounting, which include the value of changes in natural capital stocks and ecosystem services. These systems would operate at all levels to make the value of nature an integrated and 'natural' element to consider in economic activity and human well-being. Thirdly, research is required on issues of excludability, rivalry and substitutability in order to develop different institutions best suited to the protection and restoration of ES based on this critical information. Finally, scholars should consider the development of methods and conditions that allow for involvement of all relevant stakeholders in ecosystem services management.

3.4. SUSTAINABLE RURAL LIVELIHOODS (SRL)

The way in which people live on the planet has been a subject of interest ever since humans could make sense of their natural environment (Tolle, 2005). This interest is evident in the numerous ancient works that attempted to guide societal relations through military conquest, religion, tribal demarcation and art (Fukuyama, 2012). The understanding of the different ways in which people in various places on the planet live gave rise to what has been formally termed the livelihoods perspective (Scoones, 2009).

Earning a living is a complex process that involves the combination of various methodologies rather than a systematic approach based on a singular method (Carney, 1999). This complexity was characterised by Scoones (2009) as a web of activities and interactions that emphasised the diversity of ways in which people made a living. Traditional developmental

approaches focused on defined activities such as agriculture and farm labour as vehicles to development and poverty alleviation (Carney, 1998; 1999; 2002; Ellis, 2000). This defined approach to problem solving links to the distinct disciplines that characterise academia and the professional world in general (Chambers and Conway, 1992; Carney, 1998; Solesbury, 2003). In disapproval, Scoones (2009) argued that developmental approaches should mirror the complex real life realities and not try to impose artificial categories. Hence, the study of 'livelihoods' has become multidisciplinary in nature bringing together multidimensional perspectives, allowing conversations over disciplinary and professional divide (Gieryn, 1999; Scoones, 2009).

Robert Chambers and Gordon Conway pioneered the study of livelihoods in the rural set up in 1992. However, even before this notable contribution, scholars decades earlier had already begun to document the ways in which people lived and set the stage for the modern approaches to livelihoods. Fardon (1990) cited collaborations by ecologists, anthropologists, agriculturalists and economists observing changing rural systems and their development challenges in 1950s Zambia (Rhodes-Livingstone Institute) as a significant contribution to the formative stages to the modern livelihood approaches. However, due to the mono-disciplinary approach to development and the general post world war situation, such initiatives did not have major impacts as mainstream economists dominated the global development space (Scoones, 2009).

As time progressed, the numerous changes on the planet such as newly independent countries, feminist movements and pandemics, alternative applications of traditional mainstream economics began to emerge. These alternative applications included the village studies tradition, the Green Revolution, the distinctive actor-oriented approaches, household and farming systems studies, agro-ecosystem analysis, intra-household dynamics, environmental change (environment and development movement of the 1980s and 1990s) and the Brundtland Commission Report (Lipton and Moore 1972; Conway, 1985; WCED, 1987, Guyer and Peters, 1987). It was through this alternative line of thinking that the concept of sustainable rural livelihoods came into being at a hotel in Geneva (Scoones, 2009) and later through academic publications such as Chambers and Conway (1992), Scoones (1998), Carney (1998, 2002) and Park, Howden and Crimp (2012).

According to Solesbury (2003), the ideas of the previously discussed Brundtland Commission attempting to link socio-economic and ecological considerations, were further expanded by the United Nations (Agenda 21), advocating for sustainable livelihoods as a broad goal for poverty eradication (Solesbury, 2003).

Attention was therefore shifting from the traditional macroeconomic growth oriented indicators that emphasised trickle down effects towards development in terms of individual and household health, education, citizen participation, self-reliance, sustainability and well-being (Krantz, 2001). This view was encapsulated in the proceedings and reports of the first Human Development Reports from the United Nations Development Programme, the UN's 1992 Environment Conference in Rio, the 1995 World Summit for Social Development and the 1996 World Food Summit (UNDP, 1997; Krantz, 2001; Solesbury, 2003).

At the conception of the sustainable livelihoods approach, Chambers and Conway (1992) presented three major concepts that had scholarly roots in academic literature as the major determinants of sustainable livelihoods. These concepts were capability (linked to work by Sen, 1981, 1984a and Jodha, 1988), sustainability (linked to work by the Brundtland Commission and Lele, 1991) and equity linked to numerous works on social equality and discrimination (Rawls, 1958, 1971; Plott, 1967).

According to Carney (1999), the SRL approach may be traced to other concepts before it, such as the Integrated Rural Development (IRD) approach, which was based on the realisation that income generation would remain important and that increased crop yields alone would not solve rural problems. Another would be the Rural Development Agenda that had a strong emphasis on the environment, with the protection of natural resources and a continued focus on macro policy liberalisation (Carney, 1999).

Solesbury (2003) claimed that once developed and publicised, a number donor agencies embraced and used the SRL approach. These included, amongst others, CARE, Oxfam, the UNDP and the DFID. The labour government of the United Kingdom that assumed power in 1997 also embraced the concept of sustainable rural livelihoods, incorporating it in its international developmental policy (DFID, 1997). This was underscored by the development policy white paper formulated by then development minister stating that efforts to fight poverty would be through the support of sustainable development targets and policies that create sustainable livelihoods for the poor (DFID, 1997, Solesbury, 2003).

Krantz (2001) contended that efforts by the DFID and the Institute of Development Studies, University of Sussex (IDS-Sussex) in the United Kingdom deserved special mention as major investors in the SRL concept. The IDS-Sussex team outlined a tentative framework, shown in Figure 3.4 to analyse sustainable rural livelihoods, which was later used as a reference point by a number of organisations that sought to make use of the sustainable livelihoods approach. The framework highlighted contexts, resources, institutions, strategies, and outcomes as five interacting elements that determined the household's ability to achieve sustainable livelihoods (Scoones, 1998; Solesbury, 2003).

Major aspects that have stood out in sustainable rural livelihoods debates include vulnerability (Moser, 1998), societal contextualisation (Scoones, 1998), assets / capitals (Scoones, 1998; Bebbington, 1999; Sen, 1981; 1984a), livelihood strategies (Ellis, 2000) and institutional effects (Scoones, 1998). The sections that follow further analyse SRL by means of considering, livelihood strategies, capitals /assets, vulnerability, transformation and resilience in detail.

3.4.1. Sustainable Livelihoods

According to Chambers and Conway (1992), a livelihood comprises the capabilities, assets (including both material and social resources) and activities for a means of living. The capabilities and assets that households have access to, not only give them a means of making a living but, also, meaning to life and the ability to change the rules of access to capital (Bebbington, 1999).

Livelihoods are vulnerable to stresses and it is the stress factor that determines if a livelihood is sustainable and ultimately, household vulnerability (Scoones, 1998). According to Chambers and Conway (1992), a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets, while not undermining the natural resource base. Scoones (1998) discussed five major indicators of livelihood sustainability: the creation of working days, poverty reduction, well-being and capability, livelihood adaptation and natural resource base sustainability. Households that are unable to cope in the face of short / long-term changes are vulnerable and unlikely to achieve sustainable livelihoods (Chambers, 1987; Carney, 1998).

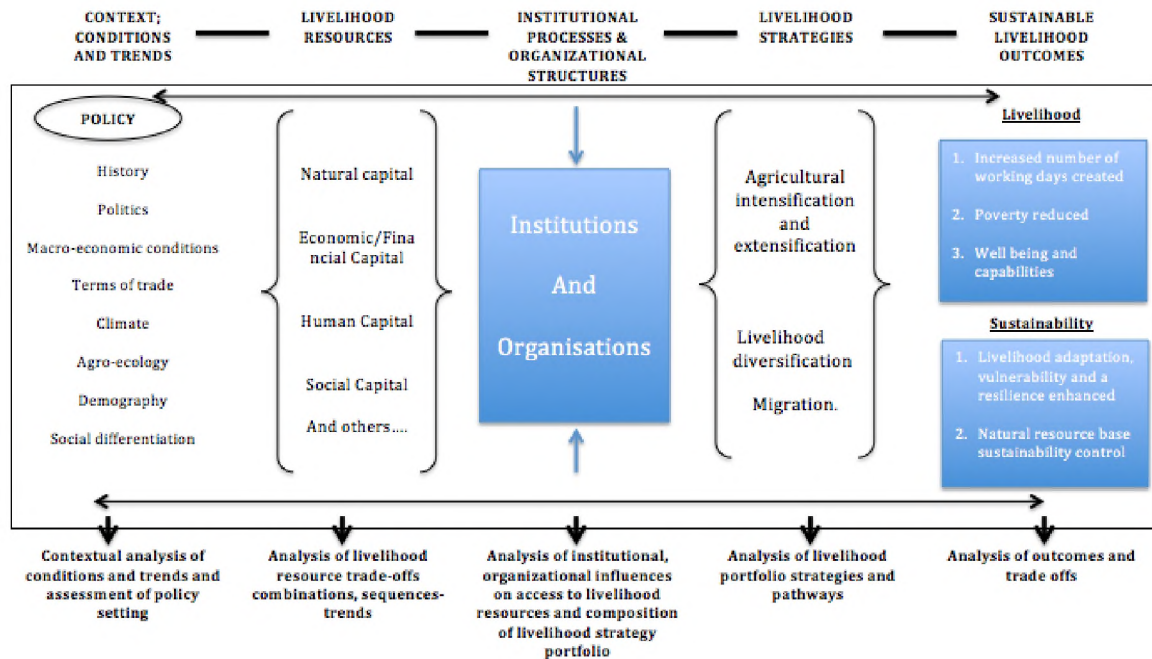


Figure 3.4: The sustainable livelihoods framework

Source: Scoones (1998).

Scoones (2010) claimed that despite relative demotion from mainstream policy debates of late, the term ‘sustainable livelihoods’ had become synonymous with ‘good’ development practice in the late 1990s. Nonetheless, major global issues such as the recognition of climate, environmental and biodiversity change as central to economic strategy and planning present clear opportunities for re-energising the SLR concept (Scoones, 2010).

3.4.2. Capitals and assets

The basic material, social, tangible, and intangible assets that are required to formulate a livelihood are known as assets or capital in mainstream SRL literature (Sen, 1984a; Scoones, 1998; Bebbington, 1999). The labelling of the basic building blocks of livelihoods as capitals allows analysis at a micro (household) and macro (multiple households) scale (Scoones, 1998; Ashley, 1999). According to Clark (2005), the capital and assets approach may be traced from Aristotle’s *Classical Political Economy*, Karl Marx’s *Das Kapital*, Rawls’s *Theory of Justice* and the Basic Needs Approach (BNA) to development pioneered by Streeten *et al.* (1981). However, more recently, 1998 Nobel Prize in Economics winner Amartya Sen’s seminal work in the 1980s is credited with the originating of the discourse (Chambers and Conway, 1992).

The discourse emerged as an alternative to standard economic frameworks about poverty and inequality in society (Clark, 2005).

According to Sen (1984b), different people and societies typically differ in their capacity to convert income and commodities into valuable achievements. Some may need additional aid to achieve what others would achieve without aid. These individual and societal differences are a mirror image of different asset combinations. Using work by Amartya Sen, Clark (2005) accentuated this point stating that the commodity requirements for more complex social achievements (such as appearing in public without shame or entertaining family and friends) typically depended on the cultural fabric (social convention and custom or status and class).

Thus, in considering livelihoods and welfare in general, the neoclassical utilitarian methods that are based on self-interest, rational behaviour (more is better) and growth may not necessarily give a clear picture of the welfare situation at micro and macro levels. Sen (1985) further discredited the neoclassical choice based approach given that it does not distinguish between different sources of pleasure and pain or different kinds of desires. Furthermore, Sen, (1984b) asserted that individuals did not always choose in accordance with their own personal interests but often considered a wider spectrum of variables. These arguments led Sen (1984b) to the conclusion that there is more to life than utility, which is only one component of human existence.

The realisation that utility did not have all the answers to measuring livelihoods and human well-being ushered in the notion of functions (what a person can be or do) and capabilities (the ability of achieving a certain function) (Sen, 1985; Saith, 2001; Clark, 2005). Functions and capabilities underpin the capital/assets approach to the formulation of livelihoods and allow for the inclusion of a number of contributing factors to achieving sustainable livelihoods. The major capitals considered as major building blocks to sustainable livelihoods are natural, financial, human, social and physical capital. However, the use of the phrase and others in the capital mix (Scoones, 1998) indicates acceptance) that there could be more capitals in the capital mix. As such, political capital and self-evaluation and esteem issues (psychological capital) have also been considered especially in the modern job employment spheres (Judge and Bono, 2001; Booth *et al.*, 1998).

3.4.3. Types of capital assets

Natural capital refers to the natural stock of environmental goods and services such as forests, soils, fish, biodiversity, wildlife and water (Scoones, 1998; Carney, 1998). Costanza *et al.* (1997) considered natural capital to be arguably the most significant of the capitals given that the latter owe their existence to it. The significance of natural capital is most notable in poor rural African communities that depend directly on the natural environment for most of their livelihood strategies (Conway, 1985; Egoh *et al.*, 2012).

Economic/financial capital refers to the cash assets, credit capabilities, savings, basic infrastructure and production equipment that allow the household to earn a living (Scoones, 1998). Bebbington (1999) brought in the idea of produced capital described in very similar terms as those given in Scoones (1998) for economic/financial capital. Human capital refers to the skills and the ability to labour in good health and physical capability (Scoones, 1998; Carney, 1998). In some cases, human capital considers both the quantity and quality of labour resources available to households under one umbrella. However, the realisation that the quality of labour has an influence on the ability of the household to manage labour assets, take advantages of economic opportunities and overall health resulted in the analysis of human capital using either quality or quantity aspects (Lipton and Ravallion, 1995; Moser, 1998). Psychological capital emerged because of the recognition that the ways in which individuals perceive themselves directly affect their ability to obtain employment (Barrick, and Mount, 1996; Judge *et al.*, 1998; Judge and Bono, 2001). Thus, self-perception and esteem are an integral part of the capital mix (Judge and Bono, 2001).

Social capital refers to the numerous social networks, claims, affiliations and associations and that allow the pursuit of livelihoods that require a combined effort (Putnam, 1993; Narayan, 1997; Scoones, 1998). Closely linked to social capital is political capital, which refers to the access to decision-making and the ability to influence the institutional rules of society (Judge and Bono, 2001). The capital assets are the determinants permitting or preventing the accumulation of other assets essential for sustainable livelihoods (Booth *et al.*, 1998; Rakodi, 1999).

3.4.4. Livelihood strategies

Households combine capital assets in various unique quantities to devise their livelihood strategies (Chambers and Conway, 1992). Scoones (1998) identified three major possible

strategies that the household could pursue. These were agricultural intensification or extensification, livelihood diversification and migration. Strategies pursued therefore have a direct link to the capital mix and will result in a trade-off where one capital may be overlooked in favour of the other due to the strategy that the household has chosen to pursue. For example, most rural African economies depend on natural capital (ecosystem goods and services) for the provisioning life giving and supporting materials such as wood for energy and fencing, wild animals for food and water for drinking (Egoh *et al.*, 2012; Fabricius, 2004; Davis 2002).

According to Glavovic and Boonzaier (2007), the centre point of the pentagon in Figure 3.5 represents zero access to capitals, whereas the outer perimeter depicts maximum access. Differently shaped pentagons reflect the different asset portfolios of various households and communities (Glavovic and Boonzaier, 2007).

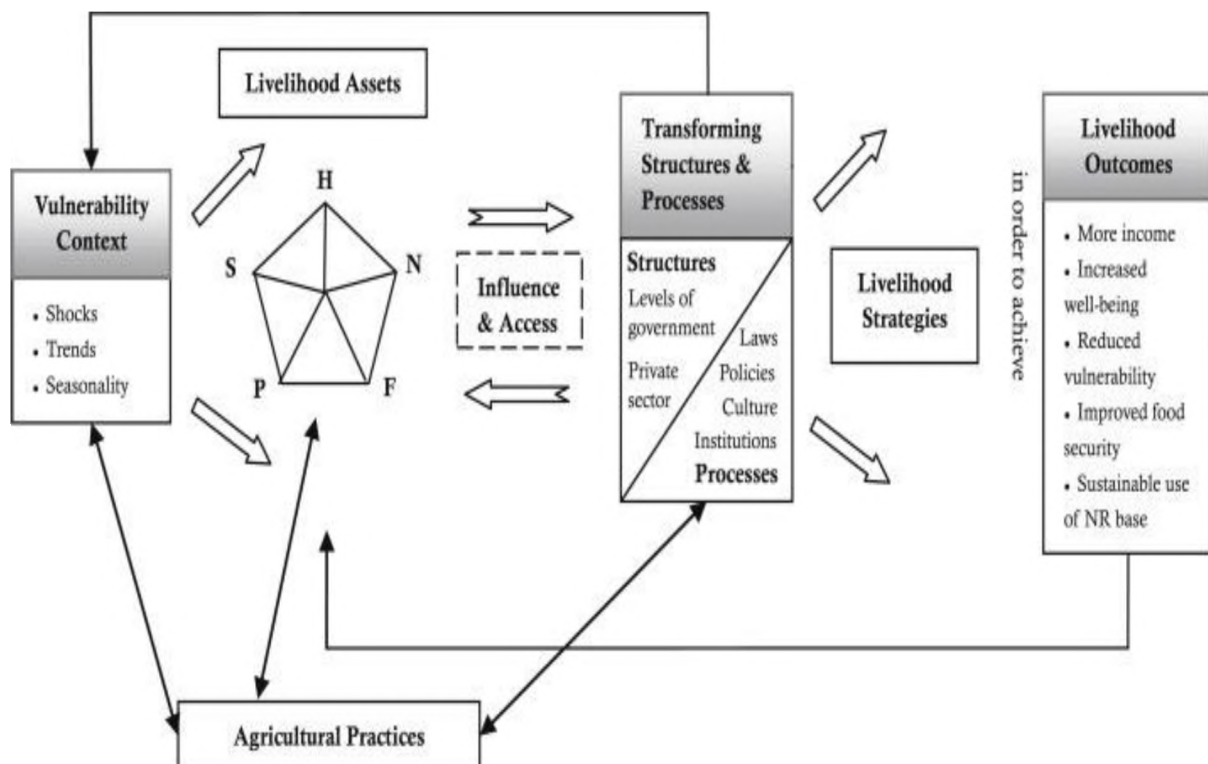


Figure 3.5: The SLA by the DFID

Source: DFID (1997)

3.4.5. Vulnerability and Resilience

Livelihood strategies are vulnerable to stresses that disrupt household capitals. Vulnerability may affect the well-being of individuals, households and communities in the face of negative change and it may affect how people respond to and deal with such negative change (Moser, 1998; and Obrist, 2000). Vulnerability may result from a number of factors such as poverty, marginalization and exclusion, amongst others. In addition, Barnett (2001) argued that social, cultural, economic and political processes generate vulnerability. The resilience of a livelihood strategy to various stresses and risks determines how sustainable it is (Chambers and Conway 1992; Scoones, 1998; Carney, 1998).

Chambers and Conway (1992) defined vulnerability as a combination of defencelessness, insecurity, and exposure to risk, shocks and stress. O’Riordan (2002) complemented Chambers and Conway’s (1992) definition, arguing that at the societal level vulnerability was the incapacity to avoid danger, or to be uninformed of impending threat, or to be politically powerless and poor so as to be forced to live in conditions of danger. The vulnerability concept describes states of susceptibility to harm, powerlessness, and marginalisation from physical and social systems (Adger, 2006). The concept enlightened the world on universal global aspects such as climate change in relation to societies and ecological systems (McCarthy *et al.*, 2001; Ionescu *et al.*, 2005). Cannon, Twig and Rowell (2003) argued that sustainable livelihoods reduced vulnerability but in the presence of poverty, the poor are most vulnerable and less capable of recovery.

Vulnerability analysis allows a shift from ill-preparedness in the event that negative changes occur to preparedness and more resilient livelihood strategies (Cannon, Twig and Rowell, 2003, ZIMVAC, 2014). Hahn, Riederer and Foster (2009) described vulnerability assessment as a diverse set of methods used to systematically integrate and examine interactions between humans and their physical and social surroundings. Consequently, DFID incorporated the vulnerability component in its version of the SRL approach (Figure 3.4). Commenting on the DFID insertion of vulnerability, Cannon, Twig and Rowell (2003) noted that this offered DFID the opportunity to integrate development work using the SRL approach with disaster preparedness, prevention and recovery.

There is a high correlation between vulnerability and poverty (Adger, 2006). Therefore, the fight against poverty should be instrumental in reducing vulnerability (Dercon and Krishnan, 2000; Adger, and Winkels, 2006). For that reason, the aim should be to protect and reinforce livelihoods in such a way that societal livelihood strategies are able to become more resilient (Cannon, Twig and Rowell, 2003). However, it should be emphasised that livelihood protection, access to capitals and resilience directly relate to the institutional frameworks in that society (Adger, 2003; Dow, Kasperson and Bohn, 2006; Glavovic and Boonzaier, 2007).

3.4.6. Livelihood Transformation

The livelihood strategies pursued by households differ with respect to environmental and social and economic circumstances (Glavovic and Boonzaier, 2007). According to EkoNomos (2012), when livelihoods are under stress and the household focuses totally on survival, the strategy is often rooted in the accessing of basic needs. However, as the stress factor reduces strategies to reduce social isolation and support participation become important (Bebbington, 1999). Once a reserve asset base has been built up, households move from coping strategies towards strategies to build their employability (Bebbington, 1999; EkoNomos, 2012). The change of livelihood strategies towards those requiring capital bases is referred to as the transformation of livelihoods (EkoNomos, 2012). According to Scoones (1998), transforming structures and processes within the livelihoods framework are the institutional frameworks that exist in the society (Figure 3.4). Institutions operate at all levels in formal and informal ways, locally, nationally and internationally (DFID, 1997; Scoones, 1998).

3.4.7. Sustainable livelihoods and IAPs

As presented in Chapter 2, invasive alien plants may affect the ability of an ecosystem to provide goods and services. The degradation of ecosystem services often causes significant destruction to livelihoods (Shackleton *et al.*, 2007; Egoh *et al.*, 2012). However, according to Rai *et al.*, (2012), the effects of invasive plants on natural habitats are more complex than the direct commonly perceived negative impacts. The possible positive impacts that they have especially at rural level have sparked a conflict of interests leading to questions as to whether they are 'friends or adversaries', 'pests or providence', and 'weeds or wonder' (Foster and Sandberg, 2004; Pasiecznik, 1999). In some parts of rural Africa, the presence of IAPs

compromises long-term ecosystem health but increase goods and services that boost livelihoods in the small-scale rural context (Shackleton, Kirby, and Gambiza, 2011).

Rural people evaluate the impact of invasive plants based on how the species influence their economic needs and livelihood strategies (Shackleton *et al.*, 2007; Rai *et al.*, 2012). Thus, those plants considered less complimentary to local livelihood strategies are likely to be viewed as lowering the amounts of accessible natural capital (Yokomizo *et al.*, 2009). Rai *et al.* (2009) further argued that the effects of invasive plants on rural livelihoods were not straightforward. Thus, the effects could be described based on the micro-economic theory of consumer preferences given that preferences over IAPs are determined by the characteristics of the rural households. Preferences regarding the invasive plants change with time as the nature of the goods and services offered by the plants change (Shackleton *et al.*, 2007; Rai *et al.*, 2009).

IAPs affect capital assets, other than natural capital (Shackleton, Kirby, and Gambiza, 2011). Water hyacinth for example has been associated with the death of livestock, humans and the destruction of physical capital such as boat engines and pumps (van Wyk and van Wilgen, 2002). Water Hyacinth also provides habitats for dangerous animals and insects such as crocodiles and malaria carrying mosquitoes (Mailu, 2001). In certain cases, water hyacinth can reduce recreational activities that contribute to the economic capital of a society (van Wyk and van Wilgen, 2002; Mailu 2001). Masocha (2010) showed that thorny *cactae* species have been associated with livestock and human injuries that may have at times required medical attention.

Despite the stated concerns, the environmental negatives of invasive plants may have positive effects that allow for livelihood diversification strategies directly linked to IAPs. This was observed to be the case in South Africa where the Working for Water programme employed mostly the rural poor to clear IAPs (van Wilgen and De Lange, 2011). Analogously, *Prosopis* pod based industries in the Northern Cape province of South Africa provide employment and a source of income for the rural poor (Dube, 2010). Rai *et al.*, (2009), Hall (2009) and Kannan, Gladwin and Uma (2008), amongst others, have documented other impacts of the livelihood diversification and transformation potential.

3.4.8. Sustainable Rural livelihoods Poverty Alleviation and Sustainable Development

Previous sections showed that the conventional neoclassical economist's definition of poverty is very narrow ignoring vital components such as gender, institutional arrangements, social exclusion and vulnerability to name but a few. Thus, the concept of sustainable livelihoods was an attempt to go beyond these conventional definitions and approaches to poverty alleviation that used indicators, other than levels of income (Carney, 1998; Krantz, 2001; Scoones 2009).

According to Krantz (2001), three factors underpinned the application of the SRL approach in relation to poverty alleviation. First, while economic growth may be essential for poverty reduction, the automatic trickledown effect advocated by scholars such as Arthur Lewis may not always be automatic given that the eradication or alleviation of poverty is dependent on the capabilities of the poor to take advantage of expanding economic opportunities. Second, in the eyes of the poor, poverty is not only a case of low income but also includes other dimensions such as bad health, illiteracy, lack of social services, vulnerability and feelings of socially powerlessness. Third, the poor themselves know their situation best and must therefore take part in the design of policies and projects intended for their betterment.

Scoones (1998) claimed that the promotion of sustainable livelihoods promoted poverty alleviation. Glavovic and Boonzaier (2007: 2) agreed with Scoones (1998) arguing that "a sustainable and vibrant livelihood system enables people to pursue robust livelihood strategies that provide, in effect, 'layers of resilience' to overcome 'waves of adversity'; enabling people to cope with and adapt to change, and even transform adversity into opportunity". Therefore, in a sustainable and vibrant livelihood system there is less poverty and less exploitation of natural capital as shown in the livelihoods transformation spectrum (Glavovic and Boonzaier, 2007; EkoNomos, 2012).

Thus, the promotion of stable resilient asset bases, diversification of livelihoods and participatory management options would contribute to the sustainable development agenda as well (Singh and Kalala, 1995; Helmore and Singh, 2001; Glavovic and Boonzaier, 2007).

3.5. NEW INSTITUTIONAL ECONOMICS (NIE)

Throughout this chapter, institutions and institutional frameworks have been noted to be critical catalysts for various functions and systems. This section will discuss institutions under

the umbrella of new institutional economics (NIE) with the aim to relate influence of institutional frameworks to SRL and ESE.

Neoclassical, market capitalism has a trace of Darwinian survival of the fittest imbedded in it and it emphasises the fact that markets brought supply and demand to an equilibrium simultaneously using the price mechanism (Smith, 1909; Johnson, Price and van Vugt, 2013). Conversely, the theory did not effectively analyse the access to resources to partake in the market (Coase, 1964; 1991). As alluded to in the previous sections, numerous physical, social and at times religious laws and constraints govern access to resources (North, 1990; Williamson, 2000). These constraints increasingly made the neoclassical market approach unrealistic and inapplicable to real world problems. It increasingly became clear that the invisible hand alone could not hold society together and guarantee the survival and growth of humanity (Coase, 1991; Williamson 2000). According to Ankarloo (2006), in an attempt to make neoclassical economic theory more realistic, social, and historical in its approach, the discipline of institutional economics was born.

Post World War two economists focused their attention on developing and expanding the neoclassical approach through the application of econometric techniques and the testing hypotheses postulated in this paradigm (Ritcher, 1996). So much was the focus on empirical techniques that other schools that sought to confront institutional arrangements in this period were ignored or linked to Marxism (Ritcher, 1996; Williamson, 2000). However, even before and after World War two, scholars such as Veblen, Commons and Schmoller had begun to realise that state activities were unavoidable, freedom of trade did not guarantee an increase in societal welfare and trust was key to societal progress. According to Joksow, (2004), these scholars (Veblen, Commons and Schmoller) were considered the faces of what has been termed the Old Institutionalism. In this regard, Joksow (2004) noted that much of what passed as institutional economics in that era lacked rigorous, systematic theoretical foundations, supporting empirical analysis and was often in line with political agendas.

The shortcomings of Old Institutionalism were debated through the works of notable scholars like Coase, North and Williamson who founded what has become known as New Institutional Economics (NIE). The New Institutional Economics was an attempt to incorporate a theory of institutions into mainstream economics. Notable works in the discipline include papers by Ronald Coase (The Nature of the Firm, 1937; The Problem of Social Cost, 1960) who

realised that the transaction was not costless as advocated by neoclassical economics, but determined by some form of administrative tools that resulted in the presence of the firm. According to North (1992:1), “the New Institutional Economics, unlike Old Institutionalism, builds on, modifies, and extends neoclassical theory to permit it to come to grips and deal with an entire range of issues heretofore beyond its ken”. New Institutional Economics argued that a capitalist market economy cannot be left to itself, but is a social system in need of design and support through laws, state governance, security and fiscal regulations, amongst other things (Coase, 1991, North, 1991, Williamson 2000; Ankarloo, 2006).

NIE recognised the complex nature of the individual and subsequently society as a whole (Coase, 1991). This nature has been attributed to the societal belief systems which North (1995) referred to as mental scaffolding that is not easily broken down and, in most cases, determined the perceived reality of the individual. This aspect (mental scaffolding) leads to multiple equilibria rather than a general equilibrium (North, 1995). NIE also rejected the unrealistic assumption of perfect knowledge in favour of incomplete information and hence giving the concept of full rationality in favour of bounded rationality, which was associated with uncertainty, information problems and transaction costs (Coase, 1991; North, 2000).

Accordingly, due to the inherent costs in gathering information, the economic agents cannot gather all the necessary information to make efficient choices (Williamson, 1985). The lack of full information immediately meant the lack of trust between the two (demand and supply side) parties in a market. Therefore, to minimise the problems of uncertainty economic agents devise rules of thought and action on which to base their decisions (North, 1995). These rules are what NIE termed the institutional environment and frameworks.

North (1992) defined Institutions as the rules of the game of a society and more formally the humanly devised constraints that structure human interaction. He argued that institutions were composed of formal rules (statute law, common law, regulations), informal constraints (conventions, norms of behaviour, and self-imposed codes of conduct), and the enforcement characteristics of both (North, 1992).

Scott (1989) went further to distinguish institutions from other constraints on human behaviour arguing that institutions were those that were dynamic, socially organised and supported. Bromley (1989) also argued that when analysing institutions it is necessary to separate them from conventions (regularities in human behaviour which everyone prefers to

conform to, e.g. stopping at a red traffic light) and entitlements (socially recognised and sanctioned expectations). Regarding conventions, Bromley (1989) considered the reasons that result in the preference to conform are unimportant. However, in contrast to Bromley (1989)'s view, scholars have indicated that the trust in society is a major determinant of the respect of conventions and, sequentially, socio-economic development (Putnam, 1995; Biti, 2013).

As interest and scholarly debate around NIE grew, various distinct branches began to emerge. In the sections that follow, the different branches of NIE will be briefly discussed followed by an in depth analysis of the formal and informal institutions that govern common pool resources. An analysis of the implications of institutions to IAPs, Poverty Alleviation (PA) and Sustainable Development (SD) is also given.

3.5.1. Branches of NIE

Numerous branches rooted in NIE have developed over the years. Olson and Kähkönen, (2000) proposed eight distinct branches that were considered under the banner of NIE these were theory of collective action, new economic history, public choice and political economy, law and economics, transaction cost economics, economics of information, the legal environment and property rights, and social capital economics. However, in relation to the subject matter of this study, the major branches of NIE briefly discussed in this section are social capital and property rights.

Social capital

Putnam (1995) defined social capital as those features of common life networks, norms and trust that enable individuals to act and work together for the common good (Putnam, 1995). Similarly, Hanifan (1916) considered the facets of social capital as those assets that count for most in the daily lives of people, namely, goodwill, fellowship, sympathy, and social intercourse among the individuals and families who make up a social unit. Given the multiple and technical definitions that exist in the field of social capital, for the purposes of this study, social capital is summarised as those event assets (tangible and intangible) that allow individuals to relate to each other with a certain degree of trust (Hanifan, 1916; Hirschman, 1958; Adelman and Morris, 1967; Bourdieu, 1986; Coleman, 1988; Putnam, 1993, 1995; Kadushin, 2012; Primmer *et al.*, 2013).

The realisation that our relationship with one another was essential to overall socio-economic well-being and trust is at the heart of the social capital building blocks theory (Hirschman, 1958). This argument was brought to light by numerous scholars, politicians and artists (Bourdieu, 1986; Coleman, 1988; Hanifan, 1916, Hirschman, 1958, Adelman and Morris, 1967, Biti, 2013; Saarikoski, Raitio, Barry, 2013; Borg, Toikka and Primmer, 2015).

Putnam (1995) argued that the engagement of locals in community affairs was critical for overall socio-economic success. According to Eade (2003), major global institutions, such as the World Bank, have endorsed the concept of social capital as an important development tool essential for alleviating poverty and achieving societal development.

The Organisation of Economic Cooperation and Development (OECD) (2001) categorised social capital into bonds (links based on a sense of common identity), bridges (links that stretch beyond a common sense of identity, e.g. associates) and linkages (links further down the social ladder). Work by Field (2003) (homogeneous diverse social divisions) and Granovetter (1983) (strong ties and weak ties) highlight the concepts of bonding and bridging. Woolcock and Sweetser (2002) considered the same categories. However, they linked the concept of bridging to connections with people in power (politically or financially) (Woolcock and Sweetser, 2002).

Dahal and Adhikari (2008) asserted that the role of social capital in the governance of collective resources such as forest resources had become a topic of widespread interest, especially in development policy debates. Due to aspects such as culture and tradition, that define most traditional structures, the knowledge of customary institutions and interactions is crucial in the management of collective resources (Uphoff, 2000; Dahal and Adhikari, 2008). Therefore, this study incorporates certain aspects of social capital (the role of informal institutions) and discusses them in the sections that follow.

Property rights

Property rights provide the basic economic incentive system that shapes resource allocation (Demsetz, 1964; Becker, 1977; Besley, 1995). When a bundle of goods and services are exchanged in the market, a set of rights to that bundle also exchange in the process (Demsetz, 1967). Alchian and Demsetz (1973) concurred, noting that what are transacted and owned are not the physical structures (bare land, bricks and mortar, gadgets and academic theories)

but the associated rights. Adding to this realisation, Furubotn and Richter (2000) stated that in the case of a sale, what happened effectively was a transfer of a 'bundle' of property rights from one person to another. Furubotn and Pejovich (1972) further noted that the value of any exchange depends on the bundle of property rights implied in the transaction. Thus, it is not the resource itself that is owned but the bundle or a portion of rights (often circumscribed by the prohibition of certain actions) to use it (Musole, 2009).

The concept of property rights is defined from a legal and economic perspective. Under continental civil law (Roman based legal systems codified into a referable system which serves as the primary source of law), property rights relate to physical objects or tangibles only, while the Anglo-American common law relates property rights to both tangibles and intangibles (including patents, copyrights and contract rights) (Musole, 2009; Alchian 1965). Furubotn and Richter (2000) alleged that property rights could be absolute (practiced universally towards all parties) or relative (applicable only toward certain parties). In their definition (especially from an economic perspective), concepts regarding the difference between a right and mere use have been extensively debated (Demsetz, 1967, Heyne, 2000; Furubotn and Richter 2000; Cole and Grossman, 2000).

With reference to the concept of 'right and mere use', Cole and Grossman (2000) claimed that a resource could be controlled without possessing a right. They noted that in the case of a right, society through formal law or informal social norms would enforce one's control or use without penalty for use (Cole and Grossman, 2000). However, Cole and Grossman (2000) also maintained that one could do many things without penalty but that did not necessarily give them the rights (e.g. firms polluting unabated). Therefore, mere continued use does not mean one has the rights (Cole and Grossman, 2000).

Zhu (2002) who differentiated legal (rights defined by the state and recognised by law) from economic rights (the ability of individuals to exercise their rights over an asset) gave another side to the definition of property rights. These multiple definitions show that it is essential for economists to distinguish rights from other interests (Zhu and Simarmata, 2013; Musole, 2009).

In NIE, North (1990) defined property rights as rights individuals appropriated from their own labour and the goods and services they possessed. This definition, though economic in nature, left the concept of possessions unexplained as possession in some way relates to the

fundamentals of ownership and property rights. Barzel (1989) avoided explaining the meaning of possessions using the word possessions opting instead to state what an individual who controlled property rights could do with possessions. These were the rights or the power, to consume, to obtain income from, and alienate these assets (Barzel, 1989). Therefore, from an economic perspective, Musole (2009) stated the ability of the individual to exercise the rights to use, obtain an income, sell, or transfer an asset is what mattered.

According to Roman law, ownership consists of the right to use an asset (*usus*), the right to capture benefits from an asset (*usus fructus*), the right to change its form and substance (*abusus*), and the right to transfer all or some of the rights specified above to others at a mutually agreed price (Pejovich, 1990). This view seems to capture the economic and legal definitions of modern property rights. In addition to their complex definition, Grafton, Squires and Fox (2000) argued that it was important that rights be divisible, exclusive, transferable, durable and flexible. Libecap (1989) further added that property rights institutions are determined through the political process, either involving negotiations among immediate group members or lobbying activities.

Challen (2000) outlined five major arguments for the emergence of property rights over objects valuable to humanity. These arguments were, first, the first occupancy argument that gave an individual the right to an object simply because they possessed it first. This argument, however, has been criticised by the likes of Bromley (1989) for the fact that it gave an unfair advantage to those born earlier, amongst other things. Second is the labour argument, which advocates for ownership of what one has produced through individual ingenuity, strength and initiative. This argument has also fallen prey to criticism in the case of ownership of children and ownership of goods produced under contractual employment by another party (Becker, 1977; Bromley, 1989). Third is the utility argument that advocates for the giving of property rights to one who would most increase overall social utility. Fourth, the political liberty argument stating that the ability to control and accumulate creates incentives and allows humans to express themselves fully. This argument has been strongly criticised in the recent past as it has been linked to primitive accumulation and insatiable egoist appetites that have seen the environment suffer and poverty increase as the rich got richer and the poor got poorer (Tolle, 2005). Fifth is the argument that property rights help develop good morals and lead to better management of the object.

The amount of control (absolute or partial) determines the strength of property right that the owner wields over the asset (Alchian and Demsetz, 1973). The ownership of property rights may be characterised by singular or multiple interests, thus, in the same property, more than one party can claim some ownership interest at any given time (Alchian and Demsetz, 1973; Enever and Isaac, 2002; Fraser, 1993; Mullan, Grosjean and Kontoleon, 2011; Musole, 2009).

In response to this quandary over rights, ownership scholars have defined the major property rights ownership structures that exist in most societies using four categories: open access; communal property; private property; and state property (Libecap, 1986; Brandao and Feder, 1995). Musole, (2009) explained the four categories showing that, in the case of state ownership, the state (or extensions of the state, such as local authorities and municipalities) possesses the property rights, which they may transfer temporarily to private users or to communities.

Private property ownership is characterised by exclusive rights to use resources, receipt of income generated from it and free transferability of the whole or part of the ownership rights. In an open access property rights regime, rights are not specifically assigned to any individual or group and anyone is free to use the resource at will. In the case of communal property, specific communities are assigned rights, which can exclude outsiders from using the resource and regulate use by members (Musole, 2009). The major focus of this study is centred on the last two categories particularly the effectiveness of the institutions that have been put in place to govern them. The section that follows discusses these institutions.

3.5.2. Governance of common property resources

The governance of common property resources has come under the global spotlight given that, in most cases, common pool resources relate to the natural environment and the sustainability of the natural environment has become a major global topic (Hardin, 1968; WCED, 1987; Wade, 1987, 1988; Ostrom, 1990, 2005; Baland and Platteau 1996; Agrawal, 2005; Woo and Webster, 2014).

Common property resources are characterised by property rights that are either open access or distinctly common property rights. In the case of state property, without proper enforcement state resources may end up resembling open access resources where it is a 'free for all' (Ostrom, 2008; Musole, 2009). In his seminal paper, Hardin (1968) claimed that, in the

case of non-private common property (absence of private property rights), the community would continue to utilise the resource aiming at individual utility maximisation without necessary investments leading to the eventual degradation of the resource. This he termed the 'tragedy of the commons' (Hardin, 1968).

Hardin (1968) noted that there was no incentive to invest in the conservation of common property, as other members were likely to benefit without sharing the investment costs thereby free riding. Hardin's (1968) 'tragedy of the commons' perspective has been criticised for failing to differentiate common property from open access given that common property systems can result in effective resource management as long as there are strong institutions (Ostrom, 1990, 2000). The 'tragedy of the commons' however may be applicable to open access resources given the characteristics of open access resources, which are summarised by Ostrom (2008) and Quinn *et al.*, (2007) as non-excludability and rivalry in consumption.

Literature cites numerous examples where the tragedy of the commons was unfolding (Berkes, 1985; Jodha, 1986, 1987; Cordell, 1989). The solution, according to Hardin (1968), was the introduction of private property rights, these would create an incentive to maintain common property more efficiently and avoid the tragedy.

A number of scholars have criticised the idea that private property rights are a panacea to the tragedy of the commons for a number of reasons (Ostrom, 1990, 2000, 2008; Challen, 2000; Gautam and Shivakoti, 2005; Quinn *et al.*, 2007). Challen (2000) pointed out that the definition of common property is very ambiguous given that multiple rights regimes may be present for the same object. One example of such a scenario would be a case where the state owned the private property rights to land then gave demarcated parcels of land to different communities as common property (Challen, 2000).

Related to the ambiguity in definition, Ostrom (1990) used a framework of property rights hierarchies showing the subordinate and superordinate nested structure of property rights regimes. The hierarchical nature further amplified the ambiguity in definition, as it was clear that the state had the highest rights, which it would parcel down to the lowest point as private individual rights based on the inherent transactional costs, as explained in Challen (2000). Interestingly, given the absence of interplanetary and intergalactic relations, Ostrom (1990)'s hierarchy argument makes the air we breathe and the sunshine perhaps the only common access resources.

Ostrom (2008) noted that the assumptions that Hardin had used such as zero communication within the community members were highly unrealistic and it was only with these assumptions upheld that the conclusions were justifiable. In the real world, community members may contribute to each other's social capital and may at times work for the common good (Hanifan, 1916; Putnam, 1995; Ostrom, 2008).

Therefore, adequate management of common pool resources may be achieved by the locals themselves with proper institutions and aid (Steins, 2001; Gautam and Shivakoti, 2005; Quinn *et al.*, 2007). Ostrom (1990) summarised eight design principles (shown in the Table 3.5) that are likely to see the success of common property management schemes.

Table 3.5: Design principles for common property management

Design principles derived from studies of long-enduring institutions for governing sustainable resources
<p>1. Clearly defined boundaries The boundaries of the resource system (e.g., pasture, irrigation system, or fishery) and the individuals or households with rights to harvest resource units are clearly defined.</p> <p>2. Proportional equivalence between benefits and costs Rules specifying the amount of resource products that a user is allocated are related to local conditions and to rules requiring labour, materials, and/or money inputs.</p> <p>3. Collective-choice arrangements Many of the individuals affected by harvesting and protection rules are included in the group who can modify these rules.</p> <p>4. Monitoring Monitors, who actively audit biophysical conditions and user behaviour, are at least partially accountable to the users and/or are the users themselves.</p> <p>5. Graduated sanctions Users who violate rules-in-use are likely to receive graduated sanctions (depending on the seriousness and context of the offense) from other users, from officials accountable to these users, or from both.</p> <p>6. Conflict-resolution mechanisms Users and their officials have rapid access to low-cost, local arenas to resolve conflict among users or between users and officials.</p> <p>7. Minimal recognition of rights to organize The rights of users to devise their own institutions are not challenged by external governmental authorities, and users have long-term tenure rights to the resource.</p> <p>For resources that are parts of larger systems:</p> <p>8. Nested enterprises Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.</p>

Source: Ostrom (1990).

Despite the perceived advantages of community management, questions have arisen its durability, continuation and resilience to change (Lam, 1998; Agrawal, 2001). These questions arise from the notion that outward and inward migrations threaten the system and the loss or presence on new members can disrupt the norms (Katz, 2000; Curran and Argardy, 2002).

3.5.3. Institutions and IAP

The management of ecosystems and the environment at large as shown in the previous sections is an institutional creation of significant importance. Shine, Williams and Gündling (2000) have acknowledged the need for internationally coordinated measures in the management of alien species in different socio-economic and environmental spheres of the world for over half a century. These coordinated measures are derived as institutional frameworks designed to control the introduction and spread of IAPs from a superordinate global level to lower continental, regional and national frameworks (CBD, 2010).

Global frameworks exist to guide the lower levels to allow for a unified effort in the conservation of nature. Shine, Williams and Gündling (2000) traced the development of global frameworks arguing that the earliest international agreements focused on the establishment of exclusion systems aimed at preventing the entry of IAPs to protect human and animal health. Modern frameworks focus not only on health issues but also on the sustainability of natural resources and biodiversity (Shine, Williams and Gündling, 2000). The Convention on Biological Diversity (CBD), currently ratified by over 170 States and the International Plant Protection Convention (IPPC) are good examples of global institutions that address alien species introduction, control and eradication across all biological taxa and ecosystems.

In southern Africa at national level a number countries, that include Zimbabwe and South Africa, have drawn up legislation that prohibits the cultivation of certain IAPs and require the compulsory removal of these IAPs from the land. In South Africa, the legal institutions, such as the Conservation of Agricultural Resources Act of 1983, have been supported by the WfW programme. The Environmental Management Agency in Zimbabwe has taken the lead in the implementation of the institutional frameworks (Environmental Management Act of Zimbabwe (2002); EMA, 2012).

3.5.4. Institutions, Sustainable Development and Poverty Alleviation

The arguments on sustainable rural livelihoods and ecosystem services economics indicated that institutional frameworks and the institutional environment were important in achieving sustainable development and alleviating poverty. It is through institutions that individuals may exercise their freedoms and have the ability to change those rules that influence their access to capital and subsequently sustainable livelihoods (Scoones, 1998, Carney, 1999). It is also with institutions such as property rights that scarce resources and the irreplaceable environment may be optimally managed and distributed (Demertz, 1977; Challen, 2005; Musole, 2009). Nonetheless, the effectiveness of institutions in facilitating and supporting the broad goals of sustainable development and poverty alleviation, according to Ostrom (1990), is dependent on their design.

3.6. CHAPTER SUMMARY

This chapter presented the theoretical framework of the study. SRL and ESE have strong links with PA and SD as shown by their universal inter-linkages. Furthermore, both SRL and ESE acknowledge the value of institutions if the goals of SD and PA are to be realised. This study centres on the impact an invasive plant has on the livelihood of a rural community dependent on the local ecosystem and the environmental management institutions. The framework discussed in this chapter is adequate to answer the major research questions posed in relation to academic theory in a post positivist paradigm. The next chapter relates the theoretical framework and IAPs to key characteristics of the study area and Zimbabwe at large.

CHAPTER 4: INVASIVE ALIEN PLANTS AND RURAL LIVELIHOODS: THE ZIMBABWEAN CONTEXT

The study focuses on Zimbabwe, particularly rural Gwanda District in the Matabeleland south province. The roots of poverty, the measures to alleviate it and the institutions that suppress poverty have been extensively researched in Zimbabwe and published by amongst others Alwang, Ersado and Taruvinga (2001), Ikubolajeh and Moseley (2002), Kozanayi (2002), Balint and Mashinya (2006) and Nyagumbo and Rurinda (2012). However, the relationship between the complexities of poverty, institutional arrangements and IAPs still represents a lacuna that calls for further research and analysis.

This chapter gives an account of Zimbabwean IAP management efforts in relation to the major livelihood strategies and the environmental management institutions of the country, with particular focus on rural Gwanda District. The chapter begins by giving an overview of Zimbabwe, citing its geographical location, the national environmental management structures, prominent livelihood strategies, dependence on ecosystem services and poverty levels. The chapter then focuses on Gwanda District stressing its demographic, socio-economic and geographical characteristics. Finally, it sheds light on the case study population used in the study by way of giving the location and explaining the characteristics of the villages in question.

4.1. OVERVIEW OF ZIMBABWE

Zimbabwe is a land locked African country located in the southern part of the continent between the Limpopo and the Zambezi rivers at latitudes 15° and 23° S and longitudes 25° and 34° E. Zimbabwe borders South Africa to the South, Botswana to the Southwest, Zambia to the Northwest and Mozambique to the East. The surface area of the country is 390 757km² while the population was estimated at slightly below 13 million in 2012 (ZIMSTATS, 2012). Zimbabwe has a population density of approximately 26 individuals / km² (ZIMSTATS, 2012). Water covers 1% of the surface area of the country and Savannah vegetation is most common countrywide albeit a moist mountainous eastern highland region supports evergreen

vegetation (EMA, 2012; ZIMSTATS, 2012). Vincent and Thomas (1960) divided the country into 5 natural agro-ecological regions based mostly on rainfall patterns as shown in the Figure 4.1 and Table 4.1.

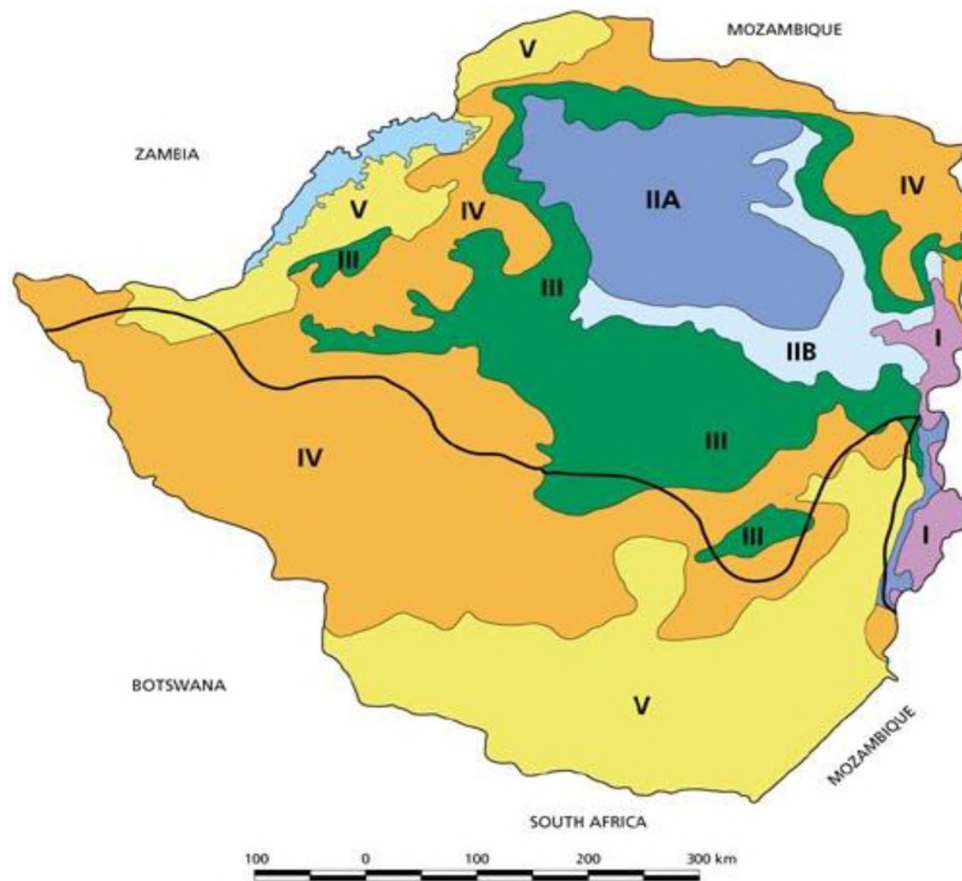


Figure 4.1: Map showing the agro ecological regions of Zimbabwe

Source Vincent and Thomas (1960).

Table 4.1: The Agro-ecological regions of Zimbabwe

Natural region	Area km ²	Rainfall mm/year	Region characteristics
I	7000	>1000	Highest rainfall in the country specialized and diversified farming comprising plantation forestry, fruit and intensive livestock production.
II	58600	750-1000	Lower rainfall than region I. Region is suitable for intensive farming based on crops or livestock production.
III	72900	650-800	Moderate rainfall with severe mid season dry spells. The farming systems are therefore based on both livestock and cash crops.
IV	147800	450-650	Low and periodic rainfall. Crop production is limited to drought resistant crops.
V	104400	<450	Very low and erratic rainfall not reliable production of even drought resistant fodder and grain crops. Farming is based on grazing natural pasture (cattle or game ranching).

Source: Vincent and Thomas (1960).

4.1.1. Environmental management in Zimbabwe

In order to understand Zimbabwean environmental management frameworks, it is important to trace them from the pre-colonial age, through the colonial era to the period after the formation of the independent state of Zimbabwe. As such, this section briefly discusses the major environmental management frameworks that characterised the three above-mentioned eras.

The pre-colonial age

Mapenza (2007) noted with disapproval that environmental management knowledge from the pre-colonial age (indigenous knowledge) had been mostly ignored in the formulation of modern policy in favour of scientific knowledge from academic sources. This loss of indigenous knowledge, according to Mapenza (2007), led to the alienation of the rural communities from the management of their own resources and the deliberate weakening of the traditional environmental management institutions.

In pre-colonial Zimbabwe, through traditional leaders and spirit mediums, natural resources were managed using custom, taboos and clan name systems (Madondo, 2000). Kwashirai (2007) concurred arguing that the ecosystems were ritually managed and the Ecosystem Services (ES) were considered a part of the spiritual realm. Land was communally owned through the spiritual powers (tribal leader, spirit mediums, etc.,) but land rights were vested in the chief/tribal leader (Kwashirai, 2007). The traditional leader had to give consent for the harvesting of natural resources and provided a sanction mechanism (superstition, penalties and custom) for violators of custom and tradition (Wilson, 1989; Mapenza, 2007).

The colonial era

The British crown claimed the land between the Zambezi and the Limpopo through the British South Africa Company (BSAC) and named Rhodesia after Cecil John Rhodes. Speculation of vast gold reserves that however, proved to be limited and difficult to extract triggered occupation (Lebert, 2003). This disappointment, according to Lebert (2003), led the BSAC to pursue agriculture in a bid to make the venture profitable. Thus, native populations had to make way for European settlers with farming interests and in most cases ending up labouring in European owned farms (Palmer, 1990; Moyo, 2006; Nnoma, 2008).

A number of laws that effectively dictated environmental governance activities were enacted in this period. To begin with, the 1894 Land Commission decrees, along with the later 1918 Privy Council decision, the Morris-Carter Commission resolutions of 1925 and the 1930 Land Apportionment Act were enacted (Nnoma, 2008). These officially divided the country into two separate societies along racial lines, European areas and Native Reserves (Nziramanga and Lee, 2002, Lebert, 2003).

During the early years of colonisation, environmental degradation was rampant in most of Rhodesia and increasingly became a major concern for the colonial government (Mapenza, 2007). This realisation led to the Simms Commission of Enquiry of 1910 which recommended, amongst other things, the establishment of exotic plantations such as pines in the Eastern Highlands and the appointment of a Forest officer ultimately resulting in the Department of Forestry within the Ministry of Agriculture in 1925 and the formation of the Forestry Commission in 1954 (Mapenza, 2007).

Furthermore, fees were levied on the commercial extraction of timber from mining areas (Moyo, 2006). This turned commercial attention towards the poorly managed African reserves further depleting them and compromising their fragile ecosystem (McGregor, 1995). In response to the depletion of African reserves, the Rhodesian government introduced the Native Reserves Forest Produce Act of 1928. Provisions of the Native Reserves Forest Produce Act were further consolidated in the Forest and Herbage Preservation Act of 1936, the Natural Resources Act of 1941, the Forest Act of 1948, the Native Land Husbandry Act of 1952 and the Parks and Wildlife Act of 1975. The Parks and Wildlife Act provided for the establishment of *inter alia* the Natural Resources Board, a national conservation watchdog and conservation of biological diversity (Madondo, 2000, Mapenza, 2007).

In 1965, the settler government unilaterally declared independence from Britain resulting in international isolation. Mutizwa-Mangiza (1985) noted that during this period the Tribal Trust Lands Act of 1967 and the 1969 Land Tenure Act were enacted together with the community development approach for the African reserves. This was an attempt to win over the traditional African chief through a restoration of their authority to allocate land and govern natural resources in the newly formed tribal trust lands (Mutizwa-Mangiza, 1985). Despite these institutional frameworks, native reserves remained financially crippled and their management was vested in the state through a top down approach (Madondo, 2000; Mlambo, 2005). The Brooks World Poverty Institute (2008) concurred arguing that it was a mistake (on the part of the Rhodesian government) to criminalise rural communities in communal lands for consumptive utilisation of certain natural goods in an attempt to protect the environment from people rather than promoting sustainable use.

Post-colonial era

In April 1980, the newly independent state of Zimbabwe was formed. The new government inherited a dualistic state characterised by segregation even within the environmental management realm. Various inherited laws were amended resulting in their de-racialisation and theoretical democratisation (Murombedzi, 1994). In this light, Mapedza (2007) observed that the Communal Lands Act and the Rural District Councils Act of 1988 eliminated the colonial dualism in local government structures effectively combining them into a single system of local government that managed natural resources within its boundaries. To promote further grassroots participation, the structures of the Rural District

Development Committee² (RDDC) incorporated Village Development Committees³(VIDCOs) and Ward Development Committees⁴ (WADCOs).

The village and ward development committees existed side by side with the traditional institutions of the chief, headman and kraal head often causing tension and duplication of roles (Madondo, 2000). The Communal Lands Act of 1982, meanwhile, had divested the chiefs of the land allocation powers vested in them in the 1960s (Moyo, 1996). However, after research and investigations by the Land Tenure Commission (LTC) in the early 1990s, villages were formally recognised as the smallest unit of social organisation and the Traditional Leaders Act of 1998 was enacted (Madondo, 2000). Under this law, Chiefs were appointed by the president and tasked with the promotion of cultural values, collection of Rural District Council (RDC) levies, taxes and natural resources management (Sithole, 1997). This framework of governance came under criticism as it centralised power in the state and resulted in collection of fines imposed in a top down approach, amongst other things (Vermeulen, 1994; Madondo, 2000; Nemarundwe, 2003; Mapedza, 2007).

The Lancaster House constitution of Zimbabwe, which had been in use since independence to 2013, had no specific clause that provided for the protection of the environment. However, the Environment Management Act of 2002 gave special attention to the environment covering the following broad aims:

- i. Providing for the sustainable management of natural resources and protection of the environment;
- ii. The prevention of pollution and environmental degradation;
- iii. The preparation of a National Environmental Plan and other plans for the management and protection of the environment; and

²The Rural District Development Committee (RDDC) is chaired by the District Administrator who is a government employee representing the Minister of Local Government and National Housing. Members of the RDDC include district heads of sectoral ministries, chairpersons of the Rural District Councillors various subcommittees, and district heads of national security (Thomas, 1991; Makumbe, 1998).

³The VIDCO normally consists of 100 households, with slight variations from area to area, and it is presided over by an elected chairperson.

⁴The WADCO is a body over-arching several VIDCOs, usually six per ward. The WADCO draws its membership from leaders of its constituent VIDCOs and is presided over by an elected councillor representing the ward at the district level in the (RDDC).

iv. The establishment of an Environmental Management Agency and an Environment Fund (EMA, 2002).

The Act sought to merge the Natural Resources Act [Chapter 20:13], the Atmospheric Pollution Prevention Act [Chapter 20:03], the Hazardous Substances and Articles Act [Chapter 15:05] and the Noxious Weeds Act [Chapter 19:07] (EMA, 2002).

The ministry with overall responsibility for the environment in Zimbabwe is the Ministry of Environment, Water and Climate. Nonetheless, three related agencies in the Ministry: the National Environmental Council, the Environmental Management Agency and the Environmental Management Board regulate environmental management (SADC Environmental Legislation Handbook, 2012).

Through respective institutions, Zimbabwe adopted the National Environmental Policy and Strategy in 2005. This policy aims to:

“Avoid irreversible environmental damage, maintain essential environmental processes, and preserve the broad spectrum of biological diversity so as to sustain the long-term ability of natural resources to meet the basic needs of people, enhance food security, reduce poverty, and improve the standard of living of Zimbabweans through long-term economic growth and the creation of employment”(National Environmental Policy and Strategies, 2009:4).

4.2. BIODIVERSITY IN ZIMBABWE

According to the Ministry of Environment and Natural Resources Management (2010) (now the Ministry of Environment, Water and Climate Change), Zimbabwe is endowed with a rich diversity of life forms. At species level, the country supports an estimated 4,440 vascular plant species, 214 of which are endemic, 672 bird species, 450 of which breed in Zimbabwe, though none are strictly endemic, 196 mammal species, 156 reptile species, 57 species of amphibians, and 132 fish species. The Ministry of Environment and Natural Resources Management (2010) also estimated that Zimbabwe had about 6000 indigenous plant species representing approximately 1 500 genera and 200 families. Of these species about 230 were considered endemic, 500 were listed as under threat of extinction and 1500 were exotic or introduced plant species. Furthermore, the report also disclosed worrying statistics that pointed to an

overall decline in the levels of biodiversity in the country since 1998 (Ministry of Environment and Natural Resources Management, 2010).

Zimbabwe is a signatory to the United Nations Convention on Biological Diversity (CBD) and, accordingly, has obligations to implement the provisions of that convention (EMA, 2012). The convention requires that all contracting partners develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity (CBD, 2010). Accordingly, in response to the CBD requirements, the Government of Zimbabwe, in close consultation with key stakeholders, developed the Zimbabwe Biodiversity Strategy and Action Plan in 1998 (Ministry of Environment and Natural Resources Management, 2010).

The Southern African Development Community (SADC) Environmental Legislation Handbook (2012) noted that in addition to the Zimbabwe Biodiversity Strategy and Action Plan, a number of sectoral policies were effectively designed to mainstream biodiversity into national development strategies, plans and programmes were formulated. These include the Wildlife Based Land Reform Policy, Forest Based Land Reform Policy, Environment Education Policy and the National Energy Policy, amongst others (SADC Environmental Legislation Handbook, 2012; Mapira, 2012).

4.3. ECOSYSTEM SERVICES IN RURAL ZIMBABWE

To address the challenge of incomplete information, Zimbabwe adopted the Ecosystem Land Classification Approach that is key in implementing the Convention on Biological Diversity framework (CBD) (Ministry of Environment and Natural Resources Management, 2010). Chenje, Sola, and Paleczny (1998) argued that studying component parts of Zimbabwe's ecosystems contributed to understanding the nation's biophysical resources and their diversity. However, this sectoral, piece-by-piece approach also led to incomplete and misleading views (Chenje, Sola, and Paleczny, 1998). In using this approach, the natural ecological farming regions of Zimbabwe, promulgated by Vincent and Thomas (1960) were further categorised according to the ecosystem they belonged to (Shown in Table 4.2).

Table 4.2: The Zimbabwean Ecosystem Land Classification

Ecosystem category	Region	Dominant vegetation type
Kalahari	IV and V	False Mopane (<i>Colophospermum mopane</i>) <i>Brachystegia spiciformis</i> (Msasa), <i>Pterocarpus angolensis</i> (Mukwa) and Zambezi Teak (<i>Baikiea</i>)
Central	II and III	Sycamore Fig, Mubvuguta (<i>Croton megalobotrys</i>) and Apple-ring Acacia (<i>Acacia albida</i>)
Zambezi	IV	<i>Colophospermum mopane</i> Mopane, <i>Kigelia Africana</i> (Sausage tree), <i>Lonchocarpus capassa</i> (Rain tree)
Save/Limpopo	IV and V	<i>Tree Savanna, Acacia and Baobab</i>
Eastern highlands	I	<i>Themeda-exothea loudetia</i> grasslands and <i>btachystegia spiciformis, julbernadia globiflora</i> Woodlands

Source: Chenje, Sola, and Paleczny (1998).

The harvesting of ecosystem goods and services is widespread in Zimbabwe as in most of rural Africa (Nemarundwe, 2003; Frost and Bond, 2008; Egoh *et al.*, 2012). However, the concept of valuing and benefitting from ES has been specially witnessed in Zimbabwe through the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), which was started in the late 1980s (Khumalo, 2003). The Brooks World Poverty Institute (2008) argued that the programme was a result of Zimbabwe's take on sustainable development presented to the UN Conference on Environment and Development (UNCED) in 1992. This programme is a typical example of an initiative based on payment for ecosystem services as a method of promoting sustainable ES use and alleviating poverty (Frost and Bond, 2008).

CAMPFIRE involves the sale of the rights to access wildlife, woodlands, water and natural rangeland by rural authorities to entrepreneurs who in turn market safaris to hunters and eco-tourists (Martin, 1986; Murphree, 1997). The Rural District Councils (RDC) in turn would pass on to producer communities through respective wards a fixed percentage (50%) of the revenues earned from ecological tourism (Khumalo, 2003; Frost and Bond, 2008).

4.4. ZIMBABWE ECONOMIC ENVIRONMENT

Like the majority of countries in sub-Saharan Africa, chronic poverty plagues Zimbabwe (World Bank, 1995, 2000, 2010; ZIMSTATS, 2013). Various authors have linked the prevalence

of poverty to the country's colonial history that disempowered the majority of citizens socially, physically and mentally (Allen, 1999; Lebert, 2003; Scoones *et al*, 2011; Rutherford, 2013).

At its formation in 1980, Zimbabwe had a highly diversified economy and was a stable middle-income country with immense potential (Sachikonye, 2002). The first decade of Zimbabwe's existence was characterised by massive education and infrastructural development programmes that created a solid background for socio-economic development (Sachikonye, 2002). However, by the mid-1990s, a dire economic forecast was beginning to unfold in Zimbabwe (Economist Intelligence Unit (EIU), 1998; World Bank, 1995).

Dashwood (2011) noted that in the mid-1990s, the poor made up 74% of the population with the prevalence highest in the rural areas. In response to the evident poverty, economic inequality and duality, the government at the turn of the millennium redistributed land from the minority white commercial farmers to the majority rural black population (Moyo, 2006).

The implementation of the land reform programme (commonly known as the Fast Track Land Reform Programme (FTLRP)) in the early 2000s brought the Zimbabwean economy to its knees as international support dwindled compromising the productive hub of the economy (Sachikonye, 2002). The period 2005-2009 saw deepening poverty, food insecurity, hyperinflation and the worsening HIV-AIDS pandemic ultimately resulting in the total demise of the Zimbabwean dollar in favour of foreign currencies such as the South African Rand and the United States Dollar (Sachikonye, 2002; Hammar, 2008). Environmental management was almost non-existent during the crisis period given that the major arms of government concentrated on averting public calamities such as mass starvation and civil war (Brooks World Poverty Institute, 2008).

Despite the depicted desperate situation, the country managed to avoid major catastrophes such as civil war and, in 2009, a coalition government was formed between the major rival political parties. This development brought a phase of stability within the economy and created some necessary conditions for economic recovery. Chavunduka and Bromely (2013), however, argued that despite the positive economic growth there was still a need to effectively deal with the Zimbabwean land issue.

Post 2009, scholars have also begun to consider the FTLRP from a different perspective arguing that it was not a complete failure as major positive developments had resulted from its implementation (Scoones *et al.*, 2011; Rutherford, 2013). Zimbabwe's economy recorded real growth of more than 9% per year in 2010-11, before slowing to 5% in 2012 and less than 2% in 2014 (Global Finance, 2013).

4.5. IAPs IN ZIMBABWE

With specific regard to IAPs, Maroyi (2012) revealed that the casual, naturalised and invasive alien flora of Zimbabwe is comprised of 391 taxa belonging to 239 genera and 73 families, representing 6.6% of the total Zimbabwean flora. Of those, 153 (39.1%) plant species were casual aliens, 154 (39.4%) were naturalised aliens, and 84 (24.5%) were invasive aliens. About 261 species (66.8%) appeared to have been intentionally introduced for various purposes such as ornamental purposes (38%), as food plants (8%), for fodder (5%) and timber (2%) (Maroyi, 2012).

According to the Ministry of Environment and Natural Resources Management (2010), invasive alien species (IAS) are one of the greatest drivers of biodiversity loss in Zimbabwe. IAS affect native biodiversity in almost every type of ecosystem throughout the country threatening ecosystem integrity, function and therefore human well-being (Ministry of Environment and Natural Resources Management, 2010). In Zimbabwe, through the Environmental Management Act and its supporting frameworks, citizens are required to control IAPs using any environmentally safe method. Common examples of the IAS problem documented in academic literature include:

- The proliferation of the water hyacinth, Kariba weed, Dodder and Water fern in Lake Chivero and other water bodies throughout the country (Zaranyika, Mutoko and Murahwa, 1994; Chikwenyere, 1999, 2001);
- The spread of *lantana Camara* (Chatanga, 2007; Sithole *et al.*, 2012) and
- The spread of *Cylindropuntia Fulgida* var *fulgida* (Masocha, 2010)

Maroyi (2012) argued that despite the occasional attention given to alien plants and weeds in Zimbabwe (e.g. Drummond 1975, Biegel 1977; Mapaura and Timberlake 2004; Maroyi

2006), comprehensive studies on plant invasions, naturalised plant species, and their impacts were lacking.

4.6. OVERVIEW OF GWANDA DISTRICT

Gwanda district (shown in Figure 4.3) is located in the Matabeleland south province of Zimbabwe (Figure 4.2). According to ZIMSTATS (2012), the district covers 14015 km² and has an estimated population of 116 357 people, a population density of 12 people/km² and 26773 households with an average 4.3 members per households.

Gwanda is largely a rural district with Gwanda town the only notable urban settlement. Gwanda district hosts the provincial capital of Matabeleland South Province, the District Administrator's and Rural District Council offices. The district has 24 wards characterised by multiple livelihood strategies that include small businesses, communal farms, small-scale mines and irrigation schemes, amongst others (ZIMSTATS, 2012).

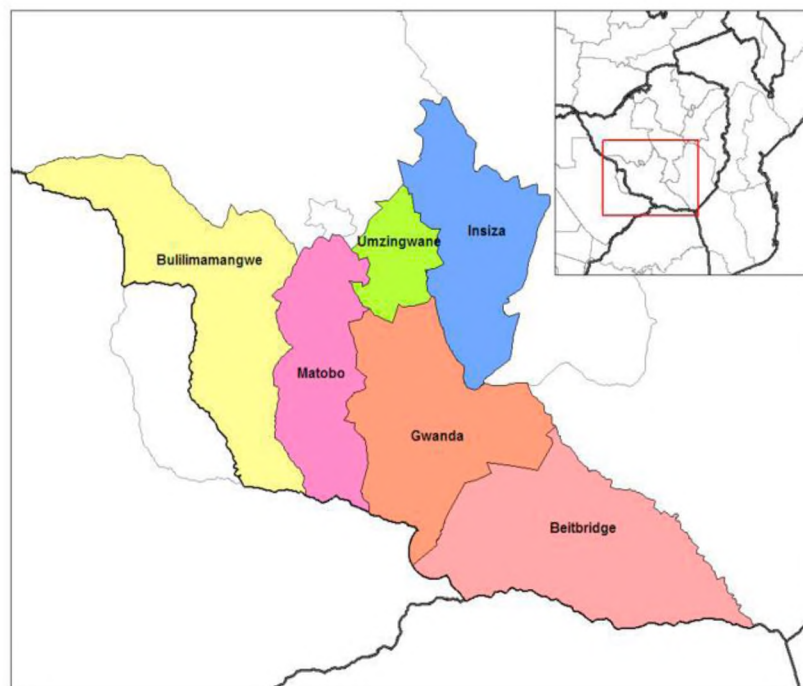


Figure 4.2: Map of Zimbabwe showing the Matabeleland South Province and its districts

Source: (ZIMSTATS, 2012).

According to GDDMP (2010), the district has opportunities for further development in eco-tourism, game and photographic safaris presented by the vast scenic surroundings. Gwanda District is prone to disasters ranging from perennial droughts, floods, land degradation, road

carnage and loss of livestock (GDDMP, 2010). These have contributed to the high levels of poverty in the district and the province as a whole (ZIMSTATS, 2013).

4.6.1. Climate

The entire district lies within Natural Regions IV and V, which are characterised by short, variable rainfall seasons averaging generally below 400 mm per year and long dry winter periods (Vincent and Thomas, 1960). Rainfall is usually associated with thunderstorms that produce rainfall of short duration and high intensity (EMA, 2012). The rainfall, in general, is less than half of the potential evaporation, thus necessitates irrigation development and more recently infield rainwater harvesting in some wards (GDDMP, 2010).

Temperatures are as high as 40°C during the summer months and on average 13°C during winter (EMA, 2012). According to the GDDMP (2010), climatic conditions make the area very vulnerable to meteorological hazards such as drought, floods, lightening, gusty winds as well as epidemics during the wet and hot season.

Ironically, Matabeleland South Province's semi-arid conditions are well suited to livestock production as the drier conditions reduce the susceptibility of the animals to disease and the costs associated with animal health management (Vincent and Thomas, 1960; Masocha, 2010).

4.6.2. Vegetation

Much of Gwanda district is undulating and dissected while the soils tend to be shallow and gravelly (Masocha, 2010). The vegetation of the District is predominantly dry deciduous Savannah. Stunted trees and shrubs of the *Colophospermum mopane*, *Commiphora africana*, *C. mollis*, *C. marlothii*, *C. pyracanthoides*, *Combretum apiculatum*, *Boscia* and *Sesamothammus lygardii* species are most common (GDDMP, 2010). Grass cover consists of mainly annuals such as *Aristida*, *Digitaria*, *Eragrostis* and *Enneapogon cenchroides* (GDDMP, 2010). Grazing potential is low and intra-seasonal variation can have a considerable effect on the amount of dry matter produced. These limited rangelands are under threat from terrestrial invasive alien species such *Cactus rosea* (*Opuntia rosea*) and *lantana camara* (Masocha, 2010; Francis, 2012; EMA, 2012). The patchy nature of vegetation renders the District very vulnerable to environmental hazards (GDDMP, 2010).

4.6.3. Rivers and Topography

The main natural water sources include Tuli River, with its main tributaries in the east bank running in north-south direction being Mnyabetsi River in Dibilashaba Communal Area, Sengezane River in Garanyemba Communal Area, Ntswangu and Pelele Rivers in Gwanda Bolamba Communal Area (Francis, 2012). The landscape of Gwanda District is characterised by hilly broken granite country with the topography becoming generally flat to undulating further south (GDDMP, 2010). In the southeast, the country becomes broken and hilly (Francis, 2010; GDDMP, 2010). Altitude drops gradually from 900 metres in the north to approximately 600 metres at the Shashe River, in the extreme south (GDDMP, 2010).

4.6.4. Economic issues

Cement production, livestock production, gold mining, game ranching and tourism are the major economic activities in the district (Francis, 2012). The low population density is attributable to climatic conditions that cannot sustain a larger population and it is further distorted by the high numbers of young people who have moved to urban centres in Zimbabwe and neighbouring countries for various reasons (GDDMP, 2012; Dube, Nkala and Sithole, 2012). Of the total number of people employed, the highest proportion (64%) are engaged in agriculture and related occupations (GDDMP, 2010). The majority of the people in the district are engaged in subsistence agriculture, which is characterised by a heavy dependence on the biophysical environment, subsequently increasing the propensity for environmental degradation (Masocha, 2010; Francis, 2012).

It was noted in the GDDMP (2010) that infrastructure in the province was in an appalling state as evidenced by a criss-cross network of flood prone gravel roads and un-repaired bridges. Furthermore, poverty is rampant in the district in line with the provincial situation. ZIMSTATS (2013) estimated a poverty prevalence rate of 44% in the province as shown in the Table 4.3.

Table 4.3: Household poverty prevalence by province in Zimbabwe

PROVINCE	PREVALENCE OF POVERTY	PREVALENCE OF EXTREME POVERTY
Bulawayo	34.5	3.4
Manicaland	43.6	5.5
Mashonaland Central	50.3	9.2
Mashonaland East	43.5	5.5
Mashonaland West	50.1	7.1
Matabeleland North	49.7	6.4
Matabeleland South	44.0	1.7
Midlands	37.7	3.0
Masvingo	21.4	0.6
Harare	35.7	3.3

Source: ZIMSTATS, (2013).

4.7. THE CASE STUDY

According to Yin (2003), case study research aims to explore and depict a setting with a view to advance understanding of the subject. The case study approach emphasises that research should be carried out in a ‘naturalistic setting’ to prompt understandings of whatever is under scrutiny in its own habitat (Cousin, 2005). This study uses an intrinsic case study, which is often used for the purposes of evaluating and understanding the case at hand in order to generalise (Hamilton *et al.*, 1977; Hall *et al.*, 2004).

Work done by Masocha (2010) and EMA, (2012) in mapping the spread of *cacti* species in the province (shown in Figure, 4.3) informed this case study. Masocha (2010) did not include Cff in the mapping of *cacti* species in the area due the mis-identification discussed in chapter two hence, most species have been considered as *Opuntia Fulgida*.

This study focused on the rural households of Ntalale, Guyu and Nhwali given the high populations of Cff in these areas. The villages of Seboza, Sengezani, Tshongwe and Nhwali are located in the three areas identified as highly invaded by cacti species (Masocha, 2010). These villages were purposively sampled based on information from the local EMA offices in the

district. Nhwali village, in particular, was chosen for successfully eradicating Cff from local rangelands.

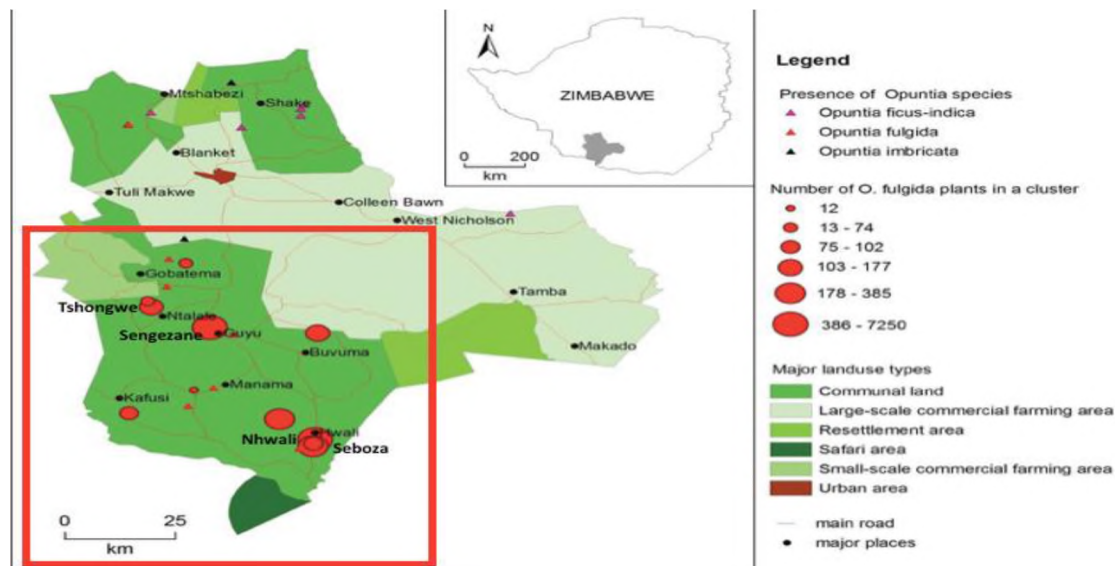


Figure 4.3: Map showing Gwanda district and the occurrence and density of *Opuntia* species in major land uses: The density of *Opuntia fulgida* plants in a cluster is proportional to the diameter of the red circles.

Adapted from Masocha (2010).

4.7.1. Sengezani village

This village falls under the Guyu rural centre. It is located in ward 14 (Population 5865; Households, 1389; Average household size, 4.2 (ZIMSTATS, 2012)) and is the most developed of the villages in the sample. The village is linked by a tarred road to Gwanda town and has a number of community centres such as a public training centre, a community clinic, an irrigation centre, a Zimbabwe Republic Police (ZRP) station and an agricultural training college situated in its boundaries. The village is also serviced by major mobile phone operators in Zimbabwe who have installed network boosters in the area. Historically, the village was home to an infantry battalion and a cattle breeding station that employed a number of people from within and outside the district.

According to pilot study findings (2013) and Sidange (Pers comm., 2013), the farm pinpointed as the source of Cff is located in this village. According to the Gwanda RDC (2012), the village has 242 households and a population of 1199 inhabitants. Due to migratory influences resulting from development initiatives in the area, the population is mixed along ethnic lines

in comparison to the other villages in the sample (EMA, 2012; Pilot study findings, 2013). Nonetheless, the main languages spoken are Ndebele and Sotho (Gwanda RDC, 2012).

4.7.2. Nhwali village

Nhwali village is located in ward 24 (Population 2698; Households, 673; Average household size, 4.0 (ZIMSTATS, 2012)) and named after the rural business centre in the location. The village was earmarked as a rural growth point, but the plans were shelved due to the inadequate water in the area (Gwanda RDC, 2012). The village has 360 households and 1360 people (Gwanda RDC, 2012). According to EMA (2012), Nhwali is a village that has been exemplary in the fight against Cff, which has been almost eradicated from the village. The majority of the population in the village belong to the Babirwa ethnic group and speak Sotho as a first language (Pilot study findings, 2013).

4.7.3. Seboza village

Seboza village is also located in Nhwali rural centre but falls under the administrative ward 20 (Population 4618; Households, 968; Average household size, 4.8 (ZIMSTATS, 2012)). The village has 127 households and a population of 732 people (Gwanda RDC, 2012). The majority of the population in the village belong to the Babirwa clan and speak Sotho as a first language (Pilot study findings, 2013).

4.7.4. Tshongwe village

Tshongwe village falls under the Ntalale rural centre and is located in administrative ward 11 (Population 4593; Households, 1079; Average household size, 4.3 (ZIMSTATS, 2012)) of Gwanda district. The village has 178 households and a population of 930 people (Gwanda RDC, 2012). The majority of the population in the village belong to the Babirwa clan and speak Sotho as a first language (Gwanda RDC, 2012; Pilot study findings, 2013).

4.8. CHAPTER SUMMARY

Zimbabwe has been a country of economic highs and lows rooted in the political climate and the institutions in effect. Given Zimbabwe's agricultural base, the natural environment has been a major factor in telling the Zimbabwean story especially in semi-arid places like rural Gwanda district where poverty and hunger are common. The prevalence of hunger and poverty make the presence of IAPs very unwelcome in the province. The issues regarding IAPs are relatively new in the province, hence the effects they have are still clouded in mystery.

The next chapter summarises the methods used to investigate the effects that Cff has on rural livelihoods in the district.

CHAPTER 5: RESEARCH METHODS AND STUDY POPULATION DEMOGRAPHICS

This chapter reviews the research methods used to investigate the impact of invasive *Cylindropuntia fulgida var fulgida* (Cff) on rural livelihoods in rural Gwanda district of Matabeleland South province in Zimbabwe. The chapter also describes the demographics of the population studied in accordance with the methods used. The study made use of both qualitative and quantitative research techniques. Academic literature and other relevant sources guided the method choice and design. The study made use of an in-depth study of a population located in Gwanda district. The chapter also presents information on the data collection tools and techniques, the data analysis and the plans to observe ethical issues.

5.1. RESEARCH DESIGN

Creation of knowledge through research is viewed from distinct paradigms. According to Joubish *et al.* (2011), a research paradigm is a worldview or framework in which research takes place. The major research paradigms are *inter alia*, positivism, post positivism, critical theories, constructivism and participatory-cooperative paradigms (Lincoln and Guba, 2005). The views of reality determine the paradigm into which research falls. Qualitative research considers multiple realities as the microscopic units that formulate the bigger picture while quantitative research involves an inquiry into a problem based on testing a theory and statistically analysing it to evaluate if the predictive generalisations of the theory hold true (Creswell, 1994; Joubish *et al.*, 2011).

This study employs a mixture of qualitative and quantitative research approaches. According to Mertens (2013), mixed methods researchers extend human understandings of how to understand complex social phenomena, as well as how to use research to develop effective interventions to address complex social problems. Lincoln and Guba (2005) observed a traditional inclination of quantitative research towards positivism and qualitative research to post positivism. In this regard, this research therefore followed a post positivist paradigm,

which examines the relationship between theory and practice, and uses new knowledge gathered from research to challenge, and sometimes add to theory (Ryan, 2006). Due to the nature of the problem in question, the limited available knowledge regarding it and the resources available, the study followed a non-interventional descriptive design. Moreover, the study made use of a case study approach to investigate the subject under discussion.

5.1.1. Deductive reasoning

Deductive reasoning/analysis tests and/or reformulates various theoretical models (Gilgun, 2001). Thus, in this case, deductive analysis used field data to search for evidence that either supported or challenged the theoretical framework. The study also used a disintegrated approach, which, according to Jagger *et al.* (2012), has a number of advantages such as avoiding respondent strategic behaviour, catering for inherent limited cognitive abilities of respondents and the ability to obtain data on a broader range of issues.

5.1.2. Study design in detail

Pilot Study

The term pilot study is used in two different ways in social science research. First, it can refer to a feasibility study done in preparation for the major study. In this case, it is designed to test logistics and gather information before a larger study; in order to improve the latter's quality and efficiency (Polit *et al.*, 2001). Second, a pilot study can also be the pre-testing or 'trying out' of a particular research instrument (Baker, 1994). In both cases, the pilot study gives advance warnings pertaining to the possible research problem obstacles that include, *inter alia*, research protocols, suitability of methods and cultural factors.

In this study, prior to major field work activities, a preliminary pilot study from the feasibility assessment perspective was conducted with the broad aims of familiarising the researcher with the research problem in the context of Gwanda district, developing networks with the local community and assessing the extent of the Cff densities in the area. Personal observation and key informant interviews collected preliminary information regarding the Cff problem in Gwanda. Snowball sampling was used to sample key individuals with useful information to build networks and a database. After the pilot study, information was collated and analysed the before main fieldwork activities commenced.

Major study

In order to explore the local perceptions towards the natural environment and particularly invasive alien plants (IAPs), the study used a predominantly qualitative approach in line with other studies that investigated similar phenomena (Henwood and Pidgeon, 2001; Fischer and Young, 2007; Selge, Fischer and Van der Wal, 2011).

The choice of a predominantly qualitative approach in this regard was due to the internal and personal nature of individual perceptions. Fischer and Young (2007) noted that qualitative methods were ideal for gathering public views and perceptions given that these views are best understood in their cultural, social and individual contexts. Correspondingly, literature states that members of the public may hold rich mental conceptions of the natural environment but lack familiarity with terminology. Hence, qualitative methods allow for alternative expression (Elder, Coffin and Farnior, 1998; Holl, 2005; Fischer and Young, 2007).

Qualitative methods in such a case also enabled the researcher to avoid the subliminal inception of ideas through confronting study participants with a pre-defined problem. Selge *et al.* (2011) argued that subliminal inception does not allow the researcher to determine whether the participant sees the problem in the first place. Besides avoiding inception, qualitative methods allowed the researcher's conceptualisation of the topic to stay in the background (Denzin and Lincoln, 2005; Schüttler, Rozzi and Jax, 2011).

The study used focus group discussions primarily concentrating on attributes of and attitudes towards the natural environment to investigate perceptions towards the natural environment and particularly IAPs. Given that the study area is characterised by a patriarchal society, it was likely that gender challenges would manifest themselves during group discussion (Mikkelsen, 1995). To mitigate these challenges the group discussions were single gendered in certain cases. Group discussions were conducted in the local languages with the aid of assistants from the study area.

In this study, the household capital composition (Natural, Human, Financial, Physical and Social) subdivided the households into different wealth categories based on survey responses. Capital assets were based on work done by Chambers and Conway (1992), Scoones (1998) and Carney (1999). Aspects of geographical location within the capital mix highlighted some authors (e.g. Bird and Shepherd, 2003 and Sunderlin *et al.*, 2005, amongst other authors) fall under physical capital.

To determine the major livelihood strategies within the four rural centres, quantitative methods are used. This study followed and modified methods used by Campbell *et al.* (2002) to determine livelihoods in arid Zimbabwe. Campbell *et al.* (2002) used memory recollection over a repetitive period of one year to investigate household activities that pointed to the major livelihoods strategies pursued within the household. The method used by Campbell *et al.* (2002) required a substantial amount of resources and thus was deemed not suitable as is.

In light of the resource challenges alluded to, the study used question blending by way of asking questions that required yearly, quarterly, weekly and daily recollection on a once off basis. This blending of questions allowed the study to extract quality information on short and long-term issues with minimum resources. The annual recollection was based on previous year's remittances, major asset and input acquisitions, crop output and livestock purchases or sales. Annual recollection allowed access to season specific information that could have been elusive due to resource constraints. Quarterly recollection sought out major activities that households were expected to remember over three-month periods such as asset and input purchases, remittances, salaries and wages, ecosystem goods and services (ES) use and livestock dynamics. In some cases, this section repeated certain questions from the yearly recollection in order to improve the reliability of the data.

Monthly recall repeated certain questions from the quarterly recall with more emphasis on labour time usage (who does what when) and social dynamics such as funerals, community meetings and other social events. Weekly recollection, on the other hand, focused on the more routine activities within the household such as livestock product harvesting (milk, eggs, meat, hides and dung), ES harvesting (water access and use, woodland harvesting, wild fruit harvesting/sale, etc.), purchases of domestic inputs, and labour time usage. Finally, daily recall validated the weekly responses in order to improve data reliability using similar questions such as the inputs for the meals and the events of the day before.

According to Campbell *et al.* (2002), labour time is one resource that the household can control and distribute to various activities almost at will. As such, the study used time spent on different activities and derived household incomes to indicate the major livelihood strategies of households.

In highlighting livelihood strategies most affected by Cff, households disclosed those activities undertaken due to the presence of Cff. The Cff related activities factored into the daily household activities and the household income to indicate the household time and income dedicated to them. Additionally, households indicated activities sacrificed due to Cff; the major capital assets affected by Cff and the income they had lost/gained due to the presence of Cff. Frequencies from survey responses were used to show the major activities sacrificed in order to attend to Cff, the major capital assets affected by Cff and the average income lost/gained.

In order to investigate the effectiveness of environmental management institutions in rural Gwanda district, the research used a qualitative approach. In assembling the method for this section, the study used ideas by Rurinda and Nyagumbo (2012) (appraising the policies and institutional frameworks affecting smallholder agricultural water management in Zimbabwe) and a Relevance Effectiveness and Formulation (REF) model of analysis. However, Rurinda and Nyagumbo (2012) did not interrogate the frameworks from the perspectives of the communities (particularly the rural) in question.

This study categorised and interrogated the institutional frameworks from the perspective of the local communities, key informants and documents were analysed. Key informants comprised officials from the Rural District Council (RDC), Environmental Management Agency (EMA), the Provincial Livestock Department, the Veterinary Department, the Forestry Department and local traditional leaders. Document analysis covered predominantly central and local government literature.

Relevance Effectiveness and Formulation (REF) model of analysis

In environmental management, the analysis of institutions is an area requiring a multidisciplinary approach rather than tools rooted in specialized knowledge of a particular discipline (Zimmerer, 2000; Wescoat, 2002; Adger *et al.*, 2003). Adger *et al.* (2003) advocated for a thick analysis when interrogating and formulating environmental management institutions. From an anthropological perspective, Geertz (1973) defined thick analysis in contrast to thin analysis as an approach which, on the one hand, avoided descriptive noncumulative cataloguing of 'culture' whilst, on the other hand, not succumbing to universal theorising of the type that is detached from the rich texture and meaning of everyday life. Adger *et al.* (2003) encouraged the use of four distinct categories (Efficiency, Equity,

Effectiveness, and Legitimacy) in developing a thick analysis of environmental management institutional frameworks. The broad interdisciplinary appeal of the four categories allows for a more comprehensive interdisciplinary interrogation of environmental management frameworks.

Efficiency is mostly associated with the economics of environmental management and often focuses on welfare maximisation (Bromley and Paavola, 2002; Holland, 2002). Effectiveness relates to the capacity of a decision to achieve its expressed objectives, and is typically of considerable interest to planners, and policy scientists (Desimone and Popoff, 2000). Equity is central to a range of social sciences that include sociology, political science and jurisprudence. Equity focuses on distributive justice or the distributional consequences of environmental management institutions (Adger, 2002; Whitehead, 2000; Adger *et al.*, 2003). Legitimacy refers to procedural justice and the extent to which decisions are acceptable to participants based on formulation and implementation (Adger *et al.*, 2003). Additionally, legitimacy relates to procedural justice and the extent to which institutions are acceptable to communities they seek to govern (Beetham, 1991; Adger *et al.*, 2003). Legitimacy also encompasses the social rules, beliefs, and norms of the society (Beetham, 1991).

With reference to the case at hand, increasing thickness in analysis of environmental management institutions calls for a consideration of the local Zimbabwean context. Zimbabwe is the product of a colonial state imposed (through a system of indirect rule of chiefs and allied traditional institutions, presided over by European native commissioners) from outside, based on conquest and subjugation and the expropriation of natural resources and power from indigenous communities (Madondo, 2000). Environmental legislation adopted at the end of the colonial state reversed the racially motivated institutions without democratising them (Madondo, 2000; Murombedzi 2003).

The Zimbabwean natural resource management legislation is dualistic in nature as it recognises the rural district council, the chiefs and allied traditional institutions (Madondo, 2000; Kwashirai, 2007). The duality has led to community alienation, confusion in implementation and formulation of environmental management institutions in rural Zimbabwe (Kwashirai, 2007; Mapenza, 2007). According to Mapenza (2007), this state of affairs has made some environmental management institutions in Zimbabwe irrelevant to the communities they seek to govern. As such, the Zimbabwean situation requires the

complementing of supply-led decentralisation needs by demand driven decentralisation, in order to make the management of natural resources relevant to the local context (Madondo, 2000; Mapenza, 2007). Arguments support participatory approaches in the creation of such institutions as a viable method of developing thick environmental management institutions (MacNaughten and Jacobs, 1997; Rowe, Marsh and Frewer, 2004; Stringer et al., 2007; Reed Dougill, and Baker, 2008).

According to Rowe, Marsh and Frewer (2004), participation is a process where individuals, groups and organisations choose to take an active role in making decisions that affect them. Participatory approaches to the formulation of environmental management institutions are increasingly viewed as international best practice (Fischer, 2000; Beierle, 2002; Stringer *et al.*, 2007; Reed, Dougill and Baker, 2008). Stringer *et al.* (2007) further stated that stakeholder participation was increasingly being regarded as a democratic right that improved the quality and durability of decisions taken regarding environmental management. Furthermore, Martin and Sherington (1997) argued that stakeholder participation reduced the likelihood of marginalisation of those on the periphery of the decision-making context or society. The inclusivity of participation therefore increases public trust in decisions, especially if participatory processes are perceived to be transparent and consider conflicting claims and views (Martin and Sherington, 1997; Richards, Blackstock, and Carter, 2004). Moreover, Reed (2007) claimed that participation improved the quality of information and enhanced the rate of adoption and diffusion of results among target groups.

Given the background of thick analysis, the value of participation and the Zimbabwean context, this study used three distinct categories (Relevance, Effectiveness and Formulation) to analyse the environmental management institutions in Gwanda. Relevance considered the colonial influence, legitimacy and duality in present day environmental management frameworks in Zimbabwe. Effectiveness related to the ability of environmental management institutions to achieve its expressed objectives. Formulation considered the broad issues of acceptance of the institution by the local community, the perceived equity created by the framework and participation in its formulation.

5.2. POPULATION AND SAMPLING

As alluded to in Chapter four, the sampling frame was the rural population of Gwanda district. The research used a case study of four rural communities to draw a sample of respondents

for the study. According to Shuttler *et al.* (2011), qualitative approaches are less inclined towards statistical significance of the sample but rather to depth of understanding of a particular phenomenon. Thus, with regard to the qualitative aspects of the study the population was organised in accordance with levels of knowledge of environmental issues and location. This form of sampling covered a cross-section of the public from a wide range of backgrounds thereby giving rich data (Fischer and Young, 2007; Garcia-Llorente, *et al.*, 2008; Selge *et al.*, 2011).

The study used multistage sampling techniques. First, the rural centres and key informants were purposively sampled based on secondary data. Second, stratified random sampling was used to determine the household survey and purposive sampling was used to select group discussion participants. Male and female group discussion participants were selected through the village head based on their local influence in environmental management issues of the specific village. The four rural communities gave the four strata for the survey.

The survey was conducted first while the group discussions and key informant interviews were conducted within the same fieldwork exercise. Group discussions and Key informant interviews were conducted in the presence of a moderator, recorded verbatim and later transcribed. One hundred and sixty six (166) respondents in Gwanda district who were either key informants or community residents formed the study sample. Fieldwork was conducted in July 2011 (a pilot study), and subsequently between February and May 2014.

5.3. DATA COLLECTION INSTRUMENTS AND TECHNIQUES

Data collection was done using questionnaires, Focus Group Discussions (FGDs), Key Informant Interviews (KII) and document analysis. Data collection was conducted in the respondent's language of choice (predominantly Ndebele, Sotho and English), with the help of local research assistants.

5.3.1. Questionnaire

The study made use of a semi-structured questionnaire to collect quantitative data. Semi-structured questionnaires make use of predetermined questions with possible answers to choose from, and open ended questions, which allow for detailed explanation from the respondents (Groves *et al.*, 2009). This approach allowed focused responses and further exploration of those issue deemed important (Opdenakker, 2006).

The questionnaire was administered face to face to the sampled household representatives (predominantly household heads) in villages within the four rural centres. Face-to-face interviews were chosen because they can be used with illiterate respondents and they allow for real time explanations from the interviewer regarding ambiguous questions (Leedy and Ormrod, 2004; Bless, Smith and Kagee, 2006; Berg, 2009). The questionnaire covered background household information (shelter, land size, demography), the household capital base, the major household activities, the time dedicated to various activities, valuation of the environment and biodiversity, major effects of Cff and the knowledge of institutions that govern the environment. Following Babbie (2008), the questionnaire was pretested to allow necessary adjustments pertaining to repetition, lack of clarity and wording, amongst other things.

5.3.2. Focus Group Discussions (FGDs)

Focus Group Discussions collected certain qualitative data. Berg (2009) argued that group discussions allow the obtaining of shared views while Bless, Smith and Kagee (2006) noted that FGDs allow the researcher to focus on the most important issues rather than individual personal aspects.

However, group discussions lack confidentiality and may pose unnecessary pressure on participants thereby not allowing them to express themselves fully in public, especially regarding sensitive issues (Denzin and Lincoln, 2000). Additionally, gender dominance and 'group leader dominance syndrome' may plague group discussions (Mikkelsen, 1995). In this light, the researcher took necessary measures to ensure participation by all the participants and avoidance of the mentioned hazards.

The study used FGD guide and visual aids (pictures, maps and other diagrams) to facilitate the FGD. Discussion topics included issues on IAP's perceptions, the use of ecosystem services, major capital/assets affected by the Cff invasion, environmental valuation and environmental management institutions.

5.3.3. Key informant interviews (KIIs)

The Education Development Centre (2004) defined key informant interviews as a loosely structured conversation with people who have specialised knowledge about subjects one wishes to understand. Huston and Sudman (1975) noted that the use key informant

interviews had its roots in cultural anthropology, although Dellinger and Leech (2007) also highlighted their (KIs) extensive use in other academic fields such as sociology and economics. KIs allowed for the verification and clarification of quantitative data and loosened the cultural barriers that restricted access to sensitive information during FGDs. The key informants comprised eight purposively selected individuals from the EMA, the RDC, the Forestry Department, the Provincial Livestock Department, the Veterinary Department and the traditional leadership. A KI guide was used in the interviews, which sought to extract information regarding IAP perceptions, the use of ecosystem services and environmental management institutions.

5.3.4. Document analysis

The study reviewed documents and other relevant literature from government publications and organisations involved Natural Resources Management to shed light on the formal environmental management institutions. Document analysis gave the researcher access to official documents (positions/opinions) that could have been omitted by respondents during the fieldwork exercise.

5.4. DATA ANALYSIS

The attributes of IAPs form the fundamental base for the attitudes towards IAPs and their management (Selge *et al.*, 2011). This study analyses the natural environment perceptions in rural Gwanda district using observed attributes and attitudes. The research used the attributes (characteristics associated with species) and the attitudes (individual's evaluation with some degree of favour or disfavour) to analyse the overall perceptions towards IAPs. Relevant computer software (NVIVO) grouped qualitative data to reveal strands of common perceptions. Firstly, an exploratory line-by-line analysis, identifying recurrent themes in the transcripts was conducted followed by systematic coding with a particular focus on attributes and attitudes. The study used Kellert's (1996) classification of environmental values to analyse quantitative data from questionnaire responses regarding environmental perceptions. Frequencies determined the common perception of the environment in rural Gwanda district. Microsoft Excel and Statistical Package for Social Studies (SPSS) derived the statistics and diagrammatic representations of environmental value perceptions.

Regarding livelihoods, the capital/asset base was monetised (based on average market prices) and used to derive the wealth quartiles of the different households using Principal Component Analysis (PCA). PCA involves combining several original variables into a few/single-derived variable(s) in this case, 'wealth'. Based on levels of wealth, the households were categorised into classes for analysis purposes. The household survey and group discussions derived the overall wealth status of the rural Gwanda households. The study analysis performed Kaiser-Meyer-Olkin Measure (KMO) of sampling adequacy in order to check the strengths of the inter correlations among the variables. Additionally, Bartlett's test of sphericity determines the appropriateness of PCA and if the correlation matrix was an identity matrix for the collected data.

The study used factor extraction, which determines the smallest number of factors that can be used to best describe the interrelationships among the set of variables. Firstly, the Kaiser's criterion or the eigenvalue rule was used. The eigenvalue of a factor represents the amount of the total variance explained by that factor. After the use of Kaiser's criterion, Catell's Scree test was conducted to further eliminate variables with limited influence on total variance. The overall household activities are categorised and the average time spent on each activity per day and incomes realised used as proxies to indicate the importance of the activity within the overall household livelihood strategies. Microsoft Excel and Statistical Package for Social Studies (SPSS) derived the statistics and diagrammatic representations.

Regarding the effects of Cff on livelihoods, the time component given to activities related to Cff was expressed as a percentage of overall daily activities and the trade-off that exists between Cff activities and other household livelihood strategies documented. The income dedicated to Cff or derived from Cff was expressed as a percentage of household wealth. Additionally, the major capital assets affected by Cff were ranked according to frequencies based on survey information. The number of livelihood strategies identified as defunct or under threat are utilised to give the effects of Cff on livelihood strategy resilience.

The study organised information gathered from the FGDs into categories with respect to the capital assets affected. This information was compared to that received from the household survey for triangulation purposes. Analysis of the major effects on the capitals was augmented work done by Shackleton *et al.* (2007). The research used graphical presentation to frame the impacts of IAPs on rural livelihoods.

With regard to environmental management institutions, the key formal environmental management institutional frameworks were divided into legal, regulatory and organisational institutions based on documents reviewed and the KIIs. An institutional matrix then presented the period of time over which the institutions have been in effect. The informal institutions were categorised according to the rural community based on identification frequency. FGDs within the three rural centres are triangulated with data concerning major informal institutions. Using a combination of the Likert scale and the REF analysis, systems of institutional framework analysis, local perceptions apropos environmental management institutions (formal and informal) were determined. A REF scorecard (Figure 5.1) was developed and used in the household survey exercise. The perspectives from the different population groups were compared and the knowledge of environmental management institutions was documented with respect to population groups. FGDs triangulated data collected from the household survey regarding informal environmental management institutions.

	Relevance (Institutions relevance to you)			Effectiveness (Institutions effectiveness to you)			Formulation (how participative was the formulation process)		
LEGAL	Not relevant	Relevant	Very relevant	Not effective	Effective	Very effective	No participative	Participative	Very participative
	Not relevant	Relevant	Very relevant	Not effective	Effective	Very effective	No participative	Participative	Very participative
REGULATORY	Not relevant	Relevant	Very relevant	Not effective	Effective	Very effective	No participative	Participative	Very participative
	Not relevant	Relevant	Very relevant	Not effective	Effective	Very effective	No participative	Participative	Very participative
ORGANIZATIONAL	Not relevant	Relevant	Very relevant	Not effective	Effective	Very effective	No participative	Participative	Very participative
	Not relevant	Relevant	Very relevant	Not effective	Effective	Very effective	No participative	Participative	Very participative

Figure 5.1: Institutional analysis score card

5.5. ETHICAL CONSIDERATIONS

Ethical issues were planned for and observed throughout the research. Before commencement of fieldwork, permission was obtained from relevant authorities (Rhodes University ethics committees, public officials in Zimbabwe, Traditional leaders). The researcher drew up comprehensive consent forms for signing by a prospective respondent before the interview commenced. The questionnaire was submitted to the Department of Economics and Economic History Ethics Committee for scrutiny. The completed questionnaire was devoid of respondents' identity particulars, used only for the purpose of academic research and kept safe at all times.

5.6. VALIDITY AND RELIABILITY

Validity refers to the dependability of the study and reliability refers to trustworthiness of the study (Creswell and Miller, 2000). Testing for validity and reliability is critical in qualitative research (Patton, 2002). As such, triangulation ensured validity, reliability and consistency of the data while questionnaires were completed and recorded in real time. Furthermore, end of interview summaries verified accuracy of data collected in the presence of the respondent.

5.7. STUDY POPULATION DEMOGRAPHICS: PILOT STUDY FINDINGS SUMMARY

A preliminary pilot study was conducted in July 2011 with the broad aims of familiarising the researcher with the research problem, developing networks with the local community and assessing the extent of the Cff densities in the area. Six key informants from the Environmental Management Agency (EMA), Rural District Council (RDC), traditional leadership and the National University of Science and Technology (NUST) participated in the pilot study.

According to the pilot study, the dominant environmental management authorities in the area are the EMA, RDC, local provincial government and the traditional leadership structures. With particular reference to Cff, results showed the Livestock, Forestry and Veterinary departments to be key stakeholders as well.

The pilot study revealed that the villages that were most affected by the Cff invasion were Nhwali, Seboza, Sengezani and Tshongwe villages. The predominant languages in the four villages are Sotho and Ndebele. The pilot study also disclosed that gaining the trust of the

villagers was essential to ensure smooth progress of the major project; hence, the researcher identified the traditional leaders in the villages and made the necessary contacts. In addition, results indicated the need to make use of research assistants/enumerators known in the community and who spoke the local languages.

Furthermore, the pilot study guided the research when securing the necessary permission to carry out the study and designing the data collection tools and techniques. Additionally, the pilot study results gave a general background of the Cff problem in Gwanda and the case study villages regarding their location, history, population and leadership structures. Table 5.1 lists the pilot study participants.

Table 5.1: Pilot study respondents

ORGANISATION/VILLAGE	POSITION	NUMBER OF PARTICIPANTS
SENGEZANI VILLAGE	Councillor	1
RURAL DISTRICT COUNCIL (RDC)	Environmental Officer	1
LIVESTOCK DEPARTMENT	Provincial Head	1
ENVIRONMENTAL MANAGEMENT AGENCY (EMA)	Research officer	2
National University of Science and Technology (NUST) Zimbabwe	Researcher	1
TOTAL		6

5.8. FIELDWORK SUMMARY

Using the sampling methods previously described, 166 respondents (80 survey respondents, 75 FGD participants and 11 key informants) were selected for the study. The study made use of a survey, Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). The survey collected mostly quantitative data while the KIIs and FGDs collected qualitative data. Relevant authorities (Local Rural District Council, the Provincial Administrator and the traditional leadership) permitted the researcher to conduct the study while all respondents gave their consent before a specific data collection process could begin. Through the KIIs (11

informants) and the FGDs (75 participants) data was collected about environmental perceptions and livelihoods from a composite sample of 86 respondents (n=86).

5.8.1. Focus Group Discussion participants

Six FGDs were held in Nhwali, Seboza, Sengezani and Tshongwe villages. Village heads organised group discussions conducted at the convenience of the villagers. The village head selected FGD participants based on convenience sampling that ensured gender sensitivity. The participants were not stratified according to categories such as levels of education, income or age. However, members of the respective local traditional leadership were present in the group discussions. A sample size of 75 participants was obtained for the FGDs. Some FGDs consisted of males or females only to guard against biases created by patriarchal societies and dominant member syndrome (explained in Mikkelsen, 1995). Moreover, the researcher moderated the discussion encouraging all participants to air their views.

The discussions were conducted in the community's languages of choice, predominantly Ndebele and Sotho. The group discussions lasted an average of 1.5 hours. The topic to be discussed was not divulged before the discussion in an attempt to avoid subliminal inception of perspectives before the discussion. The numbers and gender of group discussion participants are summarised in the Table 5.2.

Sengezane village had the highest number of group discussion participants who indicated that the spread of Cff was most pronounced in their area. Participants indicated that theirs was the most affected village due to its proximity to Guyu research station that was singled out as the potential source of the invasion. However, personal observations also revealed that Sengezane was the most modern of all the case study villages characterised by multiple business centres, tarred roads, availability of electricity and cellular network connections. Mansuri and Rao (2004) argued that participation in community initiatives was dependent on an enabling institutional environment. Therefore, the institutional environment in Sengezane gives the village a developmental advantage and may also explain the high participation in the group discussions in comparison to the other villages. Similarly, Nhwali village is second to Sengezane in terms of development and the extent of the Cff invasion and accordingly had the second highest number of discussion participants.

Table 5.2: Group discussion participants by village

VILLAGE	GENDER COMPOSITION	NUMBER OF PARTICIPANTS BY GENDER		TOTAL NUMBER OF PARTICIPANTS
Nhwali	Unisex FGD	Men	11	18
		Women	7	
Seboza	Unisex FGD	Men	9	14
		Women	5	
Sengezani	Males only FGD	11		11
	Females only FGD	15		15
Tshongwe	Males only FGD	8		8
	Females only FGD	9		9
Total				75

All group discussions started with a general question to which every participant responded. This question was, ‘what comes to mind when you think of the environment?’ This broad question allowed the participants to express themselves with respect to their perceptions of nature without restriction. The discussions then proceeded to deal with issues of environmental management institutions, IAPs, livelihood strategies and the environmental management methods the communities had employed. In comparison to other data sets in qualitative research on people’s views regarding the natural environment (for example, Hunter and Brehm, 2004, n = 20; Fischer and Young, 2007, n = 43; Schüttler *et al.*, 2011, n = 37, Selge *et al.*, 2011, n=79) the group discussion participants in this study constitute a rather extensive data set.

The group discussions provided qualitative data that aimed at understanding the ways in which participants reasoned regarding the natural environment and the major livelihood strategies affected by Cff in their communities. The discussions were also used to support data collected from the survey and for triangulation purposes. The conversations were recorded verbatim and quotes that represented majority and minority perspective are presented in Chapter 7.

5.8.2. Key informants

Eleven KIIs were held in the rural villages with representatives of relevant organisations that were thought to influence environmental management in the district. The interviews were organised through the appropriate offices and at the convenience of the key informants. The researcher selected the participants based on the relevance of the organisation to the subject under investigation or the position of authority that the individual held in the community. Organisations were therefore purposively sampled and key individuals identified through referral by senior management or a senior traditional leader. However, in most cases, the senior manager/leader was available to give data on the subject of interest. The gender dimension was overlooked when selecting participants for the KIIs as it was assumed that it did not play a dominant role in the knowledge and experience that an informant possessed. The discussions were conducted in the informant's language of choice, predominantly Ndebele and English. The interviews lasted an average of one hour. KII participants are summarised in the Table 5.3.

Table 5.3: KII Participants

ORGANISATION/VILLAGE	POSITION	NUMBER OF PARTICIPANTS
NHWALI	Councillor and Village head	2
SEBOZA	Village head	1
SENGEZANI	Councillor	1
TSHONGWE	Village head	1
RURAL DISTRICT COUNCIL (RDC)	Chief Executive Officer	1
LIVESTOCK DEPARTMENT	Provincial Head	1
ENVIRONMENTAL MANAGEMENT AGENCY (EMA)	Provincial Head & Research officer	2
VETERINARY DEPARTMENT	Provincial Head	1
FORESTRY DEPARTMENT	Provincial Head	1
TOTAL		11

Table 5.3 shows that high-ranking officers and traditional leaders that were available to give information regarding the problem in questions. This realisation was significant as it was

indicative of the urgency of the problem given the multiple challenges discussed in previous literature (Masocha, 2010; Francis, 2012). The KIIs collected specialised qualitative data that aimed at exposing complex policy related variables regarding the natural environment and effects of IAPs in the district. The interviews also supported data collected from the survey and triangulation. As in the case of the group discussions, all KIIs began with the same general question as that of the group discussions to which every key informant responded. This broad question allowed unrestricted responses from the key informants. The discussions then proceeded to deal with issues of environmental management but with particular focus on the informant's area of specialisation. The conversations were recorded verbatim and quotes that represented majority and minority perspective are presented in Chapter 7.

5.8.3. Survey respondents

The survey was carried out in four villages (previously described) located in wards 20, 11, 14 and 24 of Gwanda district. Eighty households gave data through the household head regarding their perceptions of the environment, livelihood strategies, effects of Cff on their livelihoods and the environmental management institutions in Gwanda district and Zimbabwe in general. Table 5.4 summarises the numbers of households that participated in the survey with respect to the village and ward of origin.

Marital status and gender of the household head have a bearing on household socio-economic issues such as sustainable livelihoods (Appleton, 1996; Fuwa, 2000; Habib, 2010; Oginni, Ahonsi and Ukwuije, 2013). In recognition of the effects of social status (rooted in marital status) and gender on household socio-economics, in the Table 5.4 captures the gender dimensions of the household heads and their social status based on marital status. Chapter 7 further interrogates the effect of gender on other household dynamics. Males head the majority (68%) of households in the four villages. Nhwali village has the lowest proportion (15%) of female-headed households while Sengezane village has the highest proportion (an equal portion of male and female-headed households) of female-headed households and widowers. The majority (93%) of household heads have been married at one point in their lives with 46% still married, 23% widowed and 11% divorced. Nhwali village has the highest proportion of divorced household heads while Sengezane village has the most widowed household heads.

Cavendish (2000) showed that age and education levels of the household head had a bearing on household socio-economics regarding accumulation of assets and attitudes towards environmental management. As such, the age and education levels of the household heads in the four villages are summarised in Table 5.4. The relationship between age and other socio economic variables is debated further in Chapter 7. Sixty percent of the household heads in the study area are in the age group 36 years to 44 years. Sengezane Village has the most household heads (45%) in the youth category (19-35 years) while Nhwali village has the largest portion of household heads in the 45-65 years age group.

Secondary education is the most common education level attained by most of the household heads (46%) in the study area. Nhwali village has the highest proportion of household heads that did not go to school and those who have tertiary education qualifications. Vocational training is the least common form of education in the study area (Table 5.4). In addition to gender, marital status, education and age, the occupation of the household head is a major determinant of individual perceptions, household assets and activities (see Table 5.4) (Milfont and Duckitt, 2010). Unemployment statistics stand at 46% in the study area with the highest levels recorded in Sengezani village (60%) despite the comparatively modern infrastructure found in the village. The unemployment trends reflect those observed by the national statistical agency of Zimbabwe (ZIMSTATS) for the entire province of Matabeleland South (ZIMSTATS, 2012)

Household size varies amongst and within the villages. The smallest households in the study area consist of one individual while the largest is in Seboza village and consists of 15 individuals. A household size of between three and four individuals is most common across all the villages. The mean household size in the study area is 3.89 individuals which is lower than the official average of the four wards in question (4.33), the district average of 4.3 and the national average of 4.2 individuals / household (ZIMSTATS, 2012). The most common household composition accounting for 46% of the study population is that of a father, mother and children. Families living with at least one relative account for 17% of the population while cases of non-relatives found within households are not common in the study area.

Table 5.4: Survey demographic summary

	NHWALI					SEBOZA					SENGEZANI					TSHONGWE								
WARD	11					14					20					24								
SURVEY PARTICIPATION	25%					25%					25%					25%								
GENDER OF HH	Male		Female			Male		Female			Male		Female			Male		Female						
	85%		15%			75%		25%			50%		50%			60%		40%						
AGE OF HH	>35		>45		>65	>35		>45		>65	>35		>45		>65	>35		>45		>65				
	0%		65%		35%	5%		75%		20%	45%		40%		15%	25%		60%		15%				
EDUCATION OF HH	NE	P	S	T	V	NE	P	S	T	V	NE	P	S	T	V	NE	P	S	T	V				
	30%	10%	40%	15%	5%	15%	35%	40%	5%	5%	5%	42%	58%	0%	0%	10%	35%	45%	5%	5%				
MARITAL STATUS OF HH	NM		M		D		W		NM		M		D		W		NM		M		D		W	
	10%		65%		20%		5%		5%		65%		5%		25%		10%		50%		15%		35%	
OCCUPATION OF HH	FE		IE		UE		FE		IE		UE		FE		IE		UE		FE		IE		UE	
	20%		35%		45%		20		35%		45%		5%		35%		60%		10%		55%		35%	
KEY	HH= Household head NE= never went to school; P= Primary education; S= Secondary education; T= Tertiary education; V= Vocational training NM= Never married; M= Married; D= Divorced; W= Widowed FE= Formal employment; IE= Informal employment; UE= Unemployed																							

N=80

5.9. CHAPTER SUMMARY

This research applied a predominantly mixed method design in collecting and analysing data. Multistage sampling drew the sample of respondents from Gwanda district while data collection used semi-structured questionnaires, FGDs and KII. Moreover, data regarding the characteristics of the study participants and processes that allowed for data collection have been summarised in this chapter. The chapters that follow present the study findings and analysis. In discussing and analysing study findings the chapter following immediately gives an institutional contextual setting of the study area and research problem.

CHAPTER 6: EMPIRICAL FINDINGS: ENVIRONMENTAL MANAGEMENT INSTITUTIONS IN RURAL GWANDA DISTRICT

The previous chapter gave a detailed description of study population with respect to household size, compositions and gender amongst other things. This chapter gives the contextual setting of the research area and problem from an institutional perspective. The chapter considers the natural environment management institutions in rural Gwanda using the methods explained in Chapter 5. Furthermore, it debates the natural resource management question in rural Gwanda using empirical findings from the study area and secondary data to explain the institutional environment observed. Issues covered include the politics of ownership (property rights), challenges to common property arrangements, roles of the state and the significance of social capital in the ownership of natural resources.

6.1. THE NATURAL RESOURCE MANAGEMENT QUESTION

According to Nelson (2010), the importance of natural resources in sub-Saharan Africa is a function of the central economic role that such resources play in agrarian societies. Despite Zimbabwe's move towards urbanization, the economic foundations of the nation remain the natural resource base (Murombedzi, 2010). Survey responses and data from group discussions portray this dependence on natural resources in rural Gwanda. In addition to localized natural resource dependence in sub-Saharan Africa, global food security concerns and raw material demand by emerging markets (particularly China) have resulted in a scramble for African natural resources (Cotula *et al.*, 2008).

The ever growing demand for natural resources in Africa has led to complex arrangements in the allocation of property rights for certain portions of the natural environment. Keely and Scoones (2003:91) quote an Ethiopian government policy explaining the natural resource management question stating, "If you control the land you control the people". Similar sentiments have been noted in Zimbabwe where the ruling political party (ZANU-PF⁵) in

⁵Zimbabwe African National Union - Patriotic Front

government has made natural resource access the major pillar of its socio economic transformation agenda (ZimASSET, 2013). The ZANU-PF perspective on the hegemonic position of natural resources in Zimbabwe is encapsulated in the party's motto "land is the economy, economy is the land" (Scoones, 2014).

The question relating to the allocation of natural resources with minimum conflict and economic efficiency is termed the natural resource management question in this study. The question is answered in the localized context of rural Gwanda using the broader Zimbabwean institutional environment as a point of departure and reference.

6.2. NATURAL RESOURCE GOVERNANCE IN RURAL GWANDA DISTRICT

Institutions are inherently the outcome of the political negotiations whereby people devise governance systems from local to national to global scales (North, 1990). In order to answer the natural resource management question in rural Gwanda, one must understand the political processes that determine the shape of resource governance institutions and how those institutions change over time.

The supreme environmental law in Zimbabwe is the Environmental Management Act of 2002. Prior to the establishment of this Act, Zimbabwe's Ministry of Environment and Tourism was responsible for the administration of approximately eleven acts that related (directly/indirectly) to environmental management and protection. Before the Environment Management Act of 2002, the Zimbabwean government's efforts to protect air quality were channelled primarily through the Atmospheric Pollution Prevention Act of 1971. The primary legislation protecting water was the Fish Conservation Act's whose main purpose, according to Nickerson (1994), was the conservation of indigenous fish, though it also contained a prohibition against water pollution. The Regional Water Authority Act (1976) and the Zambezi River Authority Act (1987) augmented the Fish Conservation Act.

Natural resource and wildlife protection was provided for through the Natural Resources Act, Forest, Mines and Minerals Act, National Parks Act of 1965 and the Wildlife Conservation Act of 1960. Hazardous substances were regulated primarily through the Hazardous Substances and Articles Act, supported by the Fertilisers, Farm Feeds and Remedies Act. The National Trust Act protected cultural activities while the Miscellaneous Offences Act addressed nuisances caused by odour, visual blight, and noise.

A review of past government documents⁶ showed that in certain cases, some of the Acts with a bearing on environmental management did not fall under the Environment and Tourism Ministry. In fact, six other ministries were engaged in environmental management in contemporary Zimbabwe.

According to the Zimbabwe Environmental Lawyers Association (ZELA, 2003), in 1992 the Ministry of Environment and Tourism initiated a process of environmental law reforms prompted by the 1992 Rio de Janeiro Earth Summit at which Zimbabwe participated. This process culminated in the passage of the Environmental Management Act (Chapter 20:27), No. 13 of 2002 (ZELA, 2003). Some of the reasons that necessitated environmental law reforms are summarised in the Box 6.5.1. The reforms were aimed at creating laws that protected the environment while allowing human usage for sustainable development. The Ministry of Environment Water and Climate Change and its subsidiary arms administer the Act.

Box 6.5.1: Reasons for the reform of Zimbabwean environmental law

- i. Environmental laws were old and no longer in tune with the way people live and use the environment around them;
- ii. The old laws did not consider the relationship between the different components of the environment e.g. air, water and land;
- iii. There were overlaps, duplication and sometimes conflicts between laws which were being managed by different Ministries;
- iv. The fines for causing environmental damage were very low resulting in companies and individuals committing environmental crimes and easily paying the fines instead of finding ways to avoid the damage; and
- v. Environmental issues were not being regarded as part of rights to which people should be entitled.

Source: ZELA (2003).

⁶Documents reviewed include the Cold Storage Commission Act of 1960; Fish Conservation Act of 1961; Seeds Plant Pests and Diseases Act of 1964; Atmospheric Pollution Prevention Act of 1971; Locust Control Act of 1971; Wildlife Conservation Act of 1972; Mines and Minerals Act, 1974; Natural Resources Act of 1975; Parks and Wild Life Act of 1975; Hazardous Substances and Articles Act of 1978; National Museums and Monuments Act of 1980; Forest Act of 1981; Trapping of Animals (Control) Act of 1981; Prevention of Cruelty to Animals Act of 1983; Fertilizers, Farm Feeds and Remedies Act of 1986; Drugs and Allied Substances Control Act of 1988; Animal Health Act of 1990; and the National Trust Act of 1990.

The Environmental Management Act is a general legislative framework that does not cover every environmental aspect. Other non-conflicting laws, organisations and policies complement it. However, where there are conflicts in environmental issues, the Act takes precedence. The Act provides the general environmental principles that guide environmental management. The law affords every Zimbabwean the following rights:

- i. Right to live in a clean environment that is not harmful to their health
- ii. Right to access to environmental information
- iii. Right to protect the environment for the benefit of present and future generations,
- iv. Right to participate in the implementation of legislation and policies that prevent environmental damage.

According to the Act, the Minister responsible has to prepare a National environmental management plan that outlines the strategies and measures for the protection, restoration, rehabilitation and general management of the environment. Furthermore, every local authority is expected to prepare its own environmental action plan for the area under its jurisdiction.

Control of invasive alien species

Section 118 of the Environmental Management Act provides for the control of IAPs in Zimbabwe. According to the Act, every responsible person has a duty to report (to authorities), clear or cause clearing of any invasive alien species growing on land for which he/she is responsible. It is an offence for any responsible person to fail to clear or cause clearing of any invasive alien species. Similarly, it is an offence for any person to place any invasive species or the seeds in any river, stream, irrigation canal, road or land. The Act defines responsible persons as any of the following people:

- i. "The occupier of land, or the registered owner of such land
- ii. In the case of a mine, the holder of such a location
- iii. If it is State land over which grazing or other rights have been granted to a person, the holder of such rights
- iv. For communal land, the occupier or person who has use of such land, or the Chief or headman who has jurisdiction over the land, or all or any of the inhabitants of the nearest village
- v. In the case of commonage or town lands or roads, the local authority under whose control or within whose jurisdiction such land, road or other area is situate".

At the time of institution (2002), the Environmental Management Act recognised the following as IAPs in Zimbabwe; Wild oats, Water lettuce, Dodder, Water hyacinth, Moonflower cactus, Cherry-pie, Jointed cactus or jointed pear, Azolla; and Water-fern. The list has since grown to include Cff (identified as Cactus Rosea).

6.3. ORGANISATIONAL INSTITUTIONS

According to Nickerson (1994), before the establishment of the Environmental Management Act, a number of parastatal commissions/organisations inclined towards environmental management were formed. These include The Forestry Commission, The Trustees of National Museums and Monuments, Natural Resources Board, Natural Resources Court and National Trust (Administered by The National Trust Council). Upon the establishment of the Environmental Management Act (2002), provisions were made for the formation of the following support institutions. First, Section 7-8 of the Act provides for the formation of the National Environmental Council, whose functions according to the law are to advise on policy formulation, national environmental goals and review national environmental plans.

Second, section 9 of the Environmental Management Act (2002) provides for the establishment of the Environmental Management Agency (EMA), whose duties in accordance with the law are to:

- i. Formulate quality standards on air, water, soil, noise, vibration, radiation and waste management,
- ii. Assist and participate in any matters pertaining to the management of the environment such as;
- iii. Developing guidelines for preparation of the National Plan, environmental management plans and local environmental actions plans
- iv. Regulate and monitor the collection, disposal, treatment and recycling of waste
- v. Monitor and regulate discharge or emission of pollutants or hazardous substances into the environment
- vi. Keep records in the forms of registers of all licenses and permits issued under the law
- vii. Monitor and regulate the control of invasive alien species
- viii. Regulate, monitor, review and approve environmental impact assessments
- ix. Regulate the utilisation of ecologically fragile ecosystems
- x. Make model by-laws within the jurisdiction of local authorities

- xi. Advise government on conventions and treaties which should be incorporated into national law
- xii. Coordinate the production of a five year environmental report
- xiii. Carry out periodic audits of projects
- xiv. Regulate and monitor access by any person to biological and genetic resources
- xv. Recommend to the Minister the formulation of any regulations.

Third, section 11 of the Act specifies the creation of an Environment Management Board with a major objective of managing the Environmental Management Agency. The EMA operates through a network of inspectors and officers (regulated by section 37 of the Act), who enforce environmental laws and policies. In addition, subject to the environmental management board is the Standards and Enforcement Committee provided for by section 55 of the Environmental Management Act (2002). The committee advises the Environmental Management Board on issues of water usage, quality, aquatic life, and effluent discharge. Furthermore, section 130 of Environmental Management Act (2002) states that any appeal against the decision or an order of the Minister of Environment made in terms of the Act will be made to the Administrative Court.

Other than the organisational institutions provided for by the Environmental Management Act, secondary data reviewed showed that other government arms and NGOs have an influence in environmental management in the study area. Results from document analysis revealed that the major alternative government related organisations with a bearing on environmental management are the traditional leadership structures, veterinary services office, provincial livestock and crop departments, Forestry Commission, Department of Museums and National Monuments and the local rural district council (RDC). Some of these organisations are provided for by alternative acts of parliament and in most cases fall under ministries other than that of environment and water and climate.

Key informant interviews disclosed that the majority of NGOs operating in the area though biased towards livelihoods diversification had a lesser environmental management function, given that it was difficult to separate the natural environment from rural livelihoods. Survey results also revealed that the major NGOs (in order of popularity and size of programmes)

operating in the area were World Vision, Organisation of Rural Associations for Progress (ORAP), OXFAM, SNV and agencies of the United Nations.

Regarding Gwanda, the formal laws summarized above show that a number of actors who play varying roles that result in a localized (Gwanda) answer to the natural resource management question. Nelson (2010) argued that interests and relative powers of different actors shape natural resource governance processes. In rural Gwanda, these actors include the state, state aligned organisations, national and international NGOs. Clearly, the cast encompasses a wide range of actors operating across multiple scales from local to global. The sections that follow trace the origins and roles of these formal actors explaining the impact that they have had on the management of natural resources in rural Gwanda.

6.4. THE ZIMBABWEAN STATE

The political economy of natural resource governance in Zimbabwe is centralized within the formal institutions discussed in the previous section. The centralisation was arguably influenced by the Zimbabwean colonial legacy. According to key informants, in pre-colonial rural Gwanda, the communities on behalf of various centres of power managed natural resources. Respondents indicated that the baBirwa and the Ndebele were required to manage the natural environment on behalf of the King and chiefs who occupied rural Gwanda.

Under colonialism, local people lost title to natural resources, had their indigenous knowledge suppressed and the traditional leadership undermined. Although colonisation created modern environmental administration and legislative structures, the natives lost localized control over the natural resources that they had been using for survival. According to Murombedzi (2010), Africa's colonial states were established in order to control labour, capital and resources for external, European purposes. In Rhodesia (Zimbabwe), this resulted in the concentration of central bureaucratic and executive power in the state eviscerating pre-colonial independent forms of social organization (Nelson, 2010). The State claimed wide powers over natural resources, particularly land with customary rights subordinated to claims explicitly recognized by the colonial administration (Toulmin and Quan, 2000). Under British indirect rule, every native in rural Gwanda was subject to a tribe administered by a chief recognized by customary law.

Key informants noted that the subjection to a tribal chief often resulted in the grouping together of unrelated Birwa and Ndebele groups resulting in conflict and tension within the new formulated chieftaincy. Nyathi (2014) also captured this aspect detailing the resistance to learning Ndebele in the schools of rural Gwanda district that had been forcibly subjected to Ndebele chiefs by the colonial government. Msindo (2012) also discussed similar issues related to the quarrels that often resulted when chiefs imposed by the colonial regime had to control diverse individuals as members of a single tribe.

Therefore, in rural Gwanda, there was colonial refashioning of chieftaincy and social order that fused executive, legislative and judicial powers of customary authority tied to the colonial project. Moreover, the colonial state replaced the community based management options with an external remotely located state that was fused into an individual chief. Key informants and respondents from the group discussions revealed that such an approach was bound to be limited by challenges (such as different tribal groups) related to the building of micro-social capital that is associated with the bonds and relationships amongst individual households.

Zimbabwean pre-colonial and colonial institutional history fundamentally shaped rights over natural resources, which are in turn central to the way those resources are used. Existing patterns of natural resource governance generally remain centralized. Post-independence leaders of Zimbabwe faced the challenge of consolidating state authority over scattered populations and pursuing ambitious modernization agendas (Boone, 2003). In pursuing this agenda of consolidation and expansion of central authority, the colonial state was deracialized but rarely democratized (Mamdani, 1996). As such, the alienation of the community from natural resource management continued.

Key informants and Government Acts analysed showed contemporary environmental governance in Zimbabwe to be complex going beyond the EMA Act and overflowing into other formal institutions and social dynamics. In line with other sources from literature, environmental governance was shown to be a function of power relations and practices common to rural Gwanda district (Blaikie, 2006; Bulkeley, 2005; Agrawal, 2005, 2001b, 1999). As such, although people or structures may wield power (as shown in institutions such as the EMA Act), the exercise of such power is usually dependent on a number of factors found in the environment in which power operates.

The EMA Act is predominantly implemented through the Rural District Council (RDC), elected councillors and traditional leaders. Some of these institutions theoretically exhibit devolution of state power and the transfer of environmental governance rights to local communities as enshrined in Chapter 14 of the Zimbabwean constitution. However, effectiveness of rights transfer from the state to individuals goes beyond a mere specification of rights in Government literature but touches on how such specifications mirror against praxis in everyday social practice (Gupta 1999).

Regarding the RDC, Balint and Mashinya (2006) noted that although the RDC Act of 1988 eliminated colonial dualism in local government structures, in practice, bureaucrats formulated by-laws at district level not the local communities for which the laws are meant. Local communities are, however, afforded the chance to inspect the by-laws and, if necessary, lodge objections. In this regard, Madondo (2000) argued that communities rarely inspected the by-laws partly because due to exclusion from the formulation process, long distances between the homestead and inspection centres and limited access to print media where the laws are published for inspection. As such, the RDC effectively excludes communities from forums in which crucial decisions are made over grassroots visions and aspirations. Low literacy levels among community representatives (in comparison to bureaucrats) reinforce under-representation of grassroots in the RDC (Madondo, 2000).

Regarding the elected councillors, key informants indicated that councillors found in the lower theoretically participatory community structures (VIDCOs and WADCOs) owed allegiance to political parties, who endorsed their candidature. Therefore, such a system was bound to churn out councillors who are upwardly accountable to their political benefactors and not downwardly accountable to their grassroots constituencies. Consequently, the case observed in rural Gwanda district is an attempt to make environmental governance more representative but not accountable to the grassroots. From a similar perspective, Jones and Murphree (2001) argued that in most of Zimbabwe, development proposals made at the grassroots (VIDCOs and WADCOs) largely remained on paper because decentralised planning was never considered together with decentralised implementation or decision making.

Existing side-by-side with the RDCs, councillors VIDCOs and WADCOs are the traditional leaders whose roles are provided for in the Traditional Leaders Act. The Traditional Leaders

Act recognises the village under the authority of traditional leadership comprised of chiefs and headman as the lowest unit of social organization. According to the Traditional Leaders Act, the president appoints the minister of Local Government and National Housing and the chiefs; the chiefs in turn nominate the headmen, whom the minister appoints; and the headmen nominate the village heads, whom the chief appoints. Traditional leaders are not elected, normally hold office for life and are appointed from hereditary lineages. The higher offices that appointed traditional leaders, and not the ordinary majority, have the prerogative of removing them from power.

From the information above, one observes numerous forms of community and individual disempowerment regarding natural resource management. For instance, the elected councillors deny the grassroots accountable forms of representation, traditional chiefly institutions are founded on non-participatory principles and the RDC is synonymous with the exclusion of local communities from decision-making. As such, practice and the institutional complex in rural Gwanda demonstrate incomplete devolution often stopping at village level.

Given the above, this study agrees with Madondo (2000) who argued that by making VIDCOs, WADCOs and RDDCs upwardly accountable, developing superficial consultation processes, and by providing little financial support for local decision-making, the Zimbabwean post-colonial efforts at decentralisation have fallen short of democratising natural resource governance. Thus, despite theoretical decentralization contained in formal institutions such as the EMA act, practice and the inter-relations with other factor in the institutional environment results in the exclusion of the local villagers from environmental governance and decision-making.

The described institutional complexities alienate the rural households of Gwanda and subject them to the colonial institutions of indirect rule (traditional leadership), already been shown to be plagued by less than ideal formulation approaches. Key informants noted that most collective action within the community is built on the respective levels of social capital built predominantly at household and inter-household level. The effective recognition of the village as the lowest level of social ordering by the formal institutions automatically removes the household inter-relations from the quest for answers to the environmental management question in the formal institutional realm.

Moreover, observations in rural Gwanda revealed the simultaneous presence of state actors and traditional leadership rooted in the colonial era. Such a scenario simultaneously creates citizens and subjects out of the community members who have to answer to both centres of power. Key informants argued that the state through local government (RDC) continued to function as a policy implementation actor rather than formulator in local natural resources management. As such, the analysis above paints the state as a remote, unaccountable major player in the natural resource management in rural Gwanda district.

6.4.1. State aligned organisations

Through the state and guided by the legal institutions (the Environmental Management Act) and organisational institutions (primarily the Environmental Management Agency (EMA)) are involved in the management of Cff in the study area. According to Sidange (2014), the EMA has carried out awareness campaigns in the study area on the dangers of Cff, the most efficient management methods and the general biology of the plant. Furthermore, the EMA has invested in tools (distributed to villages most affected by the invasion) designed to assist in the management of Cff. The publicity and awareness campaigns pioneered by EMA resulted in numerous print media bulletins ultimately culminating in the establishment of a parliamentary committee tasked to devise the best Cff management mechanisms (Sidange, 2014).

State aligned institutions such as EMA, however, operate in the legal confines that observe villages rather than households. Group discussion participants revealed that EMA operated through traditional leadership institutions, particularly village heads. Interviews with the traditional leadership in the area exposed the importance of social networks in the undertaking of traditional leadership duties. Traditional leaders in Nhwali and Sengezane villages explained that the good social ties in their communities had allowed them to achieve notable successes in the control of Cff.

Therefore, despite the alienation of the grassroots community perspective within state aligned agencies, the situation depicted in rural Gwanda shows their relevance. The lowest level of formal social organization (the village) highly depends of the ignored household buy-in for effective environmental management. The observations in rural Gwanda are an illustration of incomplete democratization of natural resource management. The rights to

natural resource access are ceded by a hegemonic state to subordinate state organs such as the RDC, EMA and traditional leadership but never to the lower echelons of the community.

6.4.2. Non-Governmental Organisations

Local and international development agencies have been particularly active in supporting livelihoods and natural resource management in the study area. Key informants argued that most of the NGOs mentioned in rural Gwanda (World Vision, Organisation of Rural Associations for Progress (ORAP), OXFAM, SNV and agencies of the United Nations) played a key role in promoting natural resource management.

A critical factor shaping NGO and aid agency actions is the political reality of operating in Zimbabwe. The Zimbabwean government has often argued that NGOs are diplomatic entities furthering agendas of foreign countries (Rich-Dorman, 2003). These allegations climaxed when the Zimbabwean government disallowed the operations of NGOs in rural Gwanda due to political suspicion (Chingono, 2010). As such, key informants from the NGOs and aid agencies operating in Gwanda claimed to be apolitical and interested only in pursuing their core objectives. The threat of expulsion and the fear of interfering in local politics have resulted in NGOs operating in the study area towing the formal institutional lines that are blind to the grassroots community dimension of natural resource management. However, key informants from NGOs indicated that despite the associated political risks, programme success was always higher with grass roots community buy-in.

6.5. INFORMAL INSTITUTIONS: PRE-VILLAGE LEVEL

Thus far, the debate around the institutions that have guided the management of Cff and the broader natural environment has focused on the formal institutions. These institutions have been shown to be remote and unaccountable to the households that they seek to assist. Moreover, it is evident that their effectiveness is a function of buy-in by the very households they ignore. The formal institutions therefore seem technical in nature and divorced from the lowest unit (the household) of social organization. Given this formal exclusion of the individual households (and inter-household interactions below village level) in rural Gwanda it is prudent to analyse the informal networks that govern the management of Cff and the broader natural environment in the study area.

Regarding the informal institutions, group discussion participants showed that those institutions that built social capital such as the requirement to attend certain social events and religious practices had allowed residents to discuss the challenges of Cff and act for the common good through community initiated control programmes. Therefore, it has been through the strong social capital in the area that certain common property areas had been cleared of Cff. Hardin (1968) argued that in the absence of private property rights, open access resources such as the range land of Gwanda (in the presence of a remote state) would be ultimately degraded. On the contrary, the results give a prime example of a situation where strong social networks allow villagers to act in union to avoid the tragedy of the commons. This is in line with observations by Ostrom (1990) who noted that in the presence of clear boundaries, social capital and slight institutional recognition; the tragedy of the commons could be avoided.

The majority of the informal institutions documented in rural Gwanda aimed at regulating human behaviour through African traditional religion/Christianity and culture. The vanguards of the informal institutions in rural Gwanda district are predominantly the older members of society and to a lesser extent the bearers of traditional leadership positions. Traditional leadership took a dualistic/quasi-dualistic position as it was formally recognised by national laws (Traditional Leaders Act) and simultaneously formed the bedrock of indigenous knowledge systems. According to key informant interviews, this dualistic nature of traditional leadership had weakened the capabilities of traditional leadership in favour of community elders primarily because traditional leaders were increasingly becoming extensions of the formal institutions of the state. Table 6.1 presents the 10 major informal regulations that community members in the study area abide by.

The most popular informal institutions relate to social gatherings such as funerals, weddings and community meetings. According to the results, attending the stated events is a requirement of the traditional and cultural practices of rural Gwanda district. Additionally, the community explained that tradition required them to co-exist as kinsmen and avoid mixing with outsiders through inter-marriages. Moreover, tradition valued the wisdom of the elders and required the younger members of society to accept and revere elderly counsel. The violation of this cultural aspect was considered one of the primary reasons for the disintegration of the common social ethos in the study area.

Significant informal laws in the study area also relate to the preservation of livelihood strategies. These are exemplified by the popularity of laws that forbid the grazing of livestock at night. According to group discussions, this rule protected the livestock from the risks related to darkness (theft, predators, etc.) and prevented livestock from grazing crops given the absence of shepherds at night.

Informal institutions that relate to religion and the spiritual work rank behind those dedicated to the protection of livelihoods. Key informants argued that though significant, the religious laws had become plagued with confusion emanating from the practice of multiple religions and doctrines. In some cases, this confusion was singled out as a barrier to unity of purpose and progress within the community. Informal laws that relate directly to environmental conservation were identified although, in the lower levels of the pecking order. Despite the limited number of informal rules that relate directly to environmental management, arguments in the previous sections have shown that social networks at all levels are related and allow for the building of various levels of social capital that in turn influence environmental management at inter-household level.

Table 6.1: Knowledge of informal regulatory institutions

REGULATION		ADHERENCE TO REGULATION				
		Nhwali %	Segezane %	Seboza %	Tshongwe %	Study area average %
1	Attend funerals and community gatherings	87	95	91	93	91,5
2	Live amongst your own and marry your own	84	56	76	83	74,75
3	Listen to the wisdom of the elders	73	68	71	78	72,5
4	Do not allow livestock to graze at night	82	67	65	66	70
5	Attend church groups	51	83	47	36	54,25
6	Do not go to the fields on Wednesday	28	56	41	32	39,25
7	Honour your ancestors	54	19	31	41	36,25
8	Do not farm close to the river	24	32	45	27	32
9	Do not cut down sacred trees and move into sacred lands or mountains	19	43	34	16	28
10	Do not cut down old/tall trees	11	23	16	26	19

Table 6.2 summarises the formal (legal, organisation and regulatory) and informal institutions that have guided environmental management in rural Gwanda district over time.

Table 6.2: major institutional frameworks in rural Gwanda district

	1960-1969	1970-1979	1980-1989	1990-1999	2000-date
Legal	-Cold Storage Commission Act of 1960; -Fish Conservation Act of 1961; -Seeds Plant Pests and Diseases Act of 1964; Land Tenure Act	-Atmospheric Pollution Prevention Act of 1971; -Locust Control Act of 1971; -Wildlife Conservation Act of 1972; -Mines and Minerals Act, 1974; -Natural Resources Act of 1975; -Parks and Wild Life Act of 1975; -Hazardous Substances and Articles Act of 1978;	-National Museums and Monuments Act of 1980; -Forest Act of 1981; -Trapping of Animals (Control) Act of 1981; -Prevention of Cruelty to Animals Act of 1983; -Fertilizers, Farm Feeds and Remedies Act of 1986; -Drugs and Allied Substances Control Act of 1988;	-Animal Health Act of 1990; -National Trust Act of 1990	-Environmental management Act of 2002 -Traditional leaders Act of 2001 -Rural District Councils Act of 2002
Organisational	-Forestry commission	-Forestry commission	-Department of national museums and monuments -Forestry commission		-Environmental management council -Environmental Management board -Environmental management agency
Regulatory	Native commissioner's office		-Ministry of environment and tourism -Traditional leadership	-Provincial livestock department -Agricultural extension services -Veterinary office	-Ministry of environment water and climate -Traditional leadership -Rural district council NGOs
Regulatory (Informal)	-Do not cut down tall/old trees -Attend funerals and community gatherings -Live amongst your own and marry your own -Listen to the wisdom of the elders -Honour your ancestors -Respect sacred land	-Do not allow livestock to graze at night	-Attend church groups	-Do not farm close to the river	-Do not go to the fields on Wednesday

6.6. POLITICS OF ENVIRONMENTAL GOVERNANCE IN RURAL GWANDA

This section considers the relationship between the formal and informal environment management institutions in the study area. The analysis revolves around the factors that govern the allocation of property rights to natural resources and the social capital within the informal networks.

A close look at the property rights regime governing natural resource access in rural Gwanda reveals an ill-defined common property regime. This problem of definition is rooted in the failure to recognise the households/user communities as the lowest levels of local government. Additionally, the upholding of the colonial institutions of indirect rule has left the traditional leadership structure weak and incapable of taking remedial action in issues of environmental management.

Key informants from traditional leadership in Gwanda indicated that their power was very limited and they often found it difficult to control particular isolated cases of deviant behaviour (e.g. individuals who cut trees for sale) as the forests are often considered free God-given resources for all Zimbabweans. The institutional dilemma (common vs. state property/ colonial vs. post-colonial) has indeed seen the depletion of natural capital in the form of old and sacred trees such as *uMtswili* (Silayigwana, 2014). As such, formal institutions tend to focus on the Rural District Councils RDCs as the lowest level of local government. Such property rights regime is clearly not common property but rather state property cascaded to lower levels closer to the communities but not to the communities themselves.

Table 6.3 shows that within the residents of rural Gwanda district, there is limited knowledge of the formal environmental management institutions particularly, the provision of the Environmental Management Act. The EMA, NGOs and traditional leadership institutions are the most recognised formal institutions in the study area.

Due to the limited knowledge of the formal institutions, the Relevance, Effectiveness and Formulation (REF) scorecard results were not considered representative of the population. Nevertheless, according to group discussions, the organisational arm of the formal institutions particularly the EMA and NGOs had played a notable role in the management of the environment particularly in the case of Cff. However, the community revealed that increased amounts of resources directed towards environmental management initiatives that

included the local community could improve the efficiency of environmental management programmes.

Table 6.3: Knowledge of formal institutions

Legal		Organisational (regulatory)	
Environmental Management Act	12%	EMA	83%
Traditional Leaders Act	7%	NGOs	61%
		Traditional leaders	57%
		AREX	54%
		Veterinary department	31%
		Forestry commission	19%
		Police	11%

Key informants also stated that the central state agencies have often mismanaged natural resources, due to both insufficient capacity and misaligned incentives that lead to appropriation of public assets for private gain and patronage. In Nhwali, traditional leaders explained that the state had limited resources to provide tools for the control of Cff resulting in reliance on community initiatives that brought the plant under control. Thus, in this case state management is not matched by the state’s claims of ownership. This reflection is a confirmation of resource challenges that are associated with state aligned actors.

Moreover, local chiefs in rural Gwanda noted that the state restricted local people from using local natural resources while allowing outsiders to exploit the resources through permits from state agencies, bypassing village structures. This case was highlighted in the case of mineral resources where permits were obtained from higher state authorities while the negative externalities of mining affected the lowest levels of society in the form of the local villagers. Mukamuri and Kozanayi (1999) noted similar issues and argued that such issues had resulted in protests by the rural Zimbabweans who chose not to uphold the formal laws where enforcement in most cases was non-existent.

The formulation of the formal environmental management institutions was a mystery within the community who argued that the laws always filtered to them through unclear conduits. Key informants argued that consultation in the formulation of formal institutions was rare

and, if present, the local community lacked the capacity to contribute meaningfully. The majority of the villagers (72.5%) indicated that they had been involved in Cff management and were aware of community-initiated programmes in the study area (73% of the sample). Community programmes for the management of Cff involved cutting, burning and burying of the plant. Despite the notable community efforts and the positive results observed in Nhwali and Sengezane village, the community are faced with multiple challenges as they endeavour to control Cff. The major challenges faced by the community when managing Cff are the lack of technical knowhow, injury and the lack of appropriate tools.

This state of affairs resembled a case similar to that discussed by Mapenza (2007) who showed that the formulation of formal environmental laws often excluded local communities but required their obedience to unfamiliar laws. Using the case of Cff, Table 6.4 shows that the majority in the community (65%) had not received education on the management and laws that govern invasive plants. Moreover, the most common form of accessing IAPs information is personal experience and indigenous knowledge. The situation summarized in Table 6.4 (based on survey results) shows the importance of lower level community structures in issues related to environmental management.

Table 6.4: Information of IAPs

		Frequency	Percent
Have you been given an education on IAPs	Yes	28	35
	No	52	65
Where do you get information regarding IAPs?			
Government		3.8%	
News (radio and print)		7.5%	
NGOs		12.5%	
Experience and indigenous knowledge		76.2%	

6.6.1. The Hegemonic State and the local community

Previous discussions highlighted the possible exclusion of local households from natural resources management in Zimbabwe. Challen (2000) argued that transaction costs of ownership determined allocation of property rights. In this regard, a wealth of evidence from long-term studies of forests in different parts of the world suggests that localised management institutions may perform as well or better than state owned areas (Hayes, 2006; Ostrom and Nagendra, 2006). Agrawal (2007:123) summarized this observation noting that:

“Rules that are easy to understand and enforce, locally devised, take into account differences in types of violations, help deal with conflicts, and help hold users and officials be accountable are most likely to lead to effective governance”.

In an attempt to understand the rationale for excluding local households (below village level) from direct environmental management in rural Gwanda and Zimbabwe in general, the study turns to issues of political negotiation.

According to Murphree (2000), crafting more sustainable resource management arrangements requires reforms that secure greater land and resource rights at the local level. However, the policy-makers that control such reform processes generally have substantial disincentives to implementing such measures (Nelson, 2010). This study has shown that in Zimbabwe, natural resources are inseparable from national wealth thereby making them a powerful negotiation tool in the politics of patronage and maintenance of political power. During group discussions, villagers argued that the distribution of land for agricultural and mining purposes by the state had been done along informal political lines with the aim of securing political survival through proceeds from economic rents derived from the natural resources.

This situation shows that to a certain extent the formal institutions in rural Gwanda district have become a smoke screen covering informal relations (patronage) that continue to dominate behind the scenes resulting in the accumulation of wealth by state actors. Reforms that would devolve or decentralize rights over resources to the local level, and provide institutional basis for local common property management regimes, are likely to be incompatible with the state. The lack of institutional democratization observed by Mamdani (1996) in this case seems to have been moved to representative democracy by numbers

rather than participatory democracy that include the lowest levels of the communities that is a more ideal level.

Representative democracy rests on a representative (e.g. the Village Head, ward Councilor or Member of Parliament) who is assumed to be well aware of most household needs. On the other hand, participatory democracy solicits the participation of households from the grassroots. From a similar perspective, Von Doepp and Villalón (2005:18) noted that in most of sub-Saharan Africa “control over resources translated into political advantage as incumbent elites obtained the ability to dispense patronage, run viable party organizations, and mount effective campaigns”.

As such for the Zimbabwean, joining the structures of the state has become a path to power and wealth built on informal patronage systems but displayed as formal rules for all to abide by. As summarized by Szeftel (1998), state politics becomes a means of entry into business characterized by a ‘winner-take-all mentality. The hegemonic state in rural Gwanda is thus left in a position where informal patron–client relations have bred neo-patrimonial governance and any attempt to reform the system is resisted as it goes against the grain of dominant state actors.

The dominance of the state in environmental governance is cascaded to the lower levels such as the RDC and state aligned organisations such as the EMA. Despite the limited capacity of these organisations regarding environmental management, there is a reluctance to cede institutional power to the village structures below. Additionally the influence that the state has on NGOs greatly reduces their effectiveness in pursuing pure common property initiatives that may be seen as the politisation of the NGO.

6.7. VALUE OF THE INFORMAL INSTITUTIONS

The value of informal institutions in environmental management has been explained and shown in this study. The exploration of informal institutions in rural Gwanda goes further to highlight the formulation, effectiveness and effect that these institutions have on natural resource governance. The relevance, efficiency and formulation of informal institutions are major indicators of their overall effectiveness. Focusing on these major indicators allows for thick analysis that Adjor *et al.* (2003) considered paramount when observing environmental management institutions.

The REF scorecard was used to give community perspective of the informal institutions that most of the villagers in rural Gwanda abide by (see Table 6.1). Using the REF scorecard, an indicator of 3 denoted maximum relevance while an indicator of 1 showed irrelevance of the institution. The REF scorecard delivered inconclusive results regarding the formulation of informal environmental management institutions. Group discussion shed more light on the likely reason for inconclusive results divulging that the formulation of the informal institutions was difficult to discuss given that most of them were established before many of the living residents were born.

Results showed a grouped relevance indicator of 1.3 for informal institutions. This showed that the majority of the people in the community considered the informal institutions irrelevant. Group discussions divulged that predominantly the elderly valued and held informal norms in high esteem. However, the youth were unfamiliar with these laws and chose to abide with the formal institutional requirements that had the police as enforcement agents. The informal institutions had an efficiency REF scorecard indicator of 1.107 meaning that the institutions in most cases failed to achieve their objectives.

Such low REF indicators are contrary to the earlier observation regarding the importance of the informal sector in environmental management. However, upon further probing through key informant interviews and group discussions it was revealed that the informal institutions in rural Gwanda had fallen prey to manipulation by multiple social factors.

Group discussants argued that the presence of formal laws made it difficult to enforce informal agreements given that these were not recognised by the formal structures. According to Silayigwana (2014), contrary to present day rural Gwanda, in the past, adherence to these networks was founded on strong social capital, which was in turn buttressed by kinship and observance of the same culture and tradition. Christian religious practices were also noted to play a major role in making most informal institutions inclined to local culture irrelevant.

According to Silayigwana (2014), numerous negative factors such as political polarisation plagued formulation of contemporary informal institutions and tended to reduce them to the rules followed by members of a specific political party. Furthermore, the elders (culturally with the responsibility to educate the young on informal institutions) had either passed on or had no audience given that most of the youth had either migrated or embraced formal

modern laws (Sllayigwana, 2014). Box 6.5.2 gives an example of sentiments held in the community regarding the efficiency of informal institutions.

Box 6.5.2: Perceptions on the efficiency of informal institutions

“Today the dominance of Christianity, migration and the prevalence of intermarriage amongst people of different cultures combined with the power of money have greatly reduced the efficiency of the laws left by our forefathers. For instance, as the headman, how do I tell a youth to observe a particular law when he is a Christian and fifty times richer than I am. I obviously have to let him do what he wants because the resources he has may benefit me as well”.

Source: KII Tshongwe Village (2014).

The informal institutions in rural Gwanda have been shown to be the conduits to political power through control of natural resources by the state. These informal institutions are built on social capital and are instrumental in ensuring smooth functioning of common property arrangements. However, in rural Gwanda, there is evidence of the state manipulating social capital using politics, destabilization of tribal groupings and patronage in order to further entrench its dominance in natural resource governance. Similar to the negative state effects on social capital, religious differences are also highlighted as major inhibitors to positive social capital formation.

From the survey group discussion and key informants, it is evident that politics and religion have become the catalysts for the formation of negative social capital that undermines the impact of informal institutions on natural resource governance.

In theory, decentralization of natural resource governance is the answer to the natural resource management question given that where rights over resources are either completely undefined or unenforced, conditions of ‘open access’ tend to unfold. Nonetheless, the case of rural Gwanda district suggests that strong positive social capital may avert tragedy of the commons, particularly when an environmental problem is affecting the majority of the community (e.g. the Cff invasion). However, in cases where there are negative elements of social capital or the problem is limited to a few individuals with no visible real time/short-term negative effects, the tragedy of the commons is likely to occur in spite of the enabling factors highlighted in Ostrom 1990 (e.g. strong social capital, clear boundaries, etc.). This observation raises questions on how the positive elements of social capital may be harnessed to deal with environmental problems that are not a direct threat to humans in the short term.

Therefore, a dominant state player despite the evident inefficiencies of a state property rights regime predominantly answers the natural resource management question in rural Gwanda. Common property arrangements are constantly hindered by the hegemonic state that manipulates the building blocks of the institution of social capital to its advantage. In order to combat institutional exclusion, there is need for community agency in demanding a larger stake in the control and management of natural resources.

6.8. CHAPTER SUMMARY

This chapter has given a detailed description and analysis of the institutions and power dynamics at play in rural Gwanda district. The state has been shown to be the dominant environmental management institution in the study area with the ability to influence and manipulate other institutions involved in environmental management. The next chapter delves deeper into the study findings in accordance with the thematic areas of environmental perceptions, livelihoods and the effects of Cff on livelihoods.

CHAPTER 7: RESEARCH FINDINGS: THEMATIC EMPIRICAL ANALYSIS

The previous chapter gave a detailed description and analysis of the institutional environment in the study area. This chapter analyses the effects of *Cylindropuntia fulgida var fulgida* (Cff) on the population described in Chapter 5 using the method explained in that chapter. This chapter begins by discussing the dominant environmental perceptions of the residents of rural Gwanda district. The chapter then explains the processes employed in developing a weighted monetary value of household stocks and flows that was used to place the households into wealth and income categories. The subsequent analysis focuses on the effects of Cff on livelihoods in rural Gwanda district. Quantitative and qualitative results are analysed in each of the specific themes.

7.1. ENVIRONMENTAL PERCEPTIONS IN RURAL GWANDA DISTRICT

The formulation of attitudes towards certain species in the environment ultimately informs the overall perception an individual has regarding the natural environment (Selge, Fischer and van der Wal, 2011). Limited studies (e.g. Adeola, 1996; Allsopp *et al.*, 2007) have attempted to give an angle of natural environment perceptions in the rural African context. Therefore, information concerning the ways in which African rural communities formulate attitudes about plant and animal species found in the natural environment is narrow (Aerni, 2005; Lombard and Ferreira, 2014).

This section of the chapter uses the case of Cff in rural Gwanda district, Zimbabwe to contribute literature on the environmental perceptions / worldviews and the formulation of attitudes towards plant species within the natural environment in rural sub-Saharan Africa. First, the findings on the environmental worldview of the community in question are explained in relation to literature on related phenomenon, *inter alia*, the environmental Kuznets curve theory and the sustainability-poverty debate (Grossman and Krueger, 1995;

Egoh, 2012; Liu, 2012). Second, the section explains formulation of the attitudes by the local households towards Cff based on the names given, the alleged origins and the attributes associated with the plant. The study used qualitative and quantitative fieldwork results to explain the underscored aspects.

7.1.1. Natural environment worldview/perception in rural Gwanda district

The community gave their perceptions of the environment through the survey and group discussions. These perceptions were analysed and categorised using Kellert's (1996) classification of natural environment perceptions. Figure 7.1.1 shows the distribution of the community's responses along Kellert's (1996) classifications. The response YES indicated that the natural environment was considered in the particular Kellert (1996) perspective while NO indicated that it was not considered in the particular Kellert (1996) perspective. The side labelled 'A' in the diagram represents the factors in Kellert's (1996) classification associated with the higher dimension of conservation of the natural environment while the side labelled 'B' represents those factors associated with the utilisation dimension of the natural environment (Milfont and Duckitt, 2010).

The information in the Figure 7.1.1 shows that the communities have a concern for both the conservation and utilisation of the natural environment. The naturalistic (cited by over 35% of the respondents), symbolic (cited by over 30% of the respondents) and moralistic perspectives (cited by almost 30% of the respondents) of the environment dominate the conservatory conviction. According to Kellert (1996), the utilitarian perspective is centred on maximisation of utility through the use of ecosystem goods. The information in Figure 7.1.1 corresponds with Kellert (1996) as it shows the utilitarian (cited by almost all the respondents) perspective dominating the utilisation conviction. The rural communities of Gwanda district therefore are spiritual and instrumental/anthropocentric and ecocentric/altruistic and utilitarian in their perception of the natural environment.

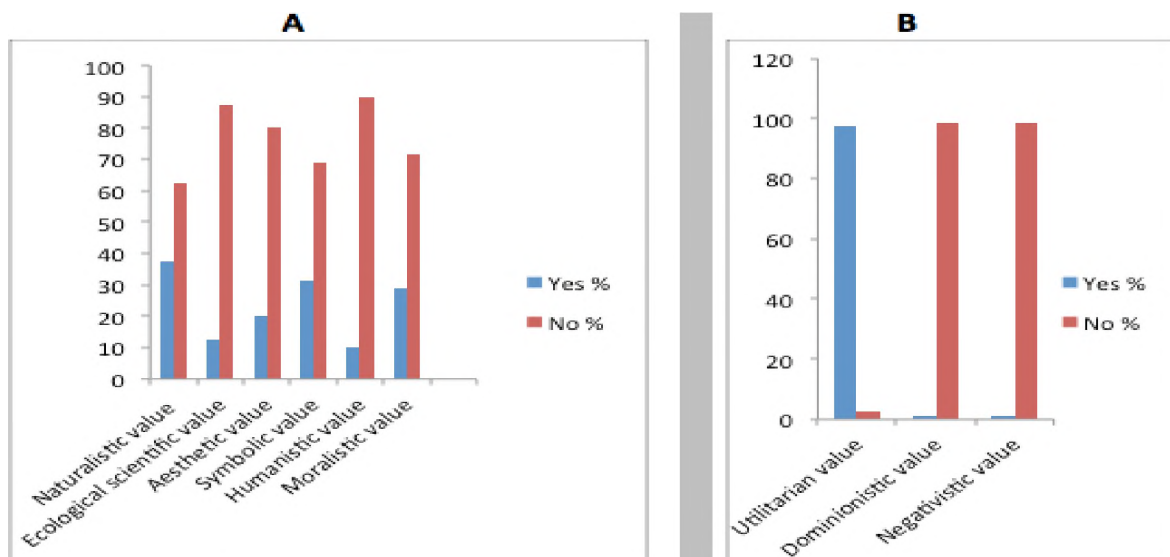


Figure 7.1.1: Community responses according to Kellert's (1996) classifications

This revelation is to an extent in line with previously discussed findings by Corral-Verdugo and Armendáriz (2000) showing a syncretic worldview of the natural environment in rural Mexico. Thus, the communities of rural Gwanda district have a syncretic view of the natural environment and this perspective is further captured by qualitative results from group discussions presented in the Box 7.1.1 that displays divergent responses from members of the same village during a group discussion.

Box 7.1.1: Syncretic view of the environment evidence from group discussions

“We love the beauty of the environment and we see God’s awesomeness in the environment. The oneness of human life with the animals is evident in the environment and we have to make sure it stays with us by conserving it. The environment is also valuable for its linkage with cultural ceremonies in most local community traditions.” **Group discussion participant.**

“When I think of the environment I think of the things it gives us like food (Meat and fruits), things we need (wood, medicine, livestock feed, refuge from danger for us and animals, etc.,) we can’t go hungry when there is food and material in the environment it is there for us to use”. **Group discussion participant.**

“Our forefathers had great conservation ethic and left us a great planet but we have begun to destroy it to the detriment of our future as a species. We have hunted animals to extinction in the forests, cut down revered trees and cleared sacred forests. The continuous disrespect of sacred ground like the Matopo hills and the *Njelele* area has brought adverse weather that has exacerbated poverty and turned people towards plundering the environment. Today some of the youth in the community have never seen an Impala which was a very common animal in this area in the recent past”. **Group discussion participant.**

Source: Group discussion Nhwali village (2014).

Nonetheless, the presence of a syncretic standpoint in the rural community does not imply that both the conservation and the utilisation convictions of the natural environment have the same weightings in the view of the local communities. In this regard, the means and standard deviation of responses to Kellert's (1996) classifications were computed (presented in the Table 7.1.1) to provide the general direction of the local community view regarding natural environment perspectives.

Table 7.1.1: The general view of the community according to Kellert (1996) classifications

Conservatory conviction of the community		
Perspective	N	Mean
Naturalistic value	80	1.63
Symbolic value	80	1.69
Moralistic value	80	1.71
Aesthetic value	80	1.80
Ecological scientific value	80	1.88
Humanistic value	80	1.90
Valid N (listwise)	80	
Utilisation conviction of the community		
Perspective	N	Mean
Utilitarian value	80	1.02
Dominionistic value	80	1.99
Negativistic value	80	1.99
Valid N (listwise)	80	

The two possible responses (YES/NO) were given the values 1 for YES and 2 for NO. Thus, according to the means of the responses shown in the Tables 7.1.1, a mean close to 1 indicates general acceptance of a perspective while close to 2 represents disagreement with the particular perspective. According to the means in Table 7.1.1, none of the natural environment conservation perspective has a mean value less than 1.5. This implies that the

general community view leans towards not conserving the natural environment. This general view is the case despite the presence of limited syncretic views highlighted in the Figure 7.1.1. The utilisation perspective of the natural environment is dominated by utilitarian consumption with a mean of almost one that is in sharp contrast to the other two perspectives (negativistic and dominionistic) leaning towards a mean value close to 2. Based on the utilitarian view (as representation of the utilisation view of the environment), it becomes clear that despite the presence of syncretic views regarding the natural environment in the study area, the general view leans towards utilisation rather than conservation. These findings hold common ground with conclusions made by Yu (2014), exposing that in comparison to their urban counterparts, rural communities in China were generally less concerned about conserving the environment.

Various factors peculiar to the individuals prompt the less common syncretic general view held by certain members of the population of rural Gwanda district. Numerous scholars have postulated a number of hypotheses concerning environmental proclivity and social attributes such as age, gender, social status, education and political ideology (Van Liere and Dunlap, 1980; Stern, Dietz and Guagnano, 1995; Lizuka, 2000; Mutalib, Fadzly and Foo, 2013; Yu, 2014). In this regard, statistically significant relationships were sought from the data in order to validate claims in literature using results from the study population. The identification of relationships that exists between social attributes and the individual view of the natural environment in the rural Gwanda population was done using correlations and Pearson Chi square tests. The significant relationships shown to have a bearing on the general view of the natural environment are those with a Pearson Chi-Square significance level of less than 0.05. Table 7.1.2 shows a significant positive correlation between age and some environmental perceptions defined by Kellert (1996) (symbolic and moralistic). In line with the positive correlation shown in Table 7.1.2, qualitative results from the group discussions suggested that age was a major determinant of the attitude that one had towards the natural environment. In this regard, respondents argued that the younger members of the population in the study area knew very little about the African traditional belief systems and knowledge (associated with the symbolic perspective) (see Box 6.2.2) that Mapenza (2007) showed to be associated environmental conservation. According to key informant interviews with local traditional leaders, the modernisation in society, advent of western religion, lack of interest in traditional

knowledge and religion explain the limited interest in conserving the natural environment within the majority of community members and especially the younger members of the population.

Box 7.1.2: Community perspectives on the age-environment view relationship

“The young are now Christians and do not care about traditional environmental values mostly because they are linked to our African traditional religion. It is only the elderly who still observe sacred forests and place as this is in line with our African religion.” **Elderly group discussion participant.**

Source: Group discussion, Sengezane village (2014).

In rural Gwanda district the quantitative survey data shows a negative correlation between occupation and certain environmental perspectives (dominionistic and ecological scientific perspective). This implies that if one holds a formal job they are less inclined to view the environment from a dominionistic or ecological perspective. Furthermore, education is not a significant determinant of environmental attitudes and views contrary to some perspectives in the literature (Van Liere and Dunlap, 1980; Lizuka, 2000).

Table 7.1.2: Correlations of Kellert (1996) perspectives and socio economic factors

KELLERT (1996) PERSPECTIVE		Age	Occupation	Education	Kellert (1996) Perspective
UTILITARIAN VALUE	Pearson Correlation	-.006	-.074	-.010	1
	Sig. (2-tailed)	.956	.514	.930	
	N	80	80	80	80
ECOLOGICAL SCIENTIFIC VALUE	Pearson Correlation	.135	-.279*	.062	1
	Sig. (2-tailed)	.234	.012	.586	
	N	80	80	80	80
NATURALISTIC VALUE	Pearson Correlation	.031	.049	.075	1
	Sig. (2-tailed)	.787	.669	.510	
	N	80	80	80	80
AESTHETIC VALUE	Pearson Correlation	-.079	-.031	-.082	1
	Sig. (2-tailed)	.485	.783	.471	
	N	80	80	80	80
SYMBOLIC VALUE	Pearson Correlation	.272*	-.025	-.134	1
	Sig. (2-tailed)	.015	.823	.236	
	N	80	80	80	80

MORALISTIC VALUE	Pearson Correlation	.281*	.109	-.052	1
	Sig. (2-tailed)	.012	.336	.648	
	N	80	80	80	80
HUMANISTIC VALUE	Pearson Correlation	.079	-.063	-.013	1
	Sig. (2-tailed)	.485	.581	.912	
	N	80	80	80	80
NEGATIVISTIC VALUE	Pearson Correlation	-.174	.063	-.004	1
	Sig. (2-tailed)	.124	.576	.970	
	N	80	80	80	80
DOMINIONISTIC VALUE	Pearson Correlation	.004	-.275*	-.004	1
	Sig. (2-tailed)	.969	.014	.970	
	N	80	80	80	80

*. Correlation is significant at the 0.05 level (2-tailed).

Table 7.1.3 further sheds light on the group discussion results that highlighted age as a determinant of environmental perceptions. Table 7.1.3 shows that older members of society in the study area (36-44 years; 45-65 years) tend to view the environment more from a naturalistic, aesthetic, symbolic and moralistic perspective in comparison to the younger members (19 to 35 years) of the population. The older population's (36 years and above) conservation conviction is centred more on the naturalistic, moralistic and symbolic perspectives than the aesthetic perspective. These perspectives (naturalistic, moralistic and symbolic) are synonymous with African traditional religion and may be an indication that the older one is, the more they are in touch with African traditional religion than other dimensions when considering the environment. These findings suggest that the qualitative findings have a base in the study area confirming statistical evidence from the survey results shown in Table 7.1.2.

Table 7.1.3: Household environmental perceptions according to age

Perspective	Response	% 19-35 years	% 36-44 years	% 45-65 years
Naturalistic	Yes	27%	38%	35%
Aesthetic	Yes	13%	21%	24%
Symbolic	Yes	7%	33%	47%
Moralistic	Yes	13%	25%	35%

The study did not ascertain if the non-youth members of the population practiced African traditional religion. Nonetheless, it is assumed that community member above 35 years lived through the colonial period when the practice of African traditional religion was common in comparison to the contemporary era that is dominated by Western culture (Nyathi, pers. Comm. 2015). This assumption is rooted in extensive research by Mamdani (1997) showing that most Africans were subjects of customary law during the colonial period. As such, these findings to a certain extent disagree with literature that associates conservation with the younger generation (Van Liere and Dunlap, 1980; Mainieri *et al.*, 1997; Mutalib, Fadzly and Foo, 2013).

The realised interest in the environment (naturalistic, aesthetic, symbolic and moralistic) amongst the non-youth members resonates with conclusions reached by Mapenza (2007) who showed that the African traditional religion was inseparable from the natural environment. In this regard, in rural Gwanda, those with higher levels of exposure to African traditional religion (generations before 1980) are more likely to have an interest in environmental conservation in comparison to the youth (<35 years).

According to White (1967), in the west, Judeo-Christian doctrines infiltrated society to its core resulting in a drive to dominate the natural environment. Nature was considered subject to man hence man could do as he pleased with nature (Schultz, Zelezny and Dalrymple, 2000). Furthermore, the Judeo-Christian religion required the elimination of any deities/gods related to nature in favour of its monotheistic God (Schultz, Zelezny and Dalrymple, 2000). White (1967) argued that Judeo-Christian western culture dominated science and technology and supported submission of the natural environment to men. An example of the dominion western perspective is the western calendar in Table 7.1.4 that predominantly glorifies lives, activities and the chronology of man (White, 1967).

In comparison to the West, Judeo Christian religion did not penetrate colonial African societies as much. Hence, African religion simultaneously reigned with its environmentally conscious traits. According to Ndebele, Mberi and Muhwati (2013), the Ndebele culture that is dominant in Gwanda is has informal institutional frameworks aimed at sustaining the human-natural environment symbiosis. Examples include the names given to the months of the year that were always explaining occurrences in the natural environment and rarely implying human dominance of nature but rather existence as a part of nature.

Furthermore, Manganyi and Buitendag (2013) accounting for the African perceptions of God showed that in southern Africa most cultures believed in a creator of all things and longed for the oneness that once existed with nature particularly wildlife. Additionally, the African cultures believed that all creation had spirits that protected them hence before one could utilise any part of the natural environment, it was necessary to first appease those spirits with particular rituals. The wildlife inclined surnames/totems also made it a taboo to eat or hunt the animal one shared a name with but rather prompted its conservation and protection.

Table 7.1.4: Months of the year African and Western perspectives

Western calendar month	Meaning and derivation	Southern African calendar equivalent	Meaning and derivation
January	Honour of Janus the Roman god of gates	Zibandlela/Masingane	When the grass has grown tall and covered the foot paths
February	Honour of Februa the Roman festival of purification	Nhlolanja	Months when dogs mate and have lots of litters
March	Honour of Mars the Roman god of war	Mbimbitho	
April	Honour of the god Aphrodite	Mabasa	Month to light the fires as the winter nears
May	Honour of the god of spring	Nkwenkwezi	Month when boys are circumcised
June	Honour of the god Junos	Nhlangula	Month of the small winds in nature
July	Honour of Emperor Julius Caesar	Ntulikazi	Month of the major winds in nature
August	Honour of Emperor Augustus Caesar	Ncwabakazi	Months to bury the winter and the heat begins
September	Seventh month	Mpadula	
October	Eight month	Mfumfu	Months when the trees begin to bloom
November	Ninth month	Lwezi	
December	Tenth month	Mpalakazi/Zibandlela	Month when the Impala produce lots of litter

Adapted from Crowl (1995) and Ndebele, Mberi and Muhwati (2013).

African traditional religion is intertwined with the natural environment and has constant references to sacred lands, trees and mountains amongst other things (Mapeza, 2007; Ndebele, Mberi and Muhwati, 2013). The communities and individuals of rural Gwanda are heterogeneous and subscribe to diverse informal institutions, religion included. The elderly subscribe to the traditional religion thus; environmental management using sacred lands, totems, taboos amongst other things applies more to them than the majority younger

population that has adopted the Judeo-Christian religion. As such, the elderly in the community of rural Gwanda revere the *uMtswili* tree and protect it using informal institutions related to culture and African traditional religion.

7.1.2. Local species knowledge: A community perspective

The group discussion results showed that forests are the most revered component of the natural environment in rural Gwanda district. According to the group discussions, within the forest, the most important components are trees because they have supported life since time immemorial through the provision of food and medicine. Table 7.1.5 shows the major native tree species identified by the population. According to the group discussions, of the trees identified, *uMtswili* (Leadwood tree) is most revered because the numbers have declined, it takes long to grow and once fully mature it produces very fine wood.

Table 7.1.5: Tree species identified as native and prominent

Community vernacular name	English name	Scientific name
<i>uMstwili</i>	Leadwood tree	<i>Combretum imberbe</i>
<i>uMnyi</i>	Bird plum	<i>Berchemia discolor</i>
<i>uXakuxaku</i>	Snort apple	<i>Azanza garckeana</i>
<i>iPhane</i>	Mopani	<i>Colophospermum mopane</i>
<i>uMganu</i>	Marula	<i>Sclerocarya birrea</i>
<i>uMkhaya</i>	Monkey thorn	<i>Acacia galpinii</i>
<i>uMklampunzi</i>	Donkey berry	<i>Grewia monticola Sond.</i>
<i>iSihaqa</i>	Long-tail cassia	<i>Cassia abbreviata Oliv. var. granitica (Baker f.) Baker f.</i>
<i>iSinga</i>	Acacia	<i>Acacia penninervis</i>
<i>iChithamuzi</i>	Rain tree	<i>Lonchocarpus capassa/Philenoptera violacea</i>
<i>uMkhomo</i>	Baobab	<i>Adansonia digitata</i>

A number of tree and plant species were considered exotic (foreign to Zimbabwe) and these included Cff, gum trees, prickly pear (*Opuntia polyacantha*) and Cherry pie (*Iantana camara*) amongst other species. Key informant interviews with the forestry department revealed that some of these foreign trees had been intentionally planted during the annual national tree

planting day (first Saturday of December) due to their ability to grow fast (in comparison to indigenous species) and provide ecosystem goods and services to the community.

The community welcomes any plant species so long as it will assist them from a livelihood perspective (Group discussion results). However, with particular reference to Invasive Alien Plants (IAPs), the group discussion participants indicated that numerous problems had emerged due to the presence of IAPs resulting in a level of caution when introducing new plant species in the community. Survey results showed that all respondents had knowledge of IAPs particularly Cff. Table 7.1.6 summarises the common IAP names, period of time that the respondent has known about the plant and the knowledge of the origins of the plant.

Table 7.1.6: Plants considered as IAPs in the local community

Scientific name	Common names	village	Period of time known	Knowledge of origins	
				Yes	No
<i>Cylindropuntia fulgida</i> var <i>fulgida</i>	Magnet, <i>Majampela Mutabosawa, Rosea Sithababaloyi, Ugetsi UMayeqela, Fulgida, Sihlalosabathakathi, isiqababa</i>		More than 10 years (80% of the population)	26%	74%
<i>Striga Asiatica</i> (Witch weed)	<i>Isona, Ubudli</i>		More than 5 years (75% of the population)	7%	93%
<i>Dichapetalum cymosum</i> (Poison leaf)	<i>UMkhawuzane</i>		More than 10 years (60% of the population)	21%	79%
<i>Lantana camara</i> (Cherry pie)	<i>Lantana</i>		More than 10 year (40% of the population)	11%	89%
<i>Euphobia ingens</i> (Euphorbia)	<i>UMhlonhlo</i>		More than 10 years (80% of the population)	32%	68%

Of the plants identified as invasive aliens by the rural community, only Cff and *Lantana camara* were alien plants. The rest of the plants are native and either invasive or dangerous to wildlife and humans. Trends within the rural community show that invasiveness or perceived danger posed by a plant species tend to invite the 'alien' tag regardless of facts pertaining to origins. The term 'invasive alien plant' has therefore become associated with

any plant species that causes the community problems. This observation is synonymous with confusion in literature regarding the naming of biological invaders (e.g. Colautti and MacIsaac, 2004; Warren, 2007, 2011; Selge, Fischer and van der Wal 2011).

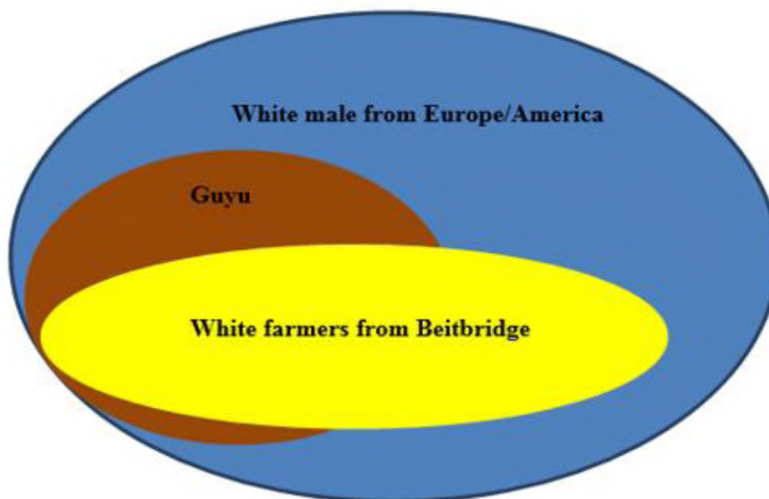
7.1.3. Formulation of attitudes towards Cff

To understand the formulation of attitudes towards Cff by the community of rural Gwanda district, it is essential to consider the names that the community have given the plant. These names reflect an attitude rooted in the characteristics, events and activities associated with the plant. Table 7.1.7 explains the meaning of the names given to Cff by the community based on key informant interviews and group discussion results. As shown in Table 7.1.7, the prominent names given to Cff suggest a plant associated with unnatural movement and witchcraft.

A number of perspectives exist apropos the origins of Cff amongst the study population. As shown in Figure 7.1.2, the majority of the group discussion participants (represented by the blue colour) argued that the plant came to the area with a white male from either Europe/America/South Africa between 1970 and 1980 primarily for protection from snakes and ornamental purposes. Alternatively, significant portions of the participants (represented by the brown colour) point to Guyu research station as the source of all the Cff plants in Gwanda district. A lesser portion of the participants (represented by the yellow colour) indicated that Cff originated from neighbouring South Africa through White farmers in the bordering Beitbridge district. The origins map in Figure 7.1.2 summarises the perceived origins of Cff in rural Gwanda district.

Table 7.1.7: Meanings of names given to Cff

NAME (LANGUAGE)	TRANSLATION AND DERIVATION
<i>ISiqabaqaba</i> (Ndebele)	The extreme heathen (derived from the Ndebele word, <i>iQaba</i> meaning heathen. In this case the plant is likened to a double heathen <i>iQabaqaba</i>)
Magnet (English)	Derived from the plants ability to attach itself to humans and animals like a magnet does to iron
<i>UMajampela, UMayeqela</i> (Ndebele)	The jumper (derived from the <i>cholla's</i> ability to spring onto humans and animals)
<i>Mutabosawa</i> (Sotho)	One that pricks and won't come off (derived from experiences people have had once they have been pricked by the spines of the plant)
Rosea (English)	Name the EMA authorities use to call the plant
<i>Sithababaloyi</i> (Sotho)	That which pricks witches (derived from the night travel difficulties the plant has caused, hence it pricks witches who are the night travellers)
<i>Ugets</i> (Ndebele)	Electricity (derived from the motion of the plant when attaching itself to a victim, as though it was powered by electricity)
<i>Sihlalosabathakathi</i> (Ndebele)	Chair of the witches (derived from the conviction that the plant glows in the dark and is used by evil people hence, only they can sit on it)
<i>Fulgida</i> (Partial scientific name) (Opuntia Fulgida)	Name the EMA authorities use to call the plant



Almost all residents believe Cff arrived with a white male (Blue)

A lesser percentage believe it arrived with a white male and was spread from Guyu (Brown)

The smallest percentage believe Cff arrived with a white farmer from Beitbridge (Yellow)

Figure 7.1.2: Origins map showing common perspective in accordance with sphere size

Qualitative data (from FDGs) results and the mis-identification of indigenous plants and alien in the Table 7.1.6 show that in the study area, origins are not major determinants of attitudes towards plant species in the environment. Likewise, the participants revealed that origins of a plant were not significant so long as the plant contributed to their livelihoods. Notions captured in Box 7.1.3 show the non-significance of origins in rural Gwanda district. The results agree with findings by Fischer and Young (2007) and Selge, Fischer and van der Wal (2011) showing that origins did not have a significant effect on the attitudes that individuals developed towards certain species in the environment.

Box 7.1.3: The significance of plant origins

“It is not necessarily a bad thing to have plants that are alien to this place because traditional healers make use of them to heal people especially if the plant is known to have medicinal benefits in its native area.” **Group discussion participants.**

Source: Group discussion, Tshongwe village (2014)

Therefore, the findings suggest that the major determinants of attitudes towards species in the natural environments are attributes of that species particularly with respect to livelihoods. The characteristics of Cff and the effects that it has on the livelihood capital mix have influenced the attitudes of the rural Gwanda population towards it.

7.2. WEIGHTED MONETARY VALUE OF HOUSEHOLD STOCKS AND FLOWS

Wealth and income are not identical although they are synonymous and have a causal relationship given that in most cases the realization of income leads to the creation of wealth (Lopez-Feldman, 2014). According to Klein (1950), income is a flow of money going to factors of production such as salaries from labour and rentals from land. Wealth, on the other hand, is a stock concept defined by a large amount of money or valuable assets and can be held in the form of savings in bank accounts; ownership of shares issued by listed companies and ownership of property amongst other forms. Furthermore, wealth generates income given that savings pay interest; shares lead to a flow of dividends and property begets rentals (Klein, 1950). Wealth and income are significant explanatory variables in the analysis of rural livelihoods. It was thus necessary to develop a means of differentiating households with respect to wealth and income as done in studies such as Cavendish (2002) and Campbell *et al.* (2002).

Before the differentiation of households, Tables 7.2.1a-c show the patterns of asset ownership, livestock and crop production in rural Gwanda district. The information on the Tables 7.2.1a-c considered only the presence of the asset in the household (not value or numbers of the same asset owned); presence of the livestock unit in the household (not value or numbers of the same unit owned) and the planting of a crop by a household (not the value of the harvest or the arable land dedicated to the crop). The summaries are discussed in detail under the sub-themes as the chapter progresses.

Building on the work done in previous studies by Cavendish (2002) and Campbell *et al*, (2002), this study separated the concept of household wealth from that of household income. Wealth in this case differed from overall household expenditure as its constituents included *inter-alia* fixed assets, livestock and consumer durable goods (stocks). Household expenditure on the other hand related more to household flows (income).

In this study, household wealth and income were considered from a qualitative and quantitative perspective. Regarding the qualitative angle, group discussion participants gave the local indicators of a wealthy/rich household. Box 7.2.1 captures the major indicators identified in the group discussion from a wealth and income perspective.

Table 7.2.1. a: Asset ownership patterns in rural Gwanda district

Asset group	Observed assets	% Of Households who own asset
Shelter	Corrugated house	58%
Agricultural tools	Hoes	100%
	Axes	96%
	Ploughs	75%
	Shovels	74%
	Picks	61%
	Rakes	39%
	Borehole	23%
	Cultivators	17%
Electrical goods	Radio	51%
	Solar panel	43%
	Television	28%
	Generator	20%
	Satellite dish	13%
	Electrified house	5%
Communication devices	Mobile phone	72%
Transportation	Wheel barrow	71%
	Bicycle	61%
	Scotch cart	60%
	Car	4%
Furniture	Beds	91%
	Kitchen furniture	34%
	Lounge furniture	28%

Table 7.2.1. b: Livestock ownership patterns in rural Gwanda district

Livestock	% Of Households who run livestock range
Goats	85%
Poultry (Chickens, Turkeys, etc.,)	80%
Donkeys	75%
Cattle	61%
Sheep	26%
Pigs	9%

Table 7.2.1. c: Crop production patterns in rural Gwanda district

Crops	% Of Households who produced crop in the last farming season
Tomatoes	59%
Green vegetables	56%
Maize	53%
Ground nuts	48%
Melons	44%
Round nuts	41%
Sorghum	41%
Millet	33%
Sweet potatoes	33%
Sugar beans	6%
Wheat	4%
Paprika	3%
Potatoes	1%

Box 7.2.1: Indicators of a prosperous household

WEALTH FACTORS

- i. High numbers of livestock particularly goats and cattle
- ii. Corrugated iron houses
- iii. Educated parents and/children
- iv. Ownership of modern technology (television, radio, generators and solar panels)

INCOME FACTORS

- i. Selling cattle and chickens
- ii. Ability to give neighbours food
- iii. Donating to community projects

The study used a weighted monetary value of the stocks and flows to analyse the wealth and income patterns in the study area from a quantitative perspective. The value was developed using Principal Components Analysis (PCA), a method that involves compressing numerous original variables into a few derived variables. The component loading factors were used as weights that determined the contribution of each component to the composite value. Table 7.2.2 shows that PCA was an appropriate method for determining the weighted wealth index (WI) value as shown by a Kaiser-Meyer-Olkin measure of sampling adequacy above 0.6. Furthermore, Table 7.2.2 shows that the results of the PCA are statistically significant as indicated by the Bartlett test for sphericity.

Table 7.2.2: Statistical test showing the appropriateness of PCA

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.612
	Approx. Chi-Square	1691.718
	Df	325
	Sig.	.000

Five factors were retained in the final exploratory factor analysis. All the factors had Eigen values above 'one'. Furthermore, the factors cumulatively explained 66,37% of the overall variance of the variables used in the PCA procedure (Table 7.2.3). This section briefly describes each factor highlighting major common components that composed the factor.

Factor one explains approximately 31.5% of the variance of the variables used. The factor (one) has been named the household asset factor given that the components with the highest loadings (corrugated iron houses, generators and scotch-carts) relate to consumer durable goods possessed by the households. The second factor explains 13,3% of the variance of the variable used. Factor two has been named the livestock and agricultural produce factor due to the high loadings in components related to dry land cropping (sorghum, round nuts, millet and melons) and livestock (donkeys).

The third factor explained 8.5% of the variance of the variables used in the PCA and was named the agricultural/equipment assets factor. The naming of factor three was due to the high loadings for equipment assets and fresh garden produce in the form of green vegetables and tomatoes. The fourth factor had high loadings for poultry and explained 6.9% of the variance of the variables used. As such, the factor was named the poultry factor.

Table 7.2.3: Factors with the highest weighting in household stocks and flows

	1	2	3	4
	Household assets	Livestock and Agricultural produce	Agricultural/equipment assets	Poultry
Number of corrugated iron houses owned	.721			
Monetary value of generators	.707			
Monetary value of goats owned	.693			
Number of beds owned	.635			
Average monetary value of sorghum harvest		.826		
Average monetary value of round nuts harvest		.801		
Average monetary value of millet harvest		.680		
Annual income Goats		.600		
Average monetary value of melons harvest		.571		
Annual income Donkeys		.571		

Monetary value of donkey's owned		.551		
Monetary value of ploughs			.722	
Monetary value of scotch carts			.660	
Number of ploughs owned			.639	
Number scotch carts owned	.561		.635	
Average monetary value of green vegetable harvest			.582	
Average monetary value of tomatoes harvest			.547	
Monetary value of corrugated iron house	.617			
Annual income Poultry				.861
Monetary value of poultry owned				.860
Average monetary value of sweet potato harvest				.612

PCA in this case aimed at highlighting the factors with the highest weighting in issues related to the average value of household stocks and flows. The components singled out in the various factors (shown in Table 7.2.3) may be categorised into household assets, agricultural produce and livestock. Furthermore, within the individual categories, there exist components associated with household flows (incomes) and stocks (wealth).

Therefore, the weighted value of household income and wealth in the study area is given by summing the stock and flow components of the reduced variables in accordance with the PCA conducted. In order to develop the weighted value, the three sub sectors (livestock, household assets and agricultural produce) were used as primary indicators of wealth and income as shown in equation I.

Box 7.2.2: Equation (I)-Household wealth and income

$$WI = (P) L + (P) HA + (P) AP$$

Where

WI represents the household wealth and income

L represents Livestock

HA represents household assets

AP represents agricultural produce

P represents the extracted principal components in the respective sub-sector

Based on the PCA results summarised in Table 7.2.3, the most significant indicators of stocks from a livestock perspective in rural Gwanda are the ownership of goats, donkeys and poultry (predominantly chickens). Regarding household flows, the sale of donkeys, goats and poultry form significant parts of the principal components. These quantitative survey results differ from the group discussion data in Box 7.2.1, which included the number of cattle owned as an indicator of wealth. However, the information conforms to results published by Francis (2012) and Masocha (2010) who argued that rural Gwanda was most suitable for small stock production due to its semi-arid nature. Therefore, the livestock components associated with household wealth and income are summarised as shown in equation (II). Terms to the left of the '+' sign relate to wealth while those on the right of the '+' sign relate to income.

Box 7.2.3: Equation (II)-Major livestock variables in household wealth and income

$$(P) L = (Go+Fo+Do) + (Gs+Fs+Ds)$$

Where

Go represents monetary value of goats owned

Gs represents income derived from goats sold the year before

Fo represents monetary value of fowls owned

Fs represents income derived from fowls sold the year before

Do represents monetary value of donkeys owned

Ds represents income derived from donkeys sold the year before

P represents the extracted principal components in the respective sub-sector

Regarding the consumer durable assets owned by the households (stocks), the major household consumer durable assets that point towards a wealthy household in rural Gwanda are the numbers and value of ploughs, scotch carts, corrugated iron houses, electricity generators and solar panels. As such, the consumer durable household assets associated with household wealth in rural Gwanda district are summarised in equation (III).

Box 7.2.4: Equation (III)-Major asset variables in household wealth

$$(P) HA = Ph + Sc + Ch + Sp + G$$

Where

Ph represents the monetary value of ploughs owned

Sc represents the monetary value of scotch carts owned

Ch represents the monetary value of corrugated iron houses owned

Sp represents the monetary value of solar panels owned

G represents the monetary value of generators owned

P represents the extracted principal components in the respective sub-sector

Regarding agricultural produce, the research used figures from the previous year's harvest to explain the flows of crops. The PCA results showed that the major agricultural products that are indicative of a household with high levels of income in rural Gwanda are the quantity and value of sorghum, millet, groundnuts, tomatoes, green vegetables, melons and sweet potatoes harvested. Assuming the family either consumes or sells its harvest, it should follow that the monetary value of the entire harvest is the best approximation of its worth. Therefore, agricultural produce that is associated with household income in rural Gwanda district is related to the value of the total harvest as summarised in equation (IV).

Box 7.2.5: Equation (IV)- Major crop variables in household income

$$(P) AP = S + M + Rn + T + Gv + Me + Sp$$

Where

S represents the monetary value of Sorghum harvested

M represents the monetary value of millet harvested

Rn represents the monetary value of round nuts harvested

T represents the monetary value of tomatoes harvested

Gv represents the monetary value of green vegetables harvested

Me represents the monetary value of melons harvested

Sp represents the monetary value of sweet potatoes harvested

P represents the extracted principal components in the respective sub-sector

Therefore, in the light of the discussed components of wealth and income (from a qualitative and quantitative perspective), the study produced a weighted value of wealth (stocks) and income (flows) (WI) in the study area. The WI derived (shown in equation V-Box 7.2.6) was further used to create the wealth and income categories of households. In equation V, the components in blue relate to household wealth while those in red relate to household income.

Box 7.2.6: Equation (V)-Expanded Household wealth and income

$$WI = [(Go + Fo + Do) + (P + Sc + Ch + Sp + G)] + [(Gs + Fs + Ds + Cs) + (S + M + Rn + T + Gv + Me + Sp)]$$

To derive the monetary value of livestock, the mean selling price was used to determine the average value of the various livestock units. Physical assets were classified into old and fairly new assets and average market prices for fairly new and second hand assets were used to value respective household assets. The value of the crop harvest was given by multiplying the total harvest and the crop specific mean selling prices realised by households who attempted to sell their produce in the previous farming season.

The composite value (WI) derived the household wealth and income quartiles shown in the Table 7.2.4. The households in the lowest 25% had a WI value between US\$0-4816, those in the second quartile had a WI value between US\$5150-9916 while those in the third quartile had a WI value between US\$10821-14898 and those in the upper quartile had a WI value between US\$15639-23172.

Table 7.2.4: Wealth quartiles in rural Gwanda

		WIQ1 0- 25%		WIQ2 26- 50%		WIQ3 51- 75%		WIQ4 76- 25%		Total	
			%		%		%		%		%
Village Name	Nhwali	3	15	14	70	1	5	2	10	20	100
	Seboza	5	25	4	20	8	40	3	15	20	100
	Sengezane	12	60	3	15	3	15	2	10	20	100
	Tshongwe	13	65	4	20	2	10	1	5	20	100
Total		33	41	25	31	14	18	8	10	80	100

The WI value has categorised households in accordance with assets held (livestock and household consumer durable goods) and agricultural income (livestock sales and crop harvest). Such a classification would be incomplete without a consideration of income from sources other than agriculture. However, Table 7.2.5 shows that in rural Gwanda district, non-agricultural income (wages, remittances, donations, mining proceeds and home industry) constitutes approximately 6% of household income flows that combine assets, agricultural income and non-agricultural income. Furthermore, Table 7.2.6 shows that the WI value and non-agricultural income have a strong positive correlation. Thus, the households with a high WI are likely to have a high income as well.

Table 7.2.5: Contribution of major components to household wealth and income

	WIQ1	WIQ2	WIQ3	WIQ4	Total
Assets: Household	24%	34%	39%	42%	35%
Assets: Livestock	33%	30%	29%	26%	29%
Agricultural income	40%	33%	25%	20%	30%
Non-Agricultural income	3%	3%	7%	12%	6%

Table 7.2.6: Correlation of non-agricultural income and WI value

		Non-Agricultural income	WI value
Non-Agricultural income	Pearson Correlation	1	.722**
	Sig. (2-tailed)		.000
	N	80	80
WI value	Pearson Correlation	.722**	1
	Sig. (2-tailed)	.000	
	N	80	80

** Correlation is significant at the 0.01 level (2-tailed).

Given the study’s focus on the natural environment, and the observed limited distortions that exclusion of non-agricultural income has on the categorisation of households, the study proceeds to use the WI value (given by household assets and non-agricultural income) as the primary tool for household categorisation regarding income and wealth in rural Gwanda district. However, as the chapter progresses, special attention is given to issues of non-agricultural income. Therefore based on the information in Table 7.2.4, the households are categorised as shown in and depicted in Figure 7.2.1.

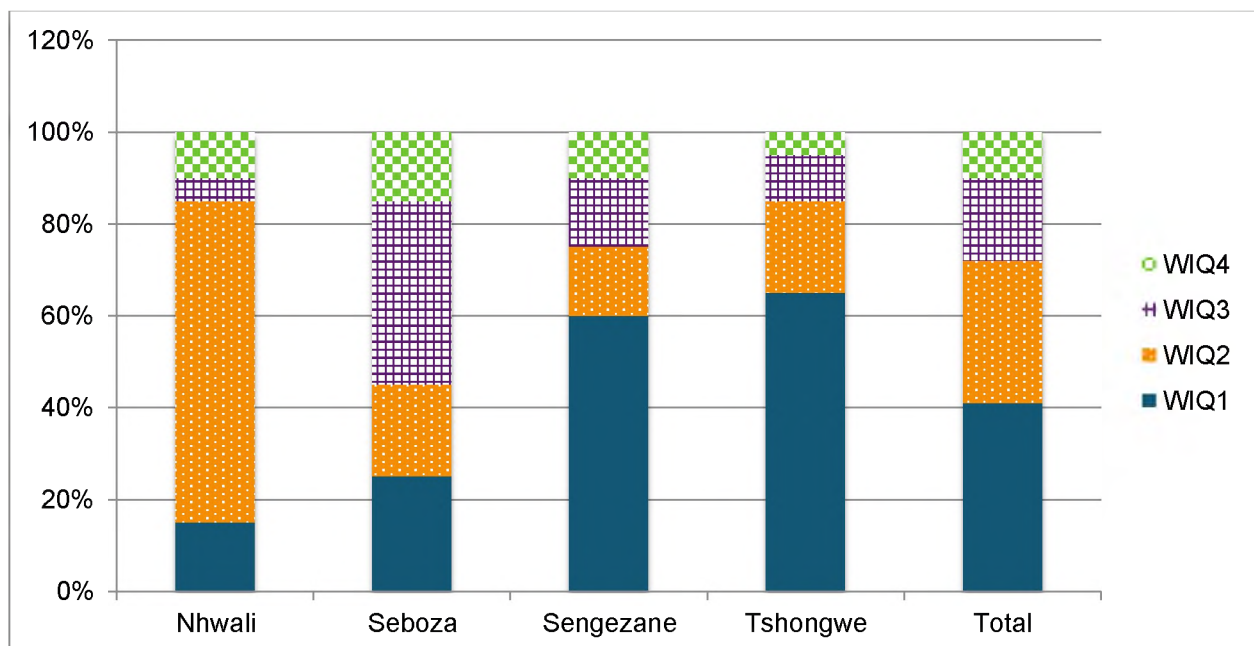


Figure 7.2.1: Wealth quartile distributions according to villages in rural Gwanda district

The results (shown in Table 7.2.4 and Figure 7.2.1) show that the majority of households fall in the first (WIQ1) and second (WIQ2) WI quartiles indicating high levels of poverty in the study area. The results are a confirmation of the statistical data published by the Zimbabwe Poverty Report (2014) showing that the levels of poverty in the Gwanda district were very high. The lowest levels of wealth are observed in the villages of Sengezane and Tshongwe as they have the highest proportion of households in WIQ1. The sections that follow explain the various thematic results in conjunction with the derived WI value of the study area.

7.3. MAJOR LIVELIHOOD STRATEGIES IN RURAL GWANDA DISTRICT

This section of the chapter uncovers the major livelihood strategies in rural Gwanda district. Literature has shown that the types of activities undertaken by a household and the amount of income realised are a function of the capital assets at its disposal, (Scoones, 1998; Bebbington, 1999; Barrett, Clay and Reardon, 2005). In this regard, this section will specifically highlight the contribution of specific capital assets (natural, physical, financial, human and social) to the formulation of livelihood strategies. Furthermore, the section explores diverse relationships that exist between capital assets and the household WI categories.

7.3.1. Natural capital

Ecological economists acknowledge that industrialized societies depend for survival not only on labour and human-made capital, but also on natural capital (Costanza, 2012). Natural capital includes access to land, water, and wildlife, from which households engage in agricultural pursuits and/or resource collection for both sustenance and income generation (Daly, 1994). Within natural capital exists certain forms of natural capital that are critical to the support of life within a certain area. These forms of natural capital are termed critical natural capital (CNC) (Dodds, 1995; Collados and Duane, 1999). In light of the above, the analysis of natural capital in rural Gwanda district seeks answers to questions associated with the common forms of natural capital accessed, CNC, investment in natural capital and environmental incomes in the study area.

Land ownership and use are primary pillars of natural capital that the households possess and have access to. According to key informants in the study area, local traditional authorities determine access to arable land in accordance to local customary laws. Furthermore, group discussion participants indicated that according to local custom, land was not owned but

rather used by various clan members. Key informants also indicated that local residents did not purchase land but the rights to use the land could be purchased by migrants through the traditional leadership of the study area.

According to group discussion participants, land utilisation in rural Gwanda was split into land for crop production and rangeland for grazing livestock. Crop production land was held as semi-private property of households and could only be transferred to members of the same family while the grazing rangeland was communally owned and utilised by members' specific villages.

Almost all (99%) the survey respondent indicated that they had access to arable land for crop production purposes. The average size of land available to households in the study is approximately 2.3 hectares while the average amount of land cultivated in the previous farming season was 1.25 hectares (54% of the average amount of arable land available to households). According to the group discussion participants the major reason for failing to cultivate all the land available was the lack of agricultural inputs and unreliable of the rainfall patterns that make crop production risky. However, despite the seeming over supply of land, a few of the households (8.8%) rented land from other households at a fee usually paid in produce realized after the harvest.

Like all natural capital, the ecosystem in rural Gwanda produces goods and services that are resultant flows of stocks of biophysical components in the natural environment. The major dominant direct flows (goods) of ecosystem goods in rural Gwanda that find their way to the household livelihood function are wood products, fresh water, wild fruits, fish, medicine and game meat. The entire population admitted harvesting all the mentioned ecosystem goods in the last year save for medicine (harvested by 90% of the population) and wildlife (harvested by 21% of the population).

The previous section's discussions around the perceptions of the environment revealed that local households in the study area were inclined towards utilisation of the natural environment albeit a conservation view related to cultural services offered by ecosystems. The utilisation dimension was shown to be dominated by households directly harvesting from the ecosystem as displayed by the direct flows. Furthermore, respondents argued that the natural environment supported agricultural activities (livestock and cropping) through the

provision and renewal of grazing rangeland and rainfall. In this case, the findings expose a combined benefit (stock and flow) that the local communities derive from the natural environment that is provision (a flow) and renewal (dependent on stocks).

In addition to the combined agricultural benefit, residents in the study area highlighted the importance of traditional religious shrines (such as the *Njelele* shrines scattered around rural Gwanda) and artefacts found in the natural environment. These cultural ecosystem services have already been shown to result in a syncretic view of the natural environment. Key informants argued that the cultural elements in the natural environment were the symbol of the native African culture in Gwanda and that their value surpassed monetary terms.

Such cultural services resonate with what Chiesura and de Groot (2003) called critical natural capital from a social dimension. According to Chiesura and de Groot (2003), conventional economics recognizes critical natural capital in the physical forms but fails to consider the importance of socio-cultural aspects of the natural environment that are fundamental to the ethnic dimensions of a society. In this regard, CNC in rural Gwanda may be considered the combined ecosystem benefits that support agriculture (considered the core activity in the study area (Francis, 2012)) and the cultural natural environment artifacts and sites that define native African culture and religion.

Accumulation and depletion of natural capital

For economists, investment means capital formation that will produce a stream of goods and services for future consumption (Wackemagel and Rees, 1997). Given the unquestioned monetary value of the direct flows harvested in Gwanda, it is critical to assess to levels of investment in sustainability of the ecosystem flows. Investment in natural capital was signified by activities within the study area that resulted in increased outputs of ecosystem goods and services.

According to group discussion participants, the major examples of investment in natural capital have been rotational grazing using paddocks, shifting cultivation and clearing of invasive alien plants that were compromising the ecosystems ability to deliver physical CNC. Nonetheless, respondents conceded that the investment dimension was prompted by the destruction of CNC. Conversely, respondents noted that under normal circumstances the utilization conviction always trumped conservation dimensions such as investment in natural capital.

The utilization conviction was reported to have resulted in the disinvestment in natural capital and ultimate depletion of natural capital. Respondents argued that the economic hardships, selfish accumulation without regard for nature and the ruling sustainability perspectives fueled the utilization conviction. Economic hardships that have characterised Zimbabwe have not spared rural Gwanda. Respondents explained that in the face of economic adversities, the harvesting of ecosystem goods and services had accelerated as these were considered gifts from God. The ecosystem goods allowed residents to complement their livelihoods and respond to the prevailing economic challenges. In line with other studies (Kratz, 2007; Shackleton *et al.*, 2001), the evidence above suggests that the natural environment of rural Gwanda may be considered a livelihood safety net.

Key informants revealed that in the case of artisanal mining activities (practiced by 13% of the population), extreme levels of natural capital depletion had occurred in pursuit of individual gain. It was reported that the methods used in mining left pits all over the rangeland that had become hazardous. Furthermore, residents explained that artisanal mining had resulted in poisoning of rivers (including aquatic life) and reduced the ecosystem's ability to produce CNC and general natural capital. Group discussion participants and key informants also stated that institutional support that existed in the study area (mostly from state and non state actors discussed in Chapter 6) was more focused on physical capital accumulation than environmental protection or natural capital accumulation.

The situation explained regarding the accumulation and depletion of natural capital in rural Gwanda district largely conforms to the weak sustainability argument. The key theoretical differences between weak and strong sustainability boil down to the possibility of substituting natural capital by man-made capital. The weak criterion considers natural and man-made capitals as substitutable as long as the level of the total capital stock (man-made/natural) remains constant (Chiesura and de Groot, 2003). The scenario depicted in Gwanda is therefore one where sustainability is considered from the overall capital base (natural and physical capital substitutable) given the dominant utilization conviction and institutional support that is biased towards the accumulation of physical capital for sustainable development (Jeater, 2011; National Association of Non-Governmental Organizations, 2013).

Environmental incomes

Environmental income refers to the incomes derived from the direct harvesting of ecosystem goods. Environmental income is a flow concept representing an income within the household. In the case of rural Gwanda, environmental income was given by the average monetary value of ecosystem goods harvested in the study area annually. Considering the income components derived using PCA in the household WI value, the average annual household income in the study area was revealed to be approximately US\$1166 (Table 7.3.1). PCA income flows differed from household expenditure as they included only agricultural income while household expenditure was inclusive of non-agricultural income as given by the household head.

On the other hand, findings from the quantitative survey data collected show that the average income from the harvest of the major ecosystem goods is US\$511 per household annually. The ecosystem goods income was not considered in the PCA stocks and flows because the ecosystem goods in rural Gwanda are produced separately in the natural environment. However, households harvest goods from the natural environment periodically to augment stocks and flows from private household activities. Thus, income from ecosystem goods harvested is on average comparable to approximately 44% of average household income flows in rural Gwanda district. The average environmental income (\$511) is evidently a significant contributor to household income analogous to income from livestock sales shown in Table 7.3.1.

Table 7.3.1: Household income flows in comparison to environmental income

COMPONENTS	LIVESTOCK SALES	VALUE OF CROP HARVEST	AVERAGE HH INCOME
AVERAGE ANNUAL INCOME FROM COMPONENT	\$853.33	\$312.42	\$1165.75
% OF COMPONENT INCOME IN AVERAGE HOUSEHOLD INCOME	73.2	26.8	100

Table 7.3.2 shows the distribution of the environmental harvest in the community in accordance with the different household wealth and income quartiles. Furthermore, table 7.3.2 shows that the average environmental harvest is a significant component of household income. The significance is most pronounced in WIQ1 and WIQ2 where environmental income is comparable to 158% and 63% of average household income flows respectively. This implies that income poor households of rural Gwanda are dependent on the natural environment for most of the flow components that construct a living.

Table 7.3.2: Environmental income and household income

WEALTH-INCOME QUARTILE (WIQ)	WIQ1	WIQ2	WIQ3	WIQ4
Total Environmental income per WIQ	\$13452	\$16740	\$8076	\$3096
Numbers of harvesters per WIQ	33	25	14	8
Average environmental income per WIQ	\$408	\$670	\$577	\$387
Average income flows per WIQ	\$258	\$1056	\$1419	\$1930
% Of households in WIQ realising environmental income	100	100	100	100
Comparison of Environmental income Average WIQ income as a %	158%	63%	41%	20%

In Table 7.3.3, households are categorised into environmental dependency quartiles (EDQs) that show the household's level of dependency on ecosystem goods. Households in the lowest EDQ1 are the least dependent on the environment for livelihood formulation while those in EDQ4 are most dependent. Table 7.3.3 further gives the proportion that the households in the EDQ constitute in the respective WIQs. Table 7.3.3 therefore shows that there are 33 (all) households that fall into EDQ4 and WIQ1 simultaneously. Furthermore, these households in the EDQ 4 constitute all (100%) the households in WIQ1 of the study area and so on. According to Table 7.3.3, the majority of households (91%) fall in EDQ 4.

Table 7.3.3: Environmental dependency and wealth in rural Gwanda district

EDQ	WEALTH-INCOME QUARTILE (WIQ)								Total	% Of N
	# In EDQ	% In WIQ 1	# In EDQ	% In WIQ 2	# In EDQ	% In WIQ 3	# In EDQ	% In WIQ 4		
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	5	63	5	6
3	0	0	1	4	1	7	0	0	2	3
4	33	100	24	96	13	93	3	37	73	91
Total	33	100	25	100	14	100	8	100	80	100

Represents number of households

Thus, comparing overall household income flows (shown in Table 7.3.2), environmental incomes and the EDQ categories, it is evident that the contribution of direct harvests of goods from the environment are highly significant contributors to livelihood strategies in rural Gwanda district especially amongst the poorest households. This information concurs with observations in other parts of sub-Saharan Africa that concluded that the environmental dependence (direct environmental harvests/forest incomes) of rural communities was high (e.g. Campbell and Luckert, 2002; Cavendish, 2000; Cocks and Dold, 2004; Shackleton and Shackleton, 2004; Viet Quang and Nam Anh, 2006 Cocks *et al.*, 2008; Heubach *et al.*, 2011; Egoh, 2012). The significance of the environmental harvest is further manifest by the fact that all households in the specific wealth quartiles harvest environmental goods as part of their livelihood strategies.

7.3.2. Physical capital

The term physical capital applies to the stock of buildings, equipment, instruments, raw materials and other physical objects used by a household in formulating livelihoods (Scoones, 1998; Bebbington, 1999). Assets held at the household level often perform several functions such as being a store of wealth and a means by which income is generated. According to Hoddinott (2006), a good physical capital environment is desirable and valuable given that physical assets improve the quality of life and allow for access to other forms of capital (financial, social and human capital). In this study, physical capital represented the wealth component of households associated with households' stocks.

Upton (2004) argued that in low-income societies physical capital may include livestock units owned by households. In this regard, the analysis of physical capital in rural Gwanda includes the livestock units owned by the individual households. Livestock have been considered capital assets given that they are produced in the past and contribute to future output. Moreover, key informants noted that in the study area, investment in livestock often required savings or borrowing based on expected future output. Group discussion participants also reported that livestock allowed increases in the size of land that a household could exploit. Therefore, the notions raised show that livestock exhibit the common characteristics of physical capital assets hence, may be considered under this umbrella within the study area. Physical capital in rural Gwanda was therefore explained by physical household assets and livestock owned.

Physical capital assets owned

The physical capital assets owned by the household in Gwanda may be grouped into shelter, agricultural equipment, electrical goods, communication devices, transportation and furniture. Table 7.2.1c showed the physical assets ownership patterns in rural Gwanda district. The most common assets owned by the households are agricultural with hoes and axes dominating the specific assets. Radios are the most common electrical goods owned while mobile phones dominate the modern communication devices owned in the study area. Transportation devices owned are mostly wheelbarrows, bicycles and scotch carts while beds dominate household furniture.

Table 7.3.4: Physical ownership of assets in rural Gwanda

Asset group	Observed assets	% of Households that own asset
Shelter	Corrugated iron house	57.5%
Agricultural tools	Hoes	100%
	Axes	96.2%
	Ploughs	75%
	Shovels	73.7%
	Picks	61.2%
	Rakes	38.7%
	Borehole	22.5%
	Cultivators	16.5%
	Tractor	0%
Electrical goods	Radio	51.2%
	Solar panel	42.5%
	Television	27.5%
	Generator	20%
	Satellite dish	12.5%
	Electrified house	5.2%
Communication devices	Mobile phone	72%
Transportation	Wheel barrow	71.3%
	Bicycle	61.2%
	Scotch cart	60%
	Car	3.7%
Furniture	Beds	91.2%
	Kitchen furniture	33.5%
	Lounge furniture	27.5%

According to Ellis (2000) among physical assets, electricity, and water supply are the most important from a development perspective. Table 7.3.4 shows that the access to electricity related assets and a dependable supply of clean water are limited in the study area despite the presence of government programmes such as the rural electrification programme (Rural Electrification Agency, 2015). However, the high access to mobile phones is in line with national mobile phone access statistics that stand at approximately 103% (POTRAZ, 2015).

Livestock ownership

Quantitative survey results showed that residents in the study area own large and small livestock units. As previously noted in the PCA discussion, Table 7.3.5 shows that small stock

(predominantly goats and chickens) dominated livestock ownership in the study area. Within large stock, donkeys and cattle are the most common animals reared. Key informants indicated that that livestock ownership patterns were influenced by the climatic conditions in Gwanda and input requirements for particular units. Respondents specified that large stock particularly cattle were vulnerable to the arid climate of Gwanda hence were risky assets. However, cattle were considered a dependable store of wealth from a market (fetched the highest price on the market in comparison to other units) perspective and a socio-cultural perspective (culturally associated with prestige). According to key informants, this perspective of cattle compelled households to own them albeit in very low numbers.

Table 7.3.5: Livestock units run in rural Gwanda district

Livestock	Unit	% of Households that own unit
Large stock	Donkeys	74.7%
	Cattle	61.2%
Small stock	Goats	85%
	Chickens	79%
	Sheep	26.2%
	Pigs	8.7%

In addition to the climatic challenges and in accordance with economic theory, residents indicated that the marginal costs required to produce a unit of livestock determined its popularity. It was highlighted that goats tended to be popular because they did not require expensive inputs (labour, feed, piped water, etc.). Regarding the store of wealth value, group discussion participants indicated that the size of the animal, its functions in the household and lifespan determined its suitability as a store of wealth. Thus, despite the high population of goats and chickens, cattle and donkeys are considered a better store of wealth in rural Gwanda.

Physical capital accumulation and disposal

Survey results revealed that almost all the income to acquire physical assets was derived from household finances. Furthermore, qualitative data from group discussions and key informants denoted that in some cases assets were accumulated through gifts and handouts from relatives and friends. In the case of livestock, respondents also noted that some NGOs had

initiated livestock accumulation programmes in the study area that had bolstered the livestock numbers of certain households. Physical capital was also reported to be an asset that was widely shared in the study area. Respondents explained that not all the residents had access to certain forms of physical capital but in most cases benefited from its availability at a neighbour's homestead.

Thus, the lending out and borrowing (sometimes at a fee) of certain forms of physical capital was common in the study area. Furthermore, multiple community members access some forms of physical capital (televisions, generator, cars and boreholes) regardless of direct ownership. Therefore, the social bonds and networks seem to allow for a multiplier effect regarding the access to physical capital in rural Gwanda district.

According to Upton (2004), selling assets in response to current shocks puts the household at risk of permanently lowering future consumption. In rural Gwanda, the disposal of physical capital is common in livestock particularly small stock. Quantitative survey results revealed that of the households owning large stock, 26% had disposed of donkeys while 19% had disposed of cattle in the year before. Regarding small stock, 83% of the households had disposed of chickens while 73% had disposed of goats in the year before. The portrayed trends conform to the previously highlighted notion that that it is easier to dispose of the smaller livestock units.

However, despite the popularity of livestock disposal, respondents indicated that this was a less than ideal situation fuelled by economic difficulty, livestock injuries, household emergencies and natural disasters, particularly drought. Additionally, it was revealed that in the case of chickens, their breeding for sale had become a significant livelihood strategy hence the high number of sales in the study area.

Relationship between physical capital and other factors

According to Table 7.3.6 there is a positive relationship amongst the WIQs, household expenditure and physical capital assets (livestock, electrical goods, electrified house and a borehole) shown in the table. Therefore, in rural Gwanda, those households that own the assets shown in Table 7.3.6 are likely to be the comparatively wealthy households with relatively higher amounts of disposable income. This implies that the prosperous households in rural Gwanda district are likely to have access to electrical physical assets and clean readily

available water as claimed by Ellis (2000) who singled out physical assets related to water and electricity as fundamental in the creation of household wealth.

Table 7.3.6 also shows that electrical goods (television, satellite dish, solar panel and a generator) statistically move together. The positive relationship within the subset of electrical goods may be due to their complimentary nature in the household. Furthermore, livestock units shown in Table 7.3.6 statistically move together hence, households in rural Gwanda district are likely to simultaneously run small and large livestock of various forms than specialize in one form of livestock unit.

Table 7.3.6: Correlation of physical capital and other factors

		WI quartile	Household expenditure per year	Cattle owned	Goats owned	Donkeys owned	Generators owned	Televisions owned	Electrified houses owned	Solar panels owned	Satellite dishes owned	Boreholes owned
WI quartile	Pearson Correlation	1	.436**	.421**	.591**	.453**	.680**	.548**	.236*	.660**	.509**	.563**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.039	.000	.000	.000
	N	80	80	80	80	79	80	80	77	80	80	80
Household expenditure per year	Pearson Correlation	.436**	1	.491**	.401**	.512**	.310**	.316**	.245*	.265*	.199	.372**
	Sig. (2-tailed)	.000		.000	.000	.000	.005	.004	.032	.017	.077	.001
	N	80	80	80	80	79	80	80	77	80	80	80
Cattle owned	Pearson Correlation	.421**	.491**	1	.541**	.704**	.226*	.102	.172	.198	.209	.185
	Sig. (2-tailed)	.000	.000		.000	.000	.044	.368	.135	.079	.063	.100
	N	80	80	80	80	79	80	80	77	80	80	80
Goats owned	Pearson Correlation	.591**	.401**	.541**	1	.503**	.572**	.235*	.142	.388**	.191	.468**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.036	.219	.000	.090	.000
	N	80	80	80	80	79	80	80	77	80	80	80
Donkeys owned	Pearson Correlation	.453**	.512**	.704**	.503**	1	.381**	.169	.164	.283*	.309**	.386**
	Sig. (2-tailed)	.000	.000	.000	.000		.001	.137	.157	.012	.006	.000
	N	79	79	79	79	79	79	79	76	79	79	79
Generators owned	Pearson Correlation	.680**	.310**	.226*	.572**	.381**	1	.548**	.313**	.540**	.567**	.629**
	Sig. (2-tailed)	.000	.005	.044	.000	.001		.000	.006	.000	.000	.000
	N	80	80	80	80	79	80	80	77	80	80	80
Televisions owned	Pearson Correlation	.548**	.316**	.102	.235*	.169	.548**	1	.471**	.598**	.641**	.364**
	Sig. (2-tailed)	.000	.004	.368	.036	.137	.000		.000	.000	.000	.001
	N	80	80	80	80	79	80	80	77	80	80	80

Electrified houses owned	Pearson Correlation	.236*	.245*	.172	.142	.164	.313**	.471**	1	.244*	.606**	.286*
	Sig. (2-tailed)	.039	.032	.135	.219	.157	.006	.000		.033	.000	.012
	N	77	77	77	77	76	77	77	77	77	77	77
Solar panels owned	Pearson Correlation	.660**	.265*	.198	.388**	.283*	.540**	.598**	.244*	1	.408**	.525**
	Sig. (2-tailed)	.000	.017	.079	.000	.012	.000	.000	.033		.000	.000
	N	80	80	80	80	79	80	80	77	80	80	80
Satellite dishes owned	Pearson Correlation	.509**	.199	.209	.191	.309**	.567**	.641**	.606**	.408**	1	.249*
	Sig. (2-tailed)	.000	.077	.063	.090	.006	.000	.000	.000	.000		.026
	N	80	80	80	80	79	80	80	77	80	80	80
Boreholes owned	Pearson Correlation	.563**	.372**	.185	.468**	.386**	.629**	.364**	.286*	.525**	.249*	1
	Sig. (2-tailed)	.000	.001	.100	.000	.000	.000	.001	.012	.000	.026	
	N	80	80	80	80	79	80	80	77	80	80	80

** .Correlation is significant at the 0.01 level (2-tailed).

* .Correlation is significant at the 0.05 level (2-tailed).

7.3.3. Financial capital

This section uses secondary and primary data collected to discuss financial capital (sometimes referred to as economic capital) in rural Gwanda district. The section shall shed light on the state of financial capital in rural Gwanda, the demand and supply side of financial capital in Gwanda and the theoretical aspects related to the findings.

According to Vitoria, Mudimu and Moyo (2012), improving access to rural financial services contributes significantly toward removing many of the constraints limiting rural development. The inhabitants of rural Gwanda are subject to the Zimbabwean financial environment and predicaments. Contemporary Zimbabwean financial markets consist of commercial banks, micro-finance institutions (MFI), insurance companies, money transfer agents, NGOs and the government (RBZ, 2011, 2012). In analysing financial capital, it is prudent to separate the demand side from the supply side factors. The demand side factors relate to the products demanded and the characteristics of those that demand financial services in rural Gwanda district. Supply side factors relate to the products supplied and agents supplying financial capital.

Demand side factors for financial capital

According to group discussions in the study area, household finances were derived from income flows, remittances, loans and savings. Financial resources in Gwanda are predominantly used for the purchase of food items (including agricultural inputs), clothes, health services and education services. Respondents indicated that the demand for finances was at its peak before the commencement of the agricultural (planting) season and between the months of December and February. In this regard, key informants indicated that the increase in the demand for money between December and February was due to high expenditure associated with the Christmas holidays and the beginning of the year.

Survey results show that the villagers augment their income flows from financial assistance by friends, relatives and formal institutions (identified by 41% of the respondents), short-term loans (identified by 26% of the respondents) and remittances from relatives living outside Gwanda district (identified by 26% of the respondents). Group discussion participants stated that most of the finances derived through assistance were dependent on the strength of the social networks that one possessed and ability to get oneself on the beneficiary lists of organisations that were involved in the disbursement of relief funds. Regarding loans,

respondents stated that most loans were short-term and attracted interest rates that ranged from 0-30% depending on the borrower-lender relationship. Financial resources from remittances were said to be dependent on factors such as the strength of the remitter-beneficiary relationship and the migrant's disposable income.

Quantitative survey results also showed that 20% of the households in the study area had savings in bank accounts. Additionally, key informants and group discussion participants indicated that savings groups had become popular in the study area especially amongst local women. Respondents explained that the common groups were those that were characterised by the periodic payments of agreed sums to specific members through contribution by all other group members. These lump sums were argued to allow for the undertaking of major household projects by the receiving member. Respondents noted that such groups were best when formed by members with strong social ties in order to avoid defaulting and allow for smoother conflict resolution. These groups are notably similar to Rotating Savings and Credit Associations (ROSCAs) and Savings and Credit Cooperative Societies (SACCOs) observed by Vitoria, Mudimu and Moyo (2012) in other parts of rural Zimbabwe.

Such social schemes are also evident in other parts of southern Africa where literature has shown them to be integral parts of the informal economy that act as safety nets and providing financial safety and augmenting household livelihood strategies (Mboweni, 1990; Bujis, 2002; Keswell, 2003; Chikadzi and Lusenga 2013).

It was reported in that these discussed forms of financial capital were accessed mostly as cash. However, group discussion participants indicated that the advent of money transfer agents and mobile phone cash transfer platforms had made the receiving of finances simpler and safer. Additionally, respondents revealed that most remittances were accessed through cross-border transporters (commonly known as *omalayitsha*) and third parties travelling to the study area from other locations.

The relative lack of diverse financial products, long-term loans and high dependence on assistance based financial capital in the study area is a confirmation of the struggles that characterise Zimbabwe's contemporary financial sector. According to the FinScope consumer survey of Zimbabwean financial capital (2011), 25% of Zimbabweans relied on money from others (household member, relatives, friends or remittances). In rural Gwanda by 2015, the situation was almost double the 2011 national estimates as shown by a figure of 41%.

Such a scenario is an indication of increasing and higher levels of financial vulnerability in the study area. According to FinScope (2011), 31% of Zimbabweans do not save formally, 27% keep all their savings at home, 16% rely only on informal mechanisms such as savings groups, 9% have/use other formal financial products and 17% of individuals have savings products from a bank. The data from the study area is in line with certain aspects of the FinScope study for instance; formal savings in rural Gwanda are at 20% similar to the 2011 national rate of 17%. Moreover, the results have already shown the acceleration of other financial products in the form of savings groups and mobile financial platforms. Group discussion participants disclosed some arguments for the lack of formal financial capital products and preference for informal savings as shown in Box 7.3.1.

Box 7.3.1: Arguments for the lack of and preference for informal savings

“We don’t understand the regulations for getting formal loans so we rely mostly on local lenders for loans. These are better than banks as they understand your situation and if you do not have the money at the required time you can always negotiate for more time”.
(Group discussion participant).

“It is very difficult to save in the current circumstances because we do not even have enough to get by so where will the savings come from.” **(Group discussion participant).**

Source: Group discussion, Sengezane village (2014).

Supply side factors of financial capital

The supply side factors of financial capital are addressed predominantly using secondary data collected regarding the Zimbabwean financial markets. According to the Reserve Bank of Zimbabwe (RBZ) (2015), Zimbabwe’s banking sector comprises 26 operational banking institutions, 16 licensed asset management companies and 157 operating micro finance institutions all regulated by the RBZ in terms of the Banking Act. The supply of financial services has been significantly affected by the economic collapse that characterised Zimbabwe since the turn of the millennium (Vitoria, Mudimu and Moyo, 2012).

According to Machethe *et al.* (2011), many service providers lost their entire cash asset bases because of hyperinflation in 2007-2009, and are struggling to recover in terms of the products they offer and scale of outreach. Furthermore, the prevailing liquidity crunch has limited the provision of services and made them generally expensive (Vitoria, Mudimu and Moyo, 2012). Interest rates for borrowing are prohibitive and only affordable to higher income clients thereby excluding the rural poor (FinScope, 2011). Similarly, Macheka (2010) noted that

formal financial players (banks, asset managers and Micro-Finance Institutions MFIs) served salaried clients in urban areas and very few reach into rural areas given that the rural communities are regarded as high risk. Credit to non-salaried individuals is almost non-existent and if available, it is mostly short-term (from 30 to 90 days) and very expensive (FinScope, 2011).

The sentiments expressed in the secondary literature were also observed in rural Gwanda district that is characterised by limited access to formal financial capital sources most likely because the area is considered high risk with limited formal employment (14% of the population). The WI categorisations previously discussed place the majority of the household in the low-income bracket thereby increasing their risk factor in the financial markets.

According to FinScope, (2011), government involvement as a supplier of financial capital to rural households remains limited due to a lack of financial resources at national level. As such, Vitoria, Mudimu and Moyo (2012) argued that donors and NGOs continue to be an important source of finance for rural communities. Similarly, Ngwenya and Ndlovu (2003) reported that donors were key finance providers in rural Zimbabwe providing at least 55 percent of the funds. The situation in Gwanda has not diverted from the perspective summarised in secondary data given that the results show that 41% of the community is highly dependent on donations for financial capital.

Regarding insurance, most rural communities in Zimbabwe are composed of smallholder subsistence farmers who unlike large-scale commercial farmers have limited exposure to and understanding of insurance (Machethe *et al.*, 2011). Moreover, insurance companies in Zimbabwe are still adjusting to the changes in the agricultural sector that were caused by the Fast Track Land Reform Programme (FTLRP). Thus, the products they previously offered to large-scale commercial farmers are not relevant to subsistence farmers and most rural communities. Accordingly, respondents in rural Gwanda district stated that most community members are not aware of the benefits or the products of insurance companies.

Despite the limited supply of financial capital products in the study area, key informants indicated that the blossoming mobile phone based money transfer platforms had allowed the households in the study area access to the formal financial capital markets. According to the group discussions, the platforms had allowed the common sources of financial capital (saving clubs and remittance) to function in a smoother manner.

Financial inclusion and exclusion in rural Gwanda

The study findings show that the study area is mostly excluded from the mainstream sources of financial capital. From the discussion thus far, various factors may be isolated and categorised as the major disablers/enablers of financial inclusion. The major enablers of financial inclusion in rural Gwanda district are communication infrastructure development (particularly mobile phone cash transfer), community savings groups, NGO grants and programmes that increased awareness and understanding of financial services. This summary of enablers of access to financial capital indicates that technological astuteness (mobile phone transactions) and strong social networks (to access assistance and join community saving groups) are fundamental factors that improve a household's access to financial capital.

From the discussion of findings, one may infer that the major financial disablers in rural Gwanda district are the failure by banks to develop relevant products, lack of physical infrastructure (financial capital access points), limited trust, limited product awareness, unstable economic conditions, a weak institutional environment (enforcing of contracts) and the high-risk tag of rural communities. Apparently, the rural Gwanda area is plagued by high transaction costs that have made formal financial capital flows shy away from the area. The high transaction costs are rooted in the financial inclusion disablers and the lack of trust between suppliers and demanders of financial capital as shown by group discussion results. The little available formal capital flows have been shown to be expensive and out of reach of the ordinary community members reflecting the high transaction costs of providing financial capital in rural Gwanda. Therefore, in accordance with the new institutional economics debate on transaction costs, rural Gwanda will find it difficult to improve its access to financial capital and ultimately to achieve local economic development in the presence of such high transaction costs (North, 1990; Williamson, 2000).

However, despite the evident high transaction costs in the realms of financial capital, the communities have turned to local informal alternatives such as savings groups and remittances. Such methodologies as shown in the findings, are rooted in social networks that exist in the society and are an example of the institution of social capital functioning as a catalyst for lowering transaction costs in a high cost market in order to allow for access to essential financial capital (Williamson 2000). While social capital has acted as a catalyst

directing the access to financial capital to the informal sector, mobile cash transfer systems are emerging as a catalyst directing financial capital to the formal sector.

According to key informants, mobile service providers have availed financial products (money transfer, mobile-phone based bank accounts, mobile-phone based insurance and mobile-phone based savings) that are readily accessible to the rural Gwanda population. As such, the mobile platforms have become agents of financial inclusion within a rural population that predominantly operates outside the formal financial space. Given that the majority (approximately 65%) of the Zimbabwean population lives in rural areas (ZIMSTATS, 2012), such a revelation adds weight to the catalyst role of the mobile phone platforms. Therefore, rural Gwanda district is predominantly an unbanked cash-based economy with limited opportunities for financial inclusion. These opportunities are determined by the strength of social networks and access to mobile phone technology and products.

7.3.4. Human capital

According to the renowned classical economist Adam Smith, “a man educated at the expense of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to an expensive machine. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education” (Smith, 1776: 118). Similarly in his Principles of Economics, Alfred Marshall stated that, “the most valuable of all capital is that invested in human beings” (Marshall 1890:564). In analysing the composition of human capital in rural Gwanda district, the study considers issues related to the state of human capital in rural Gwanda, schooling, human health, returns on human capital investment and localised methods of human capital accumulation.

According to the UNDP (2013), Zimbabwe’s Human Development Index (HDI) value for 2013 stood at 0.492 (which is in the low human development category) positioning the country at 156 out of 187 countries. From an alternative angle, comparing the ZIMSTATS census figures for rural Gwanda district between 2002 and 2012, it becomes clear that the population has declined by approximately 0.08% (from 116658 in 2002 to 115778 in 2012) in the face of national population growth statistics of 1.1% in 2012 (ZIMSTATS, 2002, 2012). According to the group discussions, the seemingly stagnant population was a direct result of the economic hardships in the country that had seen the migration of a significant number of individuals

(corroborated by 86% of households surveyed) in search of greener pastures. Moreover, respondents noted that the HIV pandemic had greatly affected the study area thereby stalling population growth.

Neoclassical economics recognises the importance of labour in the production function. Hence, a decline in population for rural Gwanda implies a decline in the amount of labour available for production. However, Robert Solow explained that productivity of human capital was not only related to number but also labour quality, a variable dependent on skill accumulation (Solow, 1957). As such, it is essential to consider the quality of labour in rural Gwanda district showing how it relates to the already exposed declining population.

Education dimension in human capital

According to Woßmann (2003), the acquisition of knowledge and skills is an investment in the sense that people forego consumption in order to increase future income. Because workers have invested in themselves to different extents through education, one hour of labour input does not yield the same output across all workers. Table 7.3.7 shows that 85% of the population of household heads in rural Gwanda have at least attended primary school. Assuming that the foundation of literacy is primary education and that the perspective of the household head represents the household, it should follow that literate individuals predominantly head households in Gwanda. The high literacy scores are in line with national scores that show Zimbabwe to have literacy rates of above 90% (ZIMSTATS, 2012).

Table 7.3.7: Highest education attained by household head

Education	Percentage	Cumulative percentage
Never went to school	15.0	15.0
Primary school	30.0	45.0
Secondary school	45.0	90.0
Vocational Training	3.8	93.8
Tertiary education	6.3	100.0
Total	100	

However, Woßmann (2003) noted that literacy relates to the ability to read and write, with understanding a simple statement related to one’s daily life. Therefore, such a measure may be misleading if used to assess the quality of human capital in rural Gwanda district. In this regard, the study considers the number of years in school or the highest qualification realised.

Table 7.3.7 shows that approximately 45% of the respondents have attained secondary education qualifications while approximately 6% have tertiary qualifications.

According to the Ministry of Education, Sports and Culture (2013), in Zimbabwe the average Zimbabwean spends seven years in primary school, five years in secondary school and four years in tertiary education. Therefore, using the ministry of education estimates and the quantitative data from the survey, approximately 45% of the population in the households of rural Gwanda district has spent more than 7 but less than 13 years in school while 6% has spent more than 13 but less than 17 years in school. Evidently, above half of the population of household representatives in the study area have received more than 7 but less than 13 years of education. Combining the years of schooling with the literacy rate of Gwanda denotes a society with notable levels of quality human capital.

Another dimension to the accumulation of human capital through education are the school enrollment patterns. Survey results show that of the children between the ages 5-18, 72% were enrolled in school. According to key informants, this figure is much higher when the range is 8-18 because a number of children in rural Gwanda were reported to begin school above the age of 7. Although school enrolment has been interpreted as a proxy for human capital stocks in some studies (O'Neill, 1995; Krueger and Lindahl, 2001), this study notes that school enrolment figures are a limited measure given that they do not give an indication of current stocks of human capital but rather potential human capital for the future.

Woßmann (2003) concurred with the observation stating that the children currently enrolled in schools are by definition not yet a part of the labour force, so that the education they are currently acquiring cannot yet be used in production. Nonetheless, the situation highlighted in rural Gwanda district is one depicting great potential regarding the accumulation of future human capital. Additionally, the figures also indicate that the society prioritises the accumulation of human capital.

Previously highlighted classical literature (Adam Smith and Alfred Marshall) asserts that investment in human capital through education increases future labour productivity and future income. However, based on the current formal employment trends (14% are formally employed) in rural Gwanda district, quantitative results from the survey showed a weak positive correlation between the education of the household head and the securing of formal employment (Table 7.3.8). Furthermore, positive (but very weak) correlations were observed

for education of the household head and the WI group. The results show that the promise of higher incomes through human capital investment does not necessarily hold in rural Gwanda district.

According to group discussions, the high levels of unemployment in the country and the weak economy have made education a weak base for income accumulation in the study area. However, respondents agreed that education increased one's skills therefore allowing them to seek employment in alternative markets where the accumulated human capital was required.

Therefore respondents argued that the accumulation of human capital was vital as it allowed for the pursuit of options outside the study area. Regarding the weak correlation between education and formal employment, respondents argued that educated people could not accept the menial jobs that were common in rural Gwanda, hence there was some accuracy in the weak relationship depicted by quantitative survey data.

The scenario depicted in contemporary Gwanda highlights a case of a weak-positive return on human capital investment. The results show that the residents in the study area invest in the building of human capital but the broader macroeconomic environment does not allow local beneficiation from accumulated human capital. As such a marginal increase in education may increase the marginal physical product (MPP) of a resident of rural Gwanda but not the marginal revenue product (MRP). The study results showed that this economic anomaly is rooted in the shrinking labour market fuelled by the on-going economic crisis. However, the advent of globalisation has allowed an international demand response that has seen MRP of Zimbabwean human capital increase with MPP through migration.

Table 7.3.8: Relationship between education and other factors

		Occupation	Wealth quartile	Education	Household expenditure per year
Occupation	Pearson Correlation	1	.359**	.350**	.138
	Sig. (2-tailed)		.001	.001	.223
	N	80	80	80	80
Wealth quartile	Pearson Correlation	.359**	1	.286*	.436**
	Sig. (2-tailed)	.001		.010	.000
	N	80	80	80	80
Education	Pearson Correlation	.350**	.286*	1	.121
	Sig. (2-tailed)	.001	.010		.285
	N	80	80	80	80
Household expenditure per year	Pearson Correlation	.138	.436**	.121	1
	Sig. (2-tailed)	.223	.000	.285	
	N	80	80	80	80

***. Correlation is significant at the 0.01 level (2-tailed).*

Human health dimension of human capital

Human health is the base of human capital accumulation since an unhealthy individual is likely to struggle to accumulate human and other capital assets. If the health of an individual results in a longer healthier life then it should follow that life expectancy is an indicator of the overall health of a society. According to the UNDP (2014), life expectancy at birth in Zimbabwe was 59.9 years. In the study area 80% of the population is below the age of 45 years and 8% have surpassed the age of 60 years. According to group discussions, HIV and AIDS had ravaged the youth in rural Gwanda until the introduction of institutional support in the form of free HIV medication and services provided by the government and other NGOs. The respondents also added that, the institutional support had given them a better chance at a longer life through the support of human capital development and conservation.

Human capital safety nets

According to the quantitative survey data, the community spends an average of 36% and 15% of average household income flows respectively on education and health annually. Given that

the expenditure on human capital is an income flow concept, these incomes are arguably substantial when compared to the average household income. Qualitative data from group discussions, however, revealed that human capital expenditure is much higher as it was subsidised by vulnerability support schemes spearheaded by the government and non-governmental organisations that shoulder a significant part of the household education and health expenses (ZIMVAC, 2014). These support schemes have arguably become human capital safety nets that act to develop and conserve human capital in rural Gwanda district.

The study has shown that human capital may be analysed in two dimensions that of accumulation and the other of conservation. The residents of rural Gwanda indicated that human capital accumulation was important although hindered by structural issues such as the misfiring economy. Furthermore, it is evident that local authorities and NGOs recognise the value of conserving current human capital as evidenced by investments in social safety nets identified by the respondents.

7.3.5. Social capital

The term social capital refers to those stocks of social trust, norms, and networks that people can draw upon to solve common problems (Adam and Roncevic 2003). Social capital is similar to other forms of capital in that it can be invested in with the expectation of future returns (Adler and Kwon 1999). However, social capital is different from other forms of capital in that it cannot be traded on the market and resides in social relationships whereas other forms of capital can be traded and may reside in the individual (Robison *et al.* 2002).

Forms of social capital in rural Gwanda district

Social capital exists within specific scales simultaneously given that one feels belonging to family, community, profession, country, and all of humanity concurrently. As such, social capital is identifiable from the individual level (micro) through intermediate group levels (meso) to the global level (macro). In this regard, literature concedes that social capital appears to be both a private and a public good (Fukuyama 1995, 2001; Lyons, 2000). In this study, the various dimensions of social capital in rural Gwanda district are categorized into trust, informal social ties, formal social ties and norms of collective action.

Trust

Measuring the levels and dimensions of trust in rural Gwanda district proved to be a difficult task in line with observations made by other researchers such as Fukuyama (2001) who linked the difficulties to the notion that trust was both a source and aspect of social capital. However, in an attempt to observe trust in rural Gwanda, this study made use of general questions during the key informant interviews and group discussions regarding the relationships amongst the villagers. These questions elicited the respondent's perspective on the levels of honesty and trustworthiness of the residents of rural Gwanda district.

Respondents noted that the levels of trust in Gwanda had been depleted in comparison to the pre-independence period. Villagers argued that after the war of liberation (late 1970s) a significant group of people became difficult to control using the local laws of the villages, citing the advent of democracy and independence. This failure to control villagers created high levels of animosity and distrust. Furthermore, villagers argued that there was an "us and them" attitude that developed between villagers and the government during the Matabeleland disturbances (*Gukurahundi*) of the early 1980s. This attitude was reported to have made villagers view each other with suspicion, as it was not known which side certain individuals belonged to. Mamdani (1996) and Msindo (2012) expressed similar sentiments regarding the roots of distrust in postcolonial Africa and Matabeleland respectively.

Despite the historical impediments to trust in the study area, villagers argued that close bonds had formed over time amongst them due to the similar predicaments they found themselves in. Moreover, it was noted that kinship relations and the cultural similarities had allowed strong relations to develop, especially after *Gukurahundi*. Nonetheless, villagers argued that situations similar to those that characterised the immediate postcolonial period had begun to grip rural Gwanda again.

Respondents revealed that the advent of national political rivalry had filtered into the district and divided communities along political lines. Furthermore, contemporary religious movements dominant in urban areas had begun to grow in the study area and divide the people along religious lines. Additionally key informants argued that the economic challenges facing Zimbabwe had turned individuals into selfish beings who would hurt each other for a little income, thereby making trust a rare commodity.

Evidently, the levels and dimensions of trust in the study area have been oscillating, particularly since the postcolonial period. The perspectives highlighted by the residents indicated that the major enablers of trust are socio-economic similarities related to kinship, comradeship (going through the challenges of life together) and proximity of settlement. The major disablers of trust in rural Gwanda were noted to be socio-economic differences related to political affiliation, religion and place of residence. It should be noted that these disablers of trust in rural Gwanda result in the formations of what has been termed negative social capital in literature (Aldridge *et al.*, 2002). Negative social capital occurs when members of a social group act and connive to the disadvantage of those excluded from the group. According to Aldridge *et al.* (2002), such behaviour worsens rather than improves economic performance; acting as a barrier to social inclusion and social mobility; dividing rather than uniting communities.

Informal social ties

The informal social ties in this case were assessed by examining those social activities that the villagers of rural Gwanda voluntarily took part in. This dimension of social capital was termed a communitarian perspective by Woolcock and Narayan (2000). Communitarians argue that the densities of social groupings in a given community are a good indicator of the levels of social capital within that community. They argue that more is better and always has a positive effect on a community's welfare (Putnam 1993, 1995; Fukuyama 1995, 1997).

Respondents from the survey ranked the major social activities that members of the household in the study area took part in. Table 7.3.9 shows the top three social activities in the study area. The most common social activities in the community ranked in the first category are funerals, church gatherings, ward and school meetings. Funerals are the most significant and common meeting place for local community members. In the second category of activities, social clubs that included time spent at beer halls, pursuit of similar interests such as social clubs, etc., were the most significant social engagements. Additionally the community also interact during workshops usually run by government agencies and non-governmental organisations (NGOs) operating in the area as shown in activity 3 in Table 7.3.9.

Table 7.3.9: Common social engagements in the study area

Activity 1	% of N	Activity 2	% of N	Activity 3	% of N
Funerals	58	Social clubs	43	Workshops	32
Church	8	Weddings	21	Social clubs	14
Ward meetings	5	Women’s clubs	15	Concerts	12
School meetings	4	Sports galas	7	Political party meetings	6

(N=80)

The activities highlighted in Table 7.3.9 are likely to bind the residents of the study area and allow them to work together for the common good. However, Narayan and Nyamwaya (1996) found evidence from the developing world demonstrating that high levels of social solidarity or informal groups did not necessarily lead to prosperity. For instance, key informants argued that political and religious meetings though low in the perking order (as confirmed by the low numbers who prioritized them in Table 7.3.9), had a major effect on social relations even when practiced by a few. Box 7.3.2 captures some views of key informants in the study area that emphasise this perspective. As such, in light of the previous discussion on issues related to trust, one may concur with observations by Narayan and Nyamwaya (1996) given that some forms of highlighted informal social ties (political party meetings and church) have been shown to exhibit negative externalities of social capital.

Box 7.3.2: Local perspectives on the effects of religion and politics in the community

“Just bring one staunch supporter of the ruling political party to this village and you will see how afraid every villager will be to discuss anything in public. Sometimes it is better when most villagers generally support the ruling political party but once you see most people shying away from political gatherings and only a few leading the political agenda, you know the society is in trouble. The same applies to religion though to a lesser extent; a family with a new belief system can cause a lot of tension in the village especially if that system is associated with witchcraft.”

Source: Key Informant rural Gwanda district (2014)

Despite the negative externalities noted, Table 7.3.10 shows that all community members value social interaction and consider the attendance of social events significant. However, the dominant lukewarm (yes but not that much) responses captured in Table 7.3.10 confirm the notion of negative externalities rooted in the destruction of individual trust. Qualitative data

(FGDs and KII) supports this finding as it exposed the notion that some members of the community felt political parties had hijacked a number of social meeting platforms resulting in apathy by those not politically aligned.

Table 7.3.10: The perceived importance of social gatherings

Importance of social events		Frequency	Percent	Cumulative Percent
	Yes, but not that much	33	41.3	41.3
	Yes	28	35.0	76.3
	Yes, very much	19	23.8	100.0
	Total	80	100.0	

Formal social ties

Formal social ties considered relations based on occupation and formal group belonging like trade unions. Group discussion participants and key informants revealed that formal social ties in rural Gwanda had become uncommon due to the lack of formal employment opportunities. However, it was noted that structural ties related to levels of education, gender and age were more evident in the community. Despite the reported limited formal social ties, key informants particularly in the traditional and political leadership explained that their position allowed them to interact with other leaders within the study area and the rest of the country. Such forms of social capital allowed the local leadership to access the higher national dimensions (macro level) of social capital.

Norms for collective actions

The most significant forms of collective action in the study area were analysed in relation to issues of elections and the conviction to vote. This study argues that the various dimensions of social capital can collectively influence substantial parts of the population in specific directions. Thus, in rural Gwanda, the size of the population that agrees with a particular social dimension or direction may be used as an indicator of power of the norms of collective action in the study area.

In the 2013 general election of Zimbabwe, 54% of the residents of rural Gwanda turned out to vote and 55% voted for the eventual winner while 32% voted for the runner up (Zimbabwe Electoral Commission (ZEC), 2013). According to ZEC (2013), voter turnout figures higher than 35% of the voting population are considered high. The high voter turnout and support of

specific candidates (above half the voting population) indicates the community's ability to take particular action in a certain direction. However, the use of political data may be misleading given that elections in Zimbabwe have often been marred by irregularities and voter intimidations (Cendrowicz, 2013). Nonetheless, the presence of a voter turnout of above 50% (ZEC, 2013) to a certain extent implies that the residents in the study area were acting on free will and social conviction.

Location of social capital building blocks

In rural Gwanda district, social capital building blocks are evidently concentrated at the meso-level of society given that the informal groups were shown to be popular in the study area. Macro-level social capital is also evident in the study area regarding issues of collective action. However, the access to the finer dimensions of macro social capital in the study area seems to be a preserve of the local traditional and political leadership. The dimension with the least social capital building potential in the study area has been shown to be the micro dimension of the individual. The low levels of trust that exist in the study area fuel the low levels of social capital accumulation at the micro level.

7.3.6. Livelihood strategies

The general production function takes the general form $Y=f(K, L)$, where Y is the amount of output produced, K is the amount of capital stock used and L is the amount of labour used. The production of a viable livelihood strategy however has been shown to result from a more complex production function dependent on capital assets (natural (N), physical (K), financial (F), human (L) and social (S)) that have been discussed. The livelihoods function for rural Gwanda takes the form $Ls=f(N, K, F, L, S)$ where livelihood strategy (Ls) is the dependent variable influenced by the delicate combinations of the capital assets.

The individual analysis of the explanatory variables showed interrelationships implying a high correlation and multi-collinearity between certain capital assets. The multi-collinearity shows that household stocks and flows are correlated and best analysed in union using approaches such as the WI value used in this study (see Table 7.2.4). Social capital in particular was shown to be a common explanatory variable in the access to all the other capital assets in the study area, while access to the other assets also influenced the levels and dimensions of social capital. According to Scoones (1998), $L=f(N, K, F, L, S)$ yields either on-farm

(agricultural intensification/extensification); off-farm (livelihood diversification) or migration activities. Livelihood strategies may be described at household, community or national level. The aim of this section is to highlight the major livelihood strategies at community level in rural Gwanda district.

On farm livelihood strategies

The major components of on-farm livelihood strategies in the study area are livestock rearing and crop production. Findings showed that in rural Gwanda district, the livestock constituent of on-farm strategies accounts for an average of 73.2% (Table 7.3.1) of overall income flows derived from on-farm strategies. Moreover, as a whole, on-farm livelihood strategies account for an average of 37% of the amalgamation of household wealth and income with a number of households exceeding the 60% mark.

Therefore, on-farm livelihood strategies particularly the rearing of livestock are the major livelihood strategies in the study area. Crop production, on the other hand, though universally practiced, is a lesser strategy. The preference for livestock is a result of the unreliable rainfall associated with the study area that makes it unsuitable for sustainable crop production (Vincent and Thomas, 1960). Additionally, according to Nyathi (pers. comm, 2015) and qualitative findings, the preference for livestock in the rural Gwanda is to an extent culturally imbedded as the dominant Sotho and Ndebele cultures encourage animal husbandry at the expense of crop production. Qualitative data gathered from group discussions support the quantitative findings as shown in responses captured in the Box 7.3.3.

Box 7.3.3: Significance of livestock in the livelihood capital mix

“The environment is important as it supports our livestock that guarantee life especially in this area where you can never be sure of the rains. It was only last year that we had good rains in a very long time so it’s important as a household to ensure that you have some form of livestock” **(Group discussion participant).**

Source: Group discussion, Tshongwe village (2014).

From the perspective of household time, quantitative results indicated that a significant amount of time was spent on on-farm activities (further buttressing their significance as a major livelihood strategy) in rural Gwanda District. Households have time spheres in which overall activities are conducted (24 hours in a day, 7 days in a week and 12 months in a year).

The lowest time sphere is the daily time sphere followed by the weekly and the monthly sphere. This study assumes that the most urgent activities take place in the low sphere (day) followed by the week and the month. These spheres are interrelated however breaking them down allows one to observe the significance of an activity. Thus, time accorded to an activity within the various time spheres gives an indication of its importance to the households.

Table 7.3.11 summarises the time spent by households in rural Gwanda district on on-farm livelihood strategies in accordance with the survey. According to the Table 7.3.11, livestock tendering is accorded the most time in the annual time sphere graduated in months meaning that 88% of households tend livestock for approximately 11 months in a year (92%), all weeks (100%) of the month in those 11 months of tending, 6 days (86%) of the week in all the active weeks and for 3 (13%) hours of the day during the average 6 days accorded to the activity. The same applies for dry land and garden cropping. Dry land cropping is practiced by almost the whole community (98%) and is accorded a significant amount of time in all time spheres despite the unreliable and unfavourable weather conditions (Vincent and Thomas, 1960).

Table 7.3.11: Time spent of on-farm livelihood strategies

Activity	% of total Households undertaking the activity	Average % Time (year)	Average % Time spent (month)	Average % Time spent (week)	Average % Time spent (day)
Livestock tendering	88	92	100	86	13
Dry-land cropping	98	50	90	86	25
Garden cropping	63	82	33	62	25

Therefore, the major livelihood strategies in rural Gwanda district are on-farm related activities dominated by the rearing of livestock. The rearing of livestock is in turn predominantly dependent on a strong natural capital base (particularly CNC) in the form of grazing land and fresh water. Additionally, the crop production component of on-farm livelihood strategies is reliant on livestock draught power and manure. Moreover, livestock represent a form of physical capital thus a household that practices the dominant livelihood

strategy is one that has stocks of physical capital in the form of livestock. Previous discussions in this chapter also showed social capital to be necessary for the investment in natural capital while human capital allows for the use of updated methods of agricultural production.

Therefore, natural and physical capital assets are the major elements in the pursuit of the dominant livelihood strategy in Gwanda. In the case of natural capital (as previously observed in the significance of environmental income), this state of affairs indicates significant reliance on ecosystem goods and services.

In this study, livelihood strategies are considered to be based on combinations of primary, secondary and tertiary capital asset. Primary assets are those shown to directly support the particular livelihood strategy while secondary capital assets indirectly support the strategy and tertiary capital assets represent an asset whose contribution to the strategy is not directly evident but inevitably present.

In the case of rural Gwanda district, the dominant livelihood strategies have been shown to be on-farm strategies dependent on physical assets in the form of livestock and agricultural equipment. Natural capital also has been shown to directly support livestock rearing and crop production. The analysis of dominant livelihood strategies also showed that the access to physical assets was dependent on the access and levels of financial capital. On the periphery, the analysis of dominant livelihood strategies showed that social and human capital formed a critical base (social relations and technical expertise) that allowed for the access to financial capital that as previously discussed, is a major ingredient for the two elementary capital assets in the dominant livelihood strategy.

As such, one may conclude that the primary capital assets in the dominant on-farm livelihood strategies are physical and natural capital while financial capital is secondary and the other capital assets (social and human) are tertiary. If the primary assets are given a top numerical score of 3 out of the 3 possibilities, secondary assets a mid point score 2 of 3 and tertiary assets a low score 1 of 3. Accordingly, the dominant livelihood strategy in rural Gwanda may be presented using the Pentagon in Figure 7.3.1.

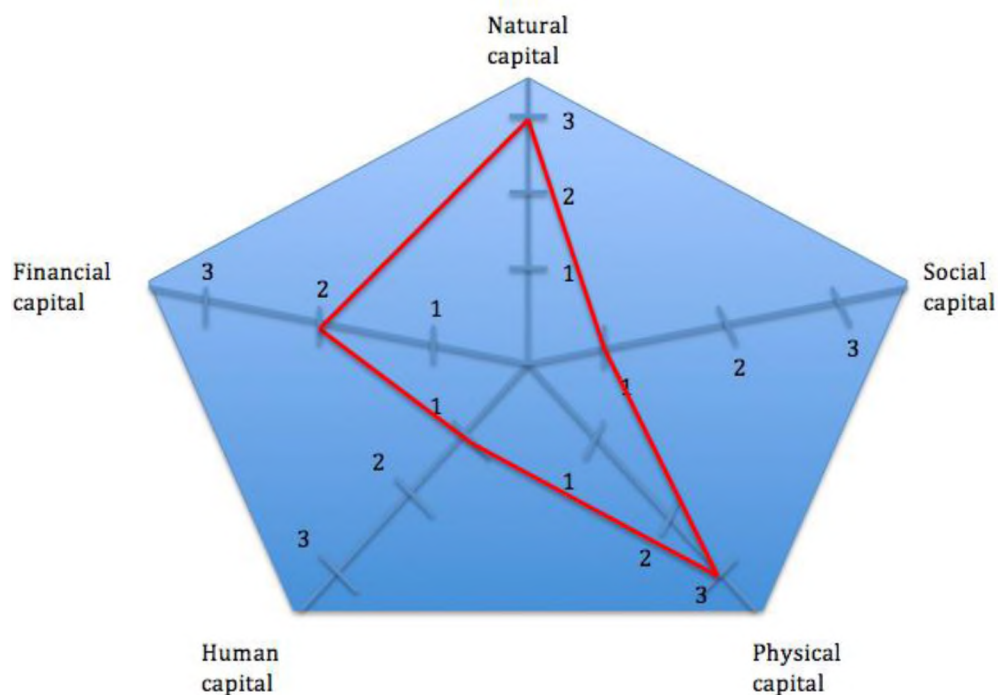


Figure 7.3.1: Pentagon showing how most household in rural Gwanda combine capital assets in pursuit of dominant on farm livelihood strategies

Off farm livelihood strategies

The major components of off-farm livelihood strategies in rural Gwanda district are assistance derived from relatives and organisations, casual labour, formal employment, home industry and mining activities. Casual labour and the receipt of assistance from relatives and formal organisations such as government and NGOs are pursued by most of the population (approximately 41% and 43% respectively). Formal employment contributes to household income but is limited to 14% of the population. Thus, assistance from relatives, government and NGOs contributes the most to household incomes and wealth amongst the off-farm strategies.

The explained common off-farm livelihood strategies depend on the access to social or human capital. Study findings showed that the pursuit of assistance is highly dependent on the various forms of social capital that exist in the study area. Assistance was divided into that from relatives and friends and that from formal organisations. The first form of assistance (from relatives and friends) is arguably related to the micro (individual) dimensions of social capital while the latter form is dependent on the meso (groups) and macro (national and global) dimensions of social capital. However, the results already noted that micro and macro

dimensions of social capital were not readily accessed in the study area though the meso dimension was the most popular.

In this regard it should follow that the dominant off farm strategies related to seeking assistance are concentrated on assistance from formal organisations and are dependent on the meso dimensions of social capital in Gwanda. Suppose a household chose to pursue the seeking of assistance from relatives and formal organisations, the primary capital assets would be social capital as shown in pentagon A in Figure 7.3.2. Pentagon A also recognises the tertiary value of financial, human and physical capital in the support of social capital inclined livelihood strategies.

Pentagon B in Figure 7.3.2 shows that the pursuit of the other off-farm livelihood strategies linked to non-agricultural income (casual labour, formal employment, home industry) requires high amounts of human capital related to acquired skill and knowledge. The human capital (primary asset) in rural Gwanda district is built on financial and physical capital (secondary assets) as depicted by pentagon B.

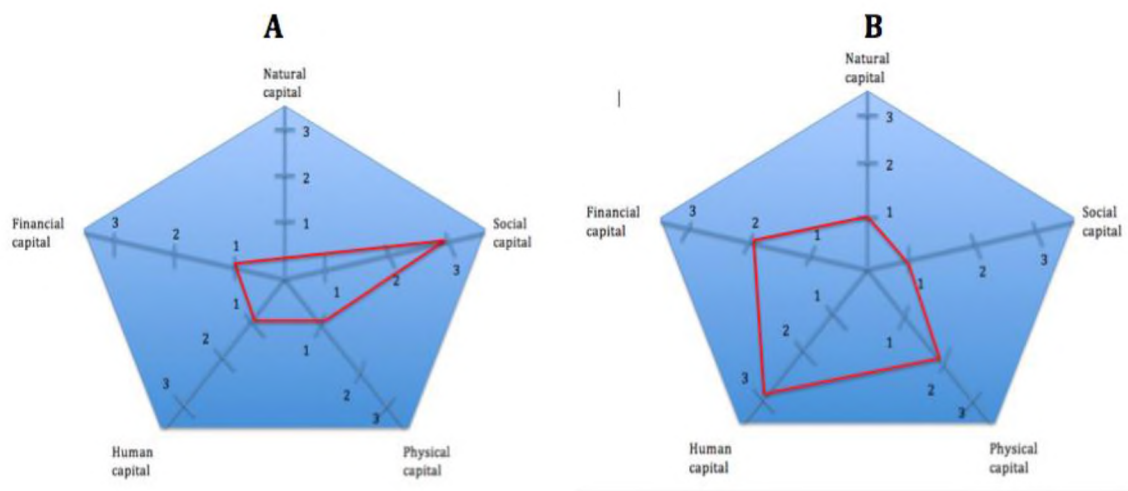


Figure 7.3.2: Pentagons showing how most household in rural Gwanda combine capital assets in pursuit of dominant off-farm livelihood strategies

In addition to the social and human capital inclined off-farm livelihood strategies, qualitative data results indicated that artisanal mining was becoming a major livelihood strategy though the laws, high human energy requirements and the costly equipment had sidelined mining as a reliable contributor to household livelihoods. The pursuit of artisanal mining would require increased access to all capital assets in the short-run. However in the long-run artisanal

mining has been shown to lead to depletion of natural capital stock and numerous social problems that deplete social capital (Mabhena, 2012; Spiegel 2015).

Off-farm activities are the second most pursued livelihood strategies in the study area after on-farm strategies. Casual labour and the receipt of assistance from relatives, government and NGOs dominate off-farm strategies. Evidently, dominant components of off-farm activities are predominantly dependent on strong social networks (social capital) and human capital. However, apart from casual labour, the other dominant off-farm livelihood strategies are non-productive, unsustainable and in the words of the local Member of Parliament “created dependent communities that had lost the ability to fend for themselves” (Dewa, 2015).

Migration

In rural Gwanda district, migration as a livelihood strategy is internal and external. Internal migration is characterised by movement to larger urban centres within Zimbabwe such as Bulawayo and Harare in search of employment while movement to South Africa and Botswana in search of employment opportunities dominates external migration. Other than income derived brought home from external areas, households also benefit from income remitted by relatives working in areas outside rural Gwanda within and outside Zimbabwe. In the study area migration took the form of family members labouring periodically in foreign lands or foreign-based family members remitting income to the household.

Qualitative data also revealed that remittances were predominantly from family members (particularly children) based in South Africa, Botswana and the United Kingdom. Table 7.3.12 shows that migration activities contribute an average of \$180 (20% of average household income flows) annually to households within the study area. Moreover, an average of 20% and 26% of the households realise migration and remitted income respectively.

Table 7.3.12: Components of migration livelihood strategies

	Migration	Remittances	Migration Strategies
Average income / household in \$	\$128	\$52	\$180
% Contribution of component	81%	19%	100%
% Of N involved in activity	20%	26%	24%

Results showed that proceeds from migration were highly dependent on the micro levels of social capital (trust) that existed between the migrant and the beneficiary. Additionally, the realisation of monetary proceeds from migration in rural Gwanda is smoothed by the access to the technical components of financial capital, particularly mobile phone based money transfer systems. As such, pursuit of a migration inclined livelihood strategy is favourable for households with high levels of micro trust and access to an array of financial capital dimensions.

However, the study has already exposed the limited levels of both trust and financial capital dimensions in the study area. As such, migration inclined activities are considered the least dominant livelihood strategies for the majority in rural Gwanda. In support of this discussed perspective, qualitative data indicated that a considerable number of locals (especially the youth) had migrated to neighbouring countries, particularly South Africa, but migration had rarely translated to dependable household incomes due to socio-economic difficulties individuals endured in foreign lands.

It should be noted that despite the dominance of certain strategies over others, households do not pursue a single strategy but rather an array of strategies to realise sustainable livelihoods. Thus, the dominance of a strategy may be considered a reflection of the amount of effort most households allocate to it.

7.4. THE EFFECTS OF CFF ON LIVELIHOODS IN RURAL GWANDA DISTRICT

This portion of the chapter focuses on the effects of *Cylindropuntia fulgida var fulgida* (Cff) on the previously discussed livelihood strategies in rural Gwanda district. Issues that will be examined (from the perspective of the local community) include *inter alia*, the positive and negative effects of Cff; capital assets most affected by Cff; plant density thresholds and implications of Cff effects on livelihood strategies in the study area.

7.4.1. Effects of *Cylindropuntia fulgida var fulgida*: A community perspective

As previously revealed, all the respondents indicated knowledge of Cff in Gwanda district. Additionally, all the respondents considered Cff a threat to the area from multiple dimensions that will be revealed as this section progresses. The results revealed that the majority of respondents (over 90%) began to consider Cff a threat more than 5 years prior to this study. Moreover, 65% of the population had their land invaded by the plant and of those whose land had been invaded by Cff, 94% stated that the primary use of this land before the invasion had been grazing livestock. The findings also revealed that the majority of the population (86%) has witnessed livestock injuries caused by Cff, 69% has witnessed wildlife injured by Cff and Cff has injured 38% of the respondents.

The community has engaged in a number of time-consuming activities in order to deal with the presence of Cff in the area. As shown in the Table 7.4.1, the major of Cff related activities include clearing the plant from household/rangeland (practiced by 63% of households), burning the plant (practiced by 59% of households) and removal of Cff thorns from livestock (practiced by 71% of households). As depicted in the Box 7.4.1, the Cff invasion has led to extra labour particularly through tending to livestock in the evenings after a day of grazing.

Table 7.4.1: Major Cff related activities in the household

Activity	Frequency of practice in the population
Clearing of the land	63%
Burning the plant	59%
Removal of thorns from livestock	71%
Burying the plant	31%
Awareness creation	3%

Box 7.4.1: Cff related activities in the household

“We come together to clear and burn this plant on Wednesdays early in the morning until lunch because we realized Cff had become a community problem as all had suffered injuries to their livestock” (Group discussion participant).

“We have to gather the livestock every evening to remove thorns and identify injuries that may have occurred during a day of grazing” (Group discussion participant).

Source: Group discussion, Tshongwe and Sengezane village (2014).

All household members carry out Cff related activities, nonetheless Table 7.4.2 suggests that women take the lead managing Cff in rural Gwanda district while children and hired labour are rare participants. In support of Table 7.4.2, group discussion participants revealed that women took the lead in Cff management due to higher access to meso-level social capital inclined towards community development projects in comparison to the men. Furthermore, the group discussion data asserts that the absence of children and hired labour from Cff related activities is due to dangerous spines on the plant and the lack of income to hire labour.

Table 7.4.2: Household participants in Cff related activities

Population group	Percent
Men	36%
Women	62%
Children	1%
Hired labour	1%
Total	100%

The households of rural Gwanda district have incurred various losses due to the presence of Cff in their area. The majority of the respondents have suffered injury to their small stock (goats, sheep and poultry) as displayed in the Table 7.4.3. Similarly, the highest financial losses are most pronounced in small stock, particularly goats (\$61.50/annum). Group discussion participants revealed that the major Cff related losses included amongst others veterinary expenses, lower meat prices, forced slaughter and unplanned livestock death.

None of the respondents suggested direct crop production losses due to the Cff invasion. However, group discussion participants brought to light the challenges that arose from livestock injuries/mortality in crop production. Those respondents who owned large livestock units (cattle 61% and donkeys 74%) argued that the negative effects that Cff had on their livestock had negatively affected crop production due to inadequate draught power and manure resulting in crop produce and financial losses that they could not quantify.

Table 7.4.3: Livestock injuries and losses

Injury to animals	Percentage of households whose animals have been injured	Mean annual financial losses in livestock range due to Cff
Cattle	10%	\$1.20
Goats	97%	\$61.50
Poultry	98%	\$39.55
Donkeys	43%	\$16
Sheep	65%	\$23.45

The sections that follow expand on the community perspective giving a detailed analysis of the common positive and negative effects of Cff and the sequential livelihood implications from the perspective of the local residents of Gwanda district.

7.4.2. Positive attributes of Cff

Most of the community members (85%) revealed that they had not seen any positive attributes from Cff and were better off without it on their land. However, despite the general hostility towards Cff, a small number of respondents suggested that a number of positive attributes were associated with Cff, particularly at low plant densities. During group discussions, respondents explained that in the study area, Cff was associated with the mysterious supernatural realm thereby appealing to certain population groups such as traditional healers. Table 7.4.4 summarises the major attributes of Cff identified by the community.

Table 7.4. 4: Positive attributes of Cff

Attributes of Cff	Frequency	Percent
Herbal treatment	3	3.8
It looks beautiful	1	1.3
Protects from lightning	2	2.5
Protects from snakes (in the household)	5	6.3
Works as an aphrodisiac	2	2.5
Protects from witchcraft	5	6.3
Strengthens the household	2	2.5
Brought the community together	1	1.3
No notable positive attributes	68	85.0

As shown in Table 7.4.4, the majority of the positive attributes (the first five (shaded yellow) in Table 7.4.4) appeal to human capital and its preservation. The human capital appeal corresponds to the provisioning component of ecosystem goods and services discussed in the Millennium Ecosystem Assessment (MEA) (2003, 2005) reports. The other positive attributes of Cff summarised in the Table 7.4.4 (protection from witchcraft and strengthening the household (shaded green)) correspond to human capital as well, although they are more inclined to cultural ecosystem services. Despite Cff contributing to the building of social capital (bringing the community together), qualitative data (from FGDs and KIIs) showed that this only occurred when the plant had reached catastrophic densities that community members could not ignore.

7.4.3. Negative effects of Cff

All the respondents, including the few who identified positive attributes of Cff, associated certain negative effects with the plant. Focus group discussions and key informant interviews showed that the negative effects of Cff had such a profound impact on the community that the positives previously discussed were constantly relegated to obscurity. Table 7.4.5 summarises the common negative effects of Cff from the perspective of the community.

Table 7.4.5: Negative effects of Cff

NEGATIVE EFFECT OF CFF	PERCENT
Reduces grazing range land	76.25
Injury to wildlife	16.3
Chokes other vegetation	10.1
Destroys the beauty of nature	5.0
Kills wildlife	2.5
Loss of biodiversity	2.5
Makes travel difficult (especially at night and for visitors)	61.25
Injury to livestock	57.5
Attaches to animals (makes management difficult)	11.25
Kills small stock	6.3
Causes diseases in livestock	1.3
Kills stray animals (Dogs)	2.5
Injury to humans	2.5
Causes diseases in humans	1.3

The negative Cff effects are categorised in Table 7.4.5 in accordance with the major capitals affected. The first section of the table (shaded green) shows those effects that impede the access to natural capital. The second section (shaded blue) shows the negative effects that impede access to social capital (particularly meso social capital). The third section (shaded brown) highlights those negative effects that hinder access to or deplete physical capital (particularly livestock). The final section (shaded pink) highlights the effects that deplete human capital.

7.4.4. Cff implications for livelihood capital assets in rural Gwanda district

This section discusses the implications that the Cff invasion of rural Gwanda district has on the capital assets that make up the livelihoods of the residents in the study area.

Natural capital

Results from the survey, group discussions and key informant interviews showed that Cff significantly reduced access to ecosystem goods and services given that it was alleged to result in the destruction of the natural capital found in rural Gwanda district. According to Table 7.4.5, the villagers of rural Gwanda argued that Cff reduced available grazing land, compromised the growth of other plants, injured and killed wildlife.

The loss of wildlife and the hindrance of growth of other plants have ultimately resulted in the loss of components of bio-diversity in rural Gwanda district. The loss of rangeland to graze livestock (identified by approximately 76% of survey respondents) was considered the most negative aspect of the Cff invasion of the study area. Therefore, the entrance of Cff in the community of rural Gwanda district has led to the gradual depletion of natural capital particularly grazing land.

Physical capital

According to Table 7.4.5 and key informants, physical capital particularly livestock are negatively affected by Cff in rural Gwanda district. Approximately 58% of the survey respondents reported Cff causing injury to their livestock (particularly small stock). In addition to injury, Cff was shown to have fatally injured not only livestock but also other household pets such as dogs. Key informants also noted that livestock injuries by Cff at times reduced the value of meat derived especially in cases where villagers in rural Gwanda attempted to sell the meat to abattoirs or other households in the area. The Cff livestock injuries have also resulted in households of rural Gwanda being forced to slaughter their livestock especially when vital organs such as the eyes have been damaged by Cff. Group discussion participants argued that such unplanned slaughters resulted in desperation that had seen them sell their meat at very low prices due to the uneven bargaining power caused by forced slaughter in the absence of a ready market.

The injuries to livestock represent a reduction in the value of physical capital from a monetary and functional perspective. Lower meat prices and forced slaughter of livestock are examples of a decrease in livestock value while an unplanned livestock death is an example of a total loss of a capital asset. Given that livestock has been shown to be a store of wealth in the study area, Cff therefore represents a tax on household physical capital investments. The survey

and group discussion results suggest that this tax is most severe on small stock (the most common livestock units) and in some cases may result in total erosion of physical assets. As such, Cff has depleted the quantities and value of physical capital particularly livestock in rural Gwanda district.

Social capital

Table 7.4.5 reveals that approximately 61% of the residents of rural Gwanda district associate Cff with difficulties in travel especially for visitors to the study area with limited knowledge of Cff-free paths and at night when vision is compromised. Previous sections of this chapter showed that visiting neighbours and relatives were major building blocks of social capital. Moreover, key informants noted that significant social activities in rural Gwanda district such as attending funerals often required night travel that had become limited by the fear of being pricked by Cff when visibility was low. As such, the fear of injury amongst the villagers of rural Gwanda has limited participation in activities that build inter-household (meso) social capital.

Furthermore, group discussion participants noted that Cff negatively impacted intra-household (micro) social capital because of the fear of injury. According to the group discussion participants, it had become risky to have relatives (especially young children) from outside the study area visiting the household as they were at a higher risk of injury from Cff because they lacked knowledge of its effects and locations in the area. However, group discussion participants noted that despite the erosion of social capital Cff being a collective community problem had managed to bring the community together through initiatives aimed at controlling it. Nonetheless, on a larger scale, the Cff invasion of rural Gwanda district has negatively impacted social capital formation in the study area effectively depleting social capital at micro and meso level.

Human capital

Despite the limited positive attributes that Cff has on human capital (see Table 7.4.4), Cff negatively affects human capital through injuries to the local residents of rural Gwanda district (sited by approximately 3% of the survey respondents). Group discussion respondents argued that young children were more vulnerable to Cff as it was they that did most of the tending of livestock in the rangeland where Cff infestations were highest. In addition to the human injuries, previous discussions (see Table 7.4.1) showed that individuals within

households spent a considerable amount of time clearing Cff from the rangeland, burning the plant and removing thorns from livestock that may have been pricked by the plant. These activities were considered a waste of valuable human capital by group discussion participants. Therefore, the Cff invasion of rural Gwanda also negatively impacts on human capital though to a lesser extent when compared to natural, physical and social capital.

Financial capital

Previous sections showed that in rural Gwanda district the access to financial capital was highly dependent on the access to other capital assets such as physical capital for collateral and social capital for effective linkages to financial capital sources (e.g. community savings groups) amongst other capital assets. Therefore, access to financial capital in rural Gwanda is dependent on preservation and accumulation of the other capital assets. In this regard, the depletion of any of the other four capital assets by Cff is assumed to result in the depletion of financial capital. Financial resources are also used when treating injuries caused by Cff in animals and humans (see Table 7.4.3). Therefore, the effect of Cff on financial capital in rural Gwanda district (direct and indirect) is negative given that Cff has been shown to result in the depletion of the other capital assets in the study area.

Summary of the Cff impact on livelihood capital assets in rural Gwanda

Cff has generally negatively impacted on all capital assets in rural Gwanda though with a more pronounced effect on natural, physical and social capital. Box 7.4.2 captures a summary of the negative impacts that Cff has in rural Gwanda district through the sentiments of group discussion participants.

Box 7.4.2: Negative effects of Cff

“Nothing good has come from having this plant on our land. It was those Ngwenya people who brought it here to our area maybe it used to work for them because Ngwenya was a traditional healer. Now it has spread all over the rangeland and our animals can’t graze and we can’t even visit each other at night”. (Group discussion participant).

“Our livestock has suffered the most and we now have to spent hours in the evening removing thorns from our animals”. (Group discussion participant).

“It has become very dangerous to send livestock to graze far from the homestead (a common practice during the dry season) because if an animal is pricked on the mouth and there are no humans to remove the thorns it will fail to feed and die”. (Group discussion participant).

“Livestock injuries have become extreme and human injuries have increased in numbers. Cff is thriving in Gwanda but the vegetation around it is choked and at times dying”. (Key informant EMA)

Source: Sidange pers. Comm (2014); Group discussions Tshongwe and Sengezane villages (2014).

The negative effects of Cff within the community of rural Gwanda district are analogous to the costs that the general public suffers from the presence to the plant. These costs are associated with the non-private rangeland of rural Gwanda district and may be private (e.g. livestock losses) or public (e.g. limited night time social activities). On the other hand, the positive attributes of Cff represent the private benefits that households enjoy when the plant is within the vicinity of the homestead.

7.4.5. Cff implications for livelihood strategies in rural Gwanda district

Figure 7.3.2 showed that dominant Livelihood strategies in rural Gwanda were on-farm strategies dependent on natural and physical capital particularly the rangeland and livestock. The second most dominant livelihood strategies in rural Gwanda are off-farm strategies based on seeking assistance that in-turn is rooted in strong social capital networks particularly intra and inter household social capital (see Figure 7.3.2).

Results from the survey, group discussions and key informant interviews have shown that in rural Gwanda district, Cff impacts negatively on predominantly natural, physical and social capital assets. These capital assets are incidentally the foundation block of the dominant livelihood strategies in rural Gwanda district. In this regard, the study concludes that Cff has

a significant negative impact on the livelihoods of the study area given that it negatively affects the building blocks of the dominant livelihood strategies.

Additionally, in an attempt to further analyse the Cff impact from an econometric perspective, Cff impact was considered alongside the WIQs. As such, the study modelled the impact of Cff on the livelihood strategies estimated using the WIQs. The Cff impact was given by a summation of households that reported injury to specific livestock units owned. In this regard, households that reported injury to a specific animal were given the value 1 while those with no reported injury to the particular animal type were given the value of 0.

The Cff impact for each household was then given by aggregating the reported injuries on successive livestock types. Cff impact (Cffl) was considered the dependent variable explained by the wealth quartiles. The minimum value of Cffl was 0, with a maximum of 5 and a mean of 3. A linear regression was then performed using quartile 4 as the base quartile. The model results (see Appendix one) were not significant in all WIQs save for WIQ1 where households with less livestock (those in WIQ1) were significantly less likely to report injury to livestock by Cff.

The model satisfied the normal distribution regression assumptions as shown by the derived histogram and points close to the regression line on the scatter plot (see Appendix one). The model however was considered weak due to a less than appropriate measure of Cffl. For instance, those households with multiple forms of livestock would have a higher Cffl in comparison to those with narrower ranges of livestock regardless of total number of units injured or owned.

7.4.6. Density thresholds of Cff in rural Gwanda district

Yokomizo *et al.* (2009) posited that the management of an invasive alien plant (IAP) required knowledge of its density impact curve and threshold points. According to the survey and group discussion results, Cff has limited positive attributes (predominantly the conservation of human capital) when the plant is domesticated and found only within individual households (i.e. private benefits). Thus, the positive attributes at low population densities are likely to accrue to the individual household than the community as a whole. However, as the densities of the plant increase and spread beyond the boundaries of the household, the individual private benefits are quickly eroded as the community begins to suffer public and

private costs (including households that derived private benefits) of Cff signified by the multiple negative effects caused by the plant.

Therefore, Cff is a low threshold plant best managed at low population densities limited to the boundaries of the households that derive private benefit from it. In this light, Cff may be classified as a 'low threshold private benefit plant' whose marginal private benefits are higher than marginal social benefits at low plant densities. IAPs, thus, can either be low or high threshold plants as shown in Yokomizo *et al.* (2009), nonetheless, it is paramount to establish if the plant results in private or public benefits. This aspect allows for more refined management approaches that specifically target primary beneficiaries from the plant. In the case of Cff, control is most efficient at low plant densities and is better exercised by the individual households that enjoy the benefits.

Below the plant density threshold, Cff in rural Gwanda district increases access to human capital benefits related to cultural ecosystem goods and services. The preservation and building of human capital increases the individual's ability to pursue other capital assets that diversify livelihoods. It is noteworthy that this dimension of human capital augmentation is related to individual perceptions of Cff associated with the socio-cultural dimensions of natural capital. Therefore, to a lesser extent, Cff in rural Gwanda district provides access to the socio-cultural dimensions of natural capital that, in turn, build on a perception of conservation of human capital. Nevertheless, the short run benefits as previously shown accrue mostly to individual households rather than the community at large.

After the density threshold point, Cff begins to negatively affect the major pillars (CNC) of on-farm and off-farm livelihood strategies (rearing of livestock and deepening social networks) in the study area. The ecosystem disturbance caused by Cff compromises the livestock support function of the ecosystem through the destruction of natural capital. The failure to support livestock rearing implies the reduction of the dominant livelihood strategy and translates to the weakening of other on-farm strategies such as crop production. Additionally the failure to pursue methods that build strong social networks such as visiting relatives (micro) and attending events (meso) that require night travel further compromises the dominant off-farm livelihood strategy (seeking assistance) in rural Gwanda district.

7.4.7. Modelling the Cff Impacts in rural Gwanda district

The impact of Cff on the livelihoods of the rural communities of rural Gwanda district may be illustrated using an extended version of the framework developed by Shackleton *et al.* (2007) (discussed in Chapter 2) showing the community benefits and costs of IAPs as plant densities change. Figure 7.4.1 presents the data (survey, FGDs and KIIs) and arguments previously discussed to show the livelihood impacts of Cff at different plant densities in rural Gwanda district. The model in Figure 7.4.1 is premised on the assumption that the invasive capabilities of Cff are known and the plant has been categorised as an aggressive and not weak invading species (Shackleton *et al.*, 2007).

Based on the model in Figure 7.4.1, Cff in rural Gwanda district is a low threshold, private benefit IAP. According to the WIQs, the study area was shown to be a place inhabited by predominantly poor people hence, when Cff is first introduced to rural Gwanda district, community vulnerability (represented by the red line) is assumed to be high due to most households falling in WIQ1 and WIQ2. Evidence from previous sections showed that in rural Gwanda district, most benefits of Cff occurred within the boundaries of the household. As such, community vulnerability to Cff does not change even with increases in plant densities (represented by the purple line) that are below the threshold point (T). However, the individual household vulnerability (represented by the declining green line) begins to decline with the increase in Cff densities as the household begins to access Cff human-capital-inclined benefits summarised in Table 7.4.4.

Therefore, before point 'T' households with Cff in their vicinity enjoy an increase in private benefits (represented by the orange line) while the rest of the community realises no benefits or losses. The benefits curve is an aggregation of the livelihood capital assets that appreciate in the presence of Cff as shown by the dotted orange curves in Figure 7.4.1. The plant then spreads beyond the individual households into the rangeland through the mechanisms previously discussed resulting in surpassing of the Cff threshold point 'T' in rural Gwanda district. As plant densities rise and surpass point T, community vulnerability immediately increases and negative aspects (represented by the dashed orange line putting the community in the negative regarding public costs) of Cff summarised in Table 7.4.5 gradually manifest in the community at large. Household benefits, on the other hand, may continue to be realised albeit diminishing due to rapid cancelation by broader negatives on the natural

environment beyond the household that were shown to constantly relegate the positives to obscurity.

After point T, Cff has spread beyond the boundaries of the individual household and begun to cause the previously discussed problems in the rangeland and increase community public costs. The gradually rising blue curve in Figure 7.4.1 shows the aggregated costs of the Cff invasion from a perspective of livelihood capital assets held by households in the study area. Evidence from the data collected through the survey, group discussions and key informants showed that in Gwanda, the capital assets that are most depleted by Cff are natural, social and physical capital (particularly livestock) as shown by the blue dotted lines that when aggregated form the solid blue Cff cost curve. Access to the other capital assets (human and financial) was also shown to be strained by the increasing Cff densities. The costs associated with natural capital further affect animal husbandry that is the dominant livelihood strategy in the study area.

For IAPs in general, control methodologies will differ in accordance with the IAP in question, invasion capabilities and geographical location. The model developed in Figure 7.4.1 recommends IAP management decisions based on plant threshold points, capital assets (natural, human, physical, financial and social) and impacts on social groups (individuals, households and communities). Individual and household benefits represent private benefits while the community benefits represent public benefit of an IAP. Following the model in Figure 7.4.1, IAPs may fall into one of four categories shown in the IAP classification and management matrix in Table 7.4.6.

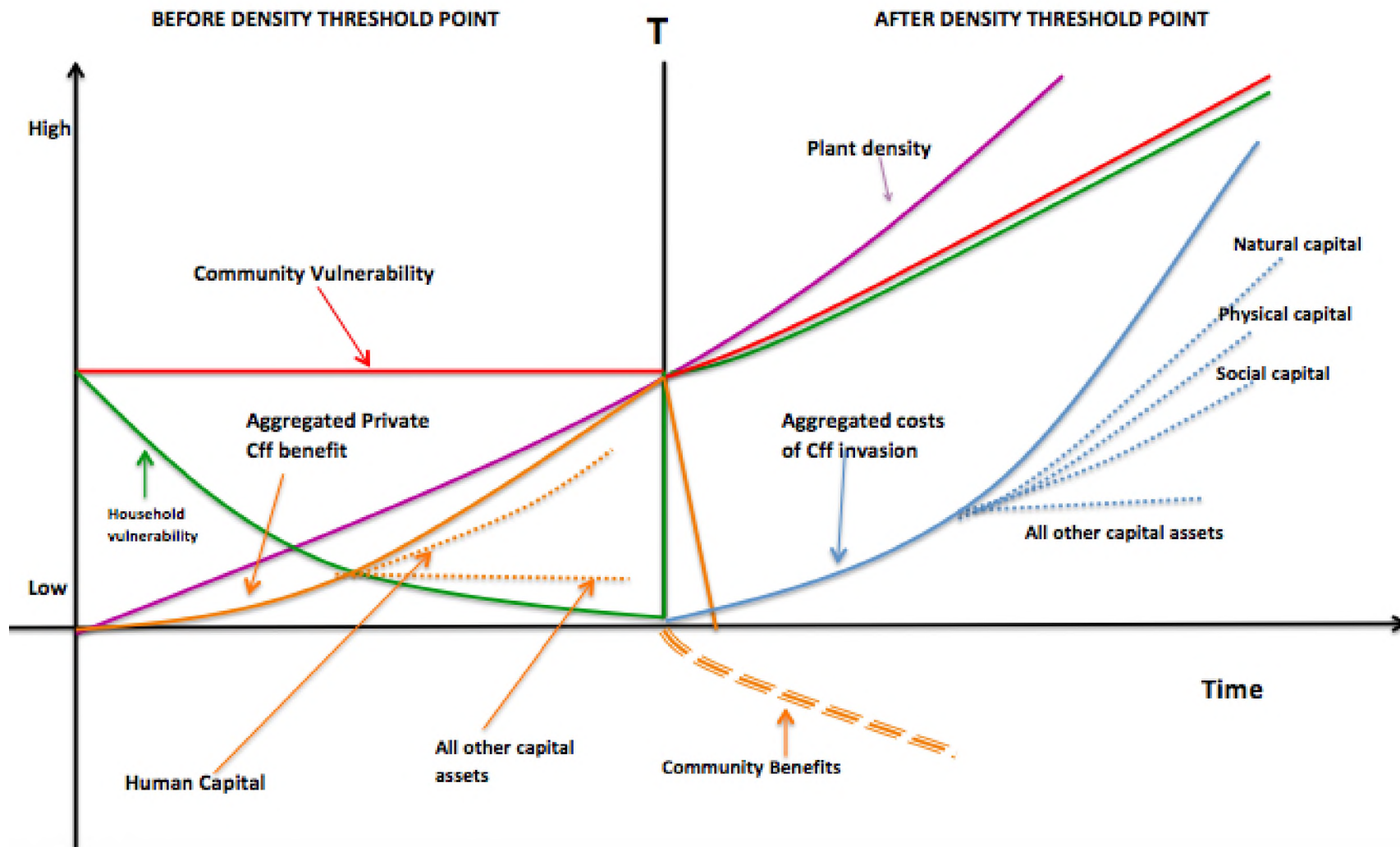


Figure 7.4.1: Modelled effects of Cff in rural Gwanda district

Table 7.4.6: IAP classification and management matrix

High	HIGH THRESHOLD PRIVATE BENEFIT	HIGH THRESHOLD PUBLIC BENEFIT	↑ T h r e s h o l d
	<p>Characteristics</p> <ul style="list-style-type: none"> • IAP has negative effect on capital assets at high plant densities • Benefits accrue to private individuals and households particularly to specific household capital assets <p>Control recommendations</p> <ul style="list-style-type: none"> • Plant control is most efficient at high densities • Control has to target restoration of capital assets most affected first • Control efforts must be led by major private beneficiaries from the plant 	<p>Characteristics</p> <ul style="list-style-type: none"> • IAP has negative effect on capital assets at high plant densities • Benefits accrue to the entire community particularly to specific capital assets <p>Control recommendations</p> <ul style="list-style-type: none"> • Plant control is most efficient at high densities • Control has to target restoration of capital assets most affected first • Control must include the entire community 	
Low	LOW THRESHOLD PRIVATE BENEFIT	LOW THRESHOLD PUBLIC BENEFIT	
	<p>Characteristics</p> <ul style="list-style-type: none"> • IAP has negative effect on capital assets at very low densities • Benefits accrue to private individuals and households particularly to specific household capital assets <p>Control recommendations</p> <ul style="list-style-type: none"> • Plant control is most efficient at low densities • Control has to target restoration of capital assets most affected first • Control efforts must be led by major private beneficiaries from the plant 	<p>Characteristics</p> <ul style="list-style-type: none"> • IAP has negative effect on capital assets only at low plant densities • Benefits accrue to the entire community particularly to specific household capital assets <p>Control recommendations</p> <ul style="list-style-type: none"> • Plant control is most efficient at low densities • Control has to target restoration of capital assets most affected first • Control must include the entire community 	
	Private	Public	

Cff in rural Gwanda district is a low threshold, private benefit IAP hence it would fall into the lower left quadrant of Table 7.4.6. The IAP private or public benefits may be a result of augmentation of one or more of the capital assets that form the foundation of household livelihood strategies. Similarly, after the threshold point the IAP affects the community by compromising one or more of livelihood capital assets. Therefore, efficient control decisions should be related to the IAP classification and the capital assets most affected.

The model explained by Figures 7.4.1 and Table 7.4.6 considers the management of IAPs from a livelihoods perspective. The model follows 5 basic steps: (1) classification of the plant's invasive capabilities, (2) identifications of the threshold densities of the IAP, (3) identification of the positive and negative attributes of the IAP, (4) identification of the major winners and losers from the IAP's presence and (5) identification of the capitals augmented or diminished by the IAP. Collection of information required by the four steps allows for placing of the plant on a particular point of the classification matrix in Table 7.4.6 with relevant management information.

Therefore, from a rural livelihoods perspective, efficient management of Cff in rural Gwanda requires control that focuses on the capital assets and livelihood strategies most affected. In this regard, Figure 7.4.1 shows that there is need to institute programmes that prioritise the conservation and building of natural, physical and social capital in rural Gwanda district. Furthermore, given that Cff has been shown to be a low threshold-private-benefit IAP, it is crucial for authorities in Gwanda to encourage villagers to destroy Cff regardless of plant densities. Additionally, the revealed almost non-existent Cff benefits and the high levels of poverty mean that institutional authorities such as the State must take the lead in Cff control rather than the local villagers.

The framework presented in Table 7.4.6 may be used to represent the effects of other IAPs that may be summarised as 'high/low threshold, public/private benefit'. Basing on the observed results and Yokomizo *et al.* (2009), such an analysis allows for the efficient use of IAP control resources and the targeting of the capital assets that are most affected.

7.5. CHAPTER SUMMARY

This chapter has given details specific to rural Gwanda district regarding the local perceptions of the natural environment, the major livelihood strategies and the effects of Cff on livelihood

strategies. The empirical analysis has shown that the rural Gwanda community views the environment from a predominantly pro-utilisation perspective. Additionally, on-farm livelihoods biased towards livestock rearing dominate the livelihood strategies in the study area. Cff was shown to negatively affect CNC and micro-social capital formation. The final chapter that follows discusses the major conclusions thus far in relation to the highlighted thematic areas.

CHAPTER 8: CONCLUSIONS

Biological invasions have stimulated debate in environmental economics regarding their impact on the value of ecosystem goods and services, their short and long-term implications on national coffers, their influence on sustainable development and poverty alleviation. The analysis of biological invasions, particularly Invasive Alien Plants (IAP), has been criticised for its lack of consistency and clarity regarding the terminology used (Colautti and Maclsaac, 2004). In environmental economics, on the one hand, IAPs are associated with socio-economic costs related to depletion of natural capital. On the other hand, IAPs result in socio-economic benefits for certain sections of society. When managing IAPs, this dual effect results in societal conflicts often-pitting long and short-term interests against each other (Shackleton *et al.*, 2007).

This study used a case of *Cylindropuntia fulgida var fulgida* (Cff) (an invasive alien plant) in rural Gwanda district of Zimbabwe to unravel the nexus of IAP, poverty and sustainable development from a rural livelihoods perspective. A sample of household heads from the rural population in Gwanda district and key informants gave the primary data for the study. Additionally, an extensive review of government documents and other relevant literature from local organisations comprised the secondary data. The study results demonstrated the effects of IAPs on rural livelihoods that were analysed along the parameters of sustainable rural livelihoods, ecosystem goods and services and new institutional economics. During the study, additional questions about IAPs arose. In order to accommodate these questions, sections towards the end of this chapter give areas that could be of interest for further investigations.

8.1. SUMMARY OF RESEARCH FINDINGS

Based on the results, it is evident that IAPs have an impact on the development process and the levels of poverty in a society. Furthermore, results confirm that the effect of IAPs directly relate to the density of the plant and its threshold point. The research outcomes show that

Cff in particular has a negative effect on natural and social capital beyond its density threshold point. The negative effect on natural capital impedes sustainable development and has the ability to condemn the rural population of Gwanda district to perpetual poverty. The institutional frameworks at play are significant determinants of the overall impact of IAPs on a community. Henceforth, it is necessary to ensure that policy makers have the best information for the effective management of IAPs.

8.1.1. Research questions revisited

The general goal of the study was to determine the impact of the IAPs on rural livelihoods in Zimbabwe. This section uses the empirical evidence from the study to answer the research questions prompted in Chapter 1.

- *What are the local perceptions regarding invasive alien species and their management?*

The residents of rural Gwanda district hold both a conservation and utilisation conviction (syncretic view) towards the environment. However, the utilisation aspect outweighs conservation. These findings were similar to those realised by Corral-verdugo and Armendáriz (2000) in a rural Mexican community. In addition to the syncretic view, residents in rural Gwanda from the pre-independence era (more than 35 years old) are more inclined towards conservation in comparison to the youth. This revelation is in contrast with literature (primarily from developed countries) that focuses the conservation inclination within the younger members of the population (Van Liere and Dunlap; 1980; Mohai and Twight, 1987). This study proposed the amalgamation of African tradition/religion and the natural environment as a probable reason for this contrast. However, additional research is necessary to validate the proposed claim.

Using the case of Cff in rural Gwanda district, the study divulged that the origin of a species in the natural environment was not much of an issue to the host community. However, the livelihood effects that the species has (regardless of origins) are the major determinant of attitudes developed towards it. In addition to considering attributes (in general) of a species as shown by Milfont and Duckitt (2010), this study has revealed that in the case of rural Africa it is better to consider attributes in relation to livelihoods. Therefore, from a rural African perspective, the term 'alien species' increasingly becomes irrelevant in the face of the

research findings. The invasiveness of a species and the impact of any species on livelihoods are clearly the significant issues.

- ***What are the major livelihood strategies in rural Gwanda?***

The majority of the households in the study area fall in the low wealth-income quartile and rural Gwanda has a negative return on human capital investment. Nonetheless, the accumulation of human capital in the study area is vital as it allowed for the pursuit of options outside the study area. The results show that the residents in the study area invest in the building of human capital but the broader macroeconomic environment does not allow local beneficiation from accumulated human capital. Gwanda is also plagued by financial exclusion rooted in the high transaction costs of extending social capital to rural areas like the study area. However, despite the evident high transaction costs in the realms of financial capital, the communities have turned to local informal alternatives such as savings groups. Furthermore, mobile phone based cash transfer systems were shown to be viable conduits to financial inclusion.

In rural Gwanda district, social capital building blocks are concentrated at the meso-level of society. Macro-level social capital is also evident in the study area regarding issues of collective action. However, the access to the finer dimensions of macro social capital is the preserve of the local traditional and political leadership. The dimension with the least social capital building potential is the micro dimension of the individual. The low levels of trust that exist in the study area fuel the low levels of social capital accumulation at the micro level. Physical capital in the study area is dominated by the ownership of livestock, immovable property and consumer durable goods.

All households in the study area practice the harvesting of natural capital and natural resources contribute substantially to household income flows. These findings were aligned with other studies conducted in sub-Saharan Africa that identify direct harvest and sale of ecosystem goods and services as a major component in the formulation of rural livelihoods (Campbell and Luckert, 2002; Shackleton and Shackleton, 2004; Egoh, 2012). The study also exposed a situation of secondary dependence on critical natural capital not related to direct human harvest for sale/consumption but rather for the support of animal husbandry. The observed secondary dependence on natural capital (also discussed by Costanza *et al.*, 1997)

thus underscores the importance of ecosystem goods and services as the support of all other capital assets.

The major livelihood strategies are on-farm strategies that involve rearing of livestock (primarily small stock) and crop production. Off-farm strategies related to acquiring assistance from relatives, government and Non-Governmental Organisations (NGOs) are the second most prominent livelihood strategy in the study area. Migration, although practised by a significant part of the population, is a lesser strategy. Natural and social capital are the primary pillars of the major livelihood strategies in rural Gwanda district.

- ***Which livelihood strategies does the Cff invasion affect?***

Cff is a low threshold invasive plant with private benefits. This study disclosed that the Cff benefits accrue privately to households that have the plant within their boundaries. The benefits primarily relate to the augmentation of human capital from a supernatural and health perspective. Nonetheless, once the plant surpasses its threshold point, the private benefits are outweighed by the public and private costs that begin to affect the entire community. Above the threshold point the Cff invasion in rural Gwanda district primarily affects natural and social capital. The negative effects on these two capital assets (natural and social) adversely affect animal husbandry and the building of social networks. Moreover, Cff compromises animal husbandry through injury of livestock. Therefore, the Cff invasion affects the rearing of livestock and derivation of assistance from various sections. Consequently, the livelihood strategies most affected are the most dominant in the study area.

- ***How effective are the Cff management institutions Gwanda?***

The institutional frameworks that govern the management of Cff in rural Gwanda district are either formal or informal. The State is the dominant institution governing directly through formal institutions such as the Environmental Management Act of 2002, Environmental Management Board, Environmental Management Council, Environmental Management Agency, Rural District Council and the traditional leadership structures. A dominant state player despite notable inefficiencies of a state property rights regime predominantly answers the natural resource management question in rural Gwanda. Common property arrangements are constantly hindered by the hegemonic state that manipulates the building blocks of the institution of social capital through politics to its advantage.

The informal institutions have been plagued by negative externalities of social capital related to political polarisation and religion. In this regard, the study showed that most of the population perceive informal institutions with suspicion ultimately weakening their positive influences. Nonetheless, the informal systems evidently hold the community together through meso-social capital that allowed for Cff community management projects in spite of resource limitations.

The community contested the formulation of both the formal and informal institutions. In the case of the formal rules, the community argued that formulation was top-down with no consideration of their input. For the informal institutions, the community revealed that mystery clouded the formulation of the long-standing laws since the formulators had long passed on. Moreover, political polarisation plagued the formulation of contemporary informal rules. This observation exposes the meddling of the hegemonic state in community affairs.

Regarding environmental degradation, the study findings support those by Ostrom (1990) who noted that the tragedy of the commons described in Hardin (1968) would not always occur in the presence of strong social positive capital. Furthermore, the study adds another dimension to the conclusions reached by Ostrom (1990). It was shown that in situations where an environmental problem affected a large part of the population, it would be possible to harness positive social capital in order to avoid the tragedy of the commons. However, in cases of negative externalities of social capital, environmental problems affecting a smaller part of the population (e.g. the case of the revered *uMtswili* tree) or where the problem had long-term effects; certain elements of the tragedy of the commons were observed.

This observation recognises the value of strong social capital in managing an immediate environmental problem with a negative effect on livelihoods like Cff. However, it also raises questions related to how to harness such social capital (crisis induced) to tackle environmental problems that are linked to conservation without immediate negative effects on livelihoods. Such a question is best answered through further research on issues of social capital and environmental management in rural Africa.

8.2. CONCLUDING REMARKS

Livelihood benefits that species in the natural environment provide strongly influence environmental perceptions of rural African communities. Based on the study results, it is evident that IAPs affect sustainable development and poverty. The study has shown that Cff compromises the local ecosystem and reduces its ability to support the dominant livelihoods in the study area. The long-term result of such a situation in the absence of control is increased poverty and the failure to realise sustainable development.

However, IAPs can also improve the poverty situation of a community before they have reached the threshold points. It is therefore imperative to know the threshold points of an invasive plant in order to ascertain the efficient point to intervene. The study also showed that benefits of invasive plants accrue to different members of a society at different times (private/public). This knowledge allows the targeting of prime beneficiaries for control programmes based on a 'user pays' principle. The comprehension of facets of Cff (and other IAPs, in general) described in this study would benefit environmental management institutions in Zimbabwe and rural Africa, in general.

8.3. POLICY RECOMMENDATIONS

Based on the findings of the study, particularly challenges and theoretical contrasts, a number of policy recommendations can be suggested. Different parties have to play supporting roles, in order to effectively manage biological invasions and limit their negative impact on sustainable development and poverty. Zimbabwean authorities could consider a series of options summarized in the sub-sections that follow.

8.3.1. Recommendations for environmental management institutions

The following recommendations are most appropriate to institutions (particularly EMA), and communities involved in the management of Cff around Zimbabwe.

- ***Prioritise the removal of Cff in all places other than the household***

The results have indicated that Cff is a low threshold private benefit plant. Thus, control strategies have to focus on ensuring that single stems of the plant are removed from all places other than private households. The management of Cff should not delay until the plant densities have risen above the threshold as this results in higher costs in comparison to control at/below the threshold point.

- ***Enhance control methods that support efforts of local communities***

The residents of the study area have managed to undertake community based Cff management projects through harnessing social capital. Given the weak Zimbabwean economy and the advantages of grassroots environmental management initiatives (Ostrom, 2000, 1990), supporting community efforts (by authorities) would save scarce resources and increase unity of purpose in the community. Such support was shown to exist (e.g. EMA supplying tools to communities) in the study area and its enhancement can only lead to more positive results.

- ***Prioritise control programmes that protect natural and social capital***

The major capital assets affected by Cff are natural and social capital. Therefore, management programmes must priorities rehabilitating the two capital assets. Control efforts should specifically focus on clearing and rehabilitation of the rangeland, roads and footpaths. Focusing on the two major capital assets does not however imply ignoring other assets.

8.3.2. Recommendations for livelihood support structures

The study highlighted the deepening of social capital as a major component that ensures sustainable livelihoods in the area. In this light, institutions that support livelihoods in rural Gwanda district should prioritise activities concerned with the deepening of social capital. The rearing of livestock particularly small stock is the most prominent strategy in the study area. Therefore, initiatives targeting sustainable livelihoods in the presence of Cff should prioritise programmes that increase household livestock numbers, nurse injuries from Cff and protect livestock from future injuries.

8.4. LIMITATIONS OF THE RESEARCH

There were three main limitations encountered in this research: unwillingness of some respondents to provide data (particularly key informants), time and financial limitations. Therefore, the results of the study are limited to the key informants who were willing to provide data. Thus, the unwillingness of some key informants to provide data for the research reduced the sampling frame, and probably introduced bias. In order to increase reliability of results, in-depth interviews were conducted with those who responded. Thus, the results can still be generalized to the whole population, although distinct features among different people and areas have to be considered. Data collection was over a relatively short period

due to time and financial limitations. However, secondary data and the group discussions were useful and mitigated this limitation.

8.5. FURTHER RESEARCH

The study raised several areas requiring further investigation and these include the following:

- a) Carrying out a study to investigate the best management methods for Cff in Gwanda in order to develop an intervention framework that will see the channelling of scarce management resources to the most viable options. Such a study would also give the best advice for Cff management in similar environments,
- b) Carrying out a studies that classify other invasive plants worldwide in accordance with the classification matrix developed in Chapter 7,
- c) Carrying out a study on the biological implications of Cff related injuries specifically regarding small stock to allow for the development of methods and substances that improve livestock resilience to the dangers of injury sores,
- d) Carrying out a study on the alternative uses of the plant in order to provide utilisation options that will contribute towards the management of the plant densities and increase overall benefits derived from Cff.
- e) Carrying out a study on social capital efficacy in conservation under conditions devoid of immediate livelihood challenges posed by an environmental disaster.

This study has contributed literature to the impact of IAPs on livelihoods, sustainable development and poverty in rural Africa. Furthermore, the study used various scoring tools (REF analysis for institutions and capital scoring for livelihood strategies) that could be applied in other studies that investigate the effectiveness of institutions and composition of household livelihood strategies. Additionally, the study used a classification matrix to classify Cff. Such a matrix (together with Figure 7.4.1) may be used in other studies to classify and show the effects of other IAPs on communities over time. The overall conclusion drawn from the study is that without effective and informed management IAPs may negatively affect the livelihoods thereby increasing poverty and derailing efforts towards sustainable development in rural African societies.

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APPENDIX 1: THE CYLINDROPUNTIA FULGIDA VAR FULGIDA IMPACT REGRESSION MODEL

Table A1: Descriptive statistics of Cffi in rural Gwanda

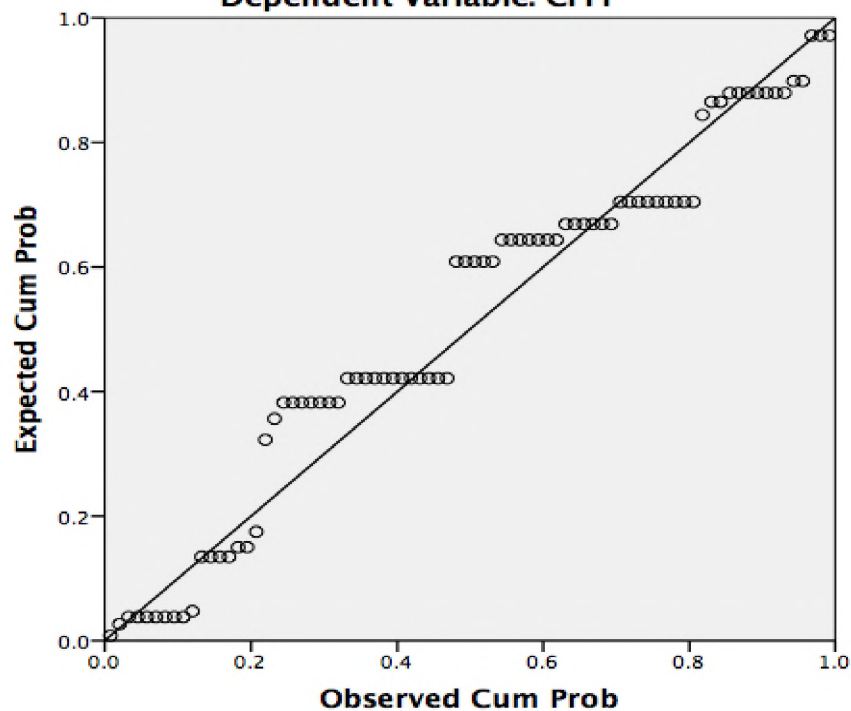
	N	Minimum	Maximum	Mean	Std. Deviation
CFFI	80	0	5	3.00	1.423
Valid N (listwise)	80				

Table A2: Cffi regression model

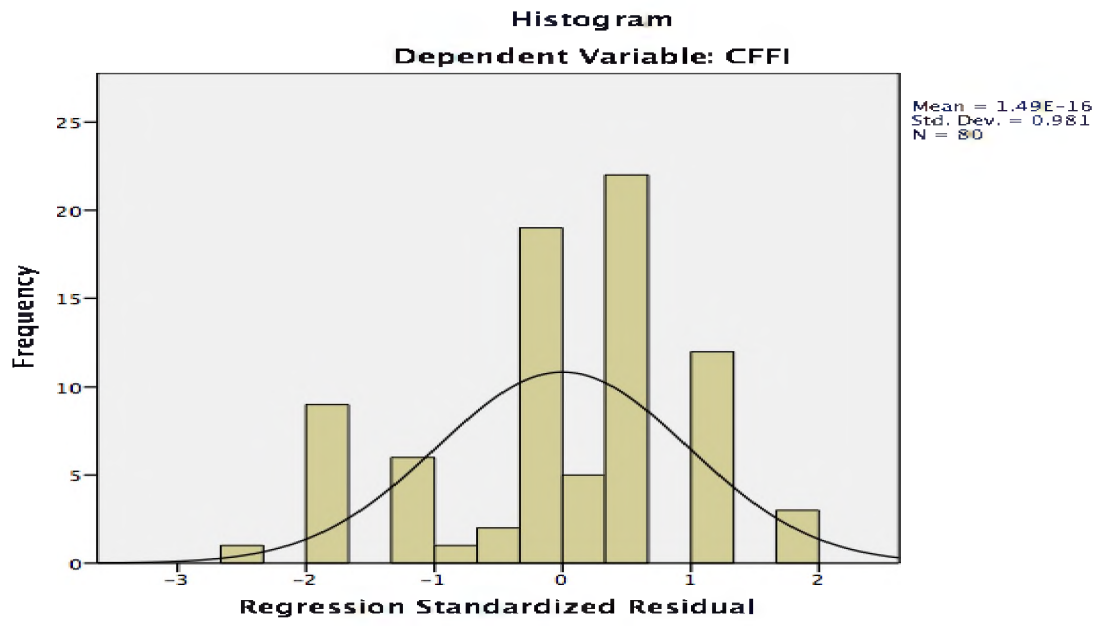
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.625	.480		7.549	.000
	WIQ1	-1.219	.537	-.422	-2.270	.026
	WIQ2	-.356	.549	-.118	-.648	.519
	WIQ3	-.125	.602	-.034	-.208	.836

a. Dependent Variable: CFFI

**Normal P-P Plot of Regression Standardized Residual
Dependent Variable: CFFI**



Scatter plot showing the distribution of variables around the regression line



Histogram showing the distribution of variables

APPENDIX 2: FIELDWORK PHOTOGRAPHS



- Goat with Cff spines attached (Seboza rangeland)



- Cff control efforts by the rural communities (Sengezane village)



- Tools supplied by EMA for the control of Cff (Sengezane village)



- **Group discussion participants (Tshongwe village)**



- **An all female group discussion in Sengezane village**

APPENDIX 3: DATA COLLECTION TOOLS



DEPARTMENT OF ECONOMICS & ECONOMIC HISTORY ☎Tel: (046) 603 8301 ☎ Fax: (046) 622 5210

HOUSEHOLD SURVEY QUESTIONNAIRE

The information obtained from this survey will be used in to better understand the effects of *Cylindropuntia fulgida var fulgida* (Cff) in Matabeleland South Province and prepare related reports.

Confidentiality and Consent: Your answers to this interview will not be released to anyone and we will not contact anyone you know about this interview. Your name will not be written on this form, and will never be used in connection with any of the information given. You do not have to answer any questions that you do not want to answer, and you may end this interview at any time you want to. However, your honest answers to these questions will help us better understand what people think, say and do about certain kinds of behaviours which would help us draw well informed conclusions. We would greatly appreciate your help in responding to this survey. It will take about 45 minutes of your time. Would you be willing to participate?"

Yes		No	
-----	--	----	--

I certify that the nature and purpose, the potential benefits and possible risks associated with participating in this research have been explained to the volunteer.

Enumerator's signature.....

- i. Questionnaire Number / / / /
- ii. Name of Enumerator _____
- iii. Date of interview / / 2014

	(1) utilitarian value, (2) naturalistic value, (3) ecologicistic-scientific value, (4) aesthetic value, (5) symbolic value, (6) humanistic value, (7) moralistic value, (8) dominionistic value (9) negativistic value																
B2	Have you heard of IAPs 1 = yes ; 2 =No																
B3	If the answer to B2 was yes, identify the IAPs and fill in the table																
	<table border="1"> <thead> <tr> <th>Name</th> <th>When did you first see the plant</th> <th>Do you know where it came from</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	Name	When did you first see the plant	Do you know where it came from													
Name	When did you first see the plant	Do you know where it came from															
	When did you first see the plant 1= < a year ago; 2= <3 years ago; 3= <5 years ago; 4= <10 years ago; 5= >10 years ago Do you know where it came from 1=Yes; 2=No																
B4	Do you know about Cff 1=Yes; 2=No																
B5	<table border="1"> <thead> <tr> <th>Name</th> <th>When did you first see the plant</th> <th>Do you know where it came from</th> </tr> </thead> <tbody> <tr> <td>Cff</td> <td> </td> <td> </td> </tr> </tbody> </table>	Name	When did you first see the plant	Do you know where it came from	Cff												
Name	When did you first see the plant	Do you know where it came from															
Cff																	
	If No fill table in based on the key in question B3																
B7	Are you willing to pay for Cff control programmes? 1=Yes 2=No																
B8	If you answered Yes to B7, How much are you willing to pay as a household annually USD.....																
B9	If you answered No to B7, who should pay (major) 1 = The government; 2 = The EMA; 3 = The chiefs ; 4 = NGOs; 5 = Other.....																

C:	LIVELIHOODS													
C1	Human capital Annual expenditure on													
	<table border="1"> <thead> <tr> <th>Education</th> <th>Health</th> <th>Clothes</th> <th>Food</th> <th> </th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Education	Health	Clothes	Food									
Education	Health	Clothes	Food											
	1= <\$100, 2= < \$200, 3 = < \$500; 4 = < \$1000, 5 = <\$2000 and 6 = >3000													

C2	Financial capital		
	Savings/year	Loans/year (source)	HH expenditure/year
	1= <\$100, 2= < \$200, 3 = < \$500; 4 = < \$1000 and 5 = <\$2000 6 = >3000		
C3	Social gatherings/month (Informal)		Number of organisations affiliated to
C4	Do you think it is important to participate in the social activities identified in C3?		
	1=No not at all; 2= yes but not that much; 3 yes; 4 = yes very much		
C5	Physical Capital Does your household currently have any of the following animals?		
	Type of animal	Number	Numbers sold last year
			Annual Income generated from sales
C6	Cattle		
C7	Pigs		
C8	Rabbits		
C9	Sheep		
C10	Goats		
C11	Poultry		
C12	Donkeys		
C13	Other (Specify).....		
C14	Do you realise or sell any animal produce or services		

Animal	Products	Annual income derived if sold
Cattle		
Pigs		
Rabbits		
Sheep		
Goats		
Poultry		
Donkeys		
Other (Specify).....		

Products

1=Milk; 2= Eggs 3= Manure; 4= Draught power 5=Meat; 6=Hides; 7=Other

Income

1= <\$100, 2= < \$200, 3 = < \$500; 4 = < \$1000 and 5 = >\$2000

C15 Do you have any of the following assets

Type of Asset Functional only	Number Owned	Monetary value (Very Old, Old, New)	Source of income
Plough			
Cultivator			
Scotch Cart			
Hoe			
Axe			
Shovel			
Rake			
Wheelbarrow			
Pick/Mattock			
Corrugated iron house			
Solar Panel			
Electrified house			
Computer			
Mobile phone			
Bicycle			
Car			
Tractor			
Television			
Generator			

	Radio			
	Beds			
	Lounge furniture			
	Kitchen furniture			
	Satellite dish			
	Borehole/Well			

C16 Natural capital
Does your household have access to arable land?
1 = Yes 2 = No

C17 Amount of arable land you have access to (in Hectares) _____

C18 What size of land did you cultivate last season
1 = 0 – 2ha 3 = 6 – 10ha
2 = 3 – 5ha 4 = >10ha

C19 Area of land the household rented from others for agriculture
1 = 0 – 2ha 3 = 6 – 10ha
2 = 3 – 5ha 4 = >10ha

C20 Area of land the household LEASED to others
1 = 0 – 2ha 2 = 3 – 5ha 3 = 6 – 10ha 4 = >10ha

C21 Do you have a family garden
1 = Yes 2 = No

C22	Crop Type Produced in the household	Input sources See codes below	Quantity harvested (kg) in the last 12 months	Price per unit sold	Method of produce See codes below	Use of revenue gained See codes below
	Maize					
	Sorghum					
	Millet					
	Wheat					
	Groundnuts					
	Round Nuts					
	Sugar beans					
	Paprika					
	Tobacco					
	Tomatoes					

	Green vegetables					
	Potatoes					
	Sweet potatoes					
	Melons					
	Other.....					
	...					

Input sources

1= Household income and resources; 2 = Government; 3 = NGOs; 4 = Community donations

5 = Private donations

Method of produce

1 = Dry land cropping; 2 = Garden production

Use of revenue gained

1= Purchase of physical capital; 2 = developing human capital; 3 = investing in natural capital;

4 = other.....

C23 Which Ecosystem Goods do you harvest

Product	Standardised Quantity/month	Income if sold
firewood		
Other wood products		
Wild fruit		
Water		
Wild life	kgs	
Medicine	Frequency	
Fish	Kgs	
Other		

Income

1= <\$100, 2= < \$200, 3 = < \$500; 4 = < \$1000 and 5 = <\$2000

C24 What other methods do you use to earn a living?

Method	Annual income	Protagonist
Mining		
Migration		
Remittances (Local)		
Assistance from local relatives and friends		
Home industry		
Other _____		

Annual income

1= <\$100, 2= < \$200, 3 = < \$500; 4 = < \$1000 and 5 = <\$2000 6 = >3000

Protagonist

1 = Father; 2= Mother; 3 = Child; 4 = Relative; 5 = Non relative;

	6 = Other _____					
C25	How much time do you allocate to the following activities					
	Activity	Months/year	Weeks/month	Day/week	Hours/day	Family members involved
	Dry land cropping					
	Gardening					
	Mining					
	Education					
	Livestock tending					
	Gathering firewood					
	Fetching water					
	Harvesting other ES					
	Social activities					
	Formal employment					
	Home industry					
	Livestock product harvesting					
	Domestic					
Key 1 = Father; 2= Mother; 3 = Child; 4 = Relative; 5 = Non relative; 6 = Other _____						
C26	When is the most leisure time realised					
	HH member	In the year	In the week	In the day		
	Father					
	Mother					
	Children					
D: THE HOUSEHOLD IMPACT OF CFF						
D1	Has any of your land been invaded by the plant					
	1= Yes 2= No					
D2	If yes what was the primary use of the land invaded					
	1= Grazing; 2=Agriculture; 3= Aesthetic value; 4= cultural activities; 5=livestock shelter; 6=Other _____					
D3	What are the positive and negative attributes of Cff in order of rank					
	Positives		Negatives			

D4	Do you think it is a threat to your area? 1.= Yes 2.= No				
D5	If yes when did you begin to consider it a threat? 1 = 1 year ago; 2= 2 years ago; 3 = 3 years ago; 4 = 4 years ago; 5= 5 years ago 6 = More than 5 years ago				
D6	What are the major Cff related activities undertaken in the household				
	Cff related Activity	Months/year	Weeks/month	Day/week	Hours/day
					Family members involved
D7	Have you or any of your family members had to seek medical attention for injuries from the plant 1= Yes; 2=No				
D8	Have any of your livestock been fatally injured by the plant 1= Yes; 2=No				

D9	Have you seen any wild life injured or trapped by the plant? 1= Yes; 2=No		
D10	Indicate in the table below if you have lost any livestock or crop production to Cff		
Livestock	Annual loss	Crop	Annual crop production loss in hectares
Cattle		Maize	
Pigs		Sorghum	
Rabbits		Millet	
Sheep		Wheat	
Goats		Groundnuts	
Poultry		Round Nuts	
Donkeys		Sugar beans	
Other		Paprika	
		Tobacco	
		Melons	
		Other	
D11	House hold income spent on Cff		
Group	Amount/year		
Hiring labour to control			
Investment in tools and other things			
Livestock health			
Human health			
Other			
Annual income 1= <\$100, 2= < \$200, 3 = < \$500; 4 = < \$1000; >1500			
D12	What activities are no longer pursued due to Cff		
Activity			

D13 What household activities are under threat because of Cff

Activity

E: ENVIRONMENTAL MANAGEMENT

E1 Which formal environmental management institutions are you aware of (by category) in Zimbabwe?

Legal (statute)	Regulatory	Organizational

E2 Do you think the formal institutional frameworks have positively contributed to environmental management?

1=Yes very much; 2=Yes but minimally; 3=No

E3 What are the major institutional contributions and letdowns of the formal institutional frameworks

Contributions	Let downs

E4	<p>Do you think the formulation of the frameworks was adequately undertaken regarding participation and relevance?</p> <p>1=Yes very much; 2=Yes but minimally; 3=No</p>																																																
E5	<p>What informal institutions govern natural resource access in your village?</p> <table border="1"> <thead> <tr> <th>Local rules</th> <th>Regulator</th> <th>Time effect</th> <th colspan="2">in</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>				Local rules	Regulator	Time effect	in																																									
Local rules	Regulator	Time effect	in																																														
E6	<p>Do you think informal institutional frameworks have positively contributed to environmental management?</p> <p>1=Yes very much; 2=Yes but minimally; 3=No</p>																																																
E7	<p>What are the major institutional contributions and letdowns of the informal institutional frameworks</p> <table border="1"> <thead> <tr> <th>Contributions</th> <th colspan="4">Let downs</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				Contributions	Let downs																																											
Contributions	Let downs																																																

E9	<p>What are the CFF control programmes that you are aware of?</p> <p>1= Community programmes; 2=NGO programmes; 3= Government programmes 4 = Private programmes; 5= Other _____</p>
E10	<p>Are you involved in any of these control programmes?</p> <p>1= Yes 2= No</p>
E11	<p>Have you been given an education on the plant?</p> <p>1= Yes 2= No</p>
E12	<p>Where do you get information regarding Cff</p> <p>1=Government(EMA&RDC); 2= Radio; 3= NGOs; 4= Television Schools 5= Other _____</p>
E13	<p>What are the major challenges you have faced in controlling the plant</p> <p>1= Finance; 2=Technical support; 3=Technical knowhow; 4= Tools; 5=Injury 6= Other _____</p>

Date _____

Ward Number _____

Rural Centre _____

Village Name _____

Group composition

Males	
Females	
Total	

A. Perceptions on IAPs and the environment

- i. What first comes to mind when you think of plants and animals here in Gwanda district?
- ii. What changes to plant life and populations do you observe in your local environment?
- iii. Why is the environment important?
- iv. What makes a plant important?
- v. What makes you dislike a plant?
- vi. What are the native plants of Gwanda?
- vii. Have you ever heard of IAPs (How they got here?)
- viii. Are you worried about their origin?
- ix. Would you introduce plant species into Gwanda?
- x. Have you heard of Cff? (historical aspects)
- xi. What are the positive and negative attributes of Cff
- xii. How should IAPs and plant species in general be managed? (awareness of latest institutional frameworks)
- xiii. Who should manage them?

B. Cff Impact

- i. What are the major positives of Cff
- ii. What are the major effects of Cff
- iii. Are there any activities that are no longer undertaken because of the presence of Cff
- iv. What major activities are under threat?

C. Environmental management institutions

- i. Which environmental management institutions are you aware of (organisational, regulatory and Legal) in Zimbabwe?
- ii. Do you think institutional frameworks have positively contributed to environmental management?
- iii. What have been the major contributions?
- iv. Do you think the formulation of the frameworks was adequately undertaken regarding participation and relevance?
- v. What are the major short comings of institutional frameworks in place?

Key Informant Interview Guide

Date _____

Organisation _____

Position of key informant _____

A. Perceptions on IAPs and the environment

- i. What makes the environment valuable to you?
- ii. What changes to plant life and populations do you observe in your local environment?
- iii. **Have you heard of IAPs? (historical aspects of Cff)**
- iv. **Does their origin matter?**
- v. **Have you heard of Cff?**
- vi. What are the positive and negative attributes of Cff?
- vii. **How should IAPs and plant species in general be managed?**
- viii. **Who should manage them?**

B. Environmental management institutions

- i. What are the major institutional frameworks (by categories) that have impacted on environmental management in rural Zimbabwe?
- ii. Do you think institutional frameworks have positively contributed to environmental management?
- iii. What have been the major contributions?