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Impacts and outcomes of the commercialisation of non-timber forest products on human well being and ecosystems health

Sola, Phosiso

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IMPACTS AND OUTCOMES OF THE COMMERCIALISATION OF NON-TIMBER FOREST PRODUCTS ON HUMAN WELL BEING AND ECOSYSTEMS HEALTH

By

Phosiso Sola

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School of Agriculture and Forest Sciences
University of Wales, Bangor
United Kingdom

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DEDICATION

I dedicate this awesome achievement to all those who gave me the rock solid support, my most beloveds Lisa and Murphy, my parents Amos and Julia and the whole Sola family

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ABSTRACT

Commercialisation of NTFPs has been widely adopted in developing countries as a benefit driven community based natural resource management (CBNRM) strategy. Like many CBNRM strategies this approach seeks to enhance livelihoods and improve sustainable resources use. However, recent studies have indicated that there is no evidence as yet that CBNRM has led to improved welfare of the community or status of natural resources.

This research aimed at evaluating outcomes and impacts of an eight year NTFPs commercialisation programme on ecosystem health and human well being in Zimbabwe. A holistic approach to conservation and development was adopted in this research. Specific methods used included, i) development and application of a novel tools for assessing the status of NTFP commercialisation and status of natural resources management institutional arrangements, ii) a questionnaire survey for the evaluation of outcomes on human well being, iii) ecological surveys for evaluating impacts on ecosystem integrity and iv) a decomposition experiment to investigate impacts of commercialisation and institutional arrangements on ecosystem function.

Major results were that, firstly, there was no NTFPs commercialisation to talk about, the business models used were not viable and returns were too low or none existent to justify the existence of the enterprises. Secondly, NTFPs commercialisation has not generated enough returns for entrepreneurs to invest in the management of natural resources, or given incentives for local institutions to control ecosystem degradation. The lack of tangible benefits of NTFPs commercialisation on human well being and ecosystem health could be due to the fact that current practices are involving the wrong people under the wrong settings. NTFPs commercialisation is being advocated for in agriculturally

marginal areas, which are geographically remote and provide limited livelihood options. These areas suffer social and political marginalisation, poor communication and transportation making commercialisation an unviable option.

Therefore based on this study, NTFPs commercialisation as a benefit driven strategy for conservation cannot be entirely dismissed. If farmers were to invest more and policy makers ensure there was adequate investment in developing this industry then better outcomes could be realised. If not benefits of NTFP commercialisation will remain elusive and the whole process a fallacy to both developmentalists and conservationists.

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ACRONYMS

CBNRM	: Community based natural resource management
CSO	: Central Statistics Office
DFID	: Development fund for international development
FAO	: Food Agriculture Organisation of the United Nations
ITPA	: Indigenous Tea Products Association
NGO	: Non governmental organisation
NRM	: Natural resource management
NTFPS	: Non-timber forest products
RDC	: Rural District Council
SAFIRE	: Southern Alliance for Indigenous Resources
SPSS	: Statistical package for social scientists
SSE	: Small scale enterprise

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.0 INTRODUCTION

1.1 Impacts and outcomes of NTFP commercialisation: Status of knowledge

Commercialisation of NTFPs has been widely adopted in developing countries as a benefit driven-community-based-natural resource management (CBNRM) strategy (Mahapatra, and Mitchell, 1997; Den Hertog, and Wiersum, 2000). Like many CBNRM strategies this approach seeks to enhance livelihoods and improve sustainable resources use. However, recent studies have indicated that there is no evidence as yet that CBNRM has led to improved welfare of the community or status of natural resources (Neumann and Hirch, 2000; Mogaka, Gacheke, Turpie and Karanja, 2001). It has been suggested that benefits should accrue in sufficient levels and appropriate forms to counter the costs of management (Mogaka, *et. al*, 2001). This raises questions of whether economic incentives can indeed lead to conservation, and also to the extent in which they can generate lasting incentives for CBNRM. This forms a formidable challenge for advocators of CBNRM.

It is worth noting that the original assumptions made about communities and their relationship with natural resources which supported CBNRM initiatives suggest that:

- Resources held under common property regimes are vulnerable to overexploitation and threatened with virtual collapse or extinction (Ostrom, 1999; Lovell, Mandondo and Moriarty, 2002)

- The 'fence and fine' approach by central governments has failed to ensure conservation in low income countries due to the inability to design and enforce biodiversity protection rules (Gibson and Koontz, 1998; Ostrom, 1999; Barret, 2001; Mehta, Leach and Scoones, 2001). This has resulted in biodiversity being under constant threat from land use changes and economic pressures (Ostrom, 1999).

- Communities have a long term need for resources and possess more knowledge about these resources than other potential actors, thereby rendering them the best managers of these resources (Mehta, Leach and Scoones, 2001).

- If communities are not involved in conservation they will use the resources destructively therefore, communities have incentives to sustainably use the resources when they are involved in conservation and the benefits they will receive will create incentives for sustainable use (Mehta, Leach and Scoones, 2001)

- There has been a realisation that resource users possess considerable capacity to maintain or enhance resources by devising rules that govern access and use (Olsson and Folke, 2001).

Therefore, the role of participation in rural development has been viewed as a prerequisite for success and a means of achieving conservation outcomes (Ostrom, 1990; Hanna, 1998). Indeed it has been suggested that small-scale forest based activities account for a substantial proportion of the total household income. For instance small-scale forest based enterprises in Zimbabwe 'employed' 237, 000 people in 1991 compared to 16,000 in the conventional forest industries (FAO, 1995). In addition, commercialisation of non timber forest products (NTFPs) has been said to add value to the forest by increasing incentives to retain forest resources (Padoch, 1992; Arnold and Perez, 2001). It has also been claimed that increased income correlates with demand for environmental quality and resource stewardship, and leads to the adoption of environmentally benign technologies and creation of incentives for better long term stewardship (Anderson, Locker and Nugent, 2002).

However the debate is still going on as to whether or not there is real evidence to suggest that small-scale enterprises (SSEs) based on non-timber products have the potential to make forest use more sustainable (Ostrom, 1999; Hulme, 2000; Neumann and Hirch, 2000). Arguments have been put forward that there is an inadequacy of literature on the impacts of commercialisation on households, and that the link between enterprise performance and livelihoods need to be validated (Hulme, 2000). Furthermore, no criteria of accessing the success of CBNRM have been developed and as such no empirical evidence exists to show that conservation does improve as a result of participation (Ostrom, 1999). This means then that the assumption of linking the extraction of NTFPs and increased incomes to participation of local people in biodiversity conservation is still largely untested.

Some schools of thought have claimed that NTFPs extraction perpetuates poverty since returns are lower than other activities, in other words it encourages people to commit themselves to low returns even when there are better opportunities (Arnold, 1994; Neumann and Hirch, 2000). To support this theory several authors have alleged that once extraction is on a commercial basis the bulk of the benefits are captured by the wealthier at expense of the poor who have no access to skills and capital and in the end only the few elite benefit (Schmitz, 1982; Campbell and Byron, 1996). Furthermore, commercialisation has been said not to necessarily provide opportunities for the rural poor, as high transaction costs associated with marketing NTFP products make them less attractive for those emerging out of poverty (Arnold, 1994; Arnold and Perez, 2001). Other research has indicated that increased markets leads to overexploitation of resources and exacerbates rather than reduce pressures that cause over harvesting (Padoch, 1992; Cunningham and Terry 1993; Byron and Arnold 1999; Cavendish 2000; Arnold and Perez, 2001) while some researchers have pointed out that no effects on ecosystem have been rigorously evaluated to make conclusive statements (Barret, Brandon, Gibson, and Gjertsen, 2001).

1.2 Defining Concepts

1.2.1 NTFP Commercialisation

Commercialisation of NTFPs is the existence of an entrepreneur (s) involved in the sale, marketing or trade in NTFPs. These products could be processed or may have minimal value addition, like grading and cleaning, before entering the market. Entrepreneurship has been taken to mean many things to different people. Some of the most common meanings are; innovation, taking risk, and owning and managing a business. An entrepreneur therefore, is a person who creates new combinations of production factors, one willing to take risks, eliminate disequilibrium between aggregate supply and demand, owns and operates a business (Petrin, 1997). For the purposes of this study NTFP commercialisation was defined as the existence of entrepreneurs in an area who are engaged in the sale, marketing and or trading of non timber forest products in their natural or processed state.

The key to NTFP commercialisation as both a developmental and conservation strategy is value addition at community level. This is usually done through developing new products or improving traditional methods of harvesting and processing to match requirements for new and expanded markets. Several problems and challenges have been faced in developing such enterprises, including the unpredictable nature of the fruiting seasons and or yields, poor infrastructure, limited processing equipment and lack of technical skills.

1.2.2 Livelihoods framework

Rural people employ multiple activities to generate income since diversification reduces the risk of livelihood failure by spreading it across more than one income source and overcomes uneven use of assets caused by seasonality (Allison and Ellis, 2001; Winters, Davis and Corral, 2002). Thus, a livelihoods approach was adopted in this research to evaluate the contribution of commercialisation to human well being. The key feature of the concept of livelihoods is the link between assets (natural, physical, financial, human and social); activities and access to assets (mediated by institutions and social relations) that together determine the living gained by an individual or household (DFID, 1999; Allison and Ellis, 2001; Winters, Davis, and Corral, 2002). Thus a livelihood comprises of the capabilities, assets (stores, resources, claims, access) and activities required for a means of living (George, 1997; DFID, 1999; Drinkwater and Rusinow, 1999; Allison and Ellis, 2001).

1.2.3 Resource management institutions

Two descriptions of institutions repeatedly feature in literature. In the first, institutions are described as the organisations that design, implement and enforce local rules (North, 1990; Murphree, 1994), while in the second they are defined as the 'rules in use'. For example, North (1990) defines institutions as the 'rules of the game' which include traditional systems (taboos and norms), local government provisions or by-laws and the national statutory instruments. From the array of literature it would seem therefore, that institutions are designed to manage human behaviour, thereby making them the most influential forces shaping the potential for sustainable resource management (Bromely, 1991). In this research institutions refer to rules in use as defined by North

(1990). I also use the term institutional arrangements when referring to the governing body, the rules in use and the mechanisms used to enforce compliance and meet justice.

1.2.4 The ecosystem approach

Together with the promotion of the integration of development in conservation of biodiversity, a shift from species to ecosystem conservation has been equally advocated as a way of reconciling the protection of ecological integrity with the provision of goods and services (Grumbine, 1994). In fact, ecosystem processes directly influence the success of both conservation and development efforts (Kremen, Merenlende and Murphy, 1994, Kremen, 2005) as they blend the needs of the people with environmental values to maintain and sustain ecosystems.

There are three primary attributes of ecosystems and these determine and constitute the biodiversity of an area (Noss, 2000), i) composition [identify and variety of elements in a collection, includes species and measures of diversity], ii) structure [physical organisation or pattern of a system, habitat complexity within communities, pattern of patches at landscape level] and iii) function [ecological and evolutionary processes including gene flow, disturbances and nutrient cycling].

Direct threats to biodiversity resulting from development include ecosystem elimination, ecosystem degradation, ecosystem disruption, species decline and elimination (Kremen, Merenlende and Murphy, 1994, Larsen, Williams, Kremen, 2005). Biological diversity provides for both stability (resistance) and recovery (resilience) from disturbances that disrupt ecosystem processes (Swift and

Anderson, 1994; Brunner and Clark, 1997. Thus the presence of numerous organisms with similar capabilities (redundancy) provides ecosystem stability as well as optimal functioning (Lawton and Brown, 1994; Gale, 2000; Walker, 1995; Hobbs and Morton, 1999).

It was against this background that this research was designed and undertaken. This is a broad study which is concerned with evaluating the outcomes and impacts of an eight year NTFP commercialisation programme on ecosystem health and human well being in Zimbabwe. The research aimed at investigating commercialisation of three products namely the baobab fruit, makoni tea and marula oil which are derived from *Adansonia digitata, Fadogia ancylantha* (annual herb) and *Sclerocarya birrea* respectively. The choice of the products was based on the existence of production units and markets for the products in Zimbabwe and abroad. As is already evident from the discussion presented in this Chapter any research on these topics is multidisciplinary in nature, and this is the approach taken in this thesis. As such the research objectives and hypothesis were:

1.3 Overall objective

Evaluate the impacts and outcomes of the commercialisation of selected NTFPs on ecosystem health and rural livelihood

Specific objectives

1. Assess the outcomes and impacts of the commercialisation of selected NTFPs on rural livelihoods

2. Investigate the contribution made by the commercialisation of selected NTFPs to ecosystem health

3. Investigate the nature of institutions and institutional arrangements and their influence on the success of ecosystem management

1.4 Thesis structure

This thesis is presented in a sequential manner such that outcomes of some preceding chapters were used in the analysis of data in the subsequent ones; however, each chapter can also be regarded as independent as the research questions addressed are different. The eight chapters can be grouped into four sections, i) introductory chapters (1 and 2), ii) livelihoods assessment (3, 4 and 5), iii) ecosystem assessment (6 and 7) and iv) general discussion (8). The specific chapters and their objectives are as follows:

Chapter 1: Is a discussion of the contextual issues under which the research was undertaken and presents the research objectives

Chapter 2: Presents description of study sites (physical location, climatic patterns and an overview of the livelihood options) and the household surveys used in the collection of most of the socio-economic data

Chapter 3: Is a description of the process of developing and applying a novel tool for assess levels of NTFPs commercialisation in the five study sites

Chapter 4: Presents findings of an evaluation of the impacts and outcomes of NTFP commercialisation on people's livelihoods, focusing on financial and human capitals

Chapter 5: Presents the findings of an evaluation of the impacts and outcomes of NTFP commercialisation on people's livelihoods focusing on social and physical capital

Chapter 6: Is a description of the process of developing and applying a tool to assess the status and likelihood of success of institutional arrangements in five study sites

Chapter 7: Presents the results of the assessment of impacts and outcomes, institutional arrangements and NTFP commercialisation on ecosystem health

Chapter 8: Is a synthesis and discussion of all the research findings, incorporating concluding remarks and recommendations

CHAPTER 2

DESCRIPTION OF STUDY SITES AND RESEARCH METHODOLOGY

2.1 Study site description

2.1.1 Location

The research was conducted in Zimbabwe, a 390 757 km^2 country in southern Africa sharing borders with Zambia, Mozambique, South Africa, Botswana and Namibia to the north, east, south and west respectively. The specific study sites were five districts from two of the ten provinces. From Manicaland Province was Chimanimani (ward 20), Makoni (ward 10) and Nyanga (ward 23) and from Mashonaland Central Province was Centenary (ward 2) (commonly known as Muzarabani) and Rushinga (ward 2) (Figure 2.1). Wards in Zimbabwe are administrative units containing at least 1000 households from six villages, though resettlement areas have slightly more and smaller villages than communal areas. In each ward, two to seven villages (depending on their size) were selected to participate in the research. Specific grid references for each site are presented in Table 2.1.

Three of these sites Makoni, Muzarabani and Nyanga are resettlement areas while Chimanimani and Rushinga are communal areas. Resettlements schemes were introduced in Zimbabwe after 1980 to solve the problem of the skewed distribution of land which had resulted in land pressure and environmental degradation in most communal areas (Chenje, Sola, and Palecnzy, 1998; Marongwe, 2002). Four resettlement programmes were implemented in the 1980s, the Model A for village settlements, Model B for co-operatives in

commercial farms, Model C for individual settler plots in commercial farms and Model D for paddock grazing in the drier regions of the south (Chenje, et. al, 1998). However, resettlement areas are now largely synonymous with model A, and will be assumed to be so through out this thesis.

In resettlement areas land use is defined with designated, settlements, crop fields and grazing land (Chenje, et. al., 1998). When they were introduced resettlement areas were directly under the control of a District Administrator through a resettlement officer who allocated pieces of land. The people resettled in these schemes were drawn from various areas irrespective of ethnic background though eventually they consisted of a few ethnic groups which were mostly from the same tribe speaking different dialects of the same language. Unlike resettlement areas, communal areas are settlements that were established prior to independence and modified under the Communal Lands Act (1982). They are under the jurisdiction of the traditional leaders and administration of the Rural district councils. This dualism has resulted in endless conflicts (Marongwe, 2002). No particular land use planning was used to determine the pattern of settlement in communal areas.

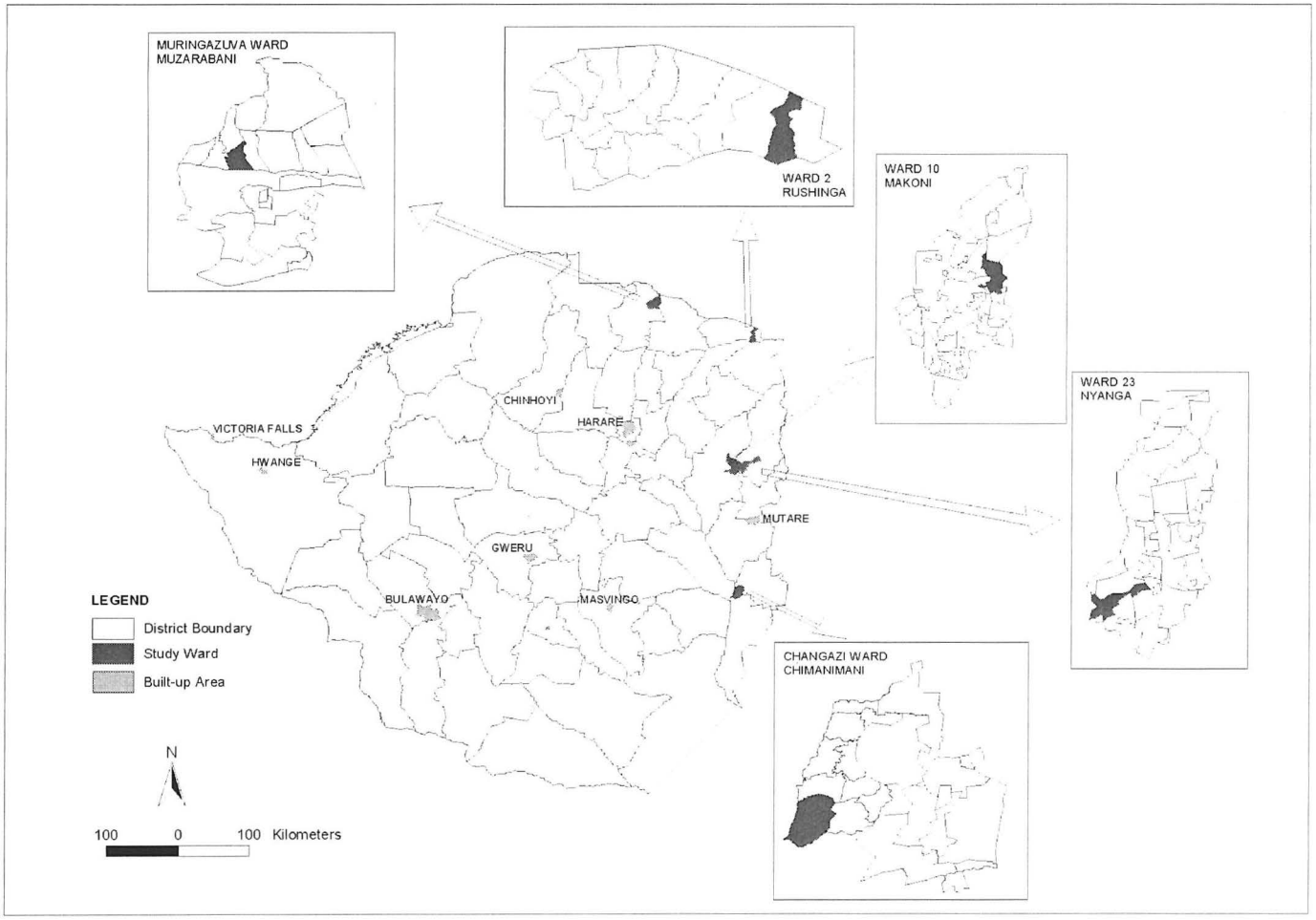

Figure 2.1: Location of study sites in Zimbabwe

2.1.2 Site selection

This research was undertaken in several villages which were participating in on-going enterprise development programmes facilitated by a regional non-governmental organisation (NGO), SAFIRE in Zimbabwe. The organisation operates in six of the ten provinces covering more than 30 districts. In all these areas the major focus is the enhancement of livelihoods and empowerment of local people to use natural resources sustainably. One of the strategies used by this organisation was to facilitate the development of small scale enterprises with a conscious strategic focus on non timber forest products, but also including agricultural commodities, minerals and water. In three of the five study areas the regional NGO had facilitated the establishment of small scale enterprises through skills development, technology transfer, marketing, product development and micro financing. The exceptions were Chimanimani and Makoni district

Within this study the philosophy of site selection was based on a desire to capture a range of commercialisation activities and varying institutional arrangements. Previous contact with communities in the five areas suggested that commercialisation of NTFPs was low in Makoni and Chimanimani and high in Nyanga and Muzarabani. Baobab based enterprises in Rushinga were felt to show low levels of commercialisation, while those concerned with marula showed high levels of commercialisation. Prior to this study it was thought that all study sites had reasonably strong institutional arrangements with varying strengths of the traditional and Rural District council (RDC) structures (Table 1). However, it was also recognised that the Zimbabwe legal system is characterised by pluralism. Local level natural resource management systems are guided and governed by several

institutions enshrined in either Central government extension departments, or the Local government as represented by Rural District councils or the Traditional Leaders empowered by the Traditional Leaders Act (Marongwe, 2002; Nhira et al., 1998).

Table 2.1: A priori classification of study sites based on initial contact with communities

Site	Grid Reference		Commercialisation of NTFPs					Status of institutional arrangements
			Product	Level of organisation	Level of processing	Period of operation (years)	Level of commercialisation	
	West to East	North to South						
Chimanimani	32°23' to 32°27'	19°49' to 19°53'	Baobab fruit	Individual	Collection and selling	>50	High	Medium traditional and medium RDC (medium)
Makoni	32°23' to 32°27'	18°10' to 18°13'	Makoni tea	Individual	Collection, fermentation and selling	2	Low	No traditional and strong RDC (strong)
Muzarabani	31°00' to 31°04'	16°18' to 16°23'	Marula oil	Wadzanai SSE	Buying of kernels, expressing oil and selling	4	Low	Medium traditional and weak RDC (weak)
Nyanga	32°31' to 32°38'	18°15' to 18°17'	Makoni tea	ITPA SSE	Collection, fermentation, crushing and selling	4	High	No traditional and strong RDC (strong)
Rushinga	32°34' to 32°38'	16°37' to 16°41'	Baobab fruit	Individual	Collection and selling	<10	Low	Strong traditional weak RDC (medium)
Rushinga	32°34' to 32°38'	16°37' to 16°41'	Marula oil	Kubatana SSE	Buying of kernels, expressing oil and selling	3	High	Strong traditional weak RDC (medium)

2.1.3 Biophysical characteristics of study areas

Rainfall

Zimbabwe is characterized by a distinct wet and dry season and unreliable rainfall which has been on the decline since 1980 (Chenje, et. al. 1998). Ward 20 in Chimanimani district is located in the lowveld area of the Sabi valley, one of the driest areas with mean annual rainfall of 400mm, while Nyanga and Makoni are cooler and receive relatively higher and more reliable rainfall of 800mm per annum. The mid Zambezi valley sites Muzarabani and Rushinga though sometimes hotter than Chimanimani have relatively higher mean annual rainfall of 700 mm and 600 mm respectively (Chenje, et. al. 1998).

Soils

Soils in Zimbabwe fall into eight groups (Nyamapfene, 1991). Four of these major groups were found in the study sites. Soils in Ward 20 of lowveld Chimanimani and Ward 2 in Muzarabani are predominantly siallitic with some sodic patches as expected of the low lying areas of the Sabi and Zambezi valleys. Rushinga though in the Zambezi valley has a slightly higher altitude than Muzarabani and soils of Ward 2 in this district are of the fersiallitic group. Soils in ward 23 of Nyanga were mostly orthoferrasiallitic while in Makoni the major group was paraferrallitic, well known for tobacco production (Nyamapfene, 1991; Chenje, et. al., 1998).

Ecoregions and biodiversity

The country of Zimbabwe has been classified into six ecoregions (Central, Eastern Highlands, Kalahari, Open Water, Save-Limpopo, Zambezi) using the ecosystem land classification scheme adapted from the North America approach. This scheme considers a wide range of factors including, soils, vegetation, geology, and altitude rainfall and many other factors (Marshall, Smith and Selby, 1996). The study sites were found in three of these ecoregions.

Chimanimani district is in the Eastern highlands and the Save-Limpopo ecoregions. This study was undertaken in the Save-Limpopo ecoregion which covers 20% of the country and is characterized by low rainfall and high temperatures. Vegetation varies from tree savanna on deep fertile soils to shrub savanna on shallower soils. The most predominant vegetation are *Colophospermum mopane, Adansonia digitata* and several *Combretum* and *Acacia* species (Chenje, et. al, 1998).

Muzarabani and Rushinga are located in the Zambezi ecoregion which covers 16% of the country. Vegetation in this ecoregion is xerophytic tree and shrub savanna dominated by *Colophospermum mopane,* and species of *Combretum, Sterculia* and *Acacia* genus. This is one area with the most diverse wildlife and for a long time acted as a natural wildlife corridor owing to low human densities and many perennial rivers that empty into the Zambezi.

Makoni and Nyanga districts are located in the Central ecoregion which covers 50% of the country comprising of the main watershed and covering all the major cities. However part of Nyanga district is in the Eastern Highlands ecoregion but this study was conducted in a ward falling in the former. The dominant vegetation in the Central ecoregion is the dry Zambezian miombo woodland with

Brachystegia spiciformis and *Julbernardia globiflora* as the dominant species. As the rainfall declines in the southerly and northerly directions the woodlands becomes predominantly savanna dominated by several *Combretum* and *Acacia* species. The ecoregion is the agriculturally most productive part of Zimbabwe and besides gazetted protected areas there is limited habitat for wildlife (Chenje, et, al., 1998).

2.1.4 Socio-economic characteristics of study sites

Population

Manicaland Province is the second most populous province after Harare with 13% of the Zimbabwean population at a density of 43 persons per km^2. On the contrary though Mashonaland Central has a high density of 35 persons per km^2 it only supports 8.5% of the Zimbabwean population (CSO, 2002). This could be attributed to its location in the harsh climatic conditions of the mid-Zambezi valley. Table 2.2 presents population figures for the study sites where Muzarabani ward 2 had the highest number of people whilst Rushinga ward 2 had the least.

Livelihood activities

Zimbabwe is an agriculturally based economy and livelihood strategies are greatly influenced by rainfall patterns. In the Muzarabani and Rushinga the major crops grown are cotton and to a lesser extent maize (Chenje, et. al. 1998). Many people in these districts were engaged in selling indigenous fruits especially *Ziziphus mauritiana*.

Makoni and Nyanga are located in markedly cooler areas of high rainfall. Major livelihoods activities in these areas were the production of horticultural crops, fruits, maize and tobacco (Chenje, et. al. 1998). In addition, some of these

people were involved in the collection and selling of forest products, and they were the first in Zimbabwe to produce a herbal tea on a commercial basis from the annual herb, *Fadogia ancylantha.*

Chimanimani further down in the southern lowveld is inherently hot and dry and the only suitable grain crops are small grains, millet and sorghum (Chenje, et. al. 1998). This is one of the areas that suffer from crop failures most years. The people of lowveld Chimanimani depend mainly on irrigated crop production, and the sale of fruit and crafts from the baobab tree.

Table 2.2: Population data for the study sites

Province	**Manicaland Province**			**Mashonaland Province**	
District	**Chimanimani**	**Makoni**	**Nyanga**	**Muzarabani (Centenary)**	**Rushinga**
District population	115, 250	247, 254	119, 370	107, 718	67, 134
Selected ward	Ward 20	Ward 10	Ward 23	Ward 2	Ward 2
Ward population	6, 279	5, 645	4, 843	14, 840	1, 569
Number of households	1, 247	1, 150	963	3, 076	334
Number of Selected villages	5	4	10	5	5

Source: CSO, 2002

2.2 Research methodology overview

Methods for evaluating outcomes and impacts of NTFP commercialisation on human well being and ecosystems are of necessity multidisciplinary in nature. The tools and techniques used here included structured household questionnaire surveys, semi-structured checklists for group discussions, ecological surveys using transects and litter decomposition experiments for biogeochemical analysis. Specific methods are described in detail in each chapter, however since the household survey was used to collect data for more than one aspect of the research, in order to avoid repetition across chapters I will describe it here in detail.

2.2.1 The household questionnaire survey

The household questionnaire survey was undertaken in each of the five study sites between the 24th September and 31st October 2004. Households were selected from a village lists acquired from the village heads and or ward councillors. Therefore, sampling was such that 10% of the households were selected by taking every Yth household on the list where: Y/N *100% = 10%. The total sample size for this survey was 360, and in no study site did the sample represent less than 30 households.

The survey constituted a series of face-to-face interviews with household heads conducted by enumerators. Enumerators were recruited from each local community for ease of acceptability and language. Educational attainment was an important factor in the selection of enumerators, and all had achieved 'O' levels (secondary school) qualifications. However, the recommendations of the community elders were also taken into account in order to ensure the reliability

of these individuals. After selection, enumerators underwent 2-day training (four separate sessions) on conducting interviews and understanding the meaning of the questions on the questionnaire. Subsequent to this exercise, the whole questionnaire was translated into local languages. Enumerators were expected, therefore, to ask the questions in the local language and to translate the answers into English as they completed the questionnaire. To minimise interpretation subjectivity most of the questions were pre-coded and only a few left open ended (Appendix 1).

Enumerators visited each selected household, and in most cases the interviews were conducted on the first visit but there were instances where appointments had to be made for a later date and/or time. Each enumerator had 25 to 45 questionnaires to complete in two weeks. Supervisory visits were made to each site as a quality control measure. Questionnaires were collected after three weeks during which each and every answer was verified with the enumerator and open ended questions post coded. In all 327 out of 360 questionnaires were completed. The data were then entered into a data file of 480 variables in SPSS 11.5 (Pallant, 2004) and analysed.

Questionnaire structure

The questionnaire was designed to cover issues on all the five livelihood capitals). The bulk of the questions pertained to human and social capitals (questions 1-26 and 33). Financial capital and natural capital assessments had 7 questions each numbers 27 to 32 and numbers 37 to 42 respectively. Physical capital evaluation had the least number of questions (3, 34 to 36). Most questions were in tabular form and pre-coded for ease of interpretation and analysis (Appendix 1).

CHAPTER 3

DEVELOPMENT OF A TOOL FOR ASSESSING THE SUCCESS OF COMMERCIALISING NON-TIMBER FOREST PRODUCTS IN DEVELOPING ECONOMIES

ABSTRACT

Commercialisation of non timber forest products (NTFPs) is a wide spread activity that has attracted attention of conservationists, development agents and policy makers in most developing countries. However, the exact contributions of NTFP commercialisation to ecosystem health and human well-being are not known, and the contribution probably differs with the level of commercialisation. I present a novel tool for assessing levels of commercialisation for specific products which enables evaluation of differential outcomes and impacts of NTFP commercialisation on human well being and ecosystem health. This tool comprises four business components: organisation, production, raw material supply and business financing and returns. Though, I conclude that the tool is robust enough for wide spread application, recommendations are also made for further development and field testing.

3.1 INTRODUCTION

Within the last two decades there has been widespread campaign and support for communities to move away from a simple strategy of collection and selling of NTFPs to developing small scale enterprises (SSEs) for processing and marketing quality products (FAO, 1987; Clay, 1992; Edwards, 1996). This move has occurred due to the recognition that entrepreneurship is a strategic intervention and a central force of economic growth and development (Petrin, 1997; Anderson, Locker and Nugent, 2002).

A belief in this assumption has been a major driver of investment in, and promotion of, the commercialisation of non timber forest products. However, the exact relationship between commercialisation of NTFPs, ecosystem health and human well being has been a subject for debate and research for several decades (Hall and Bawa, 1993; Mahapatra, and Mitchell, 1997; Byron and Arnold 1999; Ruiz-Perez and Byron, 1999, Cavendish, 2000; Den Hertog, and Wiersum, 2000; Neumann and Hirch, 2000; Arnold and Ruiz-Perez, 2001; Shackleton, 2001; Campbell and Luckert, 2002; Ambrose-Oji, 2003; Marshall, Newton and Schreckenberg, 2003). To date no clear evaluation system has been developed to investigate this relationship, yet the absence of clear evidence has not prevented suggestions being made about the outcomes of commercialisation and their impacts on livelihoods and ecosystems.

One of the suggestions advanced is that extraction of NTFPs is sustainable if population pressure is low and technology is simple (Godoy, Brokaw and Wilkie, 1995), though others say that if benefits are diffuse or concentrated there is a misalignment of incentives resulting in 'free-rider' problems (Simpson, 1998). It is also alleged that once extraction of the NTFPs is on commercial basis the bulk of the benefits are captured by the wealthier at the expense of the poor who

have no access to skills and capital (Schmitz, 1982; Edwards, 1996; Neumann and Hirch, 2000; Campbell and Byron, 1996). Yet, others suggest that this is a non issue because sale of NTFPs is used to supplement temporary declines in cash income and not for long term improvement of household welfare (Neumann and Hirch, 2000).

Any analysis of the relationship between the commercialisation of NTFPs and livelihood enhancement is likely to be clouded, especially as it could be argued that SSEs operate at different levels of development, complexity and organisation. As such, their outcomes are likely to have differential impacts depending on the contextual situation. Previous studies have suggested that even when they do occur, beneficial effects of commercialisation are said to be specific to socio-economic, social and political contexts (Neumann and Hirch, 2000). For this reason, Arnold (1994) concluded that for any such assessment, it is important to differentiate SSEs that manufacture products using materials from the forest and those that gather and sell them, as these two types of SSE have different economic roles (Arnold, 1994).

While the encouragement of small scale enterprises may seem to be beneficial for development it must be noted that only 20% of SSEs are usually successful (FAO, 1987). Generally, the growth of SSEs is held back by lack of entrepreneurial and managerial skills which are largely dependent on attitudes, disposition, level of education and training (Schmitz, 1982). Some of the major challenges faced by SSE are lack of i) basic credit infrastructure, ii) access to markets, iii) appropriate technology and iv) reliable raw material supply (Schmitz, 1982). In addition some SSE collapse due to progressive weakening and breakdown of traditional control and management systems, erosion of rights

of access and increased usage which leads to privatisation of common property resources (Christiansen, 1987).

Various methodologies have been developed to investigate factors influencing the success of NTFP commercialisation. Studies by Schmitz (1982), FAO (1987), Christiansen (1987), Mwang'ombola (1987), Parameshwaran (1987), Sahlin, (1987) and FAO (1995) characterised factors that influence the success and failure of forest based SSEs. However, none of these studies sought to evaluate the explicit contribution of relevant factors to the performance of SSEs. Despite the absence of explicit analyses, it is possible to deduce that the major characteristics which limit the success of SSEs identified by these studies included, i) the small size of the enterprise, ii) low and inconsistent production, iii) low returns and a iv) lack of market information. On the positive side NTFP commercialisation generally has a reliable resource supply and the potential to achieve sustainable harvesting.

In the last decade attention has shifted from simply characterising success factors of small scale enterprises to evaluating contributions of the NTFP commercialisation success to both ecosystem and human well being. For example, CIFOR undertook a comparative study to develop typologies of cases and to analyse their relationships with observed conservation and development outcomes (Ruiz-Perez and Byron, 1999). The process involved defining key factors, listing attributes for each factor and scoring these according to a three point annotated scale (low, medium, high) based on 'expert' judgement (Ruiz-Perez and Byron, 1999).

As was intended, this methodology is appropriate in the production of typologies of cases, and not evaluating their success, as most of the factors used in the analysis did not address the commercialisation process but were more inclined towards policy and contextual issues. The major factors were mostly about community organisation, legal rights, state policies, market functions, technology and nature of products (Ruiz-Perez and Byron, 1999). Despite this, the conclusion was that the case studies could be portrayed along a gradient of variability determined to some degree by each of the 30 attributes used to measure these factors (Ruiz-Perez and Byron, 1999).

A more recent study by Marshall, Newton and Schreckenberg (2003) has advanced yet another methodology and descriptors of what influences success and failure of SSEs based on wider scale and participatory approaches. The research was aimed at improving on the CIFOR methodology to aid decision making about the potential of NTFP commercialisation prior to investment (Marshall, et al., 2003). The methodology was developed through two workshops and aimed at investigating how success of NTFPs might be defined or measured based on the perceptions of those directly involved (Marshall, et al., 2003). The approach included producing a list of criteria and factors with the former being drawn mostly from literature and the latter from workshop discussions. Although the criteria were used to rate success no clear link was made across criteria, factor and process. In addition, the scoring was not annotated thereby, leaving it subject to interpretation. While both studies are interesting, neither has gone much beyond diagnosing the problems of lack of success, nor do they attempt to evaluate the performance and contributions of NTFP commercialisation to livelihoods and ecosystems.

This chapter is aimed at presenting results of the process used in developing and applying a tool for evaluating the performance of SSEs in order to produce a commercialisation classification to be used in subsequent analysis of impacts and outcomes on ecosystem health and human well being. For the purposes of this study, commercialisation was defined as the existence of entrepreneurs in an area who are engaged in sale, marketing and or trading of non timber forest products in their natural or processed state. The research aimed at investigating three products namely the baobab fruit, makoni tea and marula oil which are derived from *Adansonia digitata, Fadogia ancylantha* (annual herb) and *Sclerocarya birrea* respectively. The choice of the products was based on the existence of production units and viable markets for the products in Zimbabwe and abroad.

3.2 METHODOLOGY

3.2.1 Study sites

Study sites are described in detail in Chapter 2.

3.2.2 Determination of the level of commercialisation

The underlying assumption of this research is that enterprises based on the exploitation of NTFPs are operating along a continuum of commercial activities which vary according to degree of processing, profitability and organisational complexity (level of commercialisation). The less developed commercial ventures are likely to have different outcomes for livelihoods and ecosystems from the more developed ventures. These outcomes may vary not only in type and form but in magnitude and sphere of influence (individual, household and community).

In order to test this key assumption and determine the level of commercialisation for each community and SSE a novel assessment tool was developed. Tool development was based on evaluating previous work in this area as detailed in Table 3.1. Each one of these studies attempted to investigate and / or evaluate success and failures of SSEs. Each of the studies identified some of the factors that contributed to successful commercialisation, but none reported development of a composite replicable tool to enable assessment of levels of commercialisation.

In this research, I sought to develop such a tool using a four stage approach. Firstly, the list of factors characterising forest based SSEs presented in FAO

(1987) and (1995) were combined with determinants of success and failure as elucidated in other studies. Secondly, the characteristics were distilled into a manageable number of descriptors (25). Thirdly, a scale of assessment was developed based on indicators of success and failure. Here, for each descriptor, the best case scenario (most likely to lead to success) was rated as three, the worst scenario (least likely to lead to success) as one and the intermediate situation as two. These descriptors may best be thought of as numerical labels, and they do not imply that the best situation is three times better than the worst, or that if you add the worst and intermediate case you will get an equivalent to the best. Rather, I adopted these numerical labels as they are the simplest manner in which I could effectively label each situation, and then use the summary scores in further analyses.

Stage four of the tool development process required the pooling of descriptors to describe the status of the SSE according to four functions, structure (model), operation, raw material supply and returns. The level of commercialisation for each site was then determined by the sum of all the scores from the 25 descriptors, which was rated as low (if total score was less than 55%), medium (if the total score was in the range 55%- 75%) or high (if the total score was greater than 75%). Percentages were calculated based on the potential total score of 75 (Table 3.2).

3.2.3 Data collection for evaluating level of commercialisation

In the areas where NTFP based SSEs existed, data related to the level of commercial activities were collected between March and May 2004. This was achieved through conducting group discussions and meetings with three SSEs. Half day meetings were held with the members of the SSEs, Wadzanai Marula

project in Muzarabani, Kubatana Marula project in Rushinga and the Indigenous Tea Producers Association (ITPA) in Nyanga.

In areas where there were no existing NTFP SSEs (Chimanimani, Makoni and Rushinga baobab area) data were collected during community meetings. Community meetings were organised at ward level for selected villages. Attendance at these meetings ranged from 35 to 150 people. The number of villages studied was determined by the spread of people selling NTFPs (from now on referred to as NTFP entrepreneurs). Selected villages were five in Chimanimani, four in Muzarabani, two in Makoni, eight in Nyanga and seven in Rushinga.

The 25 descriptors in the Commercialisation Assessment tool were translated into the local language. Responses to the questions about the status of the SSE were recorded, and researcher provided and sought clarification where necessary. These responses were assessed against the assessment tool and scored. After completion of this work, the entrepreneurs were told the score and the major strengths and weaknesses of their enterprise were highlighted to them. These data were then translated into English and analysed.

Table 3.1: Results of the literature search on factors, attributes and characteristics which contribute to the success and failure of small scale enterprises. These factors are loosely grouped into business development functional groups. The references (Ref) to which the numbers refer are given as footnotes to the table.

Factors influencing success	Ref	Factors influencing failure	Ref
Financing, markets and marketing			
More equitable sharing of benefits from common property resources	1	Entrepreneurs indifferent to markets decisions and strongly influenced by culture	5
Clear benefits for individuals and community	2	Small and insecure markets	2
Demonstrable success	1	Lack of working capital	2
Higher prices for product	1	Lack of working capital restricts their ability to buy in bulk and hold stocks to cover periods of shortage	2
Credible and efficient marketing system	1	Turnover is very low, money tied up in stocks, cannot secure loans	5
Access to investment and working capital	6	Poor competitiveness, bulk buying not possible no capital	5
Private sector linkages	6	Shortage of finance	2
Group marketing direct to consumers	1	Products made to their wishes and skill rather than standard of markets	5
Assistance in expanding markets,	4	Low rural incomes,	2
		Seasonality of incomes	2
		Poor access to large markets,	2
		Severe completion	2
		Total lack of market information	5
		Narrow margin for absorbing risk	1
		Product storage and marketing problems	5
		Lack of working capital prevents SSE from stocking resulting in a supply gap thus investing in idle capacity	7
		Lack of working capital prevent stocking adequate raw material to even out seasonal fluctuations in their markets	7
		Profits generated accrue to those in trade not those processing	2
		Limited income surplus mean that entrepreneurs have no possibility to invest in long-term forest resource development	2
		Blocked by difficulties in accessing product markets and or credit	8
Raw material supply			
Better prospects for sustainable harvesting	1	Access to raw material due to distance or legal administrative, prices or infrastructure barriers	2
Assured existence of raw materials	2	Raw material shortages and restrictive regulations	2
Reliable supply materials	1	Forest raw material supplies may be unstable due to seasonality factors or uneven or inefficient application of regulations	2
SSE located where the resource is available	3	Lack of raw materials	6
Assistance in supply of raw material,	4	Blocked by difficulties in accessing raw material	8

Table 3.1: Cont.

Factors influencing success	Ref	Factors influencing failure	Ref
Production, skills and technology			
Appropriate technical support	1	Lack of skills	1
Marketable product	1	Lack of specialist support,	7
Increasing production	1	Practice of once off production	7
Increase product value (improve quality, processing)	1	Seasonal pattern of operations, dependence on agricultural incomes,	2
Able to manage risk (diversify products, diversify markets)	1	Due to slower production process mean longer inventory turnaround	2
Provision of investment and working capital,		SSE operation done on part-time basis making it difficult to measure real importance and productivity of sector	3
Pragmatic and prompt institutional support	1	Working capital tied to stock which limits productivity improvements	3
Simple technology, demand limited skills,	2	Production methods and techniques obsolete resulting in high costs and low quality	5
Good technology	2	Lack of proper tools, spare parts, maintenance	5
Technology permits low to average unit production cost	2	Production on individual orders hinder them from coping with a flush of demand that would require a batch or flow line production	6
Unsophisticated production	3	High waste factor and poor quality	5
Provision of technical support	4	Lack of appropriate technology	8
Skills and development and investment in equipment	6	Production on order	3
Private sector linkages	6		5
Devote time, work long hours	9		
Organisation, structure and location			
Able entrepreneur	1	Entrepreneurial ability is generally rare	1
Credible leadership	1	Predominantly rural in location	2
Good management capacity	1	Reliance on entrepreneur and family labour input	2
Favourable infrastructure and access to credit	1	Small in size	2
Management training		Managerial weakness	2
Good and timely decisions	9	Lack of organisation (manner that enables effective use of available support services which could improve access to markets	2
Creative, risk taker and flexible entrepreneur	9	Poor management	2
		Informality of organisation	2
		Heavy use of family labour	2
		Most functions carried out single handed	2
		Poor working conditions only attract poor workers	2
		Management personalised more than institutionalised	3
		Entrepreneurs work by intuition with no elaborate data	2
		Labour skills centred only on one person	5
		Shortage of skilled labour	5
		Low road density per ha	6
		Limited number of workers	6
		Very few real entre0neur	9

Reference:

1. FAO (1995)
2. FAO (1987)
3. Sahlin, in FAO (1987)
4. Parameshwaran in FAO (1987)
5. Mwang'ombola in FAO (1987)
6. Christiansen in FAO (1987)
7. Arnold, (1994)
8. Schmitz (1982)
9. Johnrud (1991)

Table 3.2: The framework of the Commercialisation status evaluation tool

Business descriptors		**Characteristics of forest based small-scale enterprises**	**Success Rating**		
			Low (1) (not likely to lead to success)	**Medium (2)** (could lead to success)	**High (3)** (most likely to lead to success)
Business structure (model)	1. Human resources	1. Small in size (number of people)	<3	3-20	>20
	2. Location	2. Predominantly rural in location (business operation)	Household	Business centre	District centre
	3. Sources of labour	3. Reliance on entrepreneur and family labour input,	No employees	Periodic casuals	Permanent employees
	4. Type of management	4. Management personalised more than institutionalised	Family	Project committee	Management unit
	5. Group dynamics	5. Identification as a group (interaction)	Rarely meet	Once /month	1 or more times a week
	6. Distance to transport network	6. Distance to transport network	>50 km	5-50 km	<5km
Raw material supply	7. Institutional arrangements	7. Supportive institutional structure	None	Weak structure	Effective institutional arrangements
	8. Harvesting techniques	8. Sustainable harvesting	Complete removal of reproductive organs	Harvesting could reduce reproduction	Benign harvesting
	9. Raw material supply	9. Raw material supply	Short supply	Periodic shortages	Reliable
	10. Resource tenure	10. Secure resource tenure	Restricted areas	Verbal agreement	Written permit
	11. Bulk buying	11. Bulk buying limited	Always	Sometimes	Rarely
Business production, skills and technology)	12. Required skills and technology	12. Demand limited skills and technology	Traditional methods	Low cost tools	Big machinery
	13. Frequency of operation	13. Business operation done on part-time basis (participation)	< day /week	1-3 days/week	4-7 days /week
	14. Seasonality of production	14. Seasonal pattern of operations	1-4 months /year	5-8 months/year	9-12 months /year
	15. Level of production	15. Irregular production	Fail to meet orders	Fulfil orders	Fulfil all orders and make new customers every year
	16. Available skills and technology	16. Limited available skills and technology	not available	good quality product	Product meet market demands
	17. Specialist support	17. Lack of specialist support	No training	Visits by experts	Linked to technical service providers
	18. Storage capacity	18. Limited storage capacity	1 month production	4 months production	6 months production
	19. Available killed labour	19. Shortage of skilled labour	None trained	Half trained	All trained
Business financing and returns	20. Capital investment	20. Low capital investment	none	Individual resources	Small loan
	21. Demonstrable success	21. Demonstrable success	Never succeeded	Break even time and again	Make profit
	22. Access to markets	22. Limited access to market	Chance sales	Local	Periodic orders
	23. Business financing	23. Shortage of finance	Always	Sometimes	Rarely
	24. Income surplus	24. Limited income surplus	Always	Sometimes	Rarely
	25. Level of returns	25. Low returns	Buy small food items	Enough to invest in assets	Have long term investments
	Scale		**L**	**M**	**H**

3.3 RESULTS

The small scale enterprises (SSEs) evaluated comprised sole traders and community enterprises located in rural settings. Membership ranged from individuals (fruits) to small groups of seven (oils) and large groups of above 140 (tea) (Table 3.3). Due to the business models adopted for the SSEs they were mostly operating from rural business centres where they suffered poor communication as a consequence of poor roads, unreliable transport and lack of electricity.

Income and profits were inherently low or non existent and production levels also very low as most SSEs repeatedly failed to meet market orders. Poor business financing and lack of financial management skills were cited as the main underlying causes of business failure. Consequently, most SSEs could not acquire enough raw materials for processing, and often when they did, the season would be over, or the markets would have been taken by others. These problems were particularly acute for fruit processors.

In most areas the raw material supply was reliable, but not guaranteed. The major challenge with supply was related to biannual production of most fruit trees and insecure user rights. In some situations they had not only to compete for access but to actively fight for the resources e.g. marula in Rushinga. Lack of income complicated things further, as the SSEs were unable to buy raw material from the non entrepreneurs.

Business operations were the strongest attributes of the SSEs and could explain why they continued to exist, in spite of their insignificant financial returns. All the SSEs had appropriate technology (products were of good quality) but skill levels were limited thus reducing production, in spite of high labour allocation.

Table 3.3 provides a summary of the commercialisation status of SSEs in the five study sites. This analysis suggested that the SSEs evaluated were operating at low levels of commercialisation. Lack of entrepreneurship was the major challenge; the models are mostly for gatherers with little to no investment in building a business. It is evident that none of the SSEs had high levels of commercialisation as had been originally envisaged during site selection (see Chapter 2).

Table 3.3: Summary of the commercialisation status of marula, baobab and makoni tea in five selected sites in Zimbabwe

Descriptor	Characteristics of forest based SSEs	Marula		Baobab		Fadogia	
		Rushinga	Muzarabani	Chimanimani	Rushinga	Nyanga	Makoni
		Rating					
Business structure (model)	1. Small in size (number of people)	2	2	1	1	3	1
	2. Predominantly rural in location (business operation)	2	2	1	1	2	1
	7. Reliance on entrepreneur and family labour input,	2	1	1	1	2	1
	8. Management personalised more than institutionalised	2	2	1	1	2	1
	14. Identification as a group (interaction)	3	3	1	1	1	1
	25. Distance to transport network	1	3	3	1	2	2
	(24)	**12**	**13**	**8**	**6**	**12**	**7**
Raw material supply	9. Supportive institutional structure	2	3	2	1	2	3
	10. Sustainable harvesting	2	2	2	2	2	3
	15. Raw material supply	1	2	2	3	3	3
	16. Secure resource tenure	2	2	2	1	2	2
	21. Bulk buying limited	1	2	3	1	1	1
	(21)	**8**	**11**	**11**	**8**	**10**	**12**
Business operations	3. Demand limited skills and technology	3	3	1	1	3	1
	4. Business operation done on part-time basis (participation)	2	2	3	1	3	3
	5. Seasonal pattern of operations	2	2	2	1	3	1
	13. Irregular production	1	1	3	2	2	3
	19. Limited available skills and technology	2	2	2	1	3	2
	20. Lack of specialist support	2	2	1	1	3	2
	22. Limited storage capacity	1	1	1	3	3	1
	23. Shortage of skilled labour	2	2	1	1	3	2
	(24)	**15**	**15**	**14**	**11**	**23**	**15**
Business financing and return	6. Low capital investment	3	3	1	1	3	1
	11. Demonstrable success	2	2	1	1	2	1
	12. Limited access to market	3	3	1	1	3	1
	17. Shortage of finance	2	2	1	1	1	1
	18. Limited income surplus	2	1	1	1	1	1
	24. Low returns	1	1	2	1	1	1
	(18)	**13**	**12**	**7**	**6**	**11**	**6**
Score		48	51	40	31	56	40
Rating		**2**	**2**	**1**	**1**	**2**	**1**
Scale		**M**	**M**	**L**	**L**	**H**	**L**

3.4 DISCUSSION AND CONCLUSION

3.4.1 NTFP commercialisation

Level of NTFP commercialisation in Zimbabwe as represented by the six cases indicated that these enterprises faced numerous challenges, constraints and barriers. Business structure and returns emerged as the greatest challenges. Enterprises were either sole traders or structured along community project designs. In addition to low bargaining power 'sole traders' were beset by prohibitive business costs (transport, marketing, appropriate technology and skills). Conversely, even if community projects have strong bargaining power most often they lack business capacity to deal with customers as well as the managerial and or entrepreneurial skills for value addition.

NTFP commercialisation covers the whole span of activities in the production – distribution chain including i) product, market and business development, ii) control of access and protection of user rights and iii) implementation of natural resource management strategies aimed at enhancing the resource. This entails skills development and facilitating access to resources, negotiation of business contracts, availing information about markets and lobbying for an enabling policy environment. Considering the outcomes of this assessment I conclude that commercialisation of NTFPs in Zimbabwe is still in its infancy and requires a significant strategic and innovative intervention if it is to sustain livelihoods and offer incentives for ecosystem conservation.

3.4.2 NTFP commercialisation assessment tool

The commercialisation assessment proved to offer a broad enough coverage of relevant issues, which is not surprising since it was drawn from literature of previous evaluations. It proved to be robust enough to cover a wide range of business functions whilst explicit and simple enough to be used by rural entrepreneurs. Therefore, it is probable that this tool can be used under a range of socio-economic and biophysical environments. Indeed, in some situations it proved to have utility beyond its designed research purpose as all the SSEs drew up work plans based on the outcomes of the evaluation. So it is possible that this tool could be used as an impact monitoring and evaluation tool for enterprise development interventions and / or to help SSEs steer their business and align their operations towards success.

Although the tool was successfully developed and applied across very different cases, there are still two issues that need to be resolved. Firstly, all the descriptors have been given the same weighting. This may not be appropriate as some of the characteristics of SSEs assessed by the tool may in fact be termed 'critical' factors, as their presence or absence is crucial for successful commercialisation. For instance, if there are no markets and entrepreneurs cannot sell then there cannot be any form of commercialisation. The same rationale applies to lack of raw material supply. However, other factors such as quality of products, technical support etc may be important but not crucial, as their absence would reduce the success of the business, but not necessarily prevent it from continuing.

If this tool were to be developed further then the addition of a weighting scale may be a valuable refinement. This was not possible here since the cases were too few and the outcomes of the assessment lay within a narrow range. Thus, the difference between best and worst cases though apparent was not wide enough for any analysis aimed at identifying critical factors. It is recommended therefore, that a wider range of cases and products be used to improve the assessment tool, and to develop a weighting system for factors.

Secondly, the sensitivity or the ability of the tool to differentiate similar situations remains unclear. In other words, the question of whether the upper value of one category and the lower value of the next category result in significant differences in the NTFP commercialisation process has not been fully tested. This arises mostly when quantitative data is required like characteristics 1, 6, 13, 14 and 18. For example using the first characteristic (small in size), it is important to know to what extent additional people in the industry improve the success of NTFP commercialisation so as to be rated as medium or high. In this study no tests were carried out to determine if 20 was a generally critical threshold for the high rating or that three should signify low commercialisation.

In using this tool I used four as the critical minimum for the medium category so as to cater for sole traders and small families where there would be low supply and limited spread of benefits in a community. At the same time, 20 was taken as the threshold for allowing more people to be involved and increase production to entice bigger markets. The same provision applies to other characteristics (6, 13, 14, 18) and also to the final score where 50% and 55% were used as critical minimum limits separating low and medium success. To ensure the validity of results from the use of this tool a sensitivity analysis would have to be carried out. This analysis should be able to determine two critical

points in the commercialisation continuum, i) the maximum value which separates low and medium success and ii) the maximum value which delineates medium and high success levels.

In spite of the problem highlighted above this tool was used to assess levels of commercialisation and conclusions were made about the Zimbabwe case. However since this is the first tool of its kind to be developed what is of merit, is the process and not necessarily the outcomes of such a process, although they can be used as pointers or indicators that require further investigation.

CHAPTER 4

COMMERCIALISATION OF NON-TIMBER FOREST PRODUCTS, ELUSIVE OUTCOMES AND PRE-MATURE JUDGEMENTS

ABSTRACT

For centuries rural households have been known to diversify livelihood activities into extraction and or trade in non-timber forest products (NTFPs). Various theories have been advanced as to the major motivation for this activity, and of these, income generation has been the most dominant. This study aimed to evaluate the extent to which the commercialisation of NTFPs had contributed to the development of financial, and to a lesser extent human capital of the households involved in NTFP commercialisation. The research was based on three species, a herbal tea (*Fadogia ancylantha*), marula (*Sclerocarya birrea*) and baobab (*Adansonia digitata)* products which were being marketed by five communities in Zimbabwe. In each one of these communities, NTFP commercialisation was at different levels of organisation, complexity and development. Major findings of the study are that, although many households harvested NTFPs very few were involved in marketing and or trade. In addition, the organisation and management of the production –market chain was very poor leading to low returns. This dysfunctional mode made evaluation of outcomes very difficult and any conclusions on performance are very tentative. However, it is concluded that the high potential manifested in NTFPs trade has not been translated into financial capital and unless the capacity of entrepreneurs is improved the commercialisation of NTFPs will remain a fallacy.

4.1 INTRODUCTION

Rural communities employ multiple activities to sustain their livelihoods and or generate income (Winters, Davis and Corral, 2002). Livelihood activity diversification has been adopted by numerous rural households to increase incomes, spread and manage risk, overcome uneven use of assets caused by seasonality, as well as cope with crop production shortfalls (Reardon, and Vosti, 1995; Campbell and Byron, 1996; Den Hertog and Wiersum, 2000; Allison and Ellis, 2001; Agarwal, 2001; Arnold and Ruiz-Perez, 2001; Reuben and Den Berg, 2001; Corral and Reardon, 2002; Shanley, Luz, and Swingland, 2002).

Empirical studies in rural Africa have revealed that non farm activities may account for 40-45 % of average household income and seem to be growing in importance (Holden, 2004). One of the most popular non farm activities that rural household diversify into is the extraction and or trade in non timber forest products (NTFPs) (FAO, 1987; Arnold 1994; Edwards, 1995; FAO, 1995; Petrin, 1994; Neumann, and Hirch, 2000; Ambrose-Oji, 2003). Many theories have been advanced as to why rural households diversify into NTFP extraction. Some suggest that extraction of NTFPs is undertaken by the poor and / or conducted in geographically and economically marginalised communities where lack of alternatives renders opportunity costs very low (Campbell and Byron, 1996; Hedge, Suryaprakash, Achoh, and Bawa, 1996; Cavendish, 2000; Neumann, and Hirch, 2000; Cavendish, 20002, Campbell et al., 2002). While others say that even if NTFPs constitute a small part of overall food consumption and income generation their absence at a critical time can greatly increase the risk of food shortages and loss of consumption insurance (Campbell, Jeffrey, Kozanayi, Luckert, Mutamba and Zindi, 2002).

Such is the perceived importance of these income sources that, some development agencies are advocating and promoting commercialisation of non timber forest products through organised processing and marketing by small scale enterprises (SSEs). However, it has also been indicated that the poor were not always able to exploit opportunities due to shortage of labour and that they were often exploited by intermediaries who control the market. As such NTFPs provide a means of existence for the poor, but may not offer opportunities for future investment (Arnold, 1994). Neumann and Hirch (2000) recorded similar conclusions that, although some households do accumulate significant capital from the commercial activities, the social status of the collectors has not been significantly changed by profits and sustainability is not guaranteed. In addition it has been suggested that the poor usually abandon NTFP activities once they have other livelihood options like agriculture (Neumann and Hirch, 2000).

Despite these short comings there is some evidence that commercialisation of NTFPs does contribute to human well being. It has been documented that forest based small-scale enterprises (SSEs) are a major source of rural livelihood in developing countries as capacity for agriculture declines (FAO, 1987). Across the world over 20% of the economically active population derive a significant proportion of livelihood from extraction of NTFPs (Browder, 1992). In West Bengal, India NTFPs extraction accounted for 70% of wage employment and 17% of household income (Mahapatra, and Mitchell, 1997). In Zimbabwe in 1991 small-scale forest based enterprises employed 237,000 people compared to 16,000 in the conventional forest industries (Arnold, 1994; FAO, 1995).

However, there is an inadequacy of literature on the impacts of commercialisation on participating households, and the current conclusions are

that only the elite benefit, and as such the link between enterprise performance and livelihoods need to be validated (Hulme, 2000; Campbell and Byron, 1996). It could be argued that NTFP commercial activities operate at different levels of development, complexity and organisation and such that resultant outcomes are likely to have differential impacts depending on the contextual situation.

This chapter is one part of a larger study which is concerned with evaluating the outcomes and impacts of NTFP commercialisation on ecosystem health and human well being in Zimbabwe. Presented here are financial and human capital outcomes of NTFP commercialisation.

4.1.2 Brief review of financial and human livelihood capitals

4.1.2.1 Financial capital

Financial capital can be defined as i) available stocks which can be held in several forms such as cash, bank deposits, ii) liquid assets like livestock, jewellery and iii) regular inflows of money including earned cash, pensions, remittances, allowances (DFID, 1999; Hulme, 2000; Allison and Ellis, 2001; Campbell et. al., 2002). In essence these are financial resources that people use to achieve livelihood objectives. To achieve desired livelihood outcomes the financial capital contribution has to be reliable (DFID, 1999), however the availability of assets (land, livestock) are also important as they improve food security and food adequacy (Reuben and Den Berg, 2001).

One way to measure financial capital is through income analysis i.e. changes in incomes (levels and patterns of expenditure, consumption, income composition and assets) (Bebbington, 1999; Hulme, 2000; Deininger and Olinto, 2001;

Reuben and Den Berg, 2001). This technique was used in both of the two major studies which have been conducted in Zimbabwe on evaluating the economic contribution made by environmental resources to rural households' welfare (Cavendish, 2000; Campbell et. al., 2002). The main approach adopted in these studies was the use of panel households in data collection and conversion of all non cash income to monetary values in order to enable estimation of total income. Conversions were based on local prices, prices of substitutes and households' own reports for both the quantity and total value of their own resource utilisations (Cavendish, 2000; Cavendish 2002).

Data were collected through recall periods (weekly and three-monthly) to capture seasonal, casual and small inputs in order to solve the problem of under estimating woodland based income and over estimating agriculturally based income (Campbell et. al., 2002; Cavendish, 2000). Income analysis was undertaken by wealth quartile and results presented aggregated data on the contribution of different income sources, total income per person, actual and proportions. Findings were that 30% of the income for people in the lowest wealth quartile was woodland based and the conclusion was that forest products are more important to the very poor than the less poor (Campbell, et al., 2002; Cavendish 2002).

4.1.2.2 Human capital

Human capital has been described as the skills and knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve livelihood objectives (George, 1997; DFID, 1999; Campbell et al., 2002). Studies have shown that development of human capital, especially the acquisition of skills and knowledge can affect conservation and livelihoods (Fedderke, De Kadt and Luiz, 1999; Narayan and Pritchett, 1999).

Even though it has been suggested that commercialisation of non timber forest products contributes to the development of human well being, no studies have been conducted to assess how this development influences human capital and capabilities. However, several studies have been conducted to show the effect of human capital on NTFP extraction. For example, findings from research in India indicated that schooling lowers the dependence of rural households on the forest by increasing chances of formal employment (Hedge, Suryaprakash, Achoh and Bawa, 1996; Godoy, Groff and O'Neill, 1998). Studies have also suggested that families with educated heads of households had more assets including housing, have diversified livelihood strategies and are less reliant on agriculture (Godoy, Groff and O'Neill, 1998; Bird and Shepherd, 2003). Suggestions have also been made that the amount of time allocated to various activities indicates the importance of the activity to the household. In their study Campbell and colleagues (2002) concluded that allocation of time to livestock, gardens and academic work increased with wealth while the poor increased time allocation to woodland resource collection.

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4.2 METHODOLOGY

4.2.1 Study sites

A description of the study site and the main survey technique were described in Chapter 2. Additional information on methods specific to this Chapter is reported below.

4.2.2 Methods

4.2.2.1 Financial capital evaluation

This research set out to explore whether people involved in the sale, marketing and or trade of non timber forest products (i.e. NTFP entrepreneurs) were more financially secure (i.e. had more financial capital) than non entrepreneurs. Other related questions asked as part of the main survey and reported here included i) a statement about the three major source of incomes, ii) identification of the largest contributor to the household income basket and iii) identification of the most reliable sources of income. Analysis of these date enabled a test of the hypothesis that increases in commercialisation will increase the proportion of people dependent on incomes from NTFPs.

No rigorous economic data collection was undertaken in this study for the simple reason that it is not very easy to get valid figures about peoples' income from standard questionnaires. Rather, reliable estimates depend on high levels of contact between researchers and respondents as reported in the previous studies of Campbell, et. al., (2002) and Cavendish (2002). Without a physical presence to observe some of the transactions, respondents may give false income figures in anticipation of aid. At the same time most rural household have a short recall memory and without readily available assistance to calculate

and record income and proceeding transactions they do not always remember accurately and have to give estimates when pressured. So, without adequate funding to increase contact between enumerators and respondents for collection of panel data, it was decided that data collection should focus on major income sources only.

4.2.2.2 Evaluating human capital development

The main research question here was to investigate whether commercialisation (collection, processing, marketing and trade) of NTFPs contributed to human capital development. Aspects of human capital assessed were changes in major livelihood activities and monthly labour allocation to livelihood activities. This was to determine if households involved in the NTFPs commercial activities had changed their labour allocation due to the commercialisation process.

4.2.3 Data analysis

Survey data were entered into a data file in SPSS version 11.5 (Pallant, 2004). Assessment of impacts and outcomes on financial capital focused on evaluating changes in household major income sources, incomes from NTFPs, monthly income deficits and organisation of NTFP utilisation activities. Changes in human capital were investigated through the assessment of household labour allocation to NTFP and other priority livelihood activities. Comparisons and statistical tests were made along the commercialisation continuum (low, medium, high) and between SSE members and non members as well as between non and NTFPs entrepreneurs (those selling NTFPs).

4.3 RESULTS

4.3.1 Human capital development

4.3.1.1 Characteristics of households

In order to provide some context to the overall study, this section presents demographic characteristics of households which will be used in later cross sectional analyses.

Most demographic characteristics, apart from household size, varied across the commercialisation continuum (Table 4.1). The proportion of adults increased with levels of commercialisation from low to high (ANOVA, df=2, F=9.966, $p<0.01$). Average age of household heads followed the same trend being lowest in low commercialisation sites and highest in the high commercialisation site. There was also a significant difference in the number of adults per household between households engaged in NTFP selling (NTFP entrepreneurs) and those who were not selling (non NTFP entrepreneurs) (ANOVA, df=1, F=4.477, $p=0.035$). These results are interesting as Godoy, Groff and O'Niel (1998) proposed that with increased schooling and wealth, family sizes become smaller and the proportion of adults is higher than in the poorer or uneducated households. While this study did not try to assess this theory specifically, the results do seem to support this supposition.

At all the three levels of commercialisation, holders of Grade 7 and 'O' level certificates accounted for up to 79% of the household members (Table 4.2). Non NTFP entrepreneur households were slightly more educated than those involved in the NTFP trade. In the low commercialisation sites entrepreneurs were slightly more educated than non entrepreneurs whilst in the medium and high site the reverse was true. However, One Way ANOVA indicated that none of the differences were statistically significant. There did though seem to be a relationship between education levels of household members and the age of the household head, which could confound the commercialisation results. The proportion of household members with 'A' levels and diplomas increased with age of household until age 65 and then decreased with increased in age.

Table 4.1: Household demographic summary

NTFP selling?	Level of commercialisation	N	Mean age of hh head	Mean number of hh members	Mean number of adults	Mean number of non resident members	Mean number of children	Mean number of female adults in hh	Mean number of male adults in hh
Yes	Low	34	47.5	8.9	3.8	2.3	5.1	1.9	1.9
	Medium	49	45.9	8.7	4.0	1.2	4.7	2.1	1.9
	High	54	54.2	8.4	5.1	3.4	3.5	2.5	2.7
	Total	137	49.6	8.7	4.4	2.4	4.3	2.2	2.2
No	Low	58	47.2	8.8	3.7	2.2	5.2	1.9	1.8
	Medium	78	47.9	7.0	3.4	1.6	3.8	1.8	1.8
	High	23	56.5	9.4	5.2	5.3	4.3	2.6	2.6
	Total	159	48.8	8.0	3.8	2.5	4.4	2.0	1.9
Total	Total	296	49.2	8.3	4.1	2.4	4.4	2.1	2.1

hh =household

Table 4.2: Percentage of household members who attained Grade 7, 'O' level or 'a' level as highest levels of education in the three levels of commercialisation

NTFP selling?	Level of commercialisation	N	Highest level of education attained			
			Grade 7	O' level	A' level	Diploma+
No	Low	34	34.6	40.3	14.4	10.6
	Medium	49	46.3	38.2	8.1	7.3
	High	54	40.9	38.6	11.4	9.1
Total		137	40.7	39.3	11.1	8.9
Yes	Low	58	38.	34.6	13.5	13.5
	Medium	78	48.7	38.5	3.9	9.0
	High	23	45.2	45.2	5.4	4.3
Total		159	44.8	40.4	6.7	8.1

4.3.1.2 Major livelihood activities

Labour is a precious resource that has to be maximised and will only be allocated to important activities. For the purposes of this study it was assumed that the first five livelihood activities ranked on a household's list of activities were the most important. The assumption being tested therefore was that if NTFP collection and selling was contributing to livelihoods then it should be one of the top five most important activities to which resources, especially labour, are invested.

Before households diversified to various income generating activities fruit and tea activities (collection, processing, selling etc) were a major household activity for 26.6% and 8.9% of the respondents respectively. However, after joining various small scale enterprises (SSEs) the proportion of households who regarded NTFP activities as major livelihood source declined, except for craft production and tea (collection and trade). This confirms the suggestion that once people have

alternatives they tend to abandon NTFP activities. Livelihood activities were not significantly different between NTFP entrepreneurs and those not involved in the trade (Mann Whitney U test, U=7184, p=0.43) but varied significantly across the levels of commercialisation (Kruskal Wallis test, X^2=17.98, df=2, p<0.001) (Table 4.3).

In 2004, almost a third (30%) of the respondents did engage in craft production and this activity was undertaken by both entrepreneurs and non entrepreneurs, suggesting that crafts were an important household asset. In addition, labour allocation to these activities differed significantly across the levels of commercialisation where fruit collection and trade was a priority in the medium sites it was 25% and in the high commercialisation site it was 30%.

A theory has been advanced that one of the most important if not the major asset that rural households have is human labour (Campbell, et. al., 2002). As such this labour should only be invested in the most important activity. However, this study has indicated that labour allocation to NTFP activities like all the other non farm activities is inversely related to crop production labour allocation (Figure 4.1). The period October to May for entrepreneurs and October to June for non entrepreneurs constitute the peak time for agricultural activities and NTFP activities only get residual labour during this period.

The proportion of NTFP entrepreneurs allocating labour to tea activities was higher than, or equal to that allocated to crop production for only three months. During all the three months the differences in proportion of respondents was never more than 10%. For non entrepreneurs the proportion of respondents who allocated labour to

tea activities was always less than 5% and far much less than that allocated to crop production. There was a significant difference between proportions of entrepreneurs and non NTFP entrepreneurs allocating labour to tea production activities (Mann-Whitney U test, U=14, p=0.001). A higher proportion of NTFP entrepreneurs allocated labour to fruit collection and trade activities than non entrepreneurs, though not significant (Figure 4.2).

Table 4.3: Household activities as stated by respondents (%) to be the top five major sources of livelihood

	Before SSE			After SSE (2004)					
	NTFP selling			NTFP selling		Commercialisation level			
	Yes	No	Total	Yes	No	Low	Medium	High	Total
Crop production	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Livestock production	63.8	81.0	68.4	66.9	66.2	51.6	75.2	70.3	66.5
Vegetable production	75.9	81.0	77.2	70.1	70.3	59.8	57.1	85.1	64.8
Craft production	29.3	19.1	26.6	27.6	20.3	55.7	5.3	39.2	29.6
Casual work	24.1	28.6	25.3	22.1	28.4	23.7	29.3	21.6	25.7
Drought relief	12.1	4.8	10.1	18.1	20.3	1.0	42.9	2.7	19.7
Fruit collection/ processing	27.6	23.8	26.6	19.7	2.7	10.3	24.8	18.9	18.8
Grass cutting	29.3	9.5	24.1	14.2	6.1	12.4	1.5	27.0	11.2
Tea collection/ processing	10.3	4.8	8.9	24.4	0.7	11.3	0.0	29.7	11.2
Formal employment	15.5	19.1	16.5	10.2	9.5	12.4	4.5	14.9	9.5
Brick moulding	10.3	9.5	10.1	7.9	4.7	8.3	3.0	10.8	6.6
Beer brewing	1.7	0.0	1.3	4.7	0.0	8.3	5.3	1.4	5.3
Mineral extraction	6.9	9.5	7.6	4.7	2.7	0.0	6.0	4.1	3.6
N	62	22	78	136	153	109	135	76	318

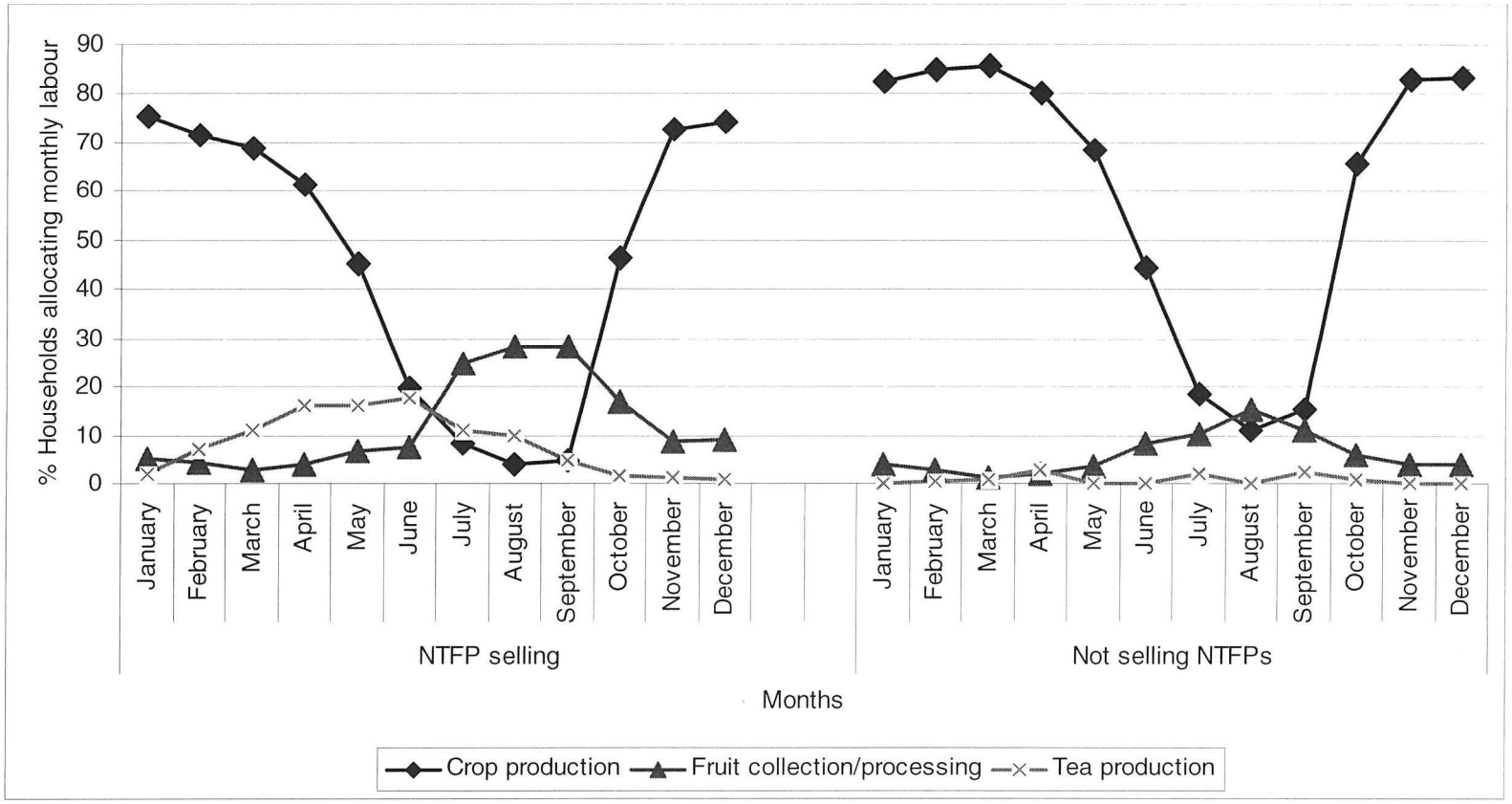


Figure 4.1: Monthly labour location to NTFP and crop production activities based on whether a particular household participated in the activity rather than actual hours spent on each activity

4.3.2 Financial capital development

4.3.2.1 Major sources of income

As with most communities in Zimbabwe the livelihoods of the surveyed households were mainly based around agriculture. The three major cash income sources for non NTFP entrepreneurs were crop, vegetable and livestock production, while for entrepreneurs they were crop production, formal employment, vegetable and livestock production. People from the low commercialisation areas reported craft sales as their major cash income source and did not consider livestock production to be in their top three. On the other hand, in the medium level sites two cash income sources (crop and livestock production) were reported by 90% of the households (Table 4.4).

As the level of commercialisation increases one may expect incomes from NTFPS to increase and/ or make contributions to a greater number of households. Sources of cash income were not different between NTFP entrepreneurs and non entrepreneurs for both before and after SSEs membership scenarios (Mann-Whitney U test, U= 603, p=0.254) and (Mann-Whitney U test, U=4235.5, p=0.87).

However cash income sources differed across the levels of commercialisation both before (Kruskal Wallis, X^2=15.123, df=2, p=0.001) and after (Kruskal Wallis, X^2=63.504, df=2, p<0.01) people joined SSEs. Before joining SSEs only 5% of the entrepreneurs and 4% of the whole sample (11 households) indicated that fruits and teas were their major cash income sources, with the greatest proportion of respondents (20%) reporting this income source residing in the low commercialisation sites (Table 4.4). This scenario did not change with people

joining SSEs, fruit and tea sales were still major sources of cash income to 4% of entrepreneurs (5 households) and 7% (8 households) of the whole sample (Table 4.5). Even if fruits and tea were ranked quite lowly as sources of cash income, in the low and high commercialisation site they remained part of the three major cash income sources in the high commercialisation site.

Sources of non cash income were not significantly different across the commercialisation continuum both before and after people joined SSEs (Kruskal Wallis test, X^2 =5.8, df=2, p=0.054 and Kruskal Wallis, X^2 =4.77, df=2, p=.092). (The proportion of households who indicated that fruit and tea provided major subsistence income sources in 2004 (after joining SSEs) was 4% which was not very different from previous years. Respondents ranked the importance of this subsistence income source 5th and 6th after (2004) and before joining SSEs respectively (Table 4.6 and 4.7). For entrepreneurs craft and fruit/ tea sales ranked 4th and 5th, but for non entrepreneurs they were not considered as important livelihood options.

Table 4.4: Major sources of cash income before households (%) became member of SSEs

Cash income source pre SSE	Entrepreneur				Non entrepreneur				Overall
	Low	Medium	High	Total	Low	Medium	High	Total	
Crop production	26.7	40.7	51.4	45.7	45.5	50.0	40.0	44.4	45.3
Livestock	6.7	33.3	24.3	24.1	22.7	50.0	33.3	31.1	26.1
Casual work	0.0	11.1	6.8	6.9	13.6	0.0	26.7	15.6	9.3
Vegetable production	13.3	3.7	2.7	4.3	13.6	0.0	0.0	6.7	5.0
Crafts	6.7	3.7	6.8	6.0	0.0	0.0	0.0	0.0	4.4
Fruits and tea	20.0	0.0	4.1	5.2	0.0	0.0	0.0	0.0	3.7
Salary	13.3	3.7	2.7	4.3	4.6	0.0	0.0	2.2	3.7
Beer brewing	13.3	0.0	0.0	1.7	0.0	0.0	0.0	0.0	1.2
Minerals	0.0	3.7	0.0	0.9	0.0	0.0	0.0	0.0	0.6
Bricks	0.0	0.0	1.4	0.9	0.0	0.0	0.0	0.0	0.6
N	34	49	54	137	58	78	23	158	296

Table 4.5: Major sources of cash income in 2004 after households (%) joined SSEs,

Source cash income 2004	Entrepreneur				Non entrepreneur				Overall
	Low	Medium	High	Total	Low	Medium	High	Total	
Crop production	26.4	51.0	43.4	42.7	46.7	55.3	46.7	51.6	46.9
Livestock	9.4	38.5	21.2	25.4	20.0	35.0	33.3	30.5	27.8
Crafts	34.0	1.0	7.1	10.5	0.0	0.0	0.0	0.0	5.6
Vegetable production	13.2	2.1	8.1	6.9	6.7	0.8	16.7	4.7	5.9
Casual work	3.8	4.2	4.0	4.0	11.7	4.1	3.3	6.1	5.0
Fruits and tea	5.7	2.1	11.1	6.5	0.0	0.0	0.0	0.0	3.5
Formal employment	3.8	1.0	1.0	1.6	11.7	2.4	0.0	4.7	3.0
Bricks	1.9	0.0	4.0	2.0	3.3	0.8	0.0	1.4	1.7
Beer brewing	1.9	0.0	0.0	0.4	0.0	0.8	0.0	0.5	0.4
Minerals	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.5	0.2
N	34	49	54	137	58	78	23	158	296

Table 4.6: Major sources of subsistence income in 2004, numbers are % of respondents

Subsistence source of income 2004	Entrepreneur				Non entrepreneur				Overall
	Low	Medium	High	Total	Low	Medium	High	Total	
Crop production	45.0	47.6	51.6	48.5	50.0	61.0	47.4	56.1	52.8
Livestock	10.0	29.8	16.1	23.9	19.2	22.0	26.3	21.6	22.6
Vegetable production	25.0	2.4	9.7	7.5	17.3	4.0	21.1	9.9	8.9
Casual work	0.0	4.8	0.0	3.0	7.7	6.0	0.0	5.9	4.6
Crafts and grass	20.0	1.2	16.1	6.7	3.9	1.0	0.0	1.8	3.9
Fruits and tea	0.0	6.0	6.5	5.2	0.0	3.0	0.0	1.8	3.3
Drought relief	0.0	7.1	0.0	4.5	0.0	3.0	0.0	1.8	3.0
Formal employment	0.0	1.2	0.0	0.8	0.0	0.0	5.3	0.6	0.7
Bricks	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.6	0.3
N	34	49	54	137	58	78	23	158	296

Table 4.7: Major sources of subsistence income before 2004, numbers are % of respondents

Subsistence source of income pre SSE	Entrepreneur				Non entrepreneur				Overall
	Low	Medium	High	Total	Low	Medium	High	Total	
Crop production	33.3	50.0	43.5	45.5	57.1	42.9	60.0	100.0	48.2
Crafts and grass	16.7	23.1	8.7	16.4	0.0	28.6	20.0	21.4	14.8
Livestock	33.3	7.7	13.0	12.7	21.4	14.3	20.0	35.7	14.8
Vegetable production	16.7	3.9	30.4	16.4	7.1	0.0	0.0	7.1	12.4
Fruits and tea	0.0	3.9	0.0	1.8	14.3	0.0	0.0	14.3	3.7
Bricks	0.0	7.7	0.0	3.6	0.0	0.0	0.0	0.0	2.5
Casual work	0.0	3.9	0.0	1.8	0.0	14.3	0.0	7.1	2.5
Drought relief	0.0	0.0	4.4	1.8	0.0	0.0	0.0	7.1	1.2
N	34	49	54	137	58	78	23	158	296

4.3.2.2 Most important income sources

Agricultural activities were reported to be the major income sources and were considered to be the largest contributors to most of the households, with crop production supporting more than 65% of the households. The before and after joining SSEs situations were very different in that before SSEs, people had fewer sources of income, and NTFP activities were generally not considered to be among the largest income sources (except for grass sales in the high commercialisation site). There were no difference between commercialisation levels before people joined SSE but after that, income sources considered to be the largest contributors were significantly different (Kruskal Wallis test, X^2 =2.019, df=2, p=0.36 and Kruskal Wallis test, X^2 =40.65, df=2, p<0.001). In the low commercialisation sites more people had diversified income sources than in the high and medium sites where 65% and 82% of the respondents stated that crop production was their major and largest income source. Craft and grass sales were the largest income source for 9% of respondents, and were highest in the low commercialisation sites. Fruit were the largest source of income to 1% (one hh) of respondents, all of whom were from the high commercialisation site (Table 4.9).

Although NTFPs were the largest income sources for some households they were certainly not the most reliable. Only 0.4% (one hh) respondents indicated that fruits and teas were their most important and reliable income source. This was a decrease from 2% in the pre SSE period (Table 4.10). In the low commercialisation sites though fruits had once been perceived as a reliable source, at the time of the survey they were not, whilst in the high commercialisation site a sizeable proportion (11%) of households stated that tea was the most reliable income source. For the medium commercialisation sites

NTFPs did not feature at all in the list of largest and reliable income sources. Consequently, in 2004 the sources of income considered to be most reliable were significantly different between commercialisation levels (Kruskal Wallis test, X^2=21.46, df=2, p<0.001). There were no significant differences between NTFP entrepreneurs and non entrepreneurs in terms of the largest (Mann Whitney U test, U=6434, p=0.78) and most reliable (Mann Whitney U test, U=857, p=0.44) income sources.

Table 4.8: Major and largest source of cash and subsistence income, numbers are % of respondents

Largest income contributor	**Low**		**Medium**		**High**		**Overall**	
	After SSE	Before SSE	After SSE	Before SSE	After SSE	Before SSE	After SSE	Before SSE
Crop production	41.7	45.5	82.4	73.3	64.8	72.7	65.3	68.6
Formal employment	5.6	18.2	3.9	13.3	3.7	6.8	4.3	10.0
Vegetable production	19.4	27.3	3.9	0.0	16.7	6.8	12.8	8.6
Livestock	2.8	0.0	5.9	0.0	9.3	11.4	6.4	7.1
Crafts	27.8	0.0	0.0	0.0	3.7	2.3	8.5	1.4
Fruits and Tea	0.0	0.0	0.0	0.0	1.9	0.0	0.7	0.0
N	36	11	51	15	54	44	141	70

Table 4.9: Major and most reliable source of cash and subsistence income, numbers are % of respondents

Most reliable income source	**Low**		**Medium**		**High**		**Total**	
	After SSE	Before SSE	After SSE	Before SSE	After SSE	Before SSE	After SSE	Before SSE
Crop production	47.3	48.2	64.5	38. 9	38.9	40.4	53.8	42.3
Livestock	7.5	7.4	28.1	38. 9	19.4	25.0	19.7	22.7
Vegetable production	10.8	18.5	4.1	16.7	19.4	13.5	10.4	15.5
Formal employment	9.7	14.8	2.5	5.6	2.8	1.9	5.0	6.2
Crafts	21.5	7.4	0.0	0.0	2.8	5.8	7.9	5.2
Fruit and tea	0.0	3.7	0.0	0.0	11.1	1.9	0.4	2.1
N	93	27	121	18	72	52	279	97

4.3.2.3 Value of NTFPs

Several arguments have been put forward that NTFPs are important sources of livelihood and serve to smooth household income and food supplies (Arnold and Ruiz-Perez, 2001; Shanley, Luz, and Swingland, 2002). The results obtained here suggested that the major reasons communities valued NTFPs at the household level were due to their importance as sources of food and cash income. These varied with level of commercialisation (Kruskal Wallis test, X^2 = 11.9, df=2, p=0.003) and whether one was an NTFP entrepreneur or not (Mann Whitney U test, U=6372, p= 0.125) There were more people from the medium commercialisation sites who valued NTFP as a food source (45%) than from the other two sites. In the low commercialisation sites people valued cash income more than food source, 41% and 34% respectively whilst in the high commercialisation site NTFPs were valued for cash income and because they offered a new livelihood option (Figure 4.2).

NTFPs were valued as a source of food by both those selling and not selling such products. However for non entrepreneurs their value as a food source was most important, while for entrepreneurs income came top of the list. The fact that they are a 'free natural supermarket' as described by Cavendish (2000) makes them even more attractive especially for those involved in commercial activities. At the same time NTFP commercialisation has been adopted as a new livelihood option by 19% of the entrepreneurs most of who were from the low and high commercialisation site (Figure 4.3).

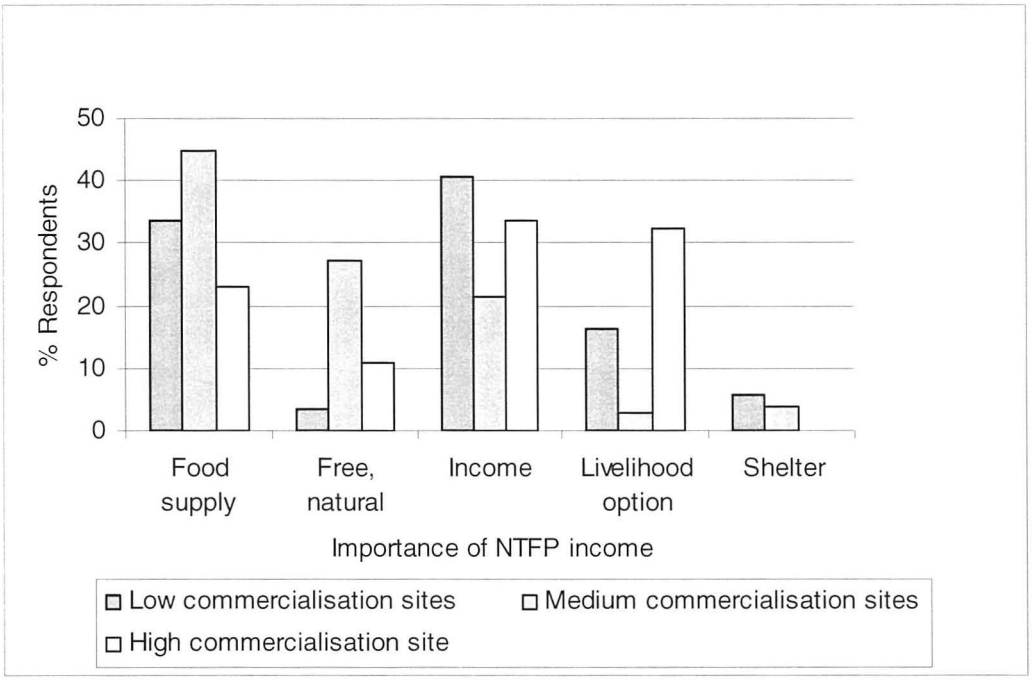


Figure 4.2: Importance of NTFPs to households in three different levels of commercial activities

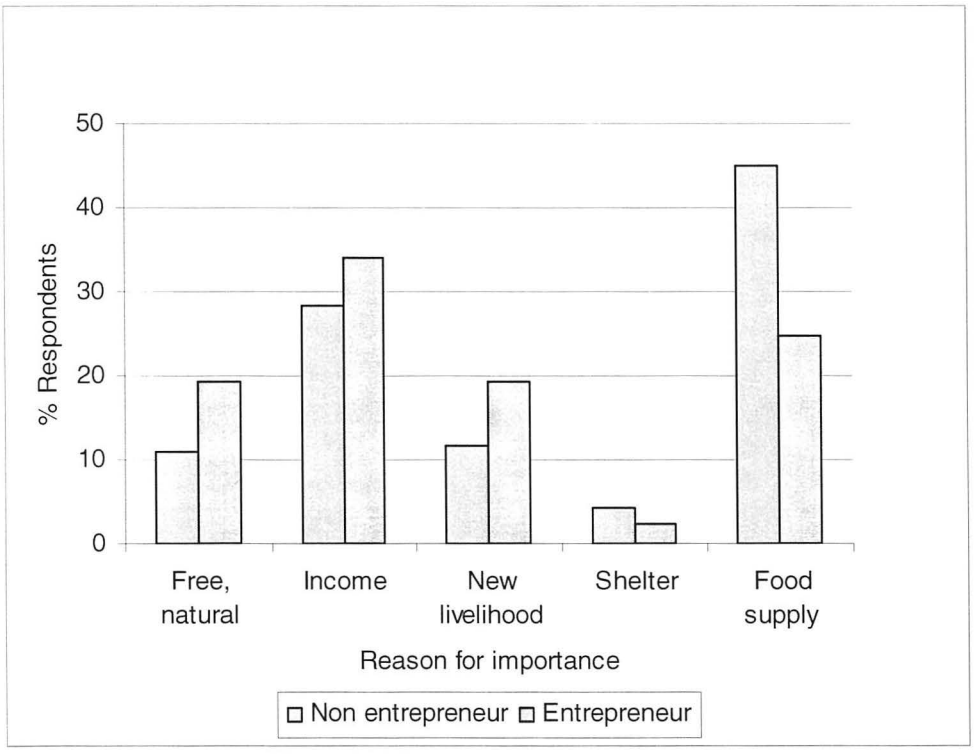


Figure 4.3: Importance of NTFPs to households involved in NTFP selling (entrepreneurs) and those not involved (non entrepreneurs)

4.3.2.4 Incomes from NTFPS

Many people in the study areas were involved in the harvesting and selling of NTFPs, confirming previous observations by numerous researchers that NTFPs extraction is an important livelihood activity. In the five study areas there was generally more harvesting by nonSSE members than SSE members (the exception being for makoni tea in the high commercialisation site). Estimates suggest that in 2003 and 2004 a total of 126, 829 and 95,900 tonnes of fruit and 12,696 and 6,245 tonnes of makoni tea leaves were harvested respectively.

The magnitude and significance of the returns from such activities were difficult to elucidate. However the results suggest that annual cash incomes generated from NTFPs averaged USD37.63[1] and USD23.63[2] per household in 2003 and 2004 respectively. Most of this income accrued to entrepreneurs in the high commercialisation site while the least was received by the medium level sites (Figure 4.4). The decrease in annual household from 2003 to 2004 could be attributed to the fall of the local currency against the more stable currencies and most likely the reduced volumes that were sold in 2004 which went down by more than 40%.

Significantly more money was made from the sale of makoni tea by primary producers than the fruit products (Table 4.10) in both 2003 and 2004. It is interesting to note that though larger volumes of baobab products were sold, income generated was not very different from that made from marula products. This difference may be attributed to the level of commercialisation since baobab was traded only in the low commercialisation sites and the marula in the medium commercialisation sites where entrepreneurs were working as SSEs. Generally

[1] 1USD= ZWD2,400
[2] 1USD=ZWD5,000

income generated in 2004 were significantly different across the levels of commercialisation (Kruskal Wallis Test, X^2= 6.062, df=2, p=0.048). Table 4.11 presents income generated by secondary processors and they are greater than that generated by primary processors (survey respondents) as they have access to bigger and international markets.

The figures obtained from selling NTFPs may not appear to justify the scale and magnitude of the activities. People indicated that it is not the figure that is important but the timing and 'consistency' of the flow, even though they are not necessarily among the top three income sources for any household.

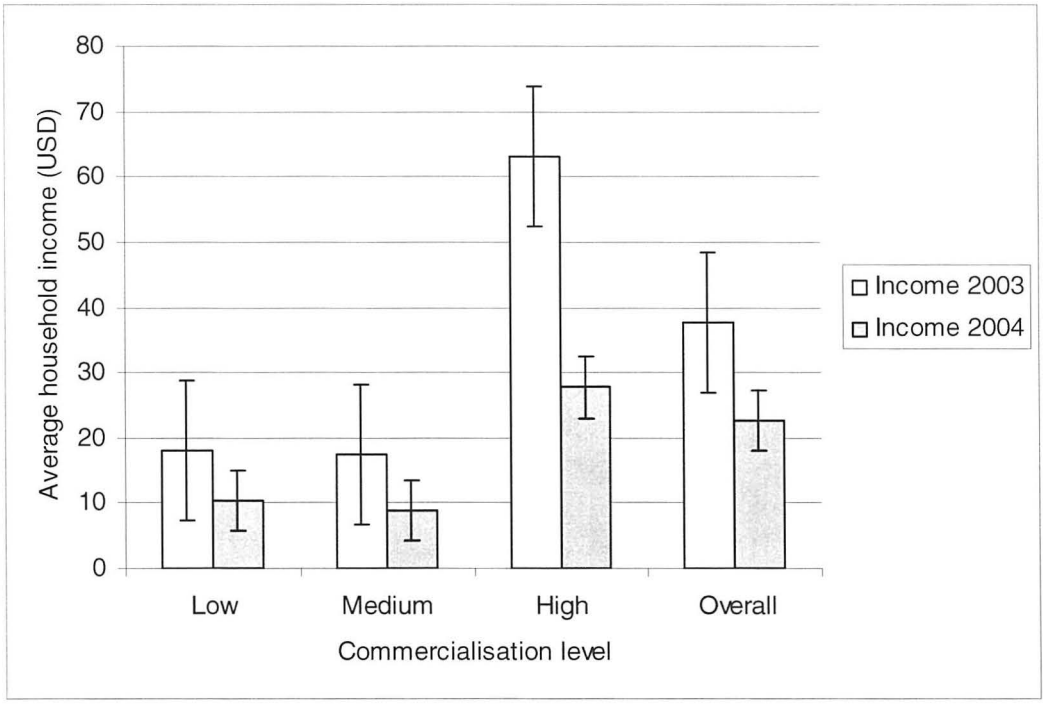


Figure 4.4: Average household income generated from selling NTFPs

Table 4.10: Cash income per household generated from NTFPs in 2003 and 2004

Species	Baobab		Makoni tea		Marula	
	Amount sold (kg)	Income (USD)	Amount sold (kg)	Income (USD)	Amount sold (kg)	Income (USD)
			Year 2003			
Average	151.85	10.14	198.63	31.15	27.67	15.46
Std. Error	117.18	2.38	49.85	14.05	15.53	6.12
			Year 2004			
Average	539.13	11.74	86.23	24.09	10	3.25
Std. Error	283.78	3.86	21.26	9.66		1.75

Table 4.11: Cash income generation by SSEs in 2004

Products	Baobab oil* (C&K Investments)		Marula oil (Wadzanai)		Makoni tea (ITPA)	
	Amount sold (kg)	Income 04 (USD)	Amount sold (kg)	Income 04 (USD)	Amount sold (kg)	Income 04 (USD)
Income	185	2,220	20	40	3,200	1,040
Number of people in SSE	2		7		142	

*Not part of the commercialisation assessment as it is run by secondary processor

4.3.2.5 Household deficits

The critical times for Zimbabwean households in terms of financial deficits are the months of October to April. This period coincides with the beginning of the agricultural season when demands for farming inputs, draft power and labour are high. In addition most households would be reaching the last of their food reserves at this time. Mid way to the end this period coincides with i) demands for school fees at the start of a new year, ii) even more labour for the agricultural activities and iii) exhausted food reserves when the new crop would be reaching maturity. The bulk of the NTFP production and marketing activities are concentrated in the 'off-season', March to September for makoni tea, June to September for marula kernel/oil and May to September for baobab fruit/oil. This means that the NTFP activities do not in any way compromise the productivity of other activities and are in essence supposed to enhance them (see section 4.3.1.2).

Prevalence of deficits was different between entrepreneurs and non entrepreneurs and had strong associations with the level of commercialisation. Only income deficits had some linkages with entrepreneurship (Spearman's rank Correlation, $r = -0.24$; $p<0.001$). The association between commercialisation level and monthly deficits were significant for food ($r= -0.30$, $p<0.001$), draft power (Spearman's rank Correlation, $r=0.77$, $p<0.005$) and income (Spearman's rank Correlation, $r= -0.23$, $p<0.001$). Labour deficits were associated with neither commercialisation level nor entrepreneurship. Unlike food where there was some respite months, income deficits were experienced through out the year. Only members of SSEs in the low and medium commercialisation sites reported no months of deficit. The proportion of people reporting income deficits was

significantly different between i) NTFP entrepreneur and non entrepreneur, ii) SSEs (8 months) and across levels of commercialisation (Table 4.12).

Table 4.12: Significance testing for income (all sources) deficits

Month	**NTFP selling?**		**SSE membership**		**Commercialisation**	
	Mann-Whitney U		Mann-Whitney U		Kruskal Wallis, df=2	
	U	P	U	P	X^2	P
January	6760.00	0.027	10225.00	0.812	0.176	0.916 [a]
February	4630.00	0.000	8865.00	0.022	37.041	0.000
March	5248.00	0.000	9039.50	0.042	27.299	0.000
April	5958.50	0.001	9502.00	0.194 [a]	13.129	0.001
May	6427.50	0.012	8790.00	0.008	17.669	0.000
June	6753.00	0.076	8717.50	0.005	17.706	0.000
July	6607.00	0.035	8513.00	0.001	11.869	0.003
August	6502.50	0.023	9058.00	0.035	6.474	0.039
September	6291.50	0.016	9448.00	0.205 [a]	9.684	0.008
October	6279.50	0.014	8699.00	0.013	11.001	0.004
November	5266.50	0.000	8980.50	0.051 [a]	16.785	0.000
December	5291.50	0.000	8793.50	0.021	26.892	0.000

[a] $p>0.05$, not significant

In the low commercialisation sites a high proportion (more than 40%) of non SSE members reported income deficits throughout the year while 20% and less of SSE members reported deficit for through out the year. At the medium level of commercialisation there were fewer people with income deficits than the low level, but more than the high level. Fewer entrepreneurs had deficits than non entrepreneurs such that they had three months recording no deficit. Similarly, fewer non NTFP entrepreneurs in SSE had deficits compared to non SSE members (Figure 4.5).

The high commercialisation site had fewer people with income deficits throughout out the year compared to the other levels. A relatively higher proportion of people in the high commercialisation site had fewer food deficit months. Entrepreneur deficits were more wide spread (households) but restricted in the number of months compared to non entrepreneurs. Non entrepreneurs had 11 months whilst entrepreneurs had 6 months where less than 20 % of the respondents reported of deficits. Non SSE members consistently reported fewer deficits than the SSE members (Figure 4.5). Generally, a higher proportion of entrepreneur SSE members had deficits than non members. For non entrepreneurs income deficits declined with increasing commercialisation whilst for entrepreneurs more people had deficits in the medium category.

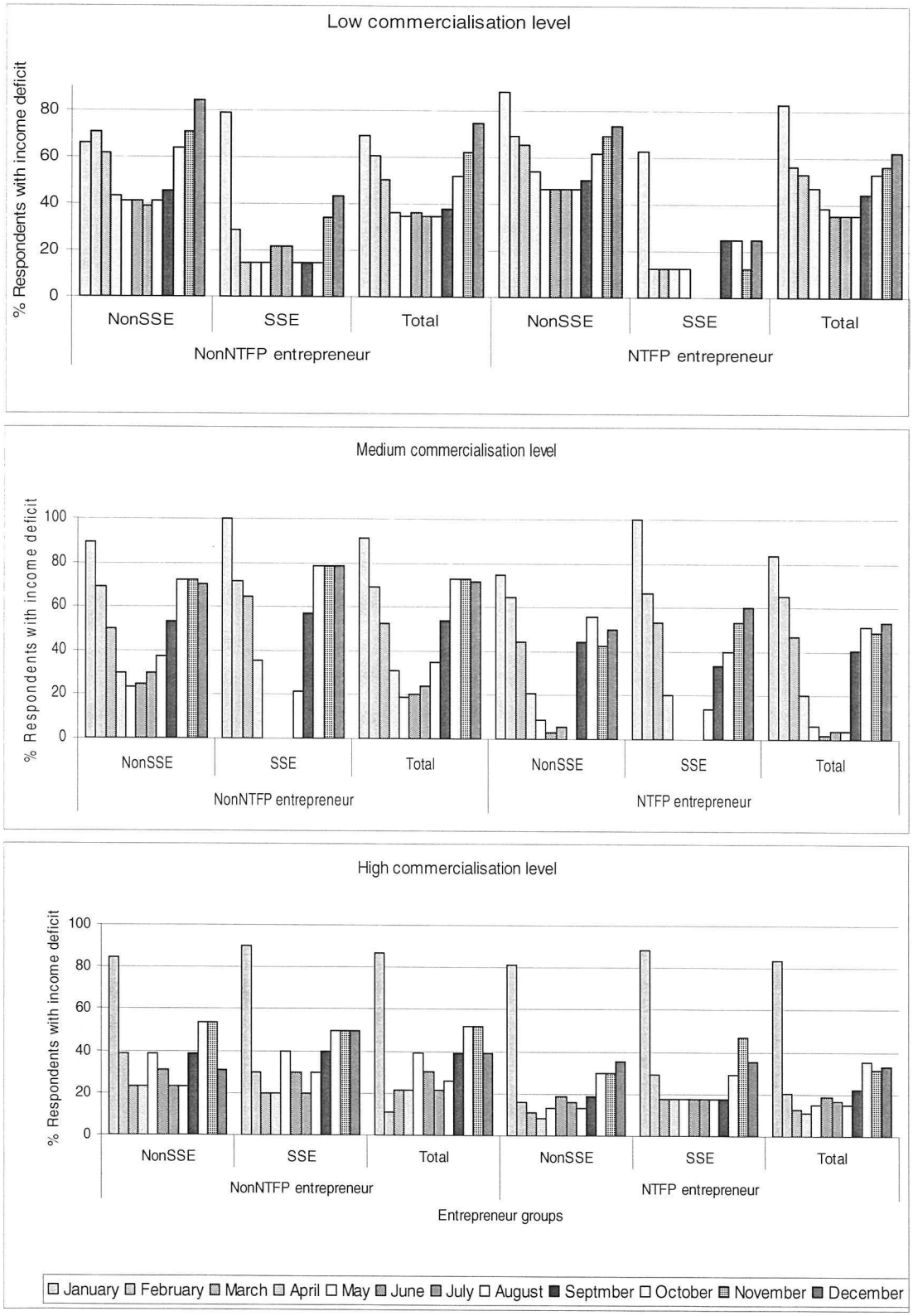


Figure 4.5: Proportion of non NTFP entrepreneurs in different levels of commercialisation that experienced income deficits

4.3.2.6 Organisation of NTFP utilisation activities

Harvesting of NTFPs was mostly for subsistence as already indicated in the earlier sections. For the purposes of this research firewood and construction poles were not included, but despite this omission a very high proportion (91%) of all the interviewed households harvested NTFPs while relatively fewer were engaged in NTFPs selling (46%). As originally envisaged the proportion of people selling NTFPs increased with levels of commercialisation (Table 4.13).

Considerably more SSE members were involved in selling of both baobab and marula fruits as well as makoni tea in the medium and high commercialisation sites than the low commercialisation sites. On the contrary there were more people involved in harvesting only in the medium and low commercialisation sites than in the high commercialisation site. It was only in the high commercialisation site where there were entrepreneurs who were involved in trade (1.3%), i.e. just buying and selling, which indicates a higher level of development of commercial activities.

Successful commercialisation of NTFPs has been said to be characterised by value addition at local level and increased bargaining power (Shackleton, 2001; Clay, 1992; Edwards, 1996; FAO, 1995). This implies some kind of organisation in marketing (Clay, 1992). The results obtained here revealed that most entrepreneurs were not involved in opportunistic collection, which suggests that NTFP collection really is a livelihood activity and not just left to chance (Figure 4.6). Most entrepreneurs were involved in individual collection, processing and marketing and very few in group processing and marketing for both SSE and non SSE members. This suggests that formalised commercialisation is reaching very few people.

As commercialisation develops and becomes more formalised and even complex, the progression from opportunistic collection to group marketing could be represented by a non linear trend (Figure 4.6). There should be very few individuals undertaking opportunistic collection, and relatively more people doing individual planned collection and processing. This would ensure value addition at household level and increase incomes. The proportion of households or individuals engaging in group collection should be lower as this has more social costs and distributes the benefits far too thinly to benefit a household, let alone an individual. However, group processing should have more people if there has to be some investment in big machinery and complex processes to be used. Group marketing should benefit as many people as possible to increase bargaining power, ensure big orders, access to big markets and removal of the middle men. In this research the area that has the closest fit to this model was the site with the highest commercial activities (which conforms to the commercialisation classification).

Some writers have suggested that people involved in NTFP industry are incurring very high opportunity costs, thereby making the industry unattractive or not viable (Neumann and Hirch, 2000). The results obtained here suggest that the contrary, most entrepreneurs say there are few costs associated with harvesting and processing of NTFPs since these are done during agricultural off season, after working hours and in most cases when there is nothing else to do. However a few did indicate that this took some of their time for other activities and required some labour and transport (Table 4.14).

Table 4.13: Household participation (%) in harvesting and selling of NTFPs

	Level of commercialisation			
NTFP related activities	**Low**	**Medium**	**High**	**Overall**
Harvesting	86.92	97.74	85.89	91.08
No harvesting	5.43	1.57	3.90	3.38
Harvesting only	57.61	59.84	25.97	50.34
Harvesting and selling	37.0	38.58	63.64	44.59
Selling only	0	0	1.30	1.69
SSE members selling	8.7	11.81	22.08	13.51
Non SSE member, selling	28.26	26.77	48.05	32.77
Selling	36.96	38.58	70.13	46.28
N	92	127	77	296

Table 4.14: Major costs incurred during harvesting, processing and sale of NTFPs

Major cost in NTFP activities	Competition with animals	Input costs, tools	Loss of harvest	Time for other activities	Competition with people	Labour	Transport	None
% Respondents (n=205)	16.60	3.83	5.53	15.32	3.40	1.70	8.09	45.11

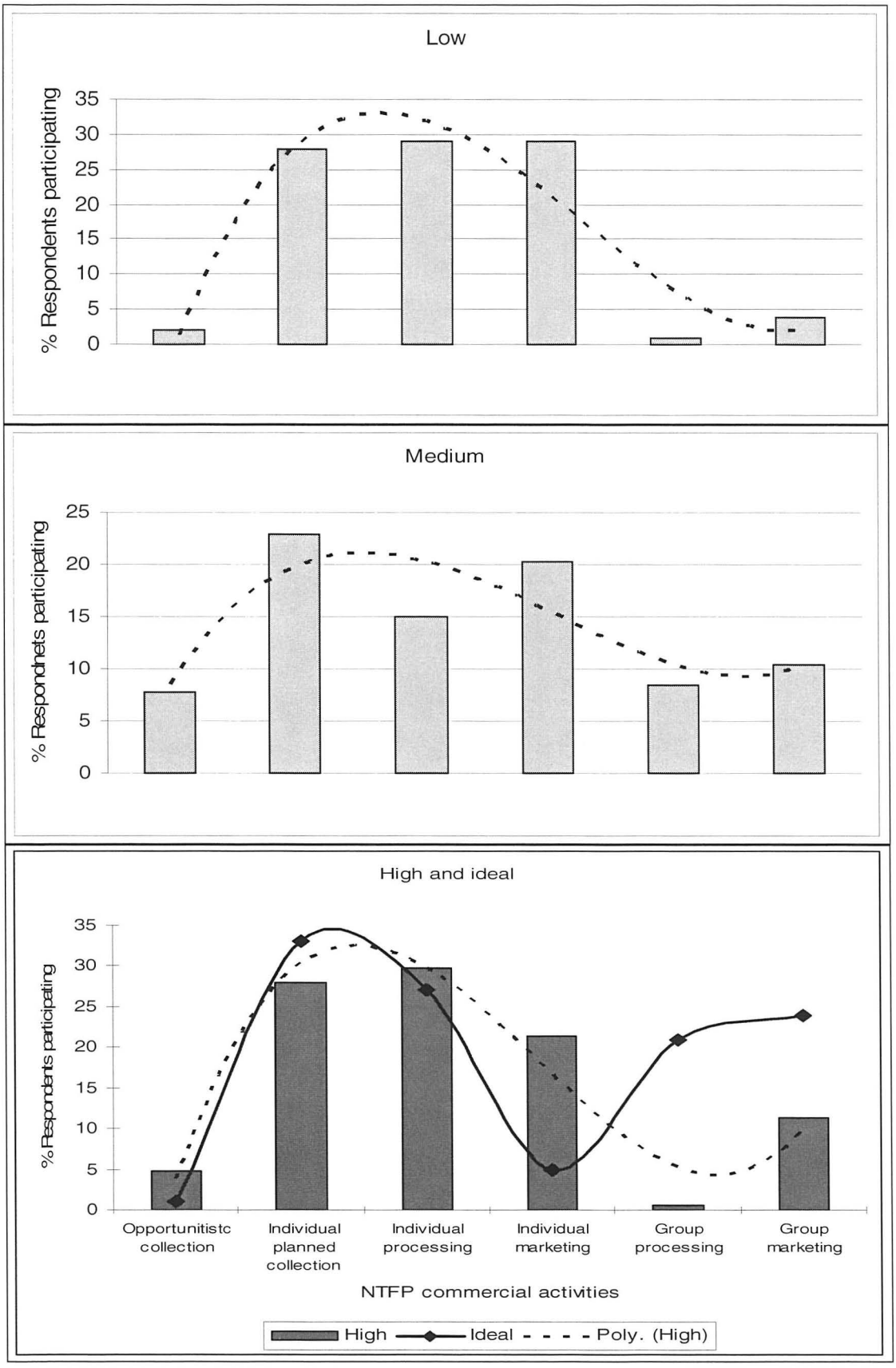


Figure 4.6: Organisation of NTFP activities in the five study sites grouped by level of commercialisation

4.4 DISCUSSION

In summary the findings of this research are that, firstly a very high proportion of rural households (almost all in some areas) harvested NTFPs and secondly half of the household participated in trade. However, only a small proportion (one in 30) of the households relied on commercialisation of high value NTFP (fruit and tea) as their largest and most reliable income source.

A lot of potential for income generation occurs through the sale and marketing of NTFPs, but the magnitude and depth of actual returns were not great enough to culminate in financial security. This is the same conclusion reached by many researchers within the last decade, i.e. that NTFP commercialisation has not changed people's well being (Arnold, 1994; Campbell and Byron, 1996; Neumann and Hirch, 2000). However, cognisance should be made that in the Zimbabwean context, it is difficult if not premature to even talk about impacts as NTFPs have not really been effectively commercialised as suggested by this study.

This study has shown that commercialisation of NTFPs had differential outcomes depending on the level of organisation and complexity of operations. The little income that was generated increased with level of commercialisation from individual gatherers and traders to the formal legal ventures like the Indigenous Tea Producers Association (ITPA). At low levels of commercialisation costs outweigh benefits as larger volumes have to be sold to equal income made by value adding SSEs.

This is an indication that with the appropriate, timely and adequate investment this livelihood has great potential. However, investment in market and technology development without entrepreneurship does not produce any impressive outcomes either. For instance, Wadzanai and Kubatana SSEs failed to generate better incomes and increased participation in NTFP trade. These two SSEs operating from Muzarabani and Rushinga, both of which were in the medium commercialisation sites, were both equipped with marula oil expressing machines yet they repeatedly failed to fulfil orders due to lack of capacity and commitment (Chapter 3). Therefore, a lack of positive outcomes from NTFP commercialisation could partly be attributed to the quality of the entrepreneur. On the other hand one would expect that the process would have an in built mechanism of improving this quality.

To complicate the situation even further commercialisation of NTFPs like any other non farm activity had to compete with other activities for labour (Hedgel et. al., 1996; Neumann and Hirch, 2000, Campbell, et. al., 2002; Shanley, Luz and Swingland, 2002). This was not just labour competition but sharing of residual labour from crop production with vegetable production, casual work etc which rank higher in the household livelihood strategies portfolio. It stands to reason then to suggest that prioritisation of major income sources influences, and is influenced by, labour allocation to livelihood activities. For instance even at the peak of the NTFPs harvesting and processing period (May to August) only half of the people involved in NTFP trade allocated labour to NTFP activities. So actually this livelihood has not been given a chance to fail let alone succeed.

The suggestion here is that the missing link in the development of NTFP commercialisation could be entrepreneurial and business management skills. The formation of SSEs to facilitate access to appropriate technology and

markets information, skills development and technical support services has reached very few NTFP entrepreneurs. In addition none of the enterprises assessed as part of this study had an incubation period of more than three years, and most of the time they were not operational (Chapter 2).

4.5 CONCLUSION

The supposedly lucrative NTFP industry with high potential of sustaining livelihoods of millions living in the agriculturally marginal areas of the savanna has remained very elusive to the rural farmers. Its time new approaches are adopted. Commercialisation of NTFPs has moved from developing markets for local products to developing products for existing markets as well as from low potential (crafts) to high potential (fruit and leaf products), but still entrepreneur incomes have not increased.

The whole production-market chain is dysfunctional. If NTFPs production and collection are seasonal, it does not mean that processing and marketing should be seasonal as well. Given the current level of investment commercialisation has had great achievements. If farmers were to invest more time, labour, innovation (skills and technology) better outcomes could be realised.

Without building the capacity of the entrepreneur, commercialisation of NTFPs will remain a fallacy. Many researchers and development agencies have consistently accepted that there were too many unknowns in the NTFPs industry, so if any break through is to be made along the subsistence-market, and community project-business continua somebody has to invest in the nurturing of the NTFPs based small scale enterprises.

CHAPTER 5

SOCIAL CAPITAL: A PREREQUISITE OR AN OUTCOME OF NTFP COMMERCIALISATION?

ABSTRACT

Rural development is increasingly being linked with livelihood diversification enabled through the development of small scale enterprises (SSEs). Promotion of SSEs is said to facilitate the development of social capital, which itself has an important influence on the success of such enterprises. The aim of this work was to evaluate whether commercialisation of non-timber forest products (NTFPs) has resulted in increased social capital for NTFP entrepreneurs (those who engage in the sale, marketing and trading of NTFPs). Levels of social capital were evaluated through the use of four indicators: i) level of networking measured by group membership ii) cost and benefits of group membership, iii) quality of participation and iv) investment in the accumulation of physical capital. Data were collected through a household survey conducted in five sites in Zimbabwe where respondents comprised both members and non-members of small scale enterprises. Each site had previously been categorised as one of three levels of commercialisation (low, medium, high) based on research conducted prior to this work (see Chapter 3). Results suggest that an NTFP entrepreneur in an SSE had more social capital and better returns from related economic activities than non SSE members and non NTFP entrepreneurs. It is concluded that social capital is both a prerequisite and an outcome of NTFP commercialisation and it is recommended that rural development facilitators should pay special attention to its development, as ultimately it could determine the sustainability of small scale enterprise development initiatives.

5.1 INTRODUCTION

Rural development interventions are increasingly emphasising community participation through the formation of group and small-scale enterprises (SSE) in pursuit of livelihood diversification and income generation (Narayan and Pritchett, 1999; Agarwal, 2001; Anderson, Locker and Nugent, 2002; Winters, Davis and Corral, 2002). In this context the SSEs are generally considered to have multiple benefits, such as being a source of social capital, a medium for transferring information, knowledge and skills, a means of improving farmers' income security and reducing pressure on agriculture (FAO, 1987). While most of these benefits are felt collectively, individuals also benefit (Bebbington, 1999, Pretty et al. 2001). However, benefits are not always uniformly distributed between households, and some individuals may benefit to a greater or lesser extent than others.

Social capital is a social resource upon which people draw during pursuit of their livelihood objectives. The most common aspects of social capital are the quantity and quality of associational life, social norms, networks and organisations, connectedness, relationship of trust, reciprocity and exchanges (Pretty and Ward, 2001; Anderson, Locker and Nugent, 2002; Winters, Davis and Corral, 2002). These are known to facilitate cooperation and provide mechanisms through which agents (individuals and otherwise) gain access to resources (George, 1997; DFID, 1999; Fedderke, De Kadt and Luiz, 1999; Narayan and Pritchett, 1999). Major functional roles of these components are the reduction of transaction costs and the provision of informal safety nets within communities (George, 1997; DFID, 1999; Narayan and Pritchett, 1999). The social associations also facilitate coordinated action for the members of the society, greater risk sharing and cooperative ventures than would have

otherwise been feasible (Coleman, 1988; Pretty and Ward, 2001; Fedderke, De Kadt and Luiz, 1999; Narayan and Pritchett, 1999). So at a general level social capital can function as a 'social safety net' that mitigates against adverse outcomes. Consequently, as social capital increases, households may be enabled to undertake more risky activities, and thereby seek higher financial returns or other livelihood benefits (Narayan and Pritchett, 1999).

Several studies have attempted to measure social capital, and these have tended to use levels of trust and reciprocity in a community as indicators of social capital (Coleman, 1988; Putnam, 1995; Knack and Keefer, 1997; Narayan and Pritchett, 1999; Martin, Rogers, Cook, Hugh and Joseph, 2004). However, relatively few studies have attempted to relate levels of social capital to levels of economic activity and/or household income. One early study which attempted to do this was conducted by Narayan and Pritchett (1999) who examined the effect of the density of associational life on village outcomes, with a special emphasis on the effect on the individual. In this work households were asked about membership, characteristics of group participation and their expressed level of trust. Results of the study showed that there were many spill over effects, and households with higher income did not have significantly different levels of social capital than others (Narayan and Pritchett, 1999).

In a slightly more recent study Winters et. al. (2002) attempted to assess the relationship between social capital and income generation. They used household participation in various activities and membership to committees and groups as key indicators of social capital. The conclusion from this study was that, although social relations facilitate generation of income, participation in economic activities was largely influenced by the household's assets position (e.g. land sizes). For instance among the Mexican households in the ejido

sector, increases in assets were matched with relative increases in participation and incomes generated (Winters, et. al., 2002).

More recently, a study was conducted to assess the relationship between social capital and food security (Martin et al., 2004) and this suggested that households with more social capital were also more food secure. However, like many similar studies the authors had a problem of identifying causality, and consequently in their conclusion, they could not separate the dependent and driving (or causal) variables relating increased social capital to being food secure (Manski, 2000; Durlauf, 2002; Manski; 2003). So, while it has been shown that high economic activity could result in greater social capital (Narayan and Pritchett, 1999), very few studies have been conducted to investigate whether increased economic activities lead to greater levels of social capital.

The work reported here is one part of a larger study which is concerned with evaluating the outcomes and impacts of NTFP commercialisation on ecosystem health and human well being in Zimbabwe. Specifically, the research reported in this chapter aims to evaluate variations in social capital among communities demonstrating varying levels of complexity, organisation and profitability from NTFP commercialisation. The assumption in this study is that households that are members of SSEs and engage in the sale of NTFPs under more advanced commercial ventures have more social capital than those which either do not belong to such SSEs or live and work in areas where NTFP commercialisation is less well developed. Thus, the aim of this work was to evaluate whether commercialisation of NTFPs has resulted in increased social capital for NTFP entrepreneurs (those who engage in the sale, marketing and trade of NTFPs). In addition to measuring social capital, the study also evaluated the extent to which social capital development contributed to the accumulation of physical

capital. Physical capital is man-made capital and includes, basic infrastructure (roads, communication, shelter, clinics, and schools) and producer goods (tools, equipment) needed to support livelihoods (George, 1997; DFID, 1999). Thus, the prediction based on the hypothesis was that NTFP entrepreneurs who were SSE members (presumably with more social capital) had invested in better housing than non-NTFP entrepreneurs and non-SSE members. As in the study by Campbell et. al. (2002) this assessment was confined to household level and the only indicator used was the quality of the shelter, as symbolised by type of 'best quality house' owned by the household.

5.2 METHODOLOGY

5.2.1 Study sites

A detailed description of the study sites and household survey is presented in Chapter 2.

5.2.2 Methods

5.2.2.1 Data collection for evaluating social capital development

Three factors, or components, of social capital were assessed in this study in order to evaluate if they changed with the level of commercialisation of NTFPs. These were:

i) level of networking measured by group membership
ii) analysis of costs and benefits of membership
iii) quality of participation in group activities.

Evaluation of the quality of participation was based on a typology of six levels advanced by previous studies namely; nominal, passive, consultative, activity specific, active and interactive (Agarwal, 2001). For the purposes of this work, one alteration was made to this framework, and this involved the omission of nominal participation from the scale as it was felt to be equivalent to group membership incorporated in the level of networking (Table 2).

Social capital was measured at household and community levels rather than individual level as suggested in previous studies (Narayan and Pritchett, 1999). Two indicators of physical capital were used and these were housing and sanitary facilities. Housing was symbolised by 'type of best house'. As Zimbabwean rural households always have more than one shelter in each homestead only the best was assessed. In order to assess the type of best house a continuum was developed where the worst was a hut, one-roomed pole and dagga under thatch and the best was a house with more than two rooms and brick walls under asbestos.

Table 5.1: Classification of quality of participation

Levels of participation	Description
1. Nominal	Mere membership in group
2. Passive	Informed of decisions, listening without speaking
3. Consultative	Asked on options in specific matters without guarantee of influencing decisions
4. Activity specific	Asked to volunteer to undertake tasks
5. Active	Expressing opinions whether or not solicited or taking initiatives of other sorts
6. Interactive (empowering)	Having a voice and influence in the group's decisions

Source; Agarwal, 2001

5.2.2.2 Data collection and analysis

Data for assessing and evaluating the contributions of NTFP commercialisation to social capital development were collected through a household questionnaire survey. This process has been fully described in chapter 2. The data were entered into a data file in SPSS11.5 (Pallant, 2004). Analysis relevant to this chapter focused on assessing changes in the levels of group membership, membership cost and benefits and the quality of participation. Comparisons and statistical tests were made to examine the relationship of variables along the commercialisation continuum (low, medium, high) and between non-members and SSE members as well as between NTFPs entrepreneurs (those selling NTFPs) and non entrepreneurs (those not selling NTFPS).

5.3 RESULTS

5.3.1 Group membership

The proportion of people who were members of various small scale enterprises averaged 26% across all levels of commercialisation, and was 24%, 23% and 35% in the low, medium and high commercialisation sites respectively. The proportion of NTFP entrepreneurs who subscribed to SSEs increased as commercialisation increased, being 24% in sites with low levels of commercialisation sites and 30% in those with medium levels. However, the difference between sites of medium and high levels of commercialisation was not so great, with the proportion of members in the high commercialisation sites being only 31%.

About a third (29%) of the NTFP entrepreneurs across all three levels of commercialisation was members of SSEs (Table 5.2). However, the relevance of this figure is unclear as group discussions with some of the local people revealed that formation of most SSEs had not arisen from spontaneous or internal purposeful collective action from within the community, but rather it had been driven by outside development agencies. This suggests that without outside pressure from NGOs (and others), and the resources they provide (e.g. inputs, loans), people in rural communities may not readily form SSEs, but may rather work independently regardless of the level of commercialisation of in their areas (Table 5.2).

The trends in membership were broadened to include non-income generating groups. At this scale, groups were classified as either agricultural (agricultural commodity and / or input associations), social (based on ethnicity, civic groups,

income generation from non-agricultural and natural resources products) or natural resource management groups (for natural resource conservation or commercialisation of NTFPs). Religious groups tended to have the highest following in all case study areas, but membership of these groups was not formally examined in this study.

A relatively higher proportion of respondents indicated that they belonged to natural resource management (NRM) based groups than agricultural or social clubs (Figure 5.1). Within each of these three classifications the actual number of groups existing across sites was inversely related to their membership (Figure 5.2). So while there were relatively fewer NRM groups, their total membership was large, conversely there were a large number of social groups, but the total membership was lower than for NRM or agricultural groups. There were no obvious trends in numbers of these groups across the commercialisation continuum. However, the proportion of NTFP entrepreneurs who subscribed to various groups was significantly higher than that of non-entrepreneurs (Mann-Whitney U test, U=461, p= 0.006). Membership of different types of groups (agricultural, social, natural resource management) varied across the commercialisation continuum (Kruskal Wallis Test, X^2= 7.798, df=2, p=0.02).

Table 5.2: SSE membership profile in relation to engagement in the sale of NTFPs for households across the study sites, expressed as percentages of the respondents in each group

Membership descriptor	Level of commercialisation			Overall average
	Low	Medium	High	
SSE member	23.92	22.84	35.07	26.35
NTFP selling	36.96	38.58	70.13	46.28
Non SSE member, not selling NTFPs	47.83	50.40	16.89	40.88
Non SSE member, selling NTFPs	28.26	26.77	48.05	32.77
SSE member, not selling NTFPs	15.22	11.03	12.99	12.84
SSE member, selling NTFPs	8.70	11.81	22.08	13.51
Proportion of NTFP entrepreneurs in SSEs	23.53	30.61	31.48	29.20
N	92	127	77	296

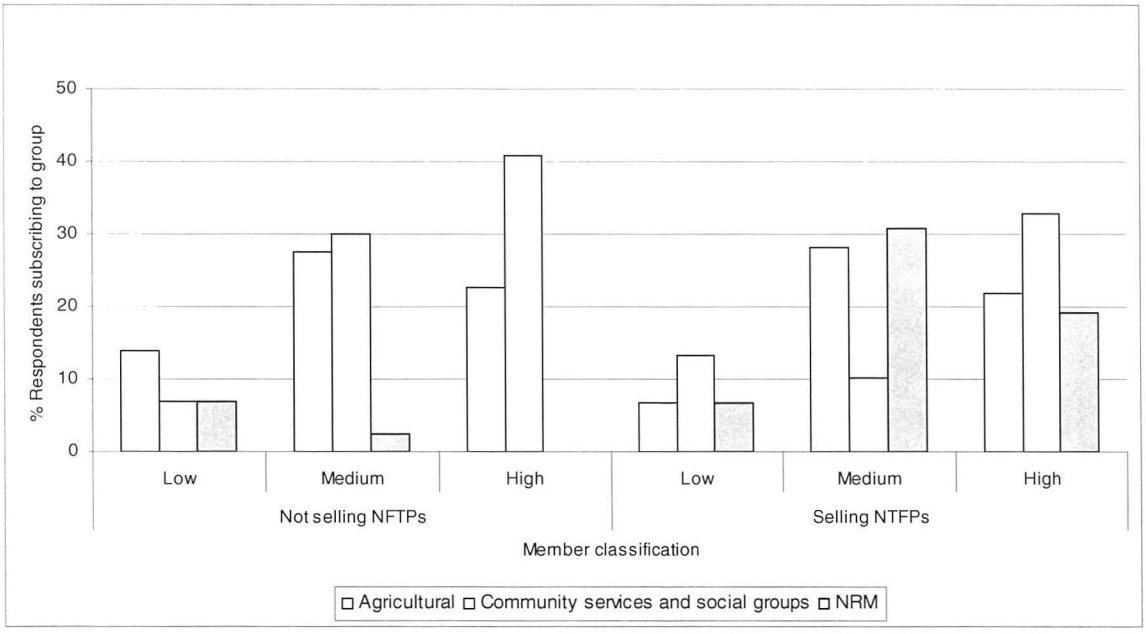


Figure 5.1: Percentage of households, split by engagement in selling non-timber forest products, who were members of non-income generating groups active in their communities.

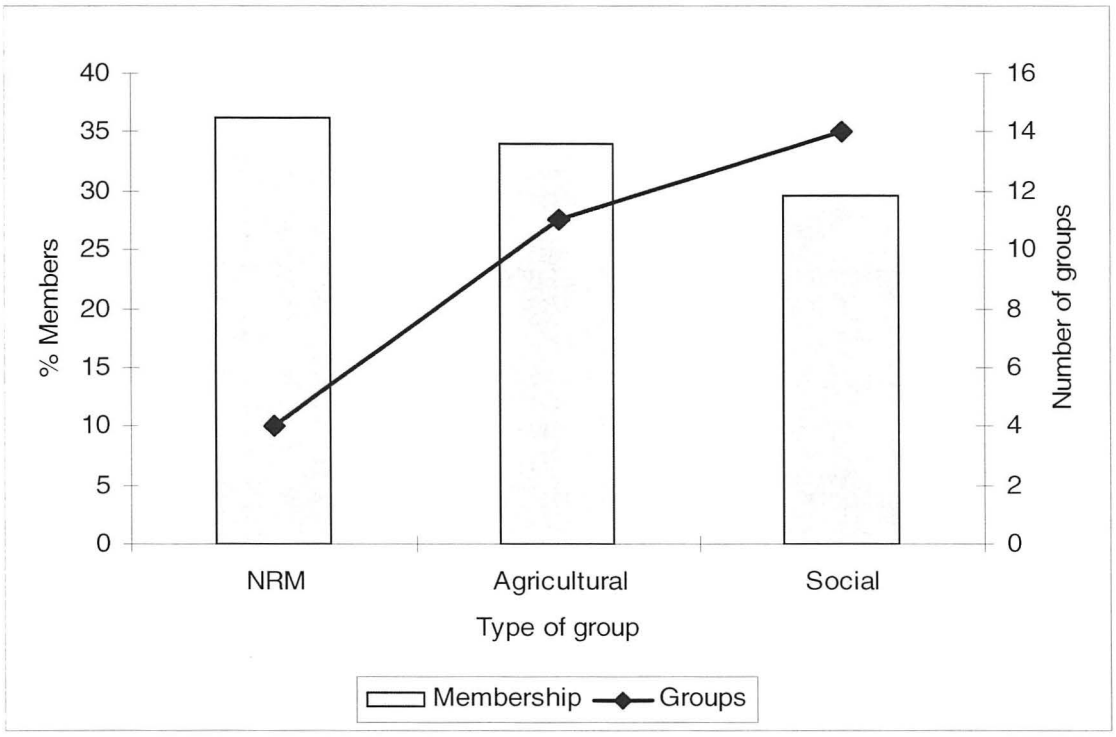


Figure 5.2: Percentage of respondent households subscribing to the three categories of groups in relation to the number of groups in each category

5.3.2 Participation

Although many people belong to a range of groups, generally the benefits accruing to individuals from such membership are to a large extent determined by the quality of their own participation. Being simply a member of a group will not necessarily guarantee full benefits or enough knowledge, skills and power for that individual to significantly affect their own livelihood. Rather, individuals probably need to participate at the highest possible level in a well functioning group if they are to gain meaningful outcomes from associational activities.

In this study, a minority of respondents were engaged in the highest levels of participation within their groups (as defined in Table 5.1) (Figure 5.3). However,

when the quality of participation was assessed against SSE membership an interesting pattern was revealed. There were higher proportions of non SSE members engaged in lower categories of quality of participation than the SSE members. At the higher categories of participation the proportion of SSE members was higher. As the quality of participation was an indicator of social capital this result suggests then that a person in a SSE is likely to have more social capital than a non SSE member (Figure 5.4).

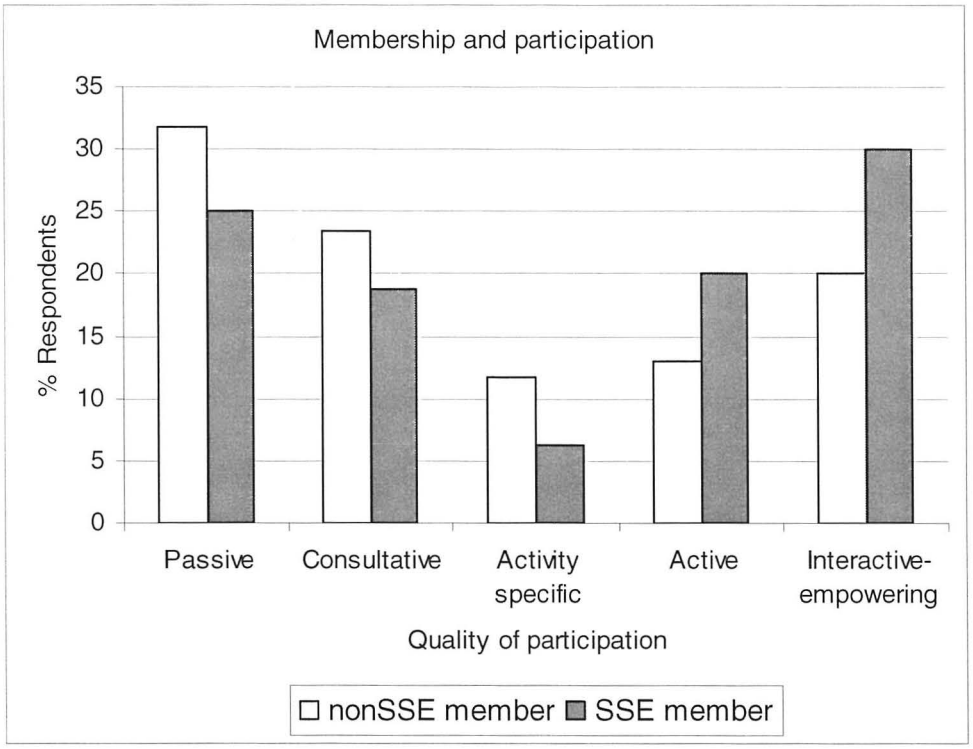


Figure 5.3: Proportion of respondents who were SSE members (n=84) and non-SSE members (n=143) reporting different levels of participation in the groups to which they belonged. Quality of participation is defined in Table 5.1

The quality of participation was negatively associated with levels of commercialisation (Spearman's Rank Correlation Coefficient, r= -0.19, p=0.011). The low commercialisation site was unusual as there was a gradual increase in the proportion of respondents reporting higher quality of participation (Figure 5.4). This seems anomalous, because even in a democratic society the number of decision makers is finite and has to be less than that of non-decision makers; hence the observations obtained for the low commercialisation site may be related to a relatively poor response rate to this question at these sites.

There was a strong positive association between quality of participation and engagement in the sale of NTFPs with the lower quality participation categories being dominated by non-NTFP entrepreneurs (Spearman's Rank Correlation Coefficient, r=0.20, p=0.009). However, NTFP entrepreneurs reported lower quality participation at the medium and high commercialisation sites when compared to the low commercialisation site (Table 5.3). For non-entrepreneurs, in the medium and high commercialisation sites the quality of participation was very low, as indicated by the higher proportions of respondents in the first three lower quality categories than the last two higher quality categories. Taken as a whole the results of this analysis suggest that people with the highest quality of participation were involved in the sale of NTFPs, members of SSEs and mostly from the high commercialisation site.

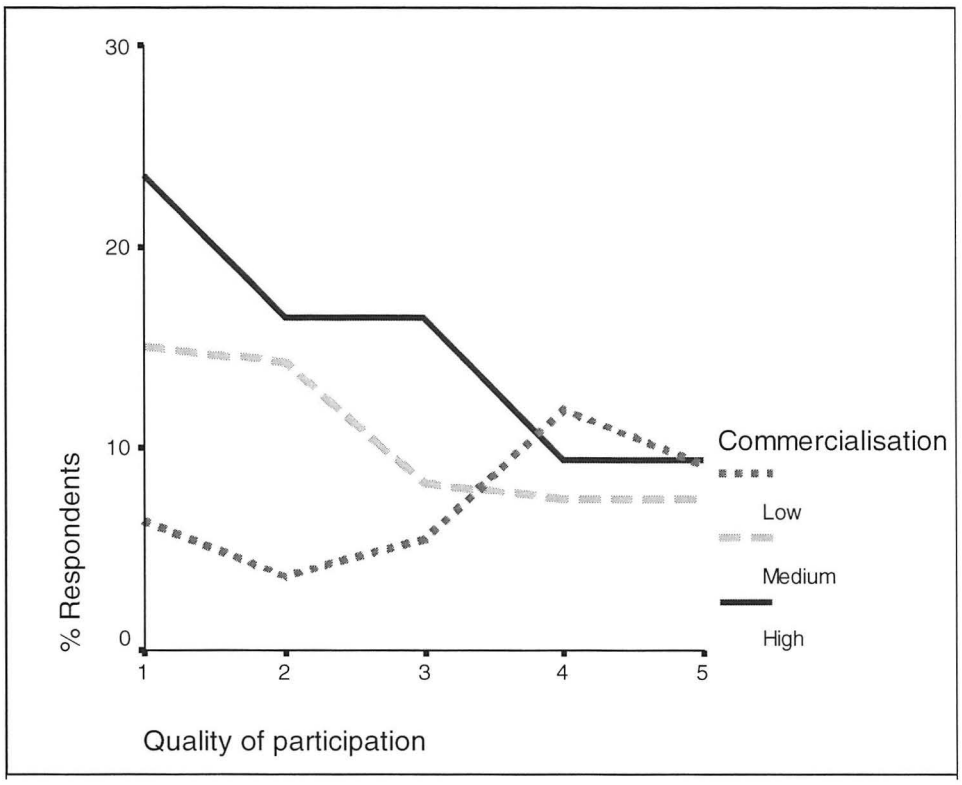


Figure 5.4: Quality of participation in the three commercialisation site expressed as percentage respondents where n is 92, 127, 77 for low, medium and high respectively

Table 5.3: Quality of participation for non NTFP entrepreneurs and NTFP entrepreneurs expressed as a percentage of respondents

Level of participation	Non NTFP entrepreneur (not selling NTFP)	NTFP entrepreneur (selling NTFPs)	Total
Passive	25.7	22.8	24.7
Consultative	20.2	26.3	22.3
Activity specific	17.4	21.1	18.7
Active	20.2	15.8	18.7
Interactive-empowering	16.5	14.0	15.7
N	109	57	166

5.3.3 Benefits of group membership

People may invest time and resources in maintaining membership to various groups with the hope of receiving benefits which enhance livelihoods in some way. Interestingly, the results of this work indicate that though many people subscribed to various groups that operate in their communities, not everyone benefited, valued and/or perceived the benefit in the same way. For example, 42% of respondents indicated that they did not get any benefits from these associations. However, the remaining 58% did report some benefit ranging from cash income, to knowledge and crime reduction. More people reported that they gained information, knowledge and skills (99%) than income (75%) or farming inputs (59%) (Figure 5.5). The types of knowledge received from groups related to health, civic education and conservation, while farming inputs generally included access to seed and fertilizer. The receipt of these benefits tended to increase as the quality of participation increased (Spearman's Rank Correlation Coefficient, $r=0.44$, $p=0.013$).

In addition, the types of benefits reported by respondents were significantly different along the commercialisation continuum (Kruskal Wallis Test, $X^2 = 23.459$, $df=2$, $p<0.001$). Not surprising, SSE members selling NTFPs in the high commercialisation sites generated almost six times the income from this source than those in low commercialisation sites, and double that of those in medium sites (Figure 5.6). This suggests that more advanced levels of commercialisation tend to accentuate the benefits of SSE membership. Indeed, as seen in Figure 5.6 the income generated by non-SSE members from the sale of NTFPs did not change in spite of changes in levels of commercialisation in their community.

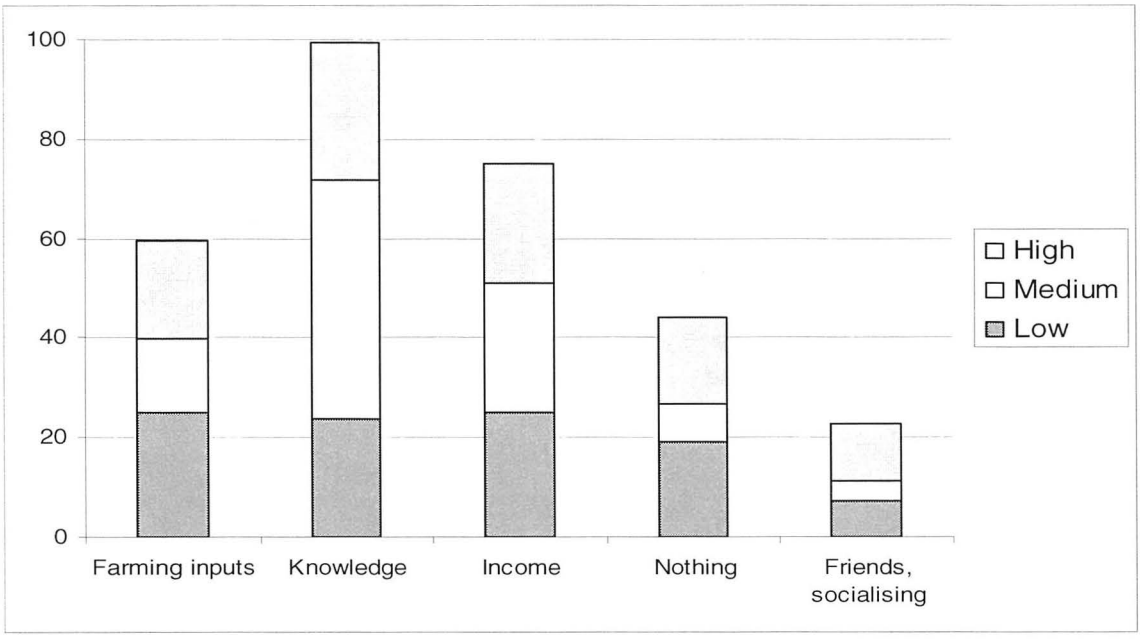


Figure 5.5: Percentage of respondents from sites of different levels of commercialisation and the different types of benefit they received from group memberships.

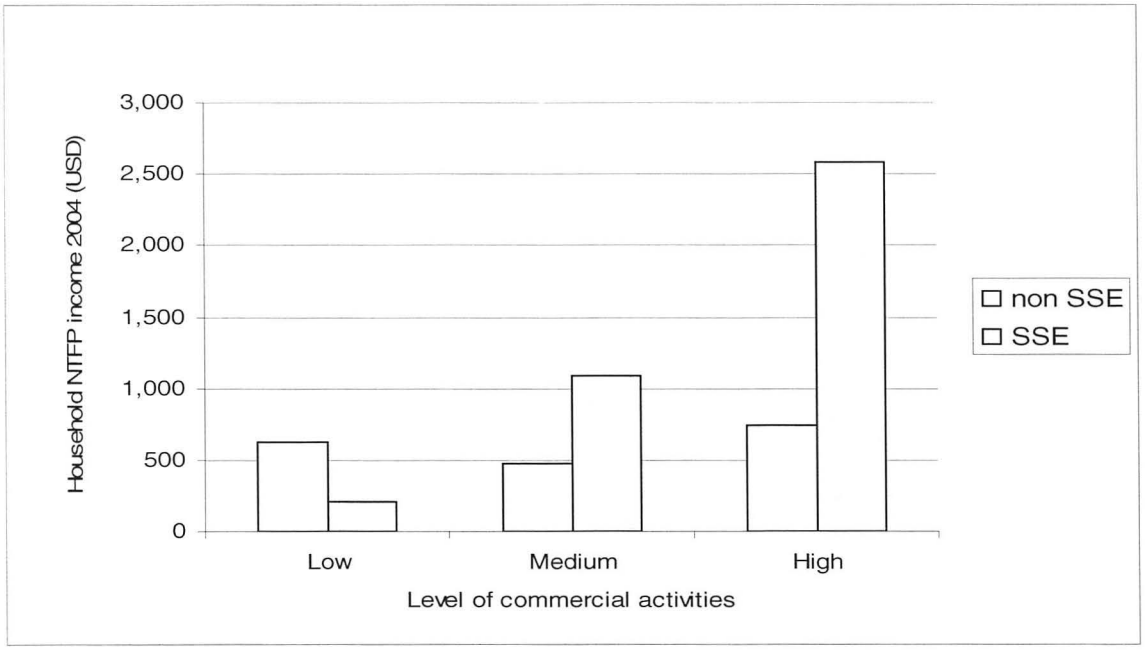


Figure 5.6: Annual household income from sales of non-timber forest products in 2004 for respondents categorised for members of small scale enterprises (SSE) and non-members of small scale enterprises (non SSE).

5.3.4 Costs of group membership

In an attempt to assess if there were any costs associated with group membership, respondents were asked to list all costs they incurred through participating in groups. In the low commercialisation site the most commonly reported costs related to opportunity costs of time and money, and similarly in the medium commercialisation site the most commonly reported costs related to the opportunity cost of time (Table 5.4). In high commercialisation sites the main cost was hatred by community members (jealousy) (Table 5.4). However it is important to note that in all three sites a large proportion of respondents did not report any costs of group membership. The proportion of respondents who reported costs varied significantly between the levels of commercialisation (membership cost: Kruskal Wallis, X^2 =18.892, df =2, p<0.001) and (non membership cost: Kruskal Wallis, X^2 =19.375, df-2, p<0.001**).**

Table 5.4: Group membership costs

Levels of commercialisation	N	Costs incurred in group participation, % respondents			
		None	Loss of time	Money and opportunities	Hatred by Community
Low	33	88.9	5.6	5.6	0.0
Medium	62	31.7	53.2	13.9	22.9
High	50	73.3	3.8	0.0	22.8
Total	145	69.9	21.8	5.9	11.4

5.3.5 Social status

5.3.5.1 Shelter and sanitation

The approach adopted here to assessing the build up of physical capital focused on the evaluation of the quality of shelter and assets in the household. The assumption is that improvements in financial and social capital bring greater changes in shelter and household assets than to equipment and public infrastructure. This is based on the assumption that shelter is very important, and most people tend to invest in improving the condition of their housing. For the purposes of this work, a progression of house quality was defined ranging over 6 'quality classes'. These ranged from a minimum quality house such as a 1-roomed, pole and dagga under a thatch roof (Figure 5.7) to the best feasible quality house which comprised of more than 2-roomed house, brick under asbestos.

Using this classification, it was clear that respondents from the high commercialisation site had the best housing, and those in the low commercialisation sites had the worst (Kruskal Wallis, X^2 =30.639, df=2, p<0.001). Although there were no significant difference in the quality of the best houses between NTFP entrepreneurs and non entrepreneurs in the medium commercialisation site, in the high commercialisation site relatively more entrepreneurs had good housing (Table 5.5). Membership to various groups also influenced the type of best house (Figure 5.8), and it appeared that members of social groups had the best housing, followed by NRM groups and agricultural group members had the worst (Kruskal Wallis, X^2= 7.108, df=2, p=0.029) houses. Respondents also suggested that participation in various networks had improved their perceptions and priorities regarding sanitation

issues. This is supported by the observation that significantly more NTFP entrepreneurs (75%) had sanitary facilities than non-entrepreneurs (70%) (Mann-Whitney U test, U=5099.5, p=0.002) (Table 5.6).

Figure 5.7: Typical pole and dagga under thatch hut found in most rural homes of the Zambezi valley. Photograph by Phosiso Sola, Rushinga 2004

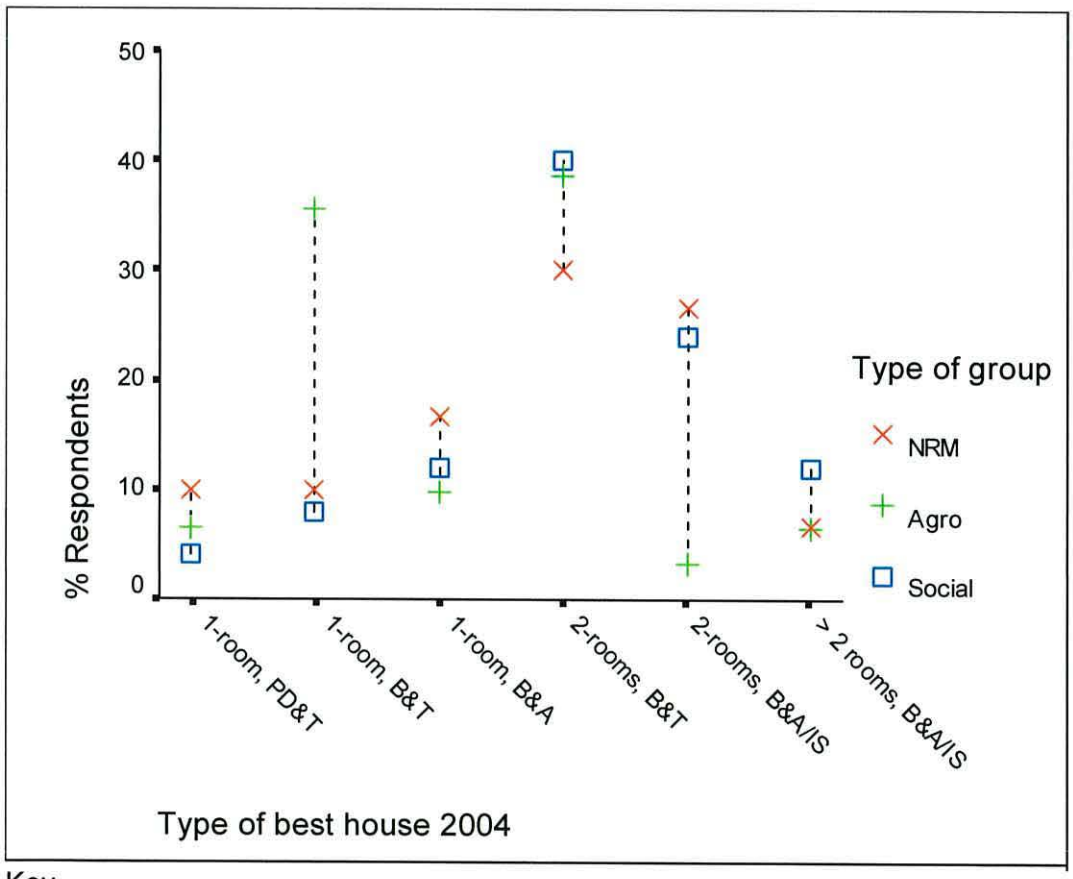
Table 5.5: Type of best houses (size and design) for SSE members and non members as well as NTFP entrepreneurs and non entrepreneurs

Level of commercialisation	SSE membership	Type of best house 2004	Proportion of respondents (%)		
			NTFP selling?		**Total**
			No	**Yes**	
Low	No	Very poor	20	24	9
		Poor	0	4	1
		Good	41	52	19
		Very good	39	20	7
		N	**44**	**25**	**69**
	Yes	Very poor	7	0	5
		Poor	0	0	0
		Good	43	38	41
		Very good	50	63	55
		N	**14**	**8**	**22**
Medium	No	Very poor	20	15	18
		Poor	36	44	39
		Good	31	35	33
		Very good	13	26	17
		N	**64**	**34**	**98**
	Yes	Very poor	0	0	0
		Poor	43	47	45
		Good	36	27	31
		Very good	21	27	24
		N	**14**	**15**	**29**
High	No	Very poor	11	8	9
		Poor	22	47	42
		Good	22	17	18
		Very good	44	28	31
		N	**9**	**36**	**45**
	Yes	Very poor	33	13	19
		Poor	0	27	19
		Good	17	27	24
		Very good	50	33	38
		N	**6**	**15**	**21**

Key
Very Poor : 1-roomed pole and dagga under thatch
Poor : 1-roomed brick under thatch or 1-roomed brick under asbestos
Good : 2-roomed brick under thatch or 2-roomed brick under asbestos
Very good : more than 2 rooms, brick under thatch or asbestos

Table 5.6: Status of sanitation in the study sites as represented by percentage of respondents with given levels of facilities. Y indicates that respondents participate in the sale of non-timber forest products; N indicates that respondents did not participate in the sale of non-timber forest products

Sanitary facilities	Level of commercialisation							
	Low		Medium		High		Total	
	Y	N	Y	N	Y	N	Y	N
No toilet	55.9	42.1	17.0	21.9	12.0	20.0	25.2	29.7
Toilet only	35.3	45.6	55.3	57.5	30.0	13.3	40.5	48.3
Toilet and bathroom	8.8	12.3	27.7	20.6	58.0	66.7	34.4	22.1
Toilets with or without bathroom	44.1	57.9	83.0	78.1	88.0	80.0	74.8	70.3



Key

PD&T	-pole and dagga under thatch	B&T	-brick under thatch
B&A	-brick under asbestos	B&A/IS	-brick under asbestos or iron sheets

Figure 5.8: Type best of house for SSE members in the three group types

5.4 DISCUSSION AND CONCLUSION

The fundamental question of whether social capital is a prerequisite or an outcome of NTFP commercialisation remains partially unanswered. From this research it is concluded that firstly, for an individual to be a successful entrepreneur they need to start with some initial level of social capital. Secondly, it is those entrepreneurs with some initial social capital that are more likely to engage in NTFP commercialisation. However, to be guaranteed of success these individuals need to develop even more social capital by engaging in more associational activities. Thirdly, to ensure sustainability social capital has to be coupled with tangible socio-economic benefits.

Only people with initial social capital will successfully engage in NTFP commercialisation since by nature most humans are risk averse. Risk aversion has been known to inhibit adoption of high return innovations which are associated with high investment and risk of failure (Johnsrud, 1991; Narayan and Pritchett, 1999). Rural NTFP entrepreneurs working alone rarely progress from gatherers to processors. They would rather invest very little and abandon the activity whenever there is the slightest hint of uncertainty. Thus, creation of horizontal associations (group formation) within the NTFP commercialisation process, especially at producer (to ensure reliable raw material supply) and primary processor levels (increased value addition at local levels) are important steps in commercialising NTFP production and marketing (Clay, 1992; Edwards, 1996). In the group approach, both the investment required and the risk of investing are shared among the members and once there are positive returns more people will get involved. However, if there are no tangible benefits such groups could disintegrate and entrepreneurs may go back to the collector-gatherer mode.

Therefore, sustainability of social capital derived from group formation may depend on the economic outcomes and benefits resulting from this. Pretty and Ward (2001) suggested that for farmers to invest in group formation approaches they must be convinced that benefits derived from groups will be greater than from individual ventures. It would seem that, although NTFP SSEs members generated more income than non members, most entrepreneurs opted not to invest in the group approach. This is not entirely surprising as there is a debate of, which comes first, social capital development or increased economic activities (Narayan and Pritchett, 1999). The question is whether people who form or join groups are already engaged in economic activities or people engage in economic activities because they already have some social capital to build on. Even this study could not answer this fundamental question.

Additionally, it is not just membership of a group that is important, but how people participate or interact that help develop successful entrepreneurs. Since at this stage, NTFPs commercialisation is about taking risks so, an entrepreneur has to understand the nature and scale of the risk being taken. It is important therefore, that the entrepreneur influences the nature and how the risk will be managed. So, successful entrepreneurs have to continue networking and participating effectively at the highest level of quality possible at all times in order to maximise benefits of networking.

There is no doubt therefore, that increased social capital leads to *increased economic activity* but in this study it is concluded that social capital is both a prerequisite and an outcome of NTFP commercialisation which leads to greater impacts on livelihoods and creation of even more social capital. Data from this research has shown that increased economic activity does contribute to the build up of social capital which in turn *increases the economic returns* from

NTFP commercialisation. Therefore, social capital development should be an integral process of NTFP commercialisation and rural development facilitators should give it special attention as ultimately it could determine sustainability of small scale enterprise development initiatives.

CHAPTER 6

ASSESSING THE STATUS OF NATURAL RESOURCES MANAGEMENT INSTITUTIONS CHARACTERISTICS, APPLICATION AND OUTCOMES

ABSTRACT

The characteristics of successful and viable institutional arrangements for managing communally owned resources have been studied for decades and many theories have been advanced as to why current institutions have failed to achieve both the conservation and development objectives that they set out to achieve. In this chapter an innovative process and tool for assessing the likelihood of institutional arrangements being successful are described, where success is defined in terms of the likelihood of institutions achieving their aims. Tool development involved a through literature survey, and the development of a structured checklist to facilitate and guide group discussions and a questionnaire for household surveys. After development, the tool was used to assess institutional arrangements in five communities in Zimbabwe. The results suggested that institutional arrangements varied substantially between the five communities studied, and indicated that institutions in one community had a very high likelihood of success and another, a very low likelihood of success. Based on these results I conclude that successful institutions are those with i) a functional management unit with both recognised authority and capacity, ii) nested, known and democratically adopted institutions, iii) operational mechanisms for managing behaviour with graduated sanctions and iv) practical and adopted natural resources enhancement strategies. Further it is proposed that after some further development the tool developed here could be used in other situations to assess likelihood of success.

6.1 INTRODUCTION

Conservation has been described by Redford and Richter (1999) as 'the management of human use of the biosphere so that it yields the greatest sustainable benefit to current generations whilst maintaining its potential to meet the needs of the future generations'. It follows from this that conservation is a socially and politically defined process, and as such, strategies for biodiversity conservation should focus on issues of human use and organisation (Brechin, Wilshisen, Fortwarngler and West, 2002). Against this background community based natural resources management (CBNRM) has been advocated as the best way to achieve conservation goals, particularly in developing countries (Schlager and Ostrom, 1992; Schlager, Blomquist and Yan Tang, 1994; Barret, Brandon, Gibson and Giertsen, 2001; Mehta, Leach and Scoones, 2001). The CBNRM approach seeks to establish a harmonious relationship between community livelihoods and natural resources, thus achieving conservation objectives alongside economic and social development goals (Meinzen-Dick and Pradhan, 2001; Olsson and Folke, 2001).

At a general level CBNRM programmes seek to increase the development options of resource dependent communities, and they tend to work best when there are strong local systems of social control, either formal or informal, to enforce rules and regulations. (Gibson and Koontz, 1998; Brechin, Wilshisen, Fortwarngler and West, 2002). Unfortunately, in many areas of the world traditional practices, which maintain social control, have been eroded by a range of factors including: changes in lifestyle and consumption habits, profound alteration of property rights and the intrusion of inappropriate state laws (Schlager and Ostrom, 1992; Schlager, Blomquist and Yan Tang, 1994; Mehta, Leach and Scoones, 2001). For these reasons the desire to revive traditional

resource management practises in order to reconcile the dual objectives of poverty alleviation and environmental conservation have often fallen short of expectations (Schlager, Blomquist and Yan Tang, 1994; Kellert, Mehta and Lichtenfeld, 2000).

For example, the absence of, or weaknesses in, management institutions have been cited as one of the causes of the failure of CBNRM in achieving its objectives (Gibson and Koontz, 1998). Additionally, the absence of incentives for institutions that govern, monitor and control the extraction of resources may be a major underlying cause of environmental degradation in many areas (Feeny, 1992). Despite the recognition of some of these problems, their solution is not trivial and require investigation into:

- what kind of institutions should be in place to cope with the dynamic behaviour of resource extraction?
- what should be their key responsibilities?
- why have the current ones failed?

Many scientists have worked towards answering these questions but the work of Ostrom (1990) stands out as being fundamental to our current understanding the performance of institutions. She described robust institutions as those that have enhanced the capacity of individuals to use the resources in a sustainable way for long periods of time, and these tend to be characterised by certain design principles (Table 6.1), (Ostrom, 1990). Ostrom (1990) then applied these design principles to evaluate the organisation of the mountain grazing and forest common property resources in Switzerland and Japan, and the irrigation systems in Spain and the Philippines. As a result of this work, she concluded

that the most successful institutions are those that last over time, constrain users to safeguard the resources and produce fair outcomes.

Interestingly, despite the landmark nature of this work, both Ostrom (1990) and Little (1994) have called for more testing of these ideas. In one such recent study, conducted in Nepal by Gautam and Shivakoti (2005), two forest systems were studied which had organised users with agreed management objectives. The aim of the research was firstly, to evaluate the roles institutions were playing in determining the condition of the forests, and secondly to consider the institutional robustness of local forest governance. One of the major conclusions of this work was that although Ostrom's design principles are useful in analysing institutional robustness there is a need for expansion and testing under varying ecological and socio-economic contexts. An example of this relates to the fact that common resource institutions for private property, as described in most of the literature on collective action by Ostrom, may not necessarily be applicable in the management of common resources under communal property regimes, where collective action is based on legally constituted rather than self organised groups.

So despite much work in this general area, there are few studies which seek to test the essential factors that contribute to the relative success of different institutions. There is also an absence of studies that seek to understand how variation in the structure and function of institutions affects their performance and outcomes. Because of this most of the conclusions about characteristics of successful institutions are case specific and cannot be generalised (Agrawal, 2001; Barret, Brandon and McPeak, 2005). In addition, most work to date has focused on user groups which cannot be compared with the community level where there are multiple claims and interest on the same resource. As a result,

there is still very little comparative evidence on characteristics of institutional arrangements that foster resource conservation and development (Barret, Brandon, McPeak, 2005). This is unfortunate as such studies could inform the future development of CBNRM and rural development policy.

The aim of this study was to establish and evaluate the status of institutions in five different locations in Zimbabwe and then consider whether their different modes of structure and functioning would have a differential influence on ecosystem management. In order to achieve this, it was necessary to develop a tool which enabled comparative evaluation of institutions between sites, and this development is also reported here.

Table 6.1: Design principles exhibited by long enduring common-pool resource institutions. Adapted from Ostrom (1990).

Principle	Explanation
Clearly defined boundaries	Known beneficiaries and known resource boundaries
Congruence	Distribution of benefits roughly proportionate to costs imposed by provisions of rules as well as appropriate rules that take into account local conditions
Collective-choice arrangements	Most individuals affected by operational rules can participate in modifying them
Monitoring	Resource monitors accountable to resource users
Graduated sanctions	Users who violate operational rules are likely to receive graduated sanctions
Conflict-resolution mechanisms	Users and their officials have access to low-cost local fora to resolve conflicts
Minimal recognition of rights to organise	Rights to devise own institutions not challenged by external governmental authorities
Nested enterprises (resources within larger systems)	Appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organised in multiple layers of nested enterprises

6.2 METHODOLOGY

6.2.1 Study sites

A detailed description of the study sites is presented in chapter 2.

6.2.2 Data collection methods

6.2.2.1 Tool development

Much discussion has been undertaken about the status of institutions in southern Africa, and the whole world over, but very few rigorous studies have been documented which begin to make comparisons between their structure and function (Barret, Lee, and McPeak, 2005). This is unfortunate as in theory a comparative analysis of the status of institutions would provide important information on what sort of institutions are required for effective ecosystem management. If such comparative assessment is to be undertaken then it is imperative that the assessment is undertaken in a consistent and repeatable manner, and provides reliable and analysable data about institutional arrangements. This requirement demands that at the minimum a framework is developed which allows such a comparison.

While such a framework could take many forms, there are some advantages in presenting such analyses in a quantitative form. These advantages are primarily related to the consistency and repeatability of data collection, regardless of the person undertaking that data collection, and also to the ease of analysing and communicating the results. A secondary advantage applies in this case and this

relates to the desire to explore data on institutions in relation to data on environmental conditions in the study sites. This task is rendered considerably easier if all the data are expressed quantitatively.

No suitable assessment tool which would permit such comparative analysis was reported in the literature, although there was much information on the kind of factors which various studies had identified as being more or less important in contributing to successful institutions. Thus there was a need to develop such a tool, and the first step in its development comprised a rigorous review of definitions and description of institutional arrangements as documented in the literature. A summary of the results of this survey are presented in Table 6. 2.

Table 6.2: Definition and characteristics of common property resource management institutions

Reference	Definition	Characteristics
Agrawal, and Gibson, 1999	Rules, regulations	-promote stability of expectations *ex ante*, and consistency in actions *ex post* -primary mechanism to mediate, attenuate, structure, mould, accentuate and facilitate particular outcomes and actions -once formed they exercise effects that are independent of forces that constituted them but can be changed by changes in behaviour
Agrawal, 2001	Rules, regulations	-successful institutions are those that last over time, constrain users to safeguard the resource, produce fair outcomes
Arrow, Bolin, Costanza, Jansson, Levin, Maler, Perrings and Pementel, 1995	Rules, regulations	-define boundaries to access, harvest and mange as well as sell resources -define rules allocating rights and duties for harvesting
Barret, Brandon, Gibson Gjertsen, 2001	Organisation	-possess authority, ability and willingness to restrict access and use -possess the wherewithal to offer incentives to use resources sustainably -have the technical capacity to monitor ecological and social conditions
Kremen et al, 1994,		-have the managerial flexibility to alter the array of incentives and the rules of access so as to cope with changes in the condition of the resource or its users
Ostrom 1999		-have the managerial flexibility to alter the array of incentives and the rules of access so as to cope with changes in the condition of the resource or its users
Becker and Ostrom, 1995,	Rules, regulations	-institutional arrangements can enhance the capacity of individuals to use resources in a sustainable way over long periods of time -robust institutions tend to be characterised by clearly defining boundaries, identify who should receive benefits and pay costs, collective choice arrangements (those affected participate in changing the rules) -rules are not self-enforcing so monitoring and conflict resolution mechanisms should be established -recognition of formal rights of users to devise their own institutions are not challenged by external government authorities and users have long-term tenure to the resource- -nested to a broader network of medium to large scale institutions
Bromley, 1994	Organisation	-have he managerial flexibility to alter the array of incentives and rules of access so as to cope with changes in the conditions of the resource and the users -benefits should flow in large enough quantities to spread through out the community
Gibson and Koontz, 1998	Organisation	-have authority, ability and willingness to restrict access and use -have wherewithal to offer incentives to use resources sustainably which in some cases means no use -have the technical capacity to monitor ecological and social conditions
Hanna, 1998	Rules, regulations	-part of institutions are the property rights detailing a bundle of entitlements that define owner's rights and duties and the rules under which those rights and duties are designed and exercised and these are nested in the institutional structure

Table 6.2 cont

Reference	Definition	Characteristics
Leach, et al, 1997	Rules, regulations	-are dynamic, changing over time a social actors alter their behaviour to suit new circumstances -institutional arrangements are dynamic, influenced by the ongoing practices and agency of numerous social actors as well as by contingent events in environment, economy and society, institutional design cannot assume predictable outcomes
Leach, Mearns and Scoones, 1999	Rules, regulations	-mediate relationships between different social actors and different components of local ecologies -institutional arrangements shape the processes of endowment and entitlement mapping -regularised practices performed overtime, eventually constitute institutions and as such are dynamic -formal institutions may require exogenous enforcement by third-party organisation (rule of law –state) -informal institutions may be endogenously enforced, upheld by mutual agreement among social actors involved, or by relations of power and authority between them
Metha et al., 2001	Rules, regulations	-institutions are seen as encompassing formal rules and conventions and also the informal codes of behaviour or norms that regulate human behaviour (North 90) -institutions regulate action to reduce uncertainty -no definition per se but can be seen as either enabling (in terms of providing means through which people negotiate their ways through in the world) or constraining (in providing rules for action) -interactions and process, embedded in practice, struggles over meaning; formal and informal interlinked with knowledge and power -are intricately linked with people's culture, beliefs and life
North, 1990	Rules, regulations	-structure incentives in human exchange -are formal and informal -details what individuals are prohibited from doing, under what circumstances what is permitted -reduce uncertainly by establishing a stable structure to human interaction (conventions, norms, statute law, common law, contracts - Constrain some activities and facilitate others, without them social interaction would be impossible
Olsson and Folke, 2001	Rules, regulations	-institutions are made up of formal constraints (rules, laws and constitutions), informal constraints (norms of behaviour, conventions and self imposed codes of conduct) and their enforcement characteristics -institutions form the constraints or framework for organisations which are departments, authorities and public sector entities (interest groups) -institutions shape behaviour
Ostrom, 1990	Rules, regulations	-used to determine who is eligible to make decisions in some arena, what actions are allowed or constraints, what aggregation rules will be used, what procedures must be followed, what information must or must be provided, what payoffs will be assigned to individuals dependent on their actions -contain prescriptions that forbid, permit or require some action or outcome -may assign de facto rights that are contrary to the de jure rights and duties of a formal legal system

A critical analysis of the findings of the literature review presented in Table 6.2 suggested four key determinants of viability of institutional arrangements:

i) **Existence of a natural resource management unit** with authority and the ability to restrict access and use (Bromley, 1994; Kremen, Merenlende and Murphy, 1994; Gibson and Koontz, 1998; Ostrom, 1999; Barret, et. al., 2001).

ii) **Existence of institutions** which were defined as taboos, local norms, provisions of local and central government instruments (North, 1990; Ostrom, 1990; Becker and Ostrom, 1995; Leach, Mearns and Scoones, 1999; Metha et al, 2001; Olsson and Folke, 2001)

ii) **Management of human behaviour** focusing on enforcement and conflict management (North 1990; Ostrom, 1990; Arrow, Bolin, Constanza, Levin, Maler, Perrings and Pementel, 1995; Becker and Ostrom, 1995)

iv) **Natural resource management strategies** which encompasses incentives for sustainable use and strategies for resource enhancement (North, 1990; Bromley, 1994)

These four determinants formed the framework for the development of the tool and subsequent analysis. In the process of tool development each one of the determinants was further disaggregated into various descriptors. These were descriptions of some key and critical aspects of the determinant that were drawn from literature presented in Table 6.2. In turn, for each descriptor a series of questions were formulated which were used to establish and evaluate the status of natural resource management institutional arrangements. Figure 6.1 is a schematic diagram to summarise the linkages between the three stages of tool development from determinant, descriptor and the questions asked at

community level to establish the status of institutional arrangements. Each one of the questions (characteristic) had an annotated scale that was used to rate the responses. This scale was based on the worst case scenario (low) intermediary and best case scenario (high). Most of these cases like the determinants and descriptors were drawn from existing literature. The final instrument comprised 40 questions and within this study it was used in two complementary ways where 30 questions were used in focus group discussions whilst the other 10 were part of a household questionnaire survey (Table 6.3).

6.2.2.2 Focus group discussions

Group discussions were undertaken before the questionnaire survey between the 24th September and 15th of October 2004. The timing was aimed at establishing rapport and introducing the research to the community before enumerators began to undertake house visits. It was at the introductory workshops where community leaders and normal people sat together and deliberated on the status of institutional arrangements in their community using the 30 semi -structured questions from the tool. Discussions were a participatory process chaired by a community member, with the researcher acting as a mere facilitator interrupting where more clarification was required. To facilitate this process, and assist the community members in rating the institutional status all the 30 questions and the annotated scale were translated into the local language. The scores were summed and a viability score and rating given and further debated. Responses from the community were captured in local language and only translated into English during analysis.

However, as already discussed in section 3.4.2 the major weakness is the delineation of low-medium and medium-high interface especially where responses are quantitative. To improve the tool this problem should be dealt with in the same way as recommended in chapter 3, where a sensitivity analysis is carried out to determine the maximum values that separate low and medium as well as medium and high success rating.

6.2.2.3 The household questionnaire survey

A further 10 questions used in the evaluation tool were not designed to be used in a focus group, but rather are to be completed in a one to one interviews with members of the community. The purpose of these questions was to elicit individual responses free of influence from other community members. This is not to discredit the group discussions as the questions used in that approach required debate and discourse, but these remaining questions sought individual perceptions. In this study these ten questions were included in a larger household questionnaire survey undertaken in the same areas as part of the same research project. In addition this household survey enabled a comparative assessment of institutional arrangements as described by the relevant community members. Details of the survey are presented in Chapter 2. In addition to the tool, two questions on interpretation of institutions and their outcomes (from the questionnaire, Annex 1, question 20 and 40) were used also used to establish the status of institutional arrangements in Zimbabwe.

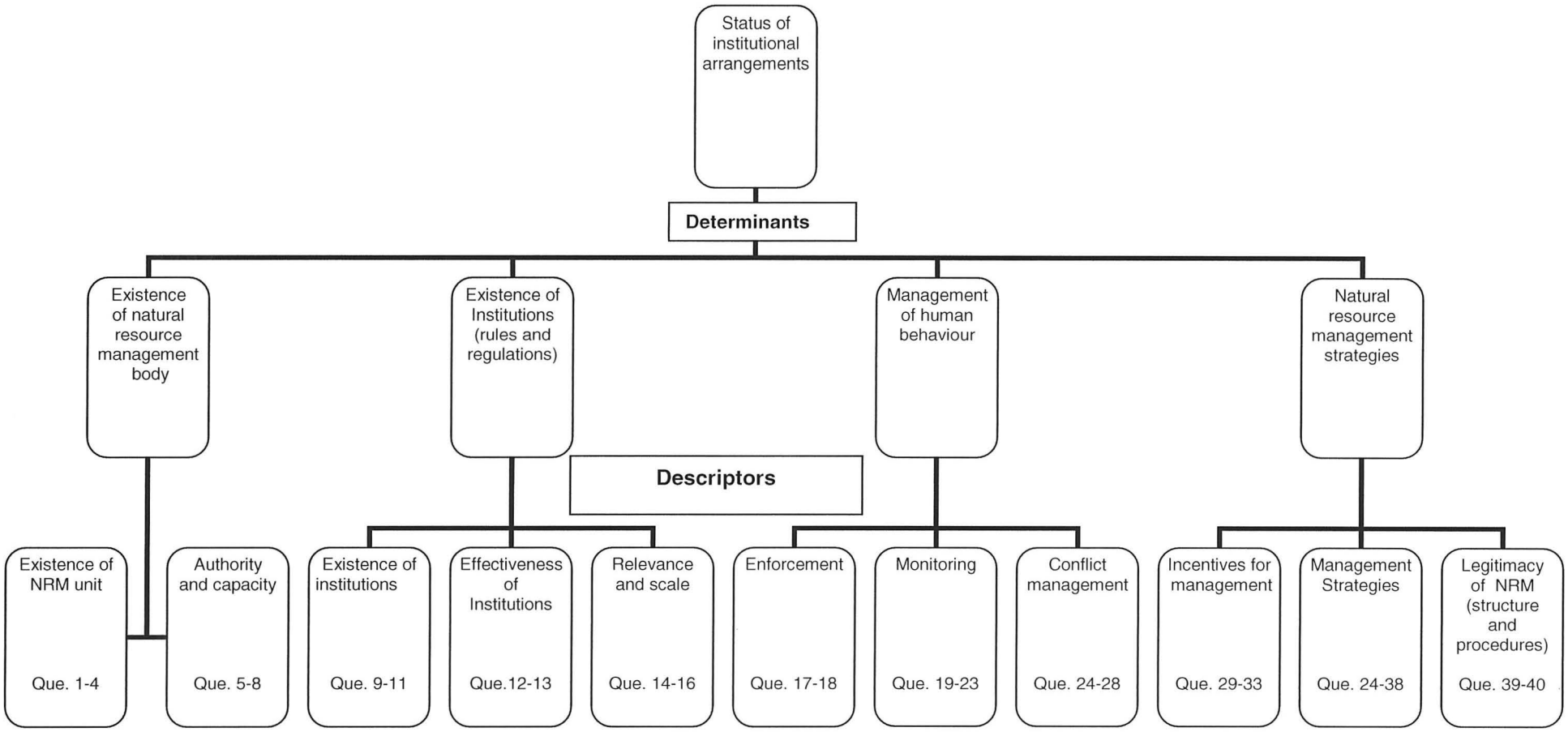


Figure 6.1: Diagrammatic layout of the stages of tool development and data analysis

Table 6.3: Tool for assessing status of natural resources management institutions and institutional arrangements, questions in italics were used only in the questionnaire survey

Determinant	Descriptor	Questions	Success rating		
			Low (1) (not likely to lead to viability)	**Medium (2) (could lead to viability)**	**High (3) (most likely to lead to viability)**
Existence of management body = group of persons tasked with overseeing implementation of rules and regulations	Existence of NRM unit	1. Is there a Natural Resource Management unit/body?	No	Don't know	Yes
		2. Is there a Natural Resource Management unit/body?	*20% -40%*	*41% -60%*	*>60%*
		3. Are there known clearly defined boundaries for NR management?	No	Not known	Yes
		4. How is participation and co-ordination within the body ensured?	No efforts made	People Volunteer	Representation from specific groups
	Authority and capacity	5. Does the management body have authority to control access and use?	No	Not recognised	Yes
		6. Does the management body have the ability to control access and use?	No capacity and know how?	Don't always stick to plans	Yes
		7. Does the management body have the willingness to control access and use?	Very corrupt	Have implemented most actions	Very willing to see sustenance of resource and welfare of people
		8. Does the management body have the technical capacity to monitor ecological and social conditions?	None	Building on IKS	Yes
Existence of institutions which are defined as the rules, regulations, norms, taboos and government instruments (Acts)	Existence of institutions	*9. Are the any local rules? Y/N*	*20% -40%*	*41% -60%*	*>60%*
		10. What constitutes the institutions?	Taboos and norms	Local rules defined by he community	Local rules linked to central government instruments
		11. What constitutes the institutions?			
		Traditional systems	*20% -40%*	*41% -60%*	*>60%*
		Local government by-laws	*20% -40%*	*41% -60%*	*>60%*
		National statutory instruments	*20% -40%*	*41% -60%*	*>60%*
	Effectiveness of institutions	12. How effective are these components?	Not at all, nobody observes them	Effective, very few observe tem since they are not enforced	Very effective, everyone knows them and are enforced
		13. How effective is each component? (take average on non zero scores)			
		Taboo	*20% -40%*	*41% -60%*	*>60%*
		Norms	*20% -40%*	*41% -60%*	*>60%*
		Council	*20% -40%*	*41% -60%*	*>60%*
		Statutory instruments	*20% -40%*	*41% -60%*	*>60%*
	Relevance and scale	14. How are rules made?	By community leadership	Collective choice arrangements	Collective action, debated
		15. Are the institutions flexible and adaptive to changing local and national needs?	Never reviewed	Reviewed but adoption very low	Reviewed and adopted
		16. Are the local institutions nested in a broader network of medium to large scale institutions?	Do not exist	Not linked	Nested in local and central government framework

Table 6.3: cont.

Determinant	Descriptor	Questions	Success rating		
			Low (1) (not likely to lead to viability)	**Medium (2) (could lead to viability)**	**High (3) (most likely to lead to viability)**
Management of behaviour controlling access and exaction	Enforcement	17. Who enforces the rules?	Nobody or Everyone	Central government structure	Chief or Council
		18. Who enforces rules?			
		Government departments	*20% -40%*	*41% -60%*	*>60%*
		Council	*20% -40%*	*41% -60%*	*>60%*
		Chief or kraalhead	*20% -40%*	*41% -60%*	*>60%*
	Monitoring	19. Who monitors use and management of natural resources	Nobody or everybody	Central government structures	Chief or council structures
		20. How frequently do they monitor?	Never	Sometimes	Always
		21. Who monitors use and management of natural resources? (average of non zero scores)			
		Government departments	*20% -40%*	*41% -60%*	*>60%*
		Council	*20% -40%*	*41% -60%*	*>60%*
		Chief, kraalhead	*20% -40%*	*41% -60%*	*>60%*
		22. How effective are the monitoring mechanisms?	Not effective, no evidence of existence	Quite effective, some cases of communicatio n of findings and decisions	Very effective, findings and decisions communicated before and after harvesting season
		23. What is monitored? (Average of non zero scores)			
		Access	*20% -40%*	*41% -60%*	*>60%*
		Use	*20% -40%*	*41% -60%*	*>60%*
		Timing	*20% -40%*	*41% -60%*	*>60%*
		Volumes extracted	*20% -40%*	*41% -60%*	*>60%*
		Areas extracted	*20% -40%*	*41% -60%*	*>60%*
		Harvesting techniques	*20% -40%*	*41% -60%*	*>60%*
	Conflict management	24. Who bears the cost of management?	Everybody yet only a few benefiting	Not clear	Resource user
		25. Have there been any conflicts over resource management?	Yes	Not known	None
		26. How were they solved and was the solution effective?	-ve, made conflict and its impacts worse	0, no change still unresolved	+ve, resolved with good outcomes
		27. Are there any clear and known graduated sanctions for defaulters?	None	Offenders go unpunished	Offenders severely punished
		28. How is compliance ensured? (Average of non zero scores)			
		Use of fines, trial, sanctions	*20% -40%*	*41% -60%*	*>60%*
		Banning from harvesting	*20% -40%*	*41% -60%*	*>60%*
		Policing and reporting	*20% -40%*	*41% -60%*	*>60%*
		Use of taboos	*20% -40%*	*41% -60%*	*>60%*
		Awareness raising	*20% -40%*	*41% -60%*	*>60%*

Table 6.3: cont.

Determinant	Descriptor	Questions	Success rating		
			Low (1) (not likely to lead to viability)	**Medium (2) (could lead to viability)**	**High (3) (most likely to lead to viability)**
Resources management strategies to enhance resource	Incentive for management	29. Is there long-term resource use tenure?	No resource tenure	Recognised user rights	Resources owned by users
		30. Are there incentives for sustainable resource use?	None	A lot of disincentives	A lot of incentives
		31. Do the natural resources generate benefits that justify management costs?	No	Benefits not equitably shared	Benefits enhance livelihoods and resource status
		32. Do the institutions enhance community/ target group's ability to exploit its own resources?	No	Subsistence use only	Subsistence and commercial harvesting
		33. Is there congruence between costs and benefits?	No	Cost borne by everyone but profits accrue to few	Benefits offset management cot for most people
	Management strategies	34. Are there any organized conscious efforts to manage natural resources?	None	Limited in scope and adoption	Very high adoption at community and household level
		35. What do the natural resources management institutions encourage people to do?	Nothing	Harvest sustainably	Harvest and manage sustainably
		36. What do the natural resources management institutions prevent people from doing?	Nothing	Commercial use	Land use conversion
		37. What NRM practices have you adopted within the last 2 year? (Average of non zero scores)			
		Fire management	*20% -40%*	*41% -60%*	*>60%*
		Controlled access to resources	*20% -40%*	*41% -60%*	*>60%*
		Soil erosion control	*20% -40%*	*41% -60%*	*>60%*
		Tree planting and domestication	*20% -40%*	*41% -60%*	*>60%*
		Controlled harvesting	*20% -40%*	*41% -60%*	*>60%*
		Commercialisation	*20% -40%*	*41% -60%*	*>60%*
		38. what are the evident outcomes of the management strategies (Average of non zero scores)			
		Increased vegetation cover	*20% -40%*	*41% -60%*	*>60%*
		Decrease in soil erosion	*20% -40%*	*41% -60%*	*>60%*
		Domestication	*20% -40%*	*41% -60%*	*>60%*
		No change	*20% -40%*	*41% -60%*	*>60%*
		Reliable supply	*20% -40%*	*41% -60%*	*>60%*
		Improved grazing	*20% -40%*	*41% -60%*	*>60%*
		Increased incomes	*20% -40%*	*41% -60%*	*>60%*
	Legitimacy of NRM mgt	39. Do the resource users share common socio-cultural backgrounds?	No, values and needs varied	People prepared to compromise difference to attain vision	People have common vision
		40. Are the institutions and the management (structure and procedures) legitimate?	No	Don't know	Yes
Overall rating			Low	Medium	High

6.2.3 Data analysis

6.2.3.1 Survey data

One of the objectives of this analysis was to identify the relative success of different institutional arrangements in the case study areas in order to enable a comparative assessment. In view of this requirement some sort of consistent evaluation system was necessary. Data from the 10 questions from the survey were analysed using SPSS 11.5 (Pallant, 2004). Frequencies were then scored for consistency with the other 30 questions used in group discussion. Scoring followed a simple procedure using proportion of positive responses such that:

i) a score of 0 was given when the proportion of positive responses was less or equal to than 0.2

ii) a score of 1 was given when the proportion of positive responses was between 0.2 and 0.4

iii) a score of 2 was given when the proportion of positive responses was between 0.4 and 0.6

iv) a score of 3 was given when the proportion of positive responses was greater than or equal to 0.6

In case of multiple answers, once each response had been scored the average of the non zero scores was used as the final score for that particular question (see questions 11, 13, 18, 21, 23, 26, 37 and 38 on Table 6.3).

6.2.3.2 Rating of the status of institutional arrangements

Scores from the focus group discussions and the household survey were pooled together under relevant descriptors as presented in Table 6.3. This enabled the scores for each descriptor and determinant to be summed individually and / or combined into a final score covering all determinants. It is important to note here that data analysis to determine the overall likelihood of institutional success based on the scores from both the group discussions and the questionnaire followed the reverse order of tool development (determinant, descriptor, questions). First, responses to each question were scored, secondly the scores of the questions for a specific descriptor were summed to give a descriptor total score, thirdly the scores of all the descriptors for each determinant were summed to give the score of the determinant and finally these scores were summed to give an overall score for each study site. However this was not a likelihood rating but a mere score. The rating was determined by calculating the percentage of each score out of a total potential score for each descriptor and determinant such that:

i) a score of 1 (low likelihood of success) was given when the score was less than or equal to 50% of the potential score

ii) a score of 2 (medium low likelihood of success) was given when the score was between 50% and 75% of the potential score

ii) a score of 3 (high low likelihood of success) was given when the score was greater or equal to 75% of the potential score.

6.3 RESULTS

The results are discussed separately for each of the four determinants of institutional success namely, existence of natural resource management unit, existence of institutions, management of behaviour and natural resource management strategies. For each of the determinants discussions are guided by the descriptors used to summarise the questions on the assessment tool. The section concludes with a discussion of the overall status and likelihood of success of institutional arrangements for each study site.

6.3.1 Existence of natural resource management unit

The lack or weakness of local level natural resource management units has been cited as one of the causes of the failure of CBNRM in achieving its objectives (Gibson and Koontz, 1998). Arguments put forward to support this claim include that there is separation of authority from responsibility since governments were not willing to devolve authority to communities. This inevitably undermines any sense of responsibility for resource conservation (Olsson and Folke, 2001, Kellert, Mehta and Lichtenfeld, 2000). This has the potential to be a real problem in Zimbabwe as unfortunately the legal system in Zimbabwe is pluralistic and complex in nature and at its worst can serve to undermine the effectiveness of natural resource management units. This occurs because in the Zimbabwean legal system community level natural resource management systems are guided and governed by several institutions operating in three parallel structures. These are:

i) Central government operating through extension departments

ii) the Local government represented by Rural District Councils (RDC) who are responsible for all development initiatives

iii) the Traditional Leaders empowered by the Traditional Leaders Act, who are said to be the custodians of the natural resources.

These three structures are rarely equally effective at the community level. For example, survey results, suggested in two of the study sites, Makoni and Nyanga, which are post independence resettlement areas, the most active management units were linked to the RDC. In the other three areas, Chimanimani and Rushinga under communal property regimes and Muzarabani (unique resettlement), most respondents indicated that the traditional leaders owned and were responsible for, the management of the natural resources.

However, this situation is not necessarily well known to all the local people and the results of the survey suggest there is considerable confusion as to which institution and structure governs which resource. Thus respondents were not really clear about the existence of a resource management body that was tasked with implementing local natural resource management rules and regulation. This confusion or lack of knowledge was more prevalent in Chimanimani, Muzarabani and Rushinga where less than 60% of the respondents indicated they had knowledge about the existence of a natural resources management unit (Table 6.4).

When viewed comparatively, Rushinga and Chimanimani scored the lowest in terms of the existence and strength of the resource management unit as most people did not even know of its/their existence. This 'invisibility' of management bodies may be linked to the pluralistic nature of the legal system as it may be a case that while many organisations are in theory responsible for providing leadership in this area, no one organisation actually assumes that lead role. This viewpoint is supported by the statement of one traditional leader who was

interviewed as part of the survey which indicated that this pluralism had undermined his traditional authority as people can use different provisions to circumvent some restrictions which he would have been previously been able to impose.

Although few respondents where aware of the existence of resource management units in three of the study sites, they did formally exist in all sites (Table 6.5). However, respondents also indicated many of the members of these units did not have enough authority and technical capacity to execute their duties. They also claimed that there was a lot of potential for institutional success in their communities, but persistent hardships such as drought and poor crop years have led to the relaxation of most resource management regulations and because of these humanitarian issues a generic 'policy of tolerance' was being implemented by many of the natural resource management units.

Table 6.4: Proportion of respondent households that indicated that they know of the existence of natural resource management unit in their community

	Study site				
	Chimanimani	**Makoni**	**Muzarabani**	**Nyanga**	**Rushinga**
Percentage respondents indicating that an NRM unit existed	40	82	55	75	40
n	59	51	80	85	52

Table 6.5: Rating and score for likelihood of viability or success for the determinant 'Existence of management unit'. This determinant is composed of the descriptors 'Existence of NRM unit' and 'Authority and capacity'.

Scoring of the descriptors is based on potential score for that descriptor and actual score for that descriptor. The actual score is shown in parenthesis. If the actual score is < 50% of the potential score then it is allocated a score of 1, signifying a low likelihood of success, if it is > 50 % but <75% then it is allocated a score of 2 indicating a medium likelihood of success, and if it 75 or greater it is allocated a score of 3, indicating a high likelihood of success. The final rating is a qualitative expression of these numerical labels such that 1 = low, 2= medium and 3=high.

Determinant	Descriptor	Potential score	Study site				
			Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
Existence of management unit	Existence of NRM unit	12	2 (8)	3 (12)	2 (9)	3 (11)	1 (6)
	Authority and capacity	12	2 (7)	2(9)	2 (8)	2 (8)	1 (5)
Likelihood of success	Score Rating	24	2 (15) Medium	3 (20) High	2 (17) Medium	3 (19) High	1 (11) Low

6.3.2. Existence of institutions (rules and regulations)

Institutions have been taken to encompass conventions, statute law, common law, contracts, taboos and norms (North, 1990). The main objectives of developing and or enacting institutions are:

i) to establish a mechanism that mediates, structures, moulds, accentuates and facilitates particular outcomes and actions (Agrawal and Gibson, 1999),

ii) to reduce uncertainty by establishing a stable structure to human interaction thus regulating actions (North, 1990; Metha et al. 2001)

iii) in simple terms to guide individuals about what is prohibited or permitted in each situation (North, 1990).

If rules are to meet the objectives of guiding behaviour, then they have to be known by the individuals whose behaviour is being controlled. For this reason it was important as part of this study to establish if the people in the study sites were aware of the existence of rules and regulations regarding natural resource management. The results of the survey suggest that a high proportion of respondents did know about the existence of local natural resource management rules and regulations in their communities (Table 6.6). However, the actual nature of the institutions as perceived by respondents varied between study sites. In Rushinga and Chimanimani a high proportion of respondents felt their institutions comprised strong traditional systems (taboos and norms), while in Makoni, Muzarabani and Nyanga they were perceived to be strong local government regulations. These results are not entirely surprising as in the communal areas (Rushinga and Chimanimani) traditional structures tend to have remained more or less intact, whereas in resettlement areas where people are of mixed origin and ethnicity such structures are weak or non existent.

A similar trend emerged when people were asked about the institutions that were being observed and effective on the ground. In communal areas respondents felt that it was the traditional institutions that were effective whilst in resettlement areas respondents indicated RDC institutions were the most effective (Table 6.6). However, the majority of respondents in all sites indicated that statutory instruments were being implemented effectively, although the presence of extension agents from government departments was not noted by all respondents. These results are in line with the pluralistic nature of institutions governing natural resources management in these areas.

The relevance and scale, or nestedness, of institutions is critical as it determines how rules are made and adapted. The existence of institutions in all the study sites was not a result of public debate, but rather they had been handed down to the people by either the district council or the traditional leaders. Respondents indicated that institutions took a long time to develop and once formulated the rules and regulations were rarely changed to take into account the changing ecological and socio-economic environment. For instance, in Nyanga the community in the study site indicated that a process of by-law formulation had been initiated almost six years ago but they had still not been ratified by the relevant cabinet minister, and as such were still not operational. A contrasting situation occurred in Rushinga, where natural resource management is mostly left to the spirit mediums. Within this system frequent decrees are made as to whether or not people could harvest certain species, including rights to commercialise forest products.

Overall the results suggest that Makoni has the highest success rating for the existence of operational natural resource management institutions, whilst Muzarabani and Rushinga had the lowest (Table 6.7). The major strengths in Makoni were that the institutions were known, were recognised and were being used, probably because they were mostly RDC provisions. On the contrary, in Chimanimani, Muzarabani and Rushinga institutions were mainly norms and taboos, which were neither followed nor backed up by local and central government instruments.

Table 6.6: Percentage of respondents indicating existence functional and effective institutions in their community

Site	**Chimanimani**		**Makoni**		**Muzarabani**		**Nyanga**		**Rushinga**	
Existence of institutions (% yes)	83		76		90		100		80	
Type of institution	Functional	Effective	Functional	Effective	Functional	Effective	Functional	Effective	Functional	Effective
Traditional	66	46	7	7	29	30	25	16	49	39
Council	12	10	60	40	43	27	49	46	37	30
Government	23	18	33	29	29	29	26	21	14	11

Table 6.7: Rating and score for likelihood of viability or success for the determinant 'Existence of institutions'. This determinant is composed of the descriptors 'Existence of institutions', ' Effectiveness' and Relevance and Scale'.

Scoring of the descriptors is based on potential score for that descriptor and actual score for that descriptor. The actual scores is shown in parenthesis. If the actual score is < 50% of the potential score then it is allocated a score of 1, signifying a low likelihood of success, if it is > 50 % but <75% then it is allocated a score of 2 indicating a medium likelihood of success, and if it 75 or greater it is allocated a score of 3, indicating a high likelihood of success. The final rating is a qualitative expression of these numerical labels such that 1 = low, 2= medium and 3=high.

Determinant	Descriptor		Study sites				
		Potential score	Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
Existence of institutions	Existence of institutions	9	2 (6)	3 (8)	2 (5)	2 (6)	2 (5)
	Effectiveness	6	2 (3)	2 (4)	2 (3)	2 (4)	2 (3)
	Relevance and Scale	9	1 (4)	2 (6)	1 (4)	2 (6)	1 (4)
Likelihood of success	Score	24	2 (13)	2 (18)	1(12)	2 (16)	1 (12)
	Rating		Medium	High	Medium	High	Medium

6.3.3. Management of behaviour (application of institutions)

Institutions and institutional arrangements are developed primarily to guide resource use by prohibiting, facilitating, or encouraging certain kinds of behaviour, and ultimately shaping behaviour and influencing the way alternatives are perceived and weighed by individuals (Murphree, 1994; Ostrom, 1990; Olsson and Folke, 2001). As such, to promote assurance and prevent the free rider scenario institutions are supposed to structure interactions between multiple actors with multiple interests (Mehta, et al., 2001). However, rules are not self-enforcing so monitoring and conflict resolution mechanisms are supposed to be an integral part of design and implementation institutional arrangements (Becker and Ostrom, 1995; Barret, Brandon, McPeak, 2005).

Contrary to the argument of Gibson *et al.* (2005) which claimed that what matters, is not which rules are in place, but rather how they are monitored and enforced, the results of this study suggest that the latter is heavily dependent on the former. Here the institutions that were strongly enforced were those of the traditional system, while the district council personnel were rarely seen monitoring resource use in the community. Government departments and district council staff rarely visited the study sites, and this served to reduce the potential success of any of their initiatives. In all the sites no enforcement agents seemed to have the means, knowledge and / or power to actually monitor resource use and enforce compliance to set rules and regulations. Further, both enforcement and monitoring were said to be too expensive to implement, and the incentive structure for local leaders to put such systems in place did not exist as their powers were being constantly challenged and limited by central government intervention.

The survey also investigated how people interpreted the local rules and regulations by asking what they were being constrained or encouraged to do. The perceptions of rules did not differ between sites though some rules were more popular than others and each site had three key ones. One regulation that was known to most people was the prohibition to destroy natural resources. In addition, it was interesting to learn that local institutions have both prohibitive and facilitative natural resources management provisions (Table 6.8).

Respondents in Chimanimani and Rushinga indicated that there were no costs attached to natural resource management whilst those in the other three sites argued that benefits were accruing to only a few, yet costs were being borne by every one. The major reason given for this was that even if a procedure had been laid out on managing the costs of resource management nobody was ensuring these procedures were being followed. None of the study sites had any clearly laid out benefit sharing mechanisms. In Makoni there were no agreed and clearly graduated sanctions, and while such sanctions may have been present in the other four sites, offenders were going unpunished, presumably due to the ambient policy of tolerance. Management of behaviour was weakest in Nyanga and Rushinga, as in these two sites nobody was known to have been tasked with monitoring resource use and ensuring compliance, making enforcement impossible (Table 6.9).

Table 6.8: Local people's interpretations of natural resources management (NRM) institutions operational in their areas, numbers are proportions (%) of respondents in a particular site.

Interpretation of local NRM institutions by local people	Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
Encourage making of fire guards	4	30	1	22	1
Encourage planting and domestication of trees	34	10	20	12	2
Encourage prevention of soil erosion	18	7	8	10	0
Encourage proper harvesting of natural resources	0	8	8	12	34
Encourage soil conservation in crop fields	5	2	0	7	4
Prohibit burning of vegetation	0	2	26	1	26
Prohibit destruction of natural resources	29	21	24	17	33
Prohibit killing of wild animals, birds	0	8	6	4	0
Prohibit stream bank cultivation	1	13	8	9	4

Table 6.9. Rating and score for likelihood of viability or success for the determinant 'Management of behaviour'. This determinant is composed of the descriptors 'Enforcement', 'Monitoring' and 'Conflict management'.

Scoring of the descriptors is based on potential score for that descriptor / actual score for that descriptor. The actual scores is shown in parenthesis. If the actual score is < 50% of the potential score then it is allocated a score of 1, signifying a low likelihood of success, if it is > 50 % but <75% then it is allocated a score of 2 indicating a medium likelihood of success, and if it 75 or greater it is allocated a score of 3, indicating a high likelihood of success. The final rating is a qualitative expression of these numerical labels such that 1 = low, 2= medium and 3=high.

Determinant	Descriptor	Potential score	Study sites				
			Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
Management of behaviour	Enforcement	6	3 (6)	3 (5)	2 (4)	2 (4)	3 (5)
	Monitoring	15	2 (8)	2 (10)	2 (10)	2 (10)	1 (6)
	Conflict management	15	2 (10)	2 (9)	2 (10)	2 (9)	2 (9)
Likelihood of success	Score	36	2 (24)	2 (24)	2 (24)	2 (23)	2 (20)
	Rating		Medium	Medium	Medium	Medium	Medium

6.3.4. Natural resource management (application of institutions)

Community based resource conservation has been describes as ' local voluntary initiatives involving a minimum of several households in which at least one of the outcomes of local management practice is either maintenance of habitats, conservation of critical resources or improvement of social and economic welfare' (Hanna, 1998). On this basis, several community based resource conservation practices were apparent in the study sites, and related mainly to prevention of fire and soil erosion. Resource control regimes related to harvesting of, and access to, natural resources had relatively low levels of adoption (Table 6.10). This could be attributed to the fact that people thought that benefits accruing from natural resource management were low and not exactly congruent with costs. Outcomes of natural resource management were mainly thought to be reduced soil erosion, improved supply of products and to a lesser extent increased vegetation cover (Table 6.11). Although none of the sites were consistently the best across the descriptors for natural resource management strategies, Makoni had the highest likelihood of success while the rest of the sites had relatively average chances of success (Table 6.12).

Table 6.10: Proportion (%) of respondents who had adopted particular natural resources management practices that contribute to the relevant management strategy

Strategies	Study site					Total
	Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga	
Fire management	13	37	31	32	30	30
Controlled access to resources	0	1	2	9	11	4
Soil erosion control	36	35	52	27	12	32
Tree planting and domestication	25	26	11	15	15	18
Controlled harvesting	29	0	5	17	23	13
Commercialisation	0	0	0	2	10	2

Table 6.11: Proportion of people who believed that the listed outcomes were a result of the adopted natural resource management strategies in their community

Outcomes	Study sites					
	Chimanimani	**Makoni**	**Muzarabani**	**Nyanga**	**Rushinga**	**Total**
Increased vegetation cover	32	17	15	16	25	20
Decrease in soil erosion	17	29	47	24	17	29
Domestication	30	13	2	16	17	14
No change	17	1	13	9	15	10
Reliable supply	4	30	18	31	12	21
Improved grazing	2	9	0	4	0	3
Increased incomes	0	0	5	0	14	3

Table 6.12: Rating and score for likelihood of viability or success for the determinant 'Existence of natural resource management strategies'. This determinant is composed of the descriptors; 'Incentive for management', 'Management strategies' and 'Legitimacy of NRM management'.

Scoring of the descriptors is based on potential score for that descriptor and actual score for that descriptor. The actual scores is shown in parenthesis. If the actual score is < 50% of the potential score then it is allocated a score of 1, signifying a low likelihood of success, if it is > 50 % but <75% then it is allocated a score of 2 indicating a medium likelihood of success, and if it 75 or greater it is allocated a score of 3, indicating a high likelihood of success. The final rating is a qualitative expression of these numerical labels such that 1 = low, 2= medium and 3=high.

Determinant	Descriptor	Potential score	Study Site				
			Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
Existence of natural resource management strategies	Incentive for management	15	2 (9)	2 (11)	2 (10)	2 (10)	1 (6)
	Management strategies	15	2 (10)	2 (11)	3 (12)	2 (10)	1 (7)
	Legitimacy of NRM mgt	6	3 (5)	3 (6)	2 (4)	3 (6)	3 (6)
Likelihood of success	Score	36	2 (24)	3 (28)	2 (26)	2 (26)	2 (19)
	Rating		Medium	High	Medium	Medium	Medium

6.3.5 Overall status of institutions

Existence of natural resources management institutions and to a lesser extent management units and emerged as the weakest characteristics of institutional arrangements in all the five sites. In some study site like Rushinga and Muzarabani likelihood of success was very low (Table 6.13). The major problem was that authority and responsibility were diffuse, across government departments, local Rural District Council and traditional leaders, all being mandated to facilitate mediation and control behaviour of the same community. As a result nobody was really accountable for enforcing local institutions. It seems then that, legal pluralism in Zimbabwe is one of the main causes of collapse of local leadership structures. This scenario has resulted in limited autonomy and increased central government interference at the local level. However, due to a lack of capacity (human and financial resources) central government has failed to make institutional arrangements at community level function. It was not surprising that most people in this survey did not even know that there was a management unit tasked with monitoring and enforcing local institutions. A case by case assessment of the study sites indicated that:

i) In Chimanimani and Muzarabani the institutional arrangements were performing at an average level and the major weakness was the lack of operational and effective rules and regulations. Given the problems already highlighted above it is very unlikely that the situation will improve in the short term unless drastic changes are made at both local and national levels.

ii) Although Nyanga ultimately received the same final rating as Chimanimani for its overall institutional arrangements there was probably more potential

at this site for improvements. The low rating is related to the nature of the two major problem issues that emerged in Nyanga which were weak mechanisms for managing behaviour and institutions that were not being effectively implemented.

iii) At one extreme end of the scale was Makoni, which had the highest likelihood of successful institutional arrangements with a score of 90 (out of 120) and a rating of 'three'. This site was the only site that had a high success rating for adopting natural resource management practices and strategies. However, like the other communities the weakest part of the institutional arrangements in Makoni was lack of effective mechanisms for managing human behaviour.

iv) At the other end of the scale ward 2 in Rushinga which emerged as having the worst institutional arrangements and as such had the least likelihood of success in this area. In this site although the unit responsible for managing resources was known it had neither capacity (authority and resources) nor the knowledge to manage. In addition the rules and regulations in place were neither effective nor sufficiently operational to control people's behaviour.

One major conclusion which emerges from this analysis is that local government by-laws tend to be associated with high likelihood of success whilst traditional systems are linked to low likelihood of institutional success. If local rules are not linked to the district council provisions or government instruments people have little respect for them. Therefore, the nested nature of institutions is important if authority is to be respected, the multiplicity of claims could be minimised and people's behaviour made more predictable in Zimbabwean communities.

Table 6.13: Rating and score or overall likelihood of viability or success of institutions and their implementation in Zimbabwe, composed of the determinants 'Existence of NRM unit', 'Existence of functional effective institutions', Managing human behaviour' and Natural resources management strategies'

Scoring of the descriptors is based on potential score for that descriptor and actual score for that descriptor. The actual scores is shown in parenthesis. If the actual score is < 50% of the potential score then it is allocated a score of 1, signifying a low likelihood of success, if it is > 50 % but <75% then it is allocated a score of 2 indicating a medium likelihood of success, and if it 75 or greater it is allocated a score of 3, indicating a high likelihood of success. The final rating is a qualitative expression of these numerical labels such that 1 = low, 2= medium and 3=high.

Determinant	Potential score	Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
Existence of natural resources management unit/body	24	2 (15)	3 (20)	2 (17)	3 (19)	1 (11)
Existence of functional and effective institutions	24	2 (13)	2 (18)	1(12)	2 (16)	1 (12)
Management of human behaviour	36	2 (24)	2 (24)	2 (24)	2 (23)	2 (20)
Adopted natural resource management strategies and practices	36	2 (24)	3 (28)	2 (26)	2 (26)	2 (19)
Likely hood of success	120	76	90	79	84	62
	Rating	Medium	High	Medium	Medium	Medium
	Rating**	Medium	High	Medium	Medium	Low

** Rating used in further analysis for purposes of this research

6.4 CONCLUSION

The primary objective of this study was to determine the characteristics of viable and /or successful institutions and institutional arrangements. As a result of this study I conclude that the four determinants and their descriptors are crucial for the success of institutional arrangements. Indeed, existence of management units without authority and capacity does not guarantee success. The establishment of these units is the barest minimum and easiest of all steps inherent in natural resource management. Governments and or facilitating agencies should go an extra mile and improve the capacity of the members to be able to monitor both ecological and socioeconomic factors so as to make informed decisions. Of paramount importance is the recognised authority of the management units. In a society with a pluralistic legal system authority can be inevitably undermined. Nestedness of institutions could guarantee that the institutional arrangements are viable but still undermines the authority of the community level bodies as their decisions are constantly contested and decision making is inevitably left to the higher level management units like the rural district councils and government departments in the case of Zimbabwe.

In addition to the lack of technical capacity, limited resources and incentives to manage people and resources can contribute to the failure of institutional arrangements for resource management. Although the institutions studied here tried to prohibit certain kinds of behaviour, in most cases there were very few positive actions being encouraged and or promoted. Prevention without providing high return alternatives may breed discontentment and could lead to civil unrest. It is therefore recommended that institutional arrangements for communal resources be coupled with resource use and enrichment mechanisms for enhancing current and future livelihoods.

The assessment tool developed and applied in this research is a new and innovative approach to assessing institutional arrangements for managing communal resources under common property regimes. It is has both scale and depth as it is based on wide ranging literature drawn from a range of studies. However, although the tool used in this research enabled production of a continuum of institutional success and a comparative assessment, more work could be done to the tool in order to improve its performance, especially in fine tuning the response options to make them all encompassing.

CHAPTER 7

IMPACTS AND OUTCOMES OF CBNRM ON ECOSYSTEM CONSERVATION

ABSTRACT

Understanding sustainable exploitation of NTFPs, as a means of achieving the complementary objectives of natural forest conservation and income generation for rural dwellers, has been the topic of substantial debate. This study sought to investigate the contribution made by commercialisation of NTFPs and local institutional arrangements to the conservation of ecosystems. Ecological surveys using transects were undertaken in five sites of varying success and strength of institutional arrangements and level of NTFP commercialisation. Data collected were on changes in ecosystem structure and composition. A 12 month leaf litter decomposition experiment was also conducted to investigate changes in ecosystem function due to levels of commercialisation and strength of institutional arrangements.

Evidence from this study suggested that community based natural resources management has failed to offer incentives to local people to use natural resources sustainably. The current benefit driven approach of NTFP commercialisation has had no influence or impact on the rate, scale and magnitude of ecosystem simplification, fragmentation and destruction. Potentially commercialisation of NTFPs could lead to ecosystem degradation as only species of value will be conserved while all else is removed. This means therefore that successful NTFP commercialisation would have to be supported by strong institutional arrangements. However, based on this study, the

hypothesis that NTFP commercialisation improves ecosystem conservation by increasing value of forests and incentives for management and forest stewardship is still largely untested.

7.1 INTRODUCTION

Understanding sustainable exploitation of NTFPs, as a means of achieving the complementary objectives of natural forest conservation and income generation for rural dwellers, has been the topic of substantial debate (Mahapatra, and Mitchell, 1997; Olsson and Folke, 2001). It has been suggested that forest conservation can no longer be dealt with in isolation but needs to be an integral component of the socio-economic development process (Den Hertog, and Wiersum, 2000). However, while this view may seem sensible, the integration of ecosystem conservation and community development is currently being viewed with increasing scepticism, and effectiveness is being questioned (Salafsy and Wollenberg, 2000; Haung, Luukkanen, Jahanson, Kaarakka, Raisanen and Vihemaki, 2002). Some view protection of natural ecosystem as the primary goal, and development as a means to achieve this (the 'biocentric' view), while others view the viability of local communities (community well being) as being the primary goal with conservation being the means to achieve this end (the 'anthropocentric' view) (Mihaeliu, Decker and Lassie, 2002).

Successful commercialisation of NTFPs can be described as one that improves the well-being of the community and enhances or maintains the quality and quantity of the resource. However, this is heavily dependent on the existence and effectiveness of institutions governing the use of the resources as much as the type and status of the resource base. Conservation implies restraint by resource users, and as such biodiversity protection will only take place through institutions such as laws, organisations or cultural practices that control behaviour (Kellert, Mehta and Lichtenfeld, 2000; Brechin, Wilshisen, fortwangler and West, 2002).

Harvesting almost inevitably involves disturbance of some kind, and ecologists recognise that disturbance is an important agent shaping ecosystem structure, function and controlling species diversity, and promoting system renewal (McIntyre and Hobbs, 1999; Larsen, Williams and Kremen, 2005). If the intensity of disturbance is high or protracted, eventually it leads to habitat destruction. Indeed, it is well known that some human activities result in irreversible loss of species and are the major agents of landscape alteration (McItyre and Hobbs, 1999), but still the effects of environmental changes on species composition, diversity and ecosystem functioning are poorly understood (Larsen, Williams and Kremen, 2005).

Together with the promotion of the integration of development in conservation of biodiversity, a shift from species to ecosystem conservation has been equally advocated as a way of reconciling the protection of ecological integrity with the provision of goods and services (Grumbine, 1994). In fact, ecosystem processes directly influence the success of both conservation and development efforts (Kremen, Merenlende and Murphy, 1994). Managing for ecological integrity has also been described as the protection of total native diversity (species, populations, ecosystems) and their ecological patterns and processes that maintain the biodiversity (Grumbine, 1994). Managing ecosystems entails managing the entire system by integrating ecological, economic and social factors to control the biological and physical system and moving from targeted stocks to targeted functions (Mangel, et al., 1996).

Ecosystem conservation requires consideration of the three primary attributes of ecosystems: composition (identity and variety), structure (physical organisation or pattern of a system, habitat complexity within communities, pattern of patches at landscape level) and function (ecological and evolutionary processes

including gene flow, disturbances and nutrient cycling), these determine and constitute the biodiversity of an area (Noss, 2000). These are discussed below.

Community structure determines the magnitude of the major ecosystem processes. Species rich ecosystems offer a large number of different pathways, and buffer species from fluctuations in the abundance of individual resources by spreading risk, implying less diversity systems would be less buffered (Lawton and Brown, 1994). Some people argue that it is the pattern of species interactions that generate ecosystem stability not just numbers of species (Lawton and Brown, 1994). At the same time, cognisance must be taken of the fact that plant communities at different levels of succession vary in species composition even though number of species might be the same i.e. a species dominant at one stage might be rare at another. However, species loss may be tolerated up to some critical threshold after which it would lead to detrimental effects on ecosystem function (Lawton and Brown, 1994).

Ecosystem function can be defined as the maintenance of energy and material flows through an ecosystem and biodiversity or as the ecosystem processes that contribute to the maintenance of homeostasis in an ecosystem (functional diversity). A multiplicity of mechanisms and pathways contribute to ecosystem resilience which means the number of species is not necessarily as important as their roles, all species play a role but some species or group of species exert more influence on ecosystem processes (Silver, Brown and Lugo, 1996). Organisms that capture, concentrate and transfer energy and nutrients across interfaces (atmospheric-terrestrial biotic, plant-soil) exert an influence on the structure and function of the ecosystem. Some of these have been termed key ecosystem processes and as such simplification and disruption of such processes is undesirable (Silver, Brown and Lugo, 1996).

Biological diversity provides for both stability (resistance) and recovery (resilience) from disturbances that disrupt ecosystem processes. Presence of numerous organisms with similar capabilities (redundancy) provides ecosystem stability as well as optimal functioning. Therefore, species diversity is essential for the ability of ecosystems to recover ecosystem processes (Lawton and Brown, 1994; Gale, 2000). Functional groups have similar impacts on the ecosystem processes such that a substitution has minor impacts (Hobbie, Jensen and Chapin III, 1994). On the other hand, species differ in rates and pathways in which they process resources and interact with other species and their physical effects on the environment. Therefore, changes in composition are likely to alter ecosystem processes (Chapin III, Walker, Hoobs, Hooper, Lawton, Sala and Tilman, 1997, Larsen, et al., 2005). Greater diversity allows a greater range of traits to be represented in an ecosystem and more efficient use of resources in a variable environment. Differential environmental sensitivity among functionally similar species gives stability (resistance and resilience) to ecosystem processes whereas if functionally different it would make ecosystems vulnerable (McNaughton, 1994, Tilman, 2001; Chapin III, et. al., 1997).

Ecosystem resilience is crucial to biodiversity conservation. Resilience is a measure of perturbation that can be absorbed before an ecosystem is dislodged to another equilibrium state or the capacity of the system to buffer disturbance (Folke, Holling and Perrings, 1996). Resilience has also been described as the quick return to normal conditions following disturbance. High resilience is equated to stability or a measure of stability (Brown and MacLeod, 1996, Pimm, 1994). As the time between disturbances or their severity increases species diversity increases, but if the time lag or the intensity is extended then competition excludes competitively inferior species (Hobbie, Jensen and Chapin III, 1994).

Even though promoting or maintaining a diversity of functionally equivalent species in ecosystems enhances their resilience. The capacity of ecosystems to recover from disturbance in species composition and to maintain the original species function in a functional group is not the same in all respects (Walker, 1995). As such ecosystems are characterised more by instability than permanence where disturbances keep shifting them to alternative directions and states, causing changes in composition of assemblages thus leading to the non-equilibrium paradigm (Hobbs and Morton, 1999).

This study sought to investigate the contribution made by the commercialisation of NTFPs and local institutional arrangements to the conservation of ecosystems. The work focused on baobab oil, marula oil and makoni tea from *Adansonia digitata*, *Sclerocarya birrea* and *Fadogia ancylantha* respectively (Figure 7.1). Investigations were made as to whether i) successful commercialisation enhanced conservation of a) the source of NTFP and b) the ecosystem in which the resource was found and ii) institutional arrangements had improved conservation of natural resources. Therefore, the two hypotheses being tested simultaneously were:

H1: Extent of NTFP commercialisation has no effect on ecosystem structure and processes

H2: Extent of institutional arrangements' strength or success has no effect ecosystem structure and processes

Predictions based on these hypotheses were:

1. Increasing levels of commercialisation increased the proportion of woodlands retained in near natural state.

2. Low levels of NTFP commercialisation have no affect on anthropogenic disturbances in ecosystems.

3. Increases in strength of institutional arrangements or likelihood of institutional success increased the proportion of areas being retained in near natural state.

4. Low levels of institutional arrangements strength or likelihood of institutional success would have no affect on levels of anthropogenic disturbances in ecosystems.

a) *Adansonia digitata*

b) *Fadogia ancylantha*

c) *Sclerocarya birrea*

Figure 7.1: Sources of three key commercial NTFPs: Baobab oil from *A. digitata* (a), makoni herbal tea from *F. ancylantha* (b) and marula oil from *S. birrea* (c)

7.2 METHODOLOGY

7.2.1 Study sites

The research was conducted in the five study sites described in detail in Chapter 2.

7.2.2 Materials and Methods

7.2.2.1 Evaluation of changes in ecosystem composition and structure

Data on ecosystem structure and composition were collected during two visits to each site between March – May 2004 and January 2005. In order to provide a sampling framework for study sites, the main road (road connecting village to growth point or major business centre) was used as the sampling frame. The distance covered by the road cutting through each site was used to evenly locate line transects placed perpendicular to the road at every one or two (depending on distance) kilometre point alternately in opposite directions. Ecological surveys using the line transects were then conducted in each study site to determine species diversity and composition as well assess the extent of anthropogenic disturbance. Transects were between two and five kilometres long and traversed the major land uses in the area which typically comprised settlements close to the road, followed at increasing distances from the road by crop fields and eventually woodlands.

Along each transect sample plots were systematically sampled at intervals of 500m and 250m in the first and second sampling period respectively. Sample plots were 100m^2 circular plots marked using a 5.64m string. In total 39 transects, with 211 plots covering 0.211ha were surveyed (Table 7.1). In each

plot woody plants were assessed for species occurrence and diameter at breast height (DBH) i.e. diameter at 1.3m from the ground (for trees >2m height). All measurements were captured in a record sheet (Appendix 2). Fruit trees (*Adansonia digitata* and *Sclerocarya birrea*) were assessed in larger plots of 50m radius marked using a Range Finder. For *Fadogia ancylantha* data captured included, occurrence, height, number of stems and leaves (Appendix 3).

Taxonomic identification was based on publications by Van Wyk and Van Wyk (1997) and Carruthers (1997). Transects and sampled plots were tracked and marked by a Global Positioning System (GPS). The gradient of land use from settlement to forest was not continuous with distance from the road, but patchy. Because of this, each sampled plot had to be independently evaluated for anthropogenic disturbance. This evaluation was based on a visual assessment and recorded as follows:

Low level of anthropogenic disturbance	-woodland with more trees than shrubs -few to no trees cut or lopped
Medium level of anthropogenic disturbance	-mixed woodland of trees and shrubs -visible evidence of deforestation and tree lopping
High level of anthropogenic disturbance	-shrubland with few to no trees -many access routes, -evidence of overgrazing and deforestation
Crop field	-land cleared for crop production -cultivated within the last three years

Table 7.1: Sampling intensity for each study site

Site	Grid Reference		Number of transects	Number of plots	Total sampled area (ha)	Total area sampled for fruit trees (ha)
	West to East	North to South				
Chimanimani	32°23' to 32°27'	19°49' to 19°53'	7	44	0.44	34.58
Makoni	32°23' to 32°25'	18°10' to 18°13'	8	42	0.42	33.0
Muzarabani	31°00' to 31°04'	16°18' to 16°23'	6	52	0.52	40.86
Nyanga	32°31' to 32°34'	18°15' to 18°17'	11	46	0.46	36.14
Rushinga*	32°34' to 32°38'	16°37' to 16°41'	7	27	0.27	21.21
Total			39	211	2.11	165.79

*Field work had to be abandoned due to circumstances beyond our control

7.2.2.2 Evaluation of ecosystem function

In this research, the cycling of nutrients was the only ecosystem function process evaluated and this was done through a decomposition experiment. This process has been used widely to assess different ecosystem properties. The most widely used method for measuring this in terrestrial ecosystems is the litter bag technique where periodic weight loss of enclosed litter represents decomposition rates (Weider and Lang, 1982; Singh and Gupta, 1977; Xuluc-Tolosa et al., 2003; Sundarapandian and Swamy, 1999; Alvarez-Sachez and Erinquez, 1996; Gond and Ong, 1983).

Litter used in the decomposition experiments cited above was generally taken from selected dominant species and was collected in three ways. Proctor (1983) used traps suspended 20-30 cm above ground, whilst in some studies fresh litter was collected from the ground by human researchers (e.g. Campbell, et al., 1994; Musvoto, et. al. 2000; Sundarapandian and Swamy, 1999; Alvarez-Sachez and Erinquez, 1996). An alternative method was used by Xuluc-Tolosa, et. al., (2003) who harvested fresh litter directly from the trees. This latter method was adopted here and following standard practice, a litter decomposition experiment was carried out in the six study sites for a period of 12 months between September 2003 and August 2004.

In each study site two or three (if feasible) areas were selected which represented different levels of anthropogenic disturbance (low, medium, high, crop field) Crop fields were chosen by virtue of consent by owner and were at least 200m from the woodland. Three one-square metre plots were located within each area such that they were 100m apart. It was on these one metre square plots that the litter decomposition experiment was undertaken. From

each area of medium (or high if there was no intermediate area) of anthropogenic disturbance, three most dominant species were selected and fresh green-yellow litter collected (50 kg bag) from the trees just before senescence in July and August 2003. The litter was sun dried until constant weight.

Leaf decomposition was evaluated using the litter bag technique where 20 g of litter were put into a litter bag of 7mm mesh and 25 x 25 cm in size. The litter bags were then pinned on the forest floor or crop field. In each plot 16 litter bags were put out giving a total of 48 per management area (woodland or crop field), 96 per study site (144 in Muzarabani, Chimanimani and Nyanga). Litter bags were systematically sampled every three months (January, May and August 2004), dried until constant weight and the mass recorded (Appendix 4). Like many field experiments this research suffered from human interference and some litter bags were removed by local people such that at the end the experimental design was as shown in Table 7.2.

Table 7.2: Number of leaf litter bags in the decomposition experiment at the end of 12 months

Level of anthropogenic disturbance	Study site					
	Chimanimani	**Makoni**	**Muzarabani**	**Nyanga***	**Rushinga 1**	**Rushinga 2****
Low				removed		
Medium	48	48	48	removed		
High	32		32	32	48	48
Crop field	removed	48	48	32	48	removed
Total	80	96	128	64	96	48

* All litter bags were removed by unknown people and the experiment re-started in January 2004

** Site excluded from the analysis

7.2.3 Data analysis

All ecological data were entered into SPSS 11.5 (Pallant, 2004) and analysed for ecosystem structure and composition. Determination of woodland and species (source of NTFP) structure and composition was undertaken for the three management categories from minimal to crop field. Sources of NTFPs were assessed in at least two sites for comparative analysis, *A. digitata* in Chimanimani Muzarabani and Rushinga, *S. birrea* in Muzarabani and Rushinga and *F. ancylantha* in Makoni and Nyanga. These were determined by an existence of commercial activities for a specific product. The assessment of the impacts of commercialisation and the influence of the status of institutions on ecosystem conservation was analysed using the continua of success developed in chapters 3 and 6.

7.2.3.1 Ecosystem structure

The landscape assessment was restricted to the level of anthropogenic disturbance in each area. Data on the number of plots in different anthropogenic categories were pooled and summarised for each site along side the different levels of commercialisation and likelihood of institutional success. A Kruskal Wallis test was used to test the differences in levels of perturbation between the sites.

Tree density, mean DBH and woodland structure were used to assess contributions made by NTFP commercialisation and successful institutions in reducing the impact of anthropogenic disturbance on ecosystem structure. One-way analysis of variance (ANOVA) and post analysis pair wise comparison using least significant differences (LSD) were used to test the differences in tree

density between areas of different anthropogenic disturbance within each specific site.

Tree community structure in all the areas with different levels of anthropogenic disturbance (pooled data from relevant plots) in each study site was assessed for deviations from the ideal reverse J shape by presenting proportions of trees in consecutive DBH categories on a bar chart. Results of the three ecosystem structure variables were then used to test the null hypotheses on commercialisation and institutional arrangements by evaluating whether the result supported or rejected the null hypothesis.

7.2.3.2 Ecosystem composition

To characterise the ecosystem structure and composition, species richness and the Shannon-Weiner diversity index ($H=-\sum (p_i \ln p_i)$ (Begon, Harper and Townsend, 1990) were computed. These were than plotted against levels of disturbance to evaluate changes in the ecosystem composition. Spearman's rank correlation coefficient was computed to assess associations between disturbance, species richness and diversity. In addition, the coefficient of Jaccard, a binary similarity coefficient was used to quantify the overlap in species composition (Krebs, 1999; Boubli, Eriksson, Wich, Hohman and Fruth, 2005) between the three levels of anthropogenic disturbance for each site.

Another characteristic of ecosystem composition is species dominance. An enumeration of changes in the number and names of species that were the most dominant in each level of disturbance was undertaken using pooled data for all the relevant samples. Species taken as dominant in anthropogenic disturbance category were those that had a frequency of more than 5%. This was done to

determine which species had survived the perturbation process from a low to high level.

To determine the number of dominant species in each, disturbance category species frequencies were summed (descending order i.e. starting with the highest) to 25%, 50% and 75% and then enumerating how many species contributed to those frequencies for each level of anthropogenic disturbance. Results of the three ecosystem composition variables were then used to test the null hypotheses on commercialisation and institutional arrangements by evaluating whether the result supported or rejected the null hypotheses.

7.2.3.3 NTFP distribution

The abundance of NTFP sources was determined by computing tree densities for *A. digitata* and *S. birrea* as well as mean number of clumps and stems for *F. ancylantha*. To analyse the distribution of NTFP sources in each study site densities were plotted against levels of anthropogenic disturbance as well as mean densities of all the other species. One way ANOVA and Spearman's Rank Correlations were used to investigate the relationship between NTFP distribution and anthropogenic disturbance in each study site. An assessment was also done to evaluate whether results of distribution and abundance of NTFP sources supported or rejected the null hypotheses about commercialisation and institutional arrangements.

7.2.3.4 Litter decomposition

Mean decomposition (weight of remaining litter) was plotted against time for each level of disturbance and study site. T-tests were performed to test the differences in mean decomposition between levels of disturbance. Spearman's rank correlation was also used to investigate the level of association between decomposition and disturbance. Results were then used to inform assessment of the two hypotheses on commercialisation and institutional strength.

7.3 RESULTS

7.3.1 Ecosystem structure

7.3.1.1 Landscape patterns

Levels of ecosystem degradation varied among the five sites with Chimanimani, Muzarabani and Rushinga having the lowest proportion of plots in the low disturbance category. Nyanga was the least degraded area overall. Levels of disturbance were significantly different between the sites (Kruskal Wallis, X^2 =90.11, df=4, $p<0.001$) and the impact of anthropogenic disturbance decreased with increasing strength of institutional arrangements. Study sites with a low likelihood of institutional success had most of the sampled plots located in the areas of high disturbance (>40%) and the converse was true for those with a high likelihood of institutional success, where most of the plots were in low and medium disturbance levels. No similar influence was evident from

commercialisation for instance one of the low commercialisation sites (Makoni) had the lowest proportion of plots in the high disturbance levels, while the second (Chimanimani) had the highest with some plots being in crop fields (Table 7.3).

A Spearman's Rank correlation confirmed these observations as there was a negative association between institutional strength and disturbance ($r= -0.25$, $p<0.001$) whilst a low though significant relation existed between levels of commercialisation and the latter ($r= 0.07$ $p= 0.02$). This suggests then that stronger institutions reduced levels of ecosystem perturbation such that increases in institutional strength resulted in decreases in anthropogenic disturbance. Therefore, as shown in Table 7.3 the null hypothesis that commercialisation on NTFPs has no effect on the ecosystem cannot be rejected whilst the second hypothesis that extent of success and strength of institutional arrangements has no effect on ecosystems is rejected based on these findings.

Table 7.3: Proportion of sample plots located in areas of different levels of anthropogenic disturbances in the five sites and summaries of hypothesis testing. Hypothesis testing summaries whether or not the distribution of sample plots across levels of anthropogenic disturbance supports or rejects the null hypothesis given in section 7.1.

X = Cannot reject null hypothesis and ✔ = Reject null hypothesis

Study site	Likelihood of institutional success	Level of commercialisation	Number of plots sampled	Level of anthropogenic disturbance				Hypothesis testing	
				Low	Medium	High	Fields	Commercialisation	Institutional arrangements
Chimanimani	Low	Low	44	11.36	6.82	43.18	38.64	✔	✔
Makoni	High	Low	42	23.81	40.48	21.43	14.29	X	✔
Muzarabani	Medium	Medium	52	10.00	16.00	22.00	52.00	✔	✔
Nyanga	Medium	High	46	33.93	25.00	19.64	21.43	✔	✔
Rushinga	Low	Medium	27	11.11	18.52	40.74	29.63	X	✔

7.3.1.2 Community structure

In all sites the deterioration of the ecosystem from low to high levels of disturbance resulted in sharp decreases in tree density, from 980 to 526 trees per hectare in Chimanimani, and 2850 t0 1556 and 2400 to 1545 in Makoni and Rushinga respectively. Although in some sites there was the intermediate response of increasing tree density with disturbance, ultimately tree density decreased to about 50% of the original figures in most sites. High tree densities were associated with younger trees or trees of small diameters. As disturbance increased tree density tended to decrease whilst DBH increased (Figure 7.2). This could be explained by the observation that in highly disturbed areas there were few scattered large trees with no undergrowth. The few trees that existed were those mostly selected for their utilitarian value which resulted in the creation of parklands of monocultures (Figure 7.3). Mean tree densities were significantly different between areas of different anthropogenic disturbances in all sites except for Nyanga (Table 7.4).

Figure 7.4 presents results on community structure in the five study sites for different levels of anthropogenic disturbance. In Chimanimani, Muzarabani and Rushinga the ecosystem structure changed across the disturbance gradient as there were increasingly more trees in the higher DBH size classes, while, in Makoni, and Nyanga the structure remained more or less unchanged. In Chimanimani the trees of DBH size >60 cm constituted 23 % in the low and 71% in high disturbance areas, whilst the same categories had 1% and 3% respectively in Nyanga. However, tree community structure in the least disturbed areas at all sites apart from Nyanga and Rushinga had an inverted J shape typical of healthy and growing populations. In Nyanga and Rushinga woodlands were dominated by the second DBH size class (11-20 cm), 34% and 50% respectively.

In Nyanga and Makoni which have miombo woodlands, changes in tree community structure among areas with the four anthropogenic disturbance levels were not significantly different whilst significant changes were recorded in the other three sites on dry savannas of the lowveld (Table 7.5). Relating the magnitude of changes in tree community structure to levels of institutional success and commercialisation presented no clear overall trends. In Makoni although there was low commercialisation the ecosystem structure was not significantly affected by anthropogenic disturbance.

Table 7.4: Summary of One-way ANOVA for density of trees per ha for the five sites and pair wise comparison (LSD) for the four levels of anthropogenic disturbances

Statistical variables	Study site				
	Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
			ANOVA		
df	3	2	3	2	3
F	42.54	12.18	11.54	1.78	19.78
P	<0.001	<0.001	<0.001	0.17*	<0.001
			Post analysis: Pair wise comparison (LSD, p-values)		
Low and medium	0.93	<0.001	0.76	0.06	0.64
Low and high	<0.001	0.002	0.058	0.35	0.008
Low and crop field	<0.001	nd	<0.001	nd	<0.001
Medium and high	<0.001	0.43	0.013	0.69	0.009
Medium and crop field	<0.001	nd	<0.001	nd	<0.001
High and crop field	<0.001		<0.001		<0.001

nd = one of the anthropogenic levels not recorded in the site

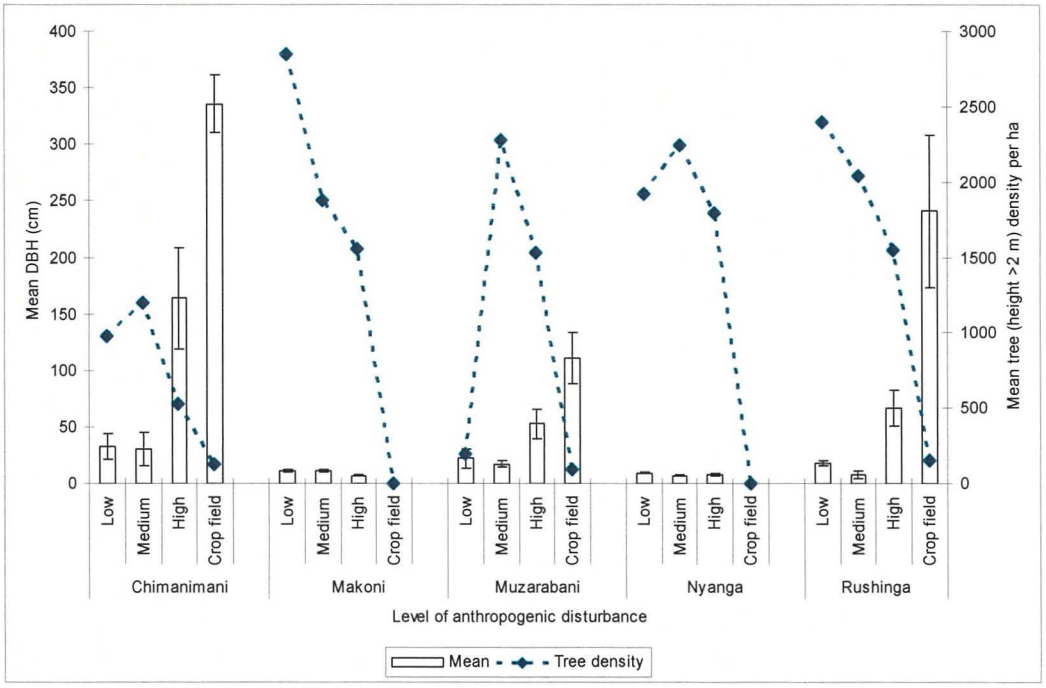


Figure 7.2: Tree abundance (density) and size (DBH) along the disturbance scale for each study site

Figure 7.3: *Adansonia digitata* parklands in Chimanimani, Photograph by P. Sola, August, 2004

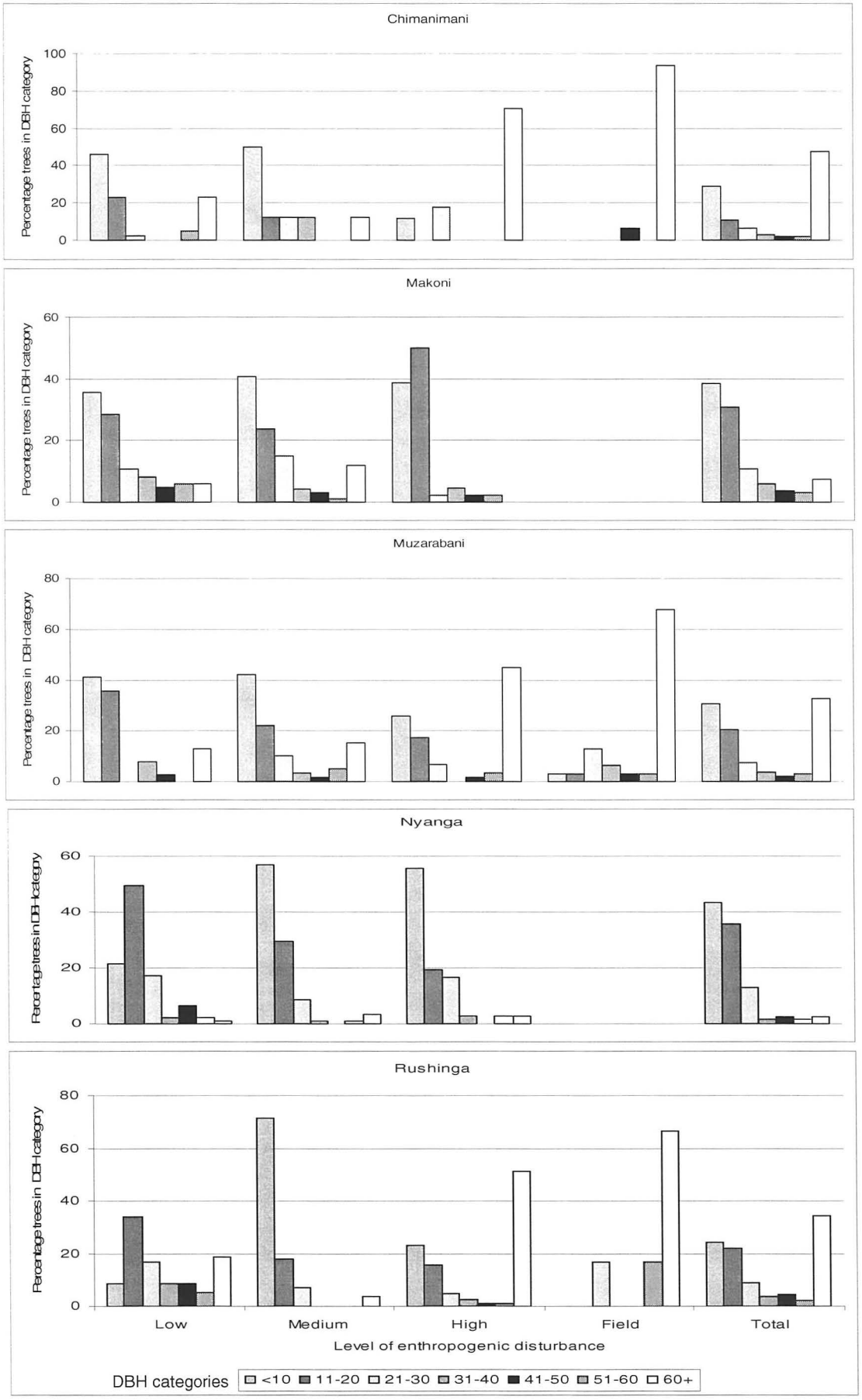


Figure 7.4: Tree community structure for areas with varying levels of disturbance in the five study sites

Table 7.5: Summary of whether or not analysis of the community structure in each one of the study sites supports or rejects the null hypotheses that commercialisation has no effect on ecosystems and success and strength of institutional arranges has no effect on ecosystems. ✔ = Reject null hypothesis, X= Cannot reject null hypothesis

Study site	Likelihood of institutional success	Level of commercialisation	Hypothesis testing					
			Tree density		Mean DBH		Tree community structure	
			Commercialisation	Institutional arrangements	Commercialisation	Institutional arrangements	Commercialisation	Institutional arrangements
Chimanimani	Low	Low	✔	✔	✔	✔	✔	✔
Makoni	High	Low	✔	X	X	✔	X	✔
Muzarabani	Medium	Medium	X	✔	✔	✔	✔	✔
Nyanga	Medium	High	✔	✔	✔	✔	✔	✔
Rushinga	Low	Medium	X	✔	✔	✔	✔	✔

7.3.2 Ecosystem composition

7.3.2.1 Tree species richness

A total of 907 trees (height > 2m) were recorded from 131 species (Appendix 5). The number of trees was highest in Makoni (300), and least in Chimanimani (113). Species richness followed the same trend with high values of 65 and 52 in Makoni and Muzarabani and lower values of 44, 43 and 30 in Rushinga, Nyanga and Chimanimani respectively. Species richness changed with changes in the level of disturbance but the direction of change varied among the five sites. In Makoni, Muzarabani and Nyanga species richness was highest at intermediate disturbance while in Chimanimani and Rushinga species richness was lowest at this level of disturbance (Figure 7.5). However, a high negative association was found between species richness and anthropogenic disturbance Chimanimani ($r= -0.87$, $p<0.001$), Makoni ($r= -0.33$, $p=0.03$), Muzarabani, ($r= -0.79$, $p<0.001$), Nyanga ($r= -0.41$, $p=0.008$) and Rushinga ($r= -0.47$, $p=0.023$). These results could not be explained by changes in level of commercialisation, but one evident trend was that species richness increased with increasing institutional success (Spearman's Rank Correlation, $r=0.3$, $p<0.001$).

A pair wise comparison (Jaccard coefficient of similarity) of tree species composition between anthropogenic disturbance levels in each site revealed that there was about 60% overlap in species found in areas of different anthropogenic disturbance (Table 7.6). This means that along the gradient of disturbance about three in every five species persisted in the new tree community and the rest would be new species. What this result cannot show is just which species persisted.

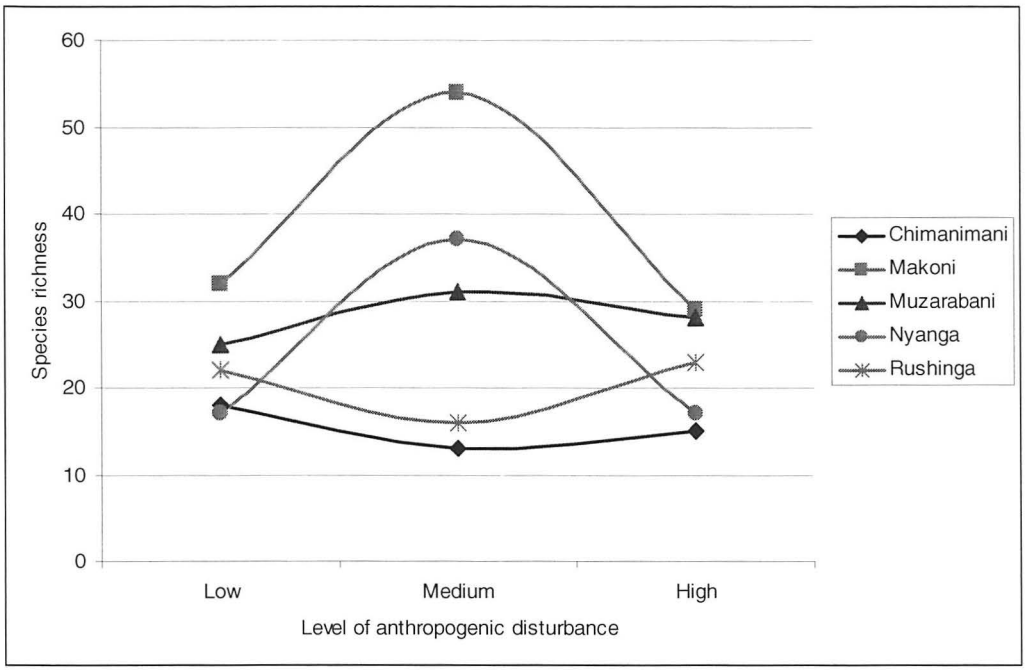


Figure 7.5: Species richness along the anthropogenic disturbance scale for each study site

Table 7.6: Jaccard similarity coefficient for pair wise comparison of tree species composition between anthropogenic levels in each site

Study site	Level of anthropogenic disturbance		
	Low and Medium	Medium and high	Low and High
Chimanimani	0.60	0.58	0.63
Makoni	0.66	0.63	0.67
Muzarabani	0.59	0.64	0.62
Nyanga	0.59	0.68	0.64
Rushinga	0.61	0.61	0.6

7.3.2.2 Species diversity

Calculation of the Shannon-Weiner diversity index showed that Chimanimani and Makoni had the most diverse woodlands with indices of 5.0 and 5.5 respectively. Nyanga was the least diverse with an index of 1.8. A plot of the Shannon-Weiner index along the disturbance scale revealed that, diversity remained almost constant in Makoni (from 4.2 to 5) and Nyanga (from 1.7 to 1.2) sites, whilst in Muzarabani and Rushinga diversity increased and in Chimanimani diversity decreased as disturbance increased (Figure 7.6). This was further supported by the Spearman's rank correlation coefficient between the two variables such that in Chimanimani ($r= -1.0$, $p<0.001$), Makoni ($r=0.33$, $p=0.03$), Muzarabani ($r=0.75$, $p<0.001$), Nyanga ($r= -0.48$, $p<0.001$) and in Rushinga ($r=1.0$, $p<0.001$). The increase could be attributed to a prolific regeneration of new species (succession) while in Chimanimani some species were being lost.

Another interesting result was that as the anthropogenic disturbance increased species dominance changed, though areas with low and high disturbance had similar species (Table 7.7). Only Nyanga had the same species being dominant in all the disturbance levels, in the other site dominance switched between species. In addition, disturbance changed the number of dominant species (Table 7.8). Dominant species decreased along the gradient of perturbation in Chimanimani, increased in Makoni and Rushinga and remained more or less constant in Muzarabani and Nyanga. These results are in concurrence with the diversity-disturbance relationship. Furthermore, an assessment of these results across commercialisation and institutional success gradients showed that the hypotheses set out earlier could not be rejected (Table 7.9).

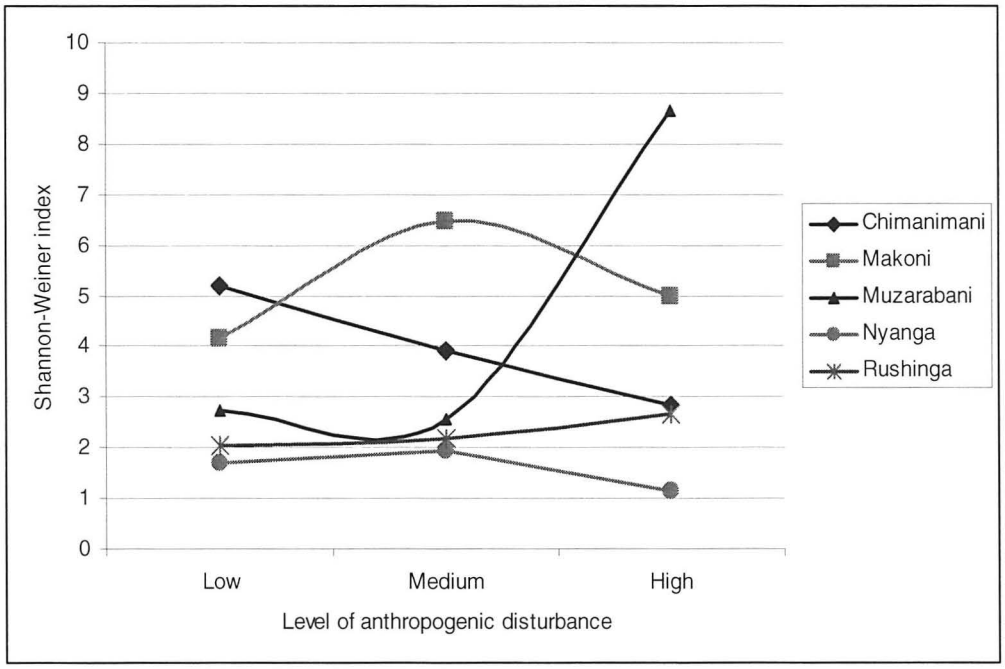


Figure 7.6: Shannon –Weiner diversity index along the anthropogenic disturbance scale for each study site

Table 7.7: Occurrence of species with more than 5% frequency in the disturbance area in the five study sites, in bold are species that have persisted from the 'original' woodland (areas of low disturbance)

Study site	Level of anthropogenic disturbance				
	Low	**Medium**	**High**	**Field**	**Overall**
Chimanimani	*Diopyros quiloensis* *Acacia karroo* *Combretum apiculatum* *Colophospermum mopane* *Adansonia digitata*	***Diospyros quiloensis*** ***Colophospermum mopane*** ***Adansonia digitata*** *Bridelia mollis* ***Combretum apiculatum*** *Dichrostachys cinerea*	***Acacia karroo*** ***Adansonia digitata*** *Acacia nilotica*	***Adansonia digitata***	*Acacia karroo* *Adansonia digitata* *Diopyros quiloensis* *Colophospermum mopane*
Makoni	*Julbernardia globiflora,* *Dichrostachys cinerea,* *Brachystegia spiciformis*	***Dichrostachys cinerea*** *Bauhinia galpinii* ***Brachystegia spiciformis*** *Terminalia stenostachya* *Lannea discolor*	***Julbernardia globiflora,*** *Terminalia stenostachya* *Monotes glaber* *Faurea saligna,* *Pterocarpus rotundifolius* ***Brachystegia spiciformis***		*Julbernardia globiflora,* *Brachystegia spiciformis* *Dichrostachys cinerea*
Muzarabani	*Sclerocarya birrea,* *Combretum apiculatum* *Bauhinia galpinii* *Combretum collinum*	***Sclerocarya birrea,*** *Colophospermum mopane* ***Combretum apiculatum***	***Combretum collinum*** *Colophospermum mopane* ***Sclerocarya birrea,*** *Friesodielsia obovata*	***Sclerocarya birrea*** *Adansonia digitata*	*Sclerocarya birrea* *Colophospermum mopane* *Combretum collinum* *Combretum apiculatum*
Nyanga	*Julbernardia globiflora,* *Brachystegia spiciformis* *Monotes glaber*	***Julbernardia globiflora*** ***Brachystegia spiciformis***	***Julbernardia globiflora,*** ***Brachystegia spiciformis***		*Julbernardia globiflora,* *Brachystegia spiciformis*
Rushinga	*Sclerocarya birrea* *Combretum collinum* *Dichrostachys cinerea,* *Terminalia sericea*	***Combretum collinum*** *Acacia nigrescens* *Markhamia zambesiaca* *Acacia nilotica*	***Combretum collinum*** ***Sclerocarya birrea*** *Combretum apiculatum*	***Sclerocarya birrea*** *Adansonia digitata*	*Combretum collinum* *Sclerocarya birrea* *Combretum apiculatum* *Acacia nilotica* *Acacia nigrescens*

Table 7.8: Number of dominant species based on % contribution of species richness (S), starting with highest contributors (most abundant)

		Level of anthropogenic disturbance		
Site	**Total % contribution of species richness**	**Low**	**Medium**	**High**
Chimanimani	<25	1	1	1
	26-50	4	2	1
	51-75	8	6	2
	75-100	10	7	13
	S	**18**	**13**	**15**
Makoni	<25	1	3	2
	26-50	2	7	5
	51-75	4	17	16
	75+	28	37	13
	S	**32**	**54**	**29**
Muzarabani	<25	2	1	2
	26-50	4	4	3
	51-75	9	11	8
	75+	16	20	20
	S	**25**	**31**	**28**
Nyanga	<25	1	1	1
	26-50	2	1	1
	51-75	3	5	2
	75+	14	32	15
	S	**17**	**37**	**17**
Rushiga	<25	1	1	1
	26-50	1	2	3
	51-75	2	5	9
	75+	20	11	14
	S	**22**	**16**	**23**

Table 7.9: Summary of whether or not analysis of the ecosystem composition in each one of the study sites supports or rejects the null hypotheses that commercialisation has no effect on ecosystems and that success and strength of institutional arranges has no effect on ecosystems; ✔ = Reject null hypothesis and X = Cannot reject null hypothesis

Study site	Likelihood of institutional success	Level of commercialisation	Hypothesis testing					
			Species richness		Species diversity		Species dominance	
			Commercialisation	Institutional arrangements	Commercialisation	Institutional arrangements	Commercialisation	Institutional arrangements
Chimanimani	Low	Low	X	✔	✔	✔	✔	✔
Makoni	High	Low	✔	✔	X	✔	✔	X
Muzarabani	Medium	Medium	X	✔	✔	✔	X	X
Nyanga	Medium	High	✔	✔	X	✔	✔	✔
Rushinga	Low	Medium	✔	✔	X	✔	X	✔

7.3.3 Distribution of sources of three commercial NTFPS

7.3.3.1 Distribution of *Adansonia digitata* and *Sclerocarya birrea*

A plot of tree density and sources of NTFPs (*A. digitata* and *S. birrea*) showed varied patterns. In Muzarabani the density of *A. digitata* decreased with decreasing tree density and increasing disturbance from 40 to 31 trees/ha whilst in Chimanimani *A. digitata* increased, from 60 to 129 exhibiting positive associations with trees density (Spearman's Rank Correlation r= 0.91, p<0.001) and with anthropogenic disturbance (Spearman's Rank Correlation r= 0.52, p=0.006. Although *A. digitata* densities in Rushinga increased from 0 to 75, this was independent of anthropogenic disturbance (Spearman's Rank Correlation r= 0, p=1) (Figure 7.7). As already presented in Table 2.1 (Chapter 2) even though in Chimanimani the commercialisation level as assessed by this study is low, the community has engaged in harvesting and selling of baobab fruit for over 50 years and this could explain the increase in the density of *A. digitata* with increasing disturbance coupled with decreased in tree density.

In Muzarabani the density of *S. birrea* decreased with increasing disturbance and decreasing tree density (Spearman's Rank Correlation r= 0.87; p <0.001) from 420 to 300 (Spearman's Rank Correlation r= -0.67, p=0.001) and from 1300 to 75 in Rushinga (Figure 7.8). In the latter site the relationship was negative (Spearman's Rank Correlation r= -0.61, p=0.01) implying that *S. birrea* decreased with increasing anthropogenic disturbance.

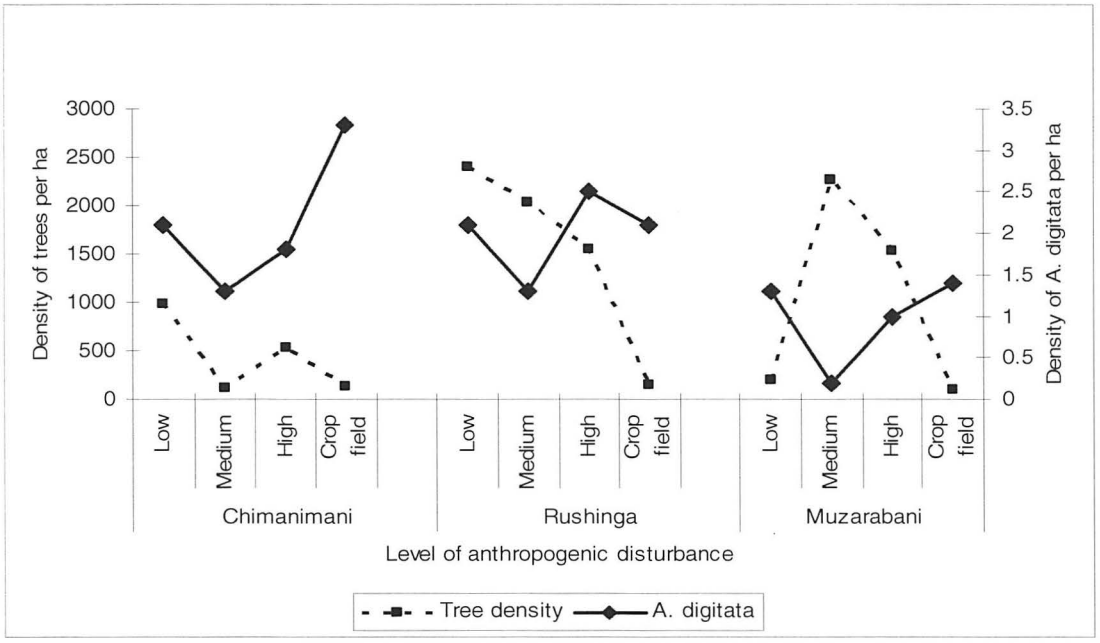


Figure 7.7: Abundance (density) of *A. digitata* in relation to tree abundance (density) across the anthropogenic disturbance scale for each site

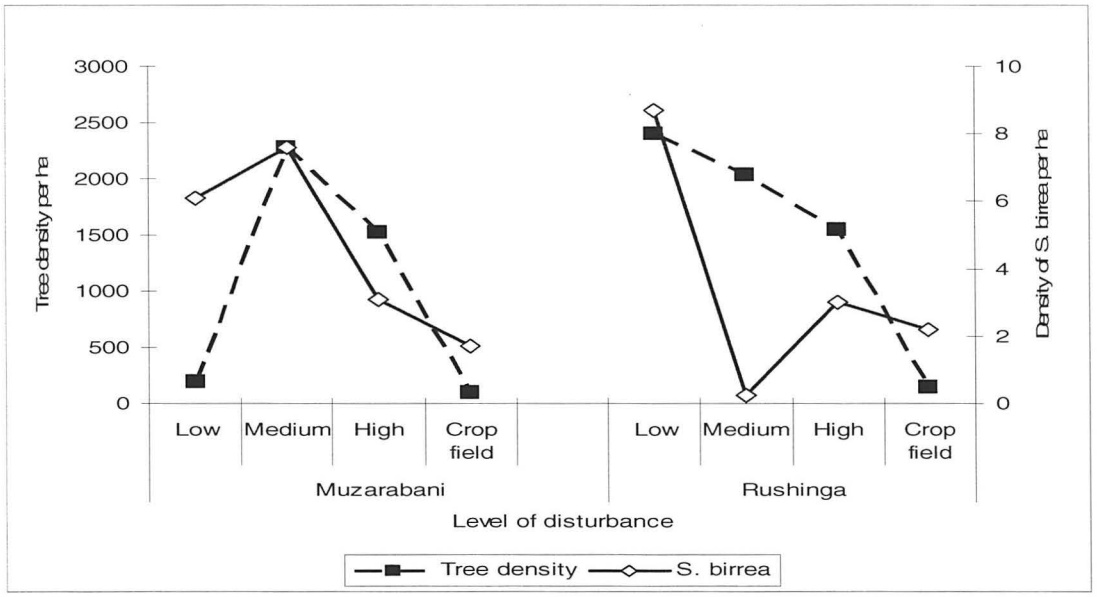


Figure 7.8: Abundance (density) of *S. birrea* in relation to tree abundance (density) across the anthropogenic disturbance scale for each site

7.3.3.2 Herbal tea

F. ancylantha was more widely distributed in Makoni than Nyanga with 40% and 26% of the plots having the plant in the respective sites. Furthermore, in Makoni 53% of the plots with the plant were in the areas of intermediate disturbance whilst in Nyanga the highest proportion of the plots with *F. ancylantha* was in the high disturbance areas (42%). Mean plant densities (number of clumps) followed the same trend in Makoni but not in Nyanga. In Nyanga more plants were found in the intermediate than the high disturbance areas (Table 7.10). A Spearman's rank correlation showed that in Nyanga there was a negative association between anthropogenic disturbance and distribution of *F. ancylantha* (Spearman's Rank correlation, r= -0.19, p=0.3) whilst in Makoni the relationship was positive (Spearman's Rank correlation r=0.14, p=0.44).

The actual size of the plant is determined by height and number of stems. In both sites mean plant height decreased by almost 30 cm, though the overall mean height in Makoni (97.3 cm) was greater than that in Nyanga (80.9 cm) where there was a consistence decrease from low to high disturbance. Further analysis indicated that mean stem density was highest in high and intermediate areas of disturbance for Makoni and Nyanga respectively (Figure 7.9). However plant height was not significantly different across disturbance levels for both Makoni (One way ANOVA, df=2, F=0.31, p=0.75), and Nyanga (One way ANOVA, df=2, F=0.96, p=0.40). In Nyanga the trend for stem density was the same as that of tree density whilst in Makoni the trend exhibited was inversely related to that of tree density which decreased with increasing disturbance. Stem density between areas of varying anthropogenic disturbance was not significantly different in Makoni (One way ANOVA, df=2, F=2.21, p= 0.13) but were significantly different in Nyanga (One way ANOVA, df=2, F=4.04, p=0.03).

The distribution and size of the herb *F. ancylantha* increased with increases in levels of commercilisation suggesting that commercialisation had an impact on this species; however, the same could not be confidently said about the fruit trees *A. digitata* and *S. birrea* (Table 7.11).

Table 7.10: Distribution and abundance of *F. ancylantha* in Nyanga and Makoni districts

		Study site							
		Makoni Level of anthropogenic disturbance				**Nyanga Level of anthropogenic disturbance**			
Variables	Statistic	Low	Medium	High	Total	Low	Medium	High	Total
Plot frequency	% plots	23.5	52.9	23.5	100	25.0	33.3	41.7	100
	N	4	9	4	17	3	4	5	12
Clumps	Mean	1.8	3.2	2.5	2.7	2	4	2.8	3
	Std. Dev	0.9	3.5	2.4	2.8	1	4.7	1.6	2.8
	N	4	9	4	17	3	4	5	12
Plant height	Mean	90.6	94.50	66.0	89.7	97.3	85.2	70.6	80.9
	N	4	14	3	21	6	11	14	31
	Std. Dev	33.3	44.9	18.5	40.1	33.8	33.8	28.5	32.1

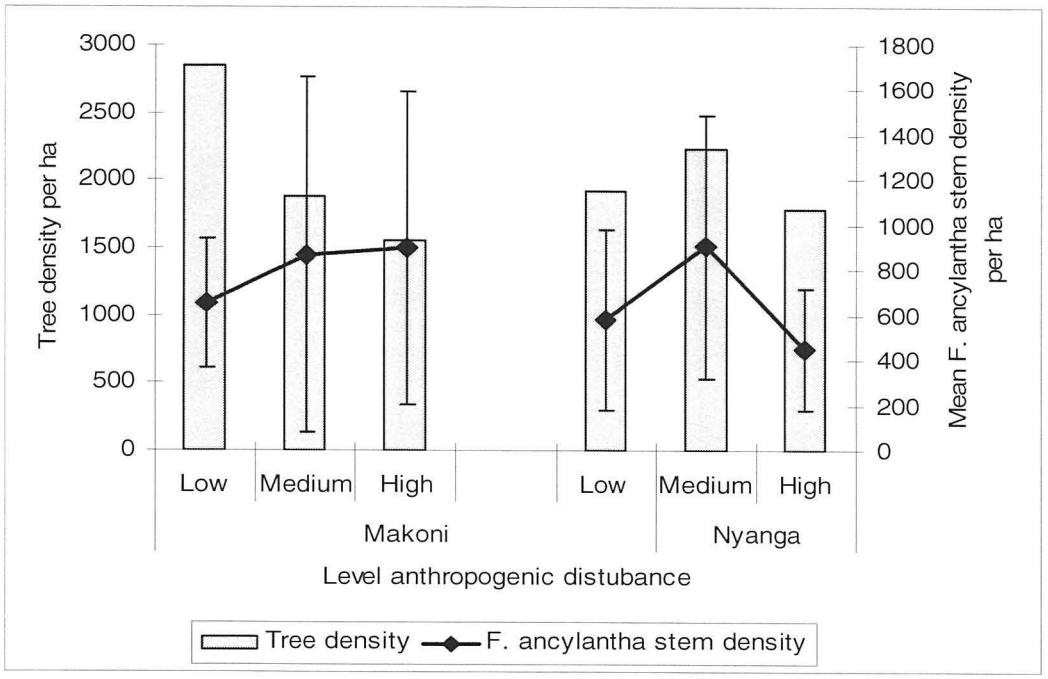


Figure 7.9: *F. ancylantha* stem density in relation to tree density and anthropogenic disturbance in Makoni and Nyanga districts

Table 7.11: Summary of whether or not analysis of the distribution of trees species that are sources of commercial NTFP in each one of the study sites supports or rejects the null hypotheses that commercialisation has no effect on ecosystems and success and strength of institutional arranges has no effect on ecosystems;

✔ = Reject null hypothesis' X= Cannot reject

Site	Level of commercialisation (LC)	Likelihood of institutional success (LIS)	Hypothesis testing											
			Fadogia ancylantha								*Adansonia digitata*		*Scerocarya birrea*	
			Distribution		Clump density		Size (height)		Mean stem density		Density		Density	
			LC	LIS	LC	LIS	LC	LIS	LC	LIS	LC	LIS	LC	LIS
Makoni	Low	High	X	X	X	X	X	X	✔	X				
Nyanga	High	High	✔	X	X	X	✔	X	✔	✔				
Chimanimani	Low	Medium									✔	X		
Muzarabani	Medium	Medium									X	✔	X	✔
Rushinga	Medium	Low									✔	✔	X	X
Muzarabani	Medium	Medium									X	X	X	X

7.3.4 Ecosystem function

Litter decomposition was highest in the hot dry savannas of the lowveld, with rates of 93% and 79% in Chimanimani and Rushinga respectively. Nyanga also had high rates of decomposition of 84.8% which was attributed to termites. The lowest decomposition was in Makoni (60%) and Muzarabani (72%). Remaining litter and percentage decomposition were inversely related variables in this experiment and their magnitudes were expected to be the same. However, in Makoni and Nyanga even though percentage decomposition (decomposition rate) was not directly related to disturbance, remaining litter and disturbance emerged to be directly associated at the three sampling times (Table 7.12). On the contrary, final decomposition was positively correlated with anthropogenic disturbance, such that an increase in disturbance resulted in an increase in decomposition. Another interesting result was that, for sites located in the hot dry lowveld (Chiman imani and Muzarabani) there was a direct positive relationship between percentage decomposition and species diversity ($r=1.0$, $p<0.001$) whilst in the sites on highveld the relationship was negative, Makoni ($r= -0.32$, $p=0.013$) and Nyanga ($r= -0.23$, $p=0.25$).

A plot of litter decomposition (remaining litter) along the anthropogenic disturbance scale revealed that decomposition rates in low disturbance sites were much lower than in the medium, high and crop fields for all sites except Nyanga (Figure 7.10). These trends were supported by T-tests performed to test the difference in mean decomposition between levels of anthropogenic disturbance. The amount of decomposed litter was significantly different between medium disturbance and crop field (Makoni), medium and high disturbance areas (Muzarabani) and high disturbance areas and crop fields

(Nyanga). However no differences were significant in Chimanimani and Rushinga (Table 7.13).

The strength of institutional arrangements had a strong association with decomposition. Decomposition rates decreased with increases in institutional success. For instance, Rushinga (LIS =low) and Chimanimani (LIS=lower medium), had the highest rates, whilst Muzarabani (LIS=upper medium) and Makoni (LIS=high) had relatively lower decomposition rates. This was evidenced by the amount of litter remaining every four months and the final decomposition after 12 months (Figure 7.10).

Table 7.12: Spearman's Rank Correlation coefficients for disturbance levels and decomposition

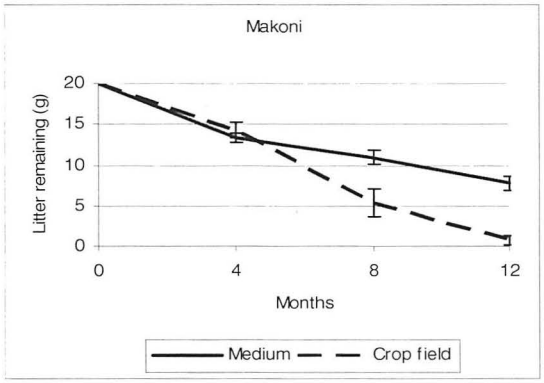
Study site	**Study sites**				
Variables	**Chimanimani**	**Makoni**	**Muzarabani**	**Nyanga**	**Rushinga**
	Spearman's Rank Correlation				
Disturbance and final decomposition	0.43 (0.18)	0.82 (0)*	0.63 (0)*	0.11 (0.68)	0.63 (0.001)*
Disturbance and % decomposition	0.21 (0.22)	0.32 (0.013)*	0.27 (0.018)*	0.23 (0.25)	0.18 (0.18)
Remaining litter and disturbance	-0.21 (0.22)	-1.0 (0)*	-0.27 (0.018)*	-1.0 (0)*	-0.18 (0.18)
Disturbance and species diversity	1.0 (0)*	-0.32 (0.013)	1.0 (0.02)*	-0.23 (0.25)	nc

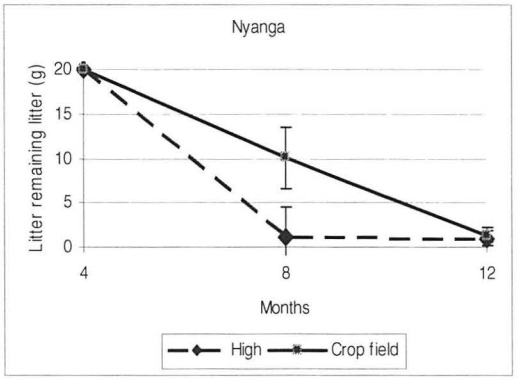
* Significant at 0.05 significance level
nc – could not be computed

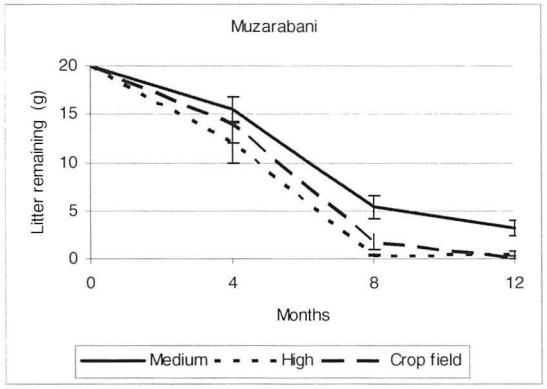
Table 7.13: Significance testing of differences in mean decomposition between areas of different levels of anthropogenic disturbance using a t-test

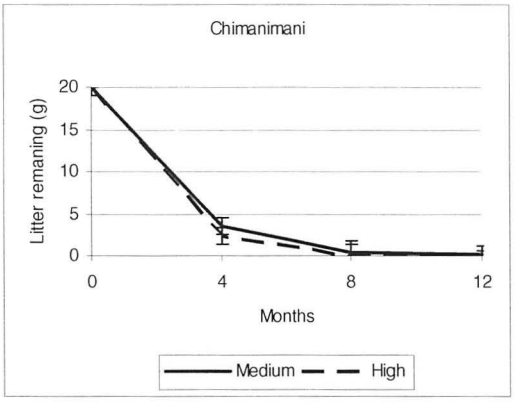
Site	Anthropogenic disturbance	T	df	p	Number of litter bags
Chimanimani	Medium and high	0.667	33	0.51	35
Makoni	Medium and crop field	3.066	58	0.003*	60
Muzarabani	Medium and crop field	-1.26	58	0.21	60
	Medium and high	2.12	46	0.04*	48
	High and crop field	0.8	48	0.43	50
Nyanga	High and crop field	-2.115	26	0.04*	28
Rushinga	High and crop field	0.733	58	0.466	60

* Significant at 0.05 significance level









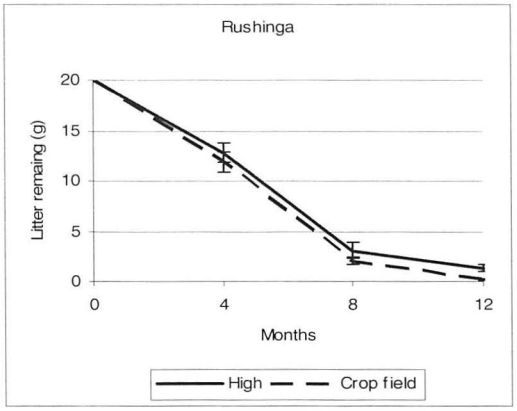


Figure 7.10: Rate of leaf litter decomposition for areas with varying anthropogenic disturbances in the five study sites

7.4 DISCUSSION

7.4.1 Discussion overview

Livelihoods of many people are dependent on forest products and therefore anthropogenic disturbance cannot be excluded from such ecosystems. There is evidence that human activities result in dramatic changes in the structure and composition of ecological communities either through species loss, introduction of exotics, or increase in invasive species (Hooper et. al., 2005) and it has been claimed that the greatest threat to ecosystems is simplification and total loss through land use conversion which often results in patchy landscapes (Smart, Whiting and Twine, 2005; Xuluc-Tolosa et. al., 2002).

CBNRM strategies are initiated to manage and guide human behaviour so as to minimise perturbation of ecosystems. Therefore, this research sought to investigate if commercialisation and institutional arrangements such as CBNRM strategies had indeed managed to reduce the impacts of anthropogenic disturbance on ecosystems and improved their conservation status in the five study areas. In summary, there is very little evidence from this research to suggest that commercialisation of NTFPs has improved ecosystem conservation in Zimbabwe. However, results from this study do suggest that the success and strength of institutional arrangements contributed to ecosystem conservation by reducing the scale of anthropogenic disturbances.

It is important to highlight that conclusions being made here are based on a simplistic view (unidirectional and non-interactive relationships between commercialisation, livelihoods, ecosystems and institutional arrangements). In this study what was being investigated were the changes in ecosystem health as a result of NTFP commercialisation and institutional success. No attempt was

made to assess how the two drivers of change interacted to change ecosystems because such an interaction does exist. It could be said that, i) in some cases successful commercialisation leads to a breakdown in local institutions presumably due to shift in power, and ii) some institutional arrangements constrain while other facilitate the success of commercialisation (Figure 7.11). This then suggests there are optimal commercialisation and institutional arrangements that would be ideal for ecosystem conservation. This aspect remains a subject for further research.

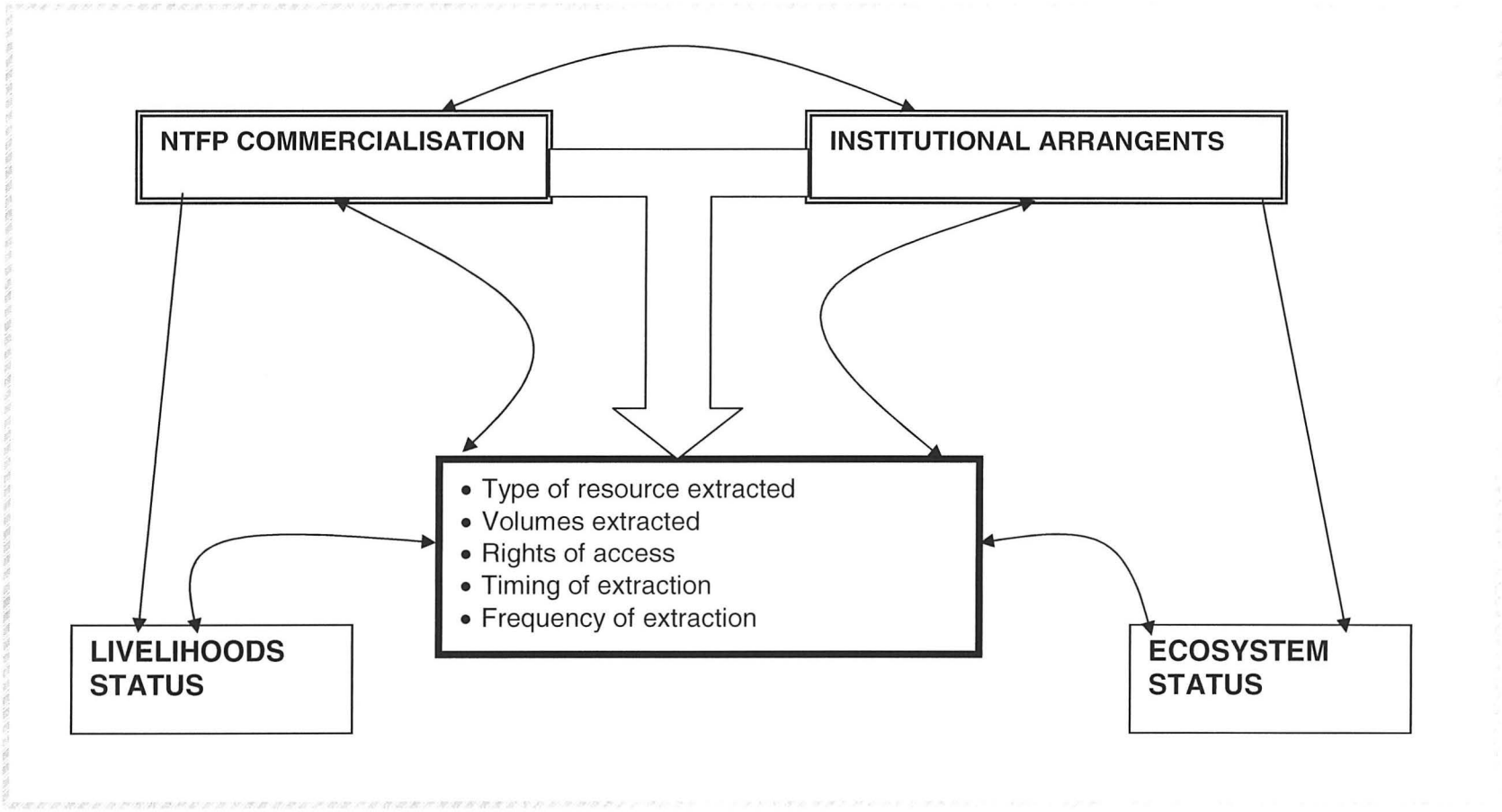


Figure 7.11: Schematic diagram of how commercialisation of NTFPs and institutional arrangements can influence the relationship between livelihoods and ecosystems. Findings on livelihoods and commercialisation were presented in chapter 4 and 5 but the big arrow representing interaction was not investigated in this research

7.4.2 Ecosystem structure and CBNRM

Extraction of products and use of ecosystem services by people is changing the structure of the ecosystems. In this research it was found that tree density and sizes of trees (DBH) decreased with increasing levels of anthropogenic disturbance. The relevant question arising from this is to what extent were CBNRM strategies reducing the decrease. From this research, indications are that commercialisation has had no impact on the magnitude of anthropogenic disturbance on ecosystems structure as there was no clear trend of decrease with increasing levels of commercialisation. In fact, some areas with low commercialisation had the least disturbed areas. However, increased strength of institutional arrangements reduced the scale of anthropogenic disturbance since less land was in the areas of high perturbation for sites with high likelihood of institutional success than in those with low and medium likelihood of success. In addition, the site with high levels of both commercialisation and strength of institutional arrangements had the most conserved ecosystem which suggests that there could be an optimal combination of the two socio-economic factors for successful conservation.

7.4.3 Ecosystem composition

This research suggests that anthropogenic disturbance has altered ecosystems by changing species composition or forcing them to into an alternative successional state regardless of levels of commercialisation. In fact species composition was changed by 40 % at every level of anthropogenic disturbance for all the study sites. In three sites species richness response to disturbance were similar to that of natural populations which exhibit increases at intermediate disturbance. This supports the intermediate response hypothesis which predicts that between species extinction and competitive equilibrium where species of low competitive ability are lost is a level of disturbance that maximises biological

diversity suggesting that species richness is enhanced by reduced competition (Connell, 1978; Huston, 1994, Wilson and Tilman, 2002)

However, not all tree communities comply with this hypothesis, for instance in this study, some sites had decreased species richness at intermediate disturbance. These results could not be explained by influences of NTFP commercialisation as at low levels of commercialisation the impact of disturbance in one site (Makoni) was not adverse thus ecosystems were better managed yet in the other (Chimanimani) which was in the same commercialisation category there were species losses as evidenced by drastic changes in species composition. It means then, that in the latter (Chimanimani) there was not just reduced competition but high degradation as predicted by this research.

Species diversity decreased with increased strength of institutional arrangements, but then more conserved areas were found in miombo woodlands which have inherently low diversity making it difficult to sustain this claim. However, to support this claim, species diversity in one site (Chimanimani) decreased due to species loss which is similar to a result that Behera, Kushwaha and Roy (2005) found working in a Himalayan forest. They concluded that decrease in the Shanonn-Weiner index along a disturbance gradient was due to high species richness in the natural forests and species loss in the degraded areas (Behera, Kushwaha and Roy, 2005). Such decreases in species diversity have been said to be linked to limitations of dominant species and emergence of unfavourable habitat conditions (Solon, 1995). Increases in species diversity with increases in anthropogenic disturbances in some of the sites could be attributed to these ecosystems responding by shrubland formation. The driving force behind maintenance of species composition to a near natural state was the strength of institutions.

Changes in species composition were coupled with changes in dominant species, which decreased with increasing disturbance though there was some constancy in areas. This trend was not influenced by commercialisation but institutional success, as less change were recorded in areas of high institutional success which implies they were conserved at a near natural state (Nyanga and Muzarabani). However, it has been said that species composition resulting from deforestation does not return to an original state as re-establishment of former dominants is very unlikely (McGregor, Maruzane and Mukwekwerere, 1999) therefore some allowances have to be made in drawing these conclusions.

Anthropogenic disturbance is destroying ecosystems and forming parklands of monocultures as only the trees most valued by the community are left standing (Schreckenberg, 1999; Crook, Lapp, 1998). Densities of *Adansonia digitata* increased with levels of disturbance in all areas where the species occurred and was valued. *Sclerocarya birrea* did not enjoy the same utilitarian value and had decreasing trend like all other species. However the distribution and growth of *Fadogia anclylantha* was not clear as in one site (Makoni) densities increased with disturbance and in another (Nyanga) there was no relationship though changes in tree density resulted in inverse changes in *F. ancylantha* variables.

7.4.4 Ecosystem function

Anthropogenic disturbance resulted in changed decomposition rates such that decomposition was low in areas of high species richness and high in degraded lands. There was no evidence that commercialisation influenced decomposition rates whilst success of institutions contributed to the reduction of decomposition rates. Institutional strength led to decreases in anthropogenic disturbance, thus increasing conserved areas of high species richness and it was in such areas that decomposition was lowest. However, anthropogenic disturbance increased with species diversity and decomposition in high decomposing environments whilst in slow decomposing environments decomposition and species diversity decreased with increases in disturbance.

7.5 CONCLUSION

Community based natural resources management have failed to offer incentives to local people to use natural resources sustainably. The current benefit driven approach of NTFP commercialisation has had no influence or impact on the rate, scale and magnitude of ecosystem simplification, fragmentation and destruction. There are many reasons for this lack of success. Firstly, as already shown in chapter 3, 4 and 5 NTFP commercialisation has not become widespread in Zimbabwe. The programmes initiated to facilitate this process had short comings, and very few people are involved, in formal trade of NTFPs making the benefits concentrated whilst the costs of extraction are borne by a wider community. Even for those few who are involved the incomes generated are too low to justify any investment in managing natural resources, let alone justifying the existence of these resources to a rural farmer struggling for day to day survival.

Potentially, commercialisation of NTFPs could lead to ecosystem degradation as only species of value will be conserved while all else is removed. This means therefore that

successful NTFP commercialisation would have to be supported by strong institutional arrangements. From this study I can conclude that indeed institutional arrangements do improve ecosystem management by reducing and or managing the rate, scale and magnitude of anthropogenic disturbance on ecosystems.

The ecosystem approach to natural resource management has not been adopted as only the species of value are conserved. Resultant ecosystems have not only lost resilience and stability but the potential value for more products and services. Parklands formed as a result of selecting valued species are of reduced value compared to the total as they reduce current and future livelihood options. As a negative feed back such ecosystems become an increasing liability to conserve and land use conversion continues.

However, not all is lost, based on this study the hypothesis that NTFP commercialisation improves ecosystem conservation by increasing value of forests and incentives for management and stewardship is still largely untested. It still remains an undisputed claim that conservationist and development practitioners working with resource users are yet to test and qualify. Differences in responses of ecosystems to perturbation bring an additional dimension to this debate that is essential to investigate when conservation strategies are being developed.

CHAPTER 8

GENERAL DISCUSSION

8.1 Research overview

This study set out to evaluate the exact nature of the relationship between commercialisation of NTFPs, ecosystem health and human well being. This relationship has been a centre of debate for the past two decades (see for example: Padoch, 1992; Mahapatra, and Mitchell, 1997; Neumann and Hirch, 2000; Brechin, Wilshusen, Fortwangler and West, 2002). As a result of these and other various studies a range of conclusions have already been reached about NTFPs, including that:

i) market-oriented conservation seldom leads to financial returns and cannot be an incentive for biodiversity conservation are premature, as such NTFP commercialisation should remain a livelihood option (Shackleton, 2001)

ii) there is no real evidence to suggest commercialisation of non-timber products have the potential to make forest use more sustainable (Byron and Arnold 1999; Cavendish 2000; Arnold and Ruiz-Perez, 2001)

iii) the objectives linking development and conservation are fundamentally flawed and a contradiction in terms (Crook, Clapp,1998; Arnold and Ruiz-Perez, 2001)

iv) commercialisation does not necessarily provide opportunities for the rural poor as high transaction costs associated with marketing make them less attractive for those emerging out of poverty (Arnold, 1994)

v) increase in markets leads to overexploitation of resources and exacerbates rather than reduces the pressures that cause over harvesting (Byron and Arnold 1999; Cavendish 2000; Arnold and Ruiz-Perez, 2001),

vi) once extraction of the NTFPs is on commercial basis the bulk of the benefits are captured by the wealthier at the expense of the poor who have no access to skills and capital (Campbell and Byron, 1996; Arnold and Ruiz-Perez, 2001)

vii) sale of NTFPs is used to supplement temporary declines in cash income and not for long term improvement of household welfare (Campbell and Byron, 1996; Neumann and Hirch, 2000; Agarwal, 2001)

viii) commercialisation of NTFPs has been said to add value to the forest by increasing incentives to retain forest resources (Arnold and Ruiz-Perez, 2001; Anderson, Locker and Nugent, 2002).

ix) NTFP commercial activities operate at different levels of development, complexity and organisation and as such their outcomes are likely to have differential impacts depending on the contextual situation (Arnold, 1994)

x) conservation implies restraint by resource users and as such biodiversity protection will only take place through institutions such as laws, organisations or cultural practices that control behaviour (Kellert, Mehta and Lichtenfeld, 2000; Brechin, et. al., 2002).

These relatively well known points served to provide the inspiration to undertake the research reported in this thesis. The objective of this work was to take a holistic approach to community development and ecosystem conservation in order to enable the identification, qualification and quantification of the outcomes and impacts of NTFP commercialisation at all levels, magnitude and scale. With that as an ambition this study adopted both the livelihoods approach (DFID, 1999) and the ecosystem approach (Grumbine, 1994, Gale, 2000, Noss, 2000) approaches to the research. This entailed assessment of all livelihood assets (financial, social, human, physical, and natural) and evaluating three key components of the ecosystem (composition, function and structure).

This chapter is an attempt to piece together the various findings detailed in the previous five chapters (chapters 3 to 7).

8.2 Measuring success of NTFP commercialisation

Despite the fact that conclusions on the outcomes and impacts of NTFP commercialisation have been advanced, there is no documented and replicable methodology or tool to assess the status of commercialisation. Given the absence of such a tool it is not surprising that no study has attempted to progress beyond characterising factors influencing success to actually evaluating the performance of NTFP based enterprises (Ruiz-Perez and Byron, 1999; Marshall, et. al., 2003). In the absence of such a study, a novel tool was developed as part of this work. This tool drew heavily on the literature which detailed the factors influencing the success of forest based small scale enterprises; Schmitz (1982), FAO (1987), and FAO (1995).

Having developed the tool and used it to assess status of NTFP commercialisation, the results were somewhat an anticlimax, and indeed the research could have ended then. This is because the results suggested that there was no real reason to try and evaluate outcomes and impacts of commercialisation because the process was dysfunctional. There was no NTFP commercialisation to talk about, the business models used were not viable and returns were too low or none existent to justify the existence of the enterprise. Enterprises were either sole traders or structured along community project designs.

In addition to low bargaining power, 'sole traders' were beset by prohibitive business costs (transport, marketing, appropriate technology and skills). Conversely, even if the community project had strong bargaining power they most often they lacked the business capacity to deal with customers as well as managerial and or entrepreneurial skills for

value addition. Above all, none of the products had secured markets, so enterprises were only working for orders and not as part of an established production-distribution chain. However, despite rather disappointing early conclusions the research continued, as discussed below.

8.3 Benefits and beneficiaries of NTFP commercialisation

The basic relationship between non timber forest products and human well being has not changed from the subsistence mode of two decades ago (Jacobs, 1984; Godoy and Bawa, 1993,) even with the advent of organised commercialisation. Many people are involved in collecting or gathering NTFPs, with a substantial proportion also involved in selling, but this is far from commercialisation as there is very little to no form of marketing and trade. The current production and selling of NTFPs is largely on a part time basis, aimed at using 'idle' or 'excess' labour freed from agricultural activities so as to cover emergencies and short term deficits. Thus my conclusion is that the commercialisation of NTFPs has not really occurred.

After making this assessment I was left wondering, why NTFP commercialisation and for whom? Of course cognisance is being taken that this is a new industry with a lot of risks and unknowns, yet if indeed there is the potential exhibited in the scientific literature of the last decade then somebody has to invest in developing this industry. Entrepreneurs are only allocating residual time, large scale industries (intended markets) are not investing much in the production –distribution chain. Due to this vacuum NTFP commercialisation has not generated much income, or any other benefits for that matter. Consequently, supply remains unreliable and the demand largely unknown.

The question remains as to who will take the risk to develop this industry from mere gatherer to entrepreneur and from subsistence to commercial mode. NTFP commercialisation should be taken as a business not a community development strategy, and as such entrepreneurship is important. This calls for the development of appropriate business models. However, caution has to be taken that although small scale enterprises (SSEs) generated more money than individual 'traders', at an individual level the dividends from SSEs were meaningless.

The lack of tangible outcomes of NTFP commercialisation on human well being could be due to the fact that current practices are involving the wrong people under the wrong settings, as Johnsrud (1997) wrote finding an entrepreneur is a very difficult process. Currently, NTFP commercialisation is being advocated for adoption in agriculturally marginal areas, which are geographically remote and provide limited livelihood options (Hedge, Suryaprakash, Achoh, and Bawa, 1996; Neumann, and Hirch, 2000). These areas suffer social and political marginalisation, poor communication and transport making commercialisation dependent on development agents for negotiating contracts, marketing etc.

In fact, it has been suggested that social capital and public infrastructure are a prerequisite for success of income generation activities (Winters, Davis, and Corral, 2002). I conclude therefore, that i) for one to be a successful entrepreneur they have to start with some initial social capital, ii) in any case it is those people with some initial social capital that will engage in NTFP commercialisation, iii) social capital has to be coupled with tangible socio-economic benefits if such association are to be sustained and iv) successful NTFP commercialisation will only take place when the is adequate appropriate infrastructure especially transport and means of communication. Because current NTFP commercialisation has not generated enough returns for entrepreneurs to invest in the

management of natural resources, or given incentives for local institutions to manage human behaviour ecosystem degradation is continuing unabated. This means that NTFPs have failed to pay for their existence, but this is not so in areas where they are an important and major safety net, in these areas all other species are cleared from ecosystems and only the valuable species retained forming parklands (Schreckenberg, 1999). Is that the likely outcome of NTFP commercialisation, were it to be a functional industry?

8.4 Measuring institutional success

One of the challenges that social and development scientists have faced is determining what kind of institutions are successful and viable (Agrawal, 2001; Mehta, Leach and Scoones, 2001; Barret, Lee and McPeak, 2005). In this research I advance a four determinant, 11 descriptor tool which can be used to determine the likelihood of success and strength of natural resource management institutional arrangements for communally owned resources. Developing a tool to assess viability of institutions was in itself a mammoth task let alone assessing them.

Two major lessons emerged from this study. Firstly, the existence of management units without authority and capacity does not guarantee success. This is the barest minimum and easiest of all steps inherent in the process of developing institutional arrangements for natural resource management. However, management bodies without capacity are as good as non existent, as the members are not able to monitor both ecological and socioeconomic conditions so as to make informed decisions in developing and implementing adaptive management strategies.

One other major impediment, as already indicated by many authors, is allocation of responsibility that is not matched by devolution of authority to the same level (Mehta and Lichtenfeld, 2000; Olsson and Folke, 2001). In Zimbabwe for instance, authority and responsibility were so diffuse across government departments, the local Rural District Council and traditional leaders who were all being mandated to facilitate and control use natural resources by the same communities. As a result nobody was really accountable for enforcing local institutions. It seems then that, legal pluralism in Zimbabwe is one of the main causes of collapse of local leadership structures, and a scenario that has resulted in limited autonomy and increased central government interference at the local level.

However, I concluded that viable and successful natural resources institutional arrangements are those that have, i) functional management unit with both recognised authority and capacity, ii) nested, known and democratically adopted institutions, iii) operational mechanisms for managing behaviour with graduated sanctions and iv) practical and adopted natural resources enhancement strategies. The research also set out to test the hypothesis of whether institutional arrangement had any effects on ecosystem integrity. Indeed this research has shown that institutional arrangements influence ecosystem integrity by reducing the scale and magnitude of anthropogenic disturbance on ecosystems. Further more influences of institutional arrangements are differential depending on their strength and or likelihood of success.

8.5 Implications for policy

If NTFP commercialisation has to contribute to fulfilling both CBNRM objectives of development and conservation it cannot happen on its own. Development agents need to invest in product and market development as well as entrepreneurship. Secondly this industry will not succeed if confined to marginal and remote areas with no infrastructure.

Governments need to improve infrastructure in these areas or else NTFP commercialisation will remain an industry of the disadvantaged. A new targeting policy should be adopted to ensure the environment is conducive and the entrepreneurs capable to take this industry beyond subsistence and convince the markets about reliable supply.

8.6 Implications for research

This research set out to investigate the contribution of NTFP commercialisation to ecosystem health and human well being. In order to do this I tried to advance new tools and techniques of just how this could be undertaken. The previous sections have detailed how far this research managed to achieve its goals. This section is an attempt to reflect on how best things could have been done and highlight areas of further research. In essence, there are four questions that are critical if the relationship between NTFP commercialisation, human well being and ecosystem health is to be understood

i. NTFPs commercialisation as a development strategy is still largely untested

Although like most researchers I have drawn conclusions about the NTFP commercialisation and livelihoods relationship, this was based on weak cases, and as such NTFP commercialisation as a benefit driven CBNRM remains untested. Further work of similar approach and depth would shed more light if conducted in areas where NTFP commercialisation is a major livelihood activity and the major source of income.

ii. Outcomes of NTFP commercialisation on conservation are still not validated

This study has shown that NTFP commercialisation has had little or no influence on the ecosystem status because extraction levels are very low. It would be more beneficial for this assessment to be undertaken in areas where returns and/ or extraction levels and rates have increased significantly due to commercialisation.

iii. Link between institutional arrangements and NTFP commercialisation

This research did not investigate this relationship, it would be important to know circumstances under which increases in NTFP commercialisation are matched by increases in strength of institutional arrangements and those that lead to their breakdown.

iv. Relationship between social capital development and economic activities

An attempt was made to investigate changes in social capital as NTFP commercialisation increased but due to the low success of commercialisation attribution became an insurmountable problem calling for more carefully planned research in this area.

8.7 Personal reflection

Looking back, I would say this research was an enjoyable experience, although it is clear that the design and execution of the research had flaws. The most challenging part of the

research was the assessment of human and physical capitals, and to a lesser extent social capital. This is because there are no specific activities enshrined in the NTFP commercialisation process that are set to influence the development or acquisition of these two livelihood assets by individuals, households and communities. Inevitably, I ran into the problems of attribution or identification (Manski, 2003). But still I believe that the process does influence the development of the two capitals and think that if long term time series data are collected including detailed baselines with clear indicators this could be easily evaluated. Yet I would hasten to say the problem of attribution would only be minimised in areas of advanced NTFP commercialisation characterised by high returns and resource extraction.

One other thing that is not particularly satisfactory in this study is the site selection. Selection of study sites was a bit restricted as the research was in the confines of a project. Under different circumstances a more rigorous approach should be adopted. Initially a whole host of SSEs and communities should be assessed using the commercialisation assessment tool and the final selection made based on the results of such an exercise. This would then give the researcher study sites that vary significantly, thus enabling the outcomes and impacts to be more easily identified.

To make the situation worse for me, this study was not conducted under the best of conditions. It was at a time when Zimbabwe had wide spread political tension and the country was going through a series of drought years or extended mid season dry spells. Generally, the economy was set on a path of an all times high decline with shortages of basic commodities including fuel, making it difficult to get into the study areas and for entrepreneurs to engage in meaningful trade. If a similar study is to be undertaken it would benefit a lot from increased number of cases, inter country and even more intercontinental

comparisons so as to reduce the influence of contextual factors and increase the operational range of NTFP commercialisation.

8.8 CONCLUSION

Repeatedly this study has suggested that NTFP commercialisation has not occurred in Zimbabwe, as such investigating outcomes and impacts of this process was a great challenge. Therefore, it is premature to dismiss NTFP commercialisation as a CBNRM strategy for development and ecosystem conservation. Actually, given the current level of investment, NTFP commercialisation has had great achievements. If farmers were to invest more time, labour, innovation (skills and technology) and policy makers were to ensure there was investment in developing markets and entrepreneurship then better outcomes could be realised. If not, outcomes and impact of NTFP commercialisation will remain elusive, and the whole process will be a fallacy to both developmentalists and conservationists, and we will all keep wondering, why so much debate has revolved around NTFPs over the recent years.

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APPENDIX 1: Household questionnaire

This study is for a research for post graduate degree and the responses given will not be used for any other purposes other than scientific research.

Site.....

1. Name of respondent.....

2. Sex of respondent..... Female, Male, Couple

3. Village..... 4. Ward.....

5. Which major group do you belong to?
Chieftainship Council Ordinary community member
Gvt dept Farming group NTFP Business group/person

6. Who is the head of household?..... Male Female

7. How old is the household head?.....

<25	26-35	35-50	>50

8. How many people belong to this household? .....

Adults..... (Males ..... Females.....) Children..... (Girls..... boys.....)

9. Number of people in the household with the following qualifications

Grade 7	"O" level	"A" level	Diploma and above

10. How many are non-resident?

<25	26-35	35-50	>50

11a. Are you a member of an enterprise group? Y/N

11b. Name of EG: .....

12. Which groups* do you belong to?

Name of group	Benefits of participating	Cost of participating	Cost of not participating

*Groups: Social, income generating, conservation, churches, political, governance, etc

13. What level of participation do you have in these groups?

Name of group	**Nominal** membership in group	**Passive** (being informed of decisions, listening without speaking)	**Consultative** (being asked on specific matters without guarantee of influencing decisions)	**Activity specific** (being asked to volunteer to undertake tasks)	**Active** (expressing opinions whether or not solicited or taking initiatives)	**Interactive - empowering** (having voice and influence in the group's decisions)

14. What are you five major livelihood activities? Tick.

Activity	**Before joining enterprise group**	**Current**
Crop production		
Livestock production		
Casual work		
Beer brewing		
Vegetable production		
Brick moulding		
Craft production		
Selling of fruit products		
Grass cutting		
Oil production		
Tea production		
Mineral extraction		
Drought relief		
Formal employment		
Other (specify		

15. During which months do you undertake these activities? Indicate low, medium, high.

Activity/Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Crop production												
Livestock production												
Casual work												
Beer brewing												
Vegetable production												
Brick moulding												
Craft production												
Selling fruit products												
Grass cutting												
Oil production												
Tea production												
Mineral extraction												
Drought relief												
Formal employment												
Other specify												

16. For which months and activities do you use hired labour?

Activity/Month	1	2	3	4	5	6	7	8	9	10	11	12
Crop production												
Livestock production												
Casual work												
Beer brewing												
Vegetable production												
Brick mounlding												
Craft production												
Selling fruit products												
Grass cutting												
Oil production												
Tea production												
Mineral extraction												
Drought relief												
Formal employment												
Other specify												

17. Is there a Natural Resource Management unit? Y /N

18. Are there any local rules? Y /N

18a. What constitute the local rules (tick) and how effective are these components?

Component	Specific rule	Effectiveness		
		(Not at all) Nobody observes them	(Effective) Very few observe them since they are not enforced	Very effective) Everyone knows them and are enforced
Taboos				
Norms				
Council				
Central Govt.				

19. Do you perceive the institution and its management (structure and procedures) legitimate? Y/ N

20. What do the natural resources management institution encourage or prevent you from doing?

1. .....
2. .....
3. .....

21. Who enforces the institutions?

Gvt depart	Council	Nobody	Chief	Everyone

22. Who monitors use of natural resources and how effective are they?

Who	Gvt depart	Council	Nobody	Chief	Everyone
Effectiveness					
Reason					

1. Not effective, no evidence of existence 2. Not effective but seen them around
3. Quite effective, some cases of communication of findings and decisions
4. Very effective, findings and decisions communicated before and after harvesting season

23. What do they monitor and how frequently?

	Access (who, numbers	Use	Timing	Volumes extracted	Volumes sold	Areas extracted	Harvesting techniques
Frequency							

24. How is compliance ensured?.....

.....

25. How has the institution (existence and implementation) contributed to resource conservation? Give reason

Contribution	1	2	3	4	5	Reason/evidence/Indicator

1. (--ve) More resource degradation
2. (-ve) Reduced quality of resources
3. (0)No contribution
4. (+ve) Resources status maintained
5. (++) Improved quality and quantity of resources

26. How has the institution (existence and implementation contributed to livelihood enhancement? Give reason

Contribution	1	2	3	Reason/evidence/Indicator

1.(-ve) Resource degradation has left people with less livelihood options
2. (0)No contribution
3. (+ve) Created more reliable safety nets

27a. What are your major income sources (cash and non cash) before joining the enterprise group?

27b. What are your major income sources (cash and non cash) after joining the enterprise group?

Activity	**Before joining enterprise group**		**Current**	
	Cash	**Non cash**	**Cash**	**Non Cash**
Crop sales				
Livestock sales				
Wages, Casual work				
Beer sales				
Salary, Formal employment				
Pension				
Allowances (specify)				
Remittances				
Brick sales				
Craft sales				
Selling of fruit products				
Grass sales				
Oil sales				
Tea sales				
Mineral sales				
Drought relief				
Loans				
Other (specify				

28a. Which income source is most important (largest contributor)?
28.b Which income source is most important (most reliable)?

	Income source importance	
Activity	**Largest**	**Reliable**
Crop production		
Livestock production		
Casual work		
Beer brewing		
Formal employment		
Pension		
Allowances (specify)		
Remittances		
Brick moulding		
Craft production		
Selling of fruit products		
Grass cutting		
Oil production		
Tea production		
Mineral extraction		
Drought relief		
Other (specify		

29. Why is income from forest products important?.....

.....

30a. Do you harvest any NTFPs? Y/N

30b. Which NTFPs do you harvest? How much did you harvest in 2003?

NTFP	Volume harvested in 2003

31a. Do you sell any NTFPs? Y/N

31b How much did you sell in 2003 and 2004? At what price? How much income did you make?

NTFP	Volume 2003	Unit price 2003	Income 2003	Volume 2004	Unit price 2004	Income 2004

32a, What major costs do you incur in extracting and processing non-timber forest products?
32b. How have you met the costs?

Cost item	Cost ZWD	Strategy

32c. Which of these activities regarding NTFPs do you do? Tick

Activity	Opportunistic collection	Individual planned collection	Individual processing	Individual marketing	Organised group collection	Group processing	Group marketing
Participation							

33b. During which months do you suffer deficits?

Activity/Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Food grains												
Draft power												
Labour												
Money												
Other specify												

34. How do you spend and or invest your income?

	Crop production (inputs)	**Livestock production (inputs and acquisition)**	**Resource management**	**Food**	**Education and skills acquisition**	**Processing technology**	**Marketing**	**Savings**	**Other**
Investment before enterprise									
Investment after enterprise									

35. What type of infrastructure do you have access to? Tick

Infrastructure	**Before**	**Current**
Number of houses		
Type of house 1-thatch , 2- 2roomed thatch, 3-2roomed asbestos/tin, 4->2 rooms asbestos/tin		
Energy source 1-wood and paraffin, 2-solar, 3-electricity		
Communication 1-public phone, 2-own phone, 3-cell phone		
Sanitation 1-no toilet, 2-blair toilet, 3- toilet and bathroom		
Water 1-river water, 2-open well 3-community borehole, 4-own borehole, 5-piped water		
Assets 1-radio, 2-bicycle, 3-Lounge suit 4-TV, 5-Car		
Equipment 1-hoes, 2-plough, 3-planter		

36. How much land do you hold?

Land holding	Homestead	Crop field	Vegetable garden	Irrigation plot	Woodlot
Before					
After					

37. Which forest product is most useful?

	Preference		
	1	2	3
Consumption			
Income			
Construction			
Firewood			
Craft			
Fodder			

38. Which of these are diminishing, why?

Forest product	Reasons for diminishing

39. Which of these is increasing, why?

Forest product	Reasons for increasing

40a) What management practices have you adopted over the last 2 years to conserve biodiversity?

40b) What are the evident outcomes?

40c) how effective were these practices and outcomes?

Management practice		**Adopted**	**Outcomes**	**Effectiveness**				
				1	**2**	**3**	**4**	**5**
Fire management				Reduction in quality and quantity of resources	Did not endure, no trace	No effect on resource and harvesting regimes	Reduced pressure on natural resources	Improved quality and quantity of resource
Controlled access to grazing	Zoned areas							
	Limited livestock numbers							
Controlled access products and services	Limited numbers							
	Zoned areas							
	Zoned times							
Soil erosion control	Gulley reclamation							
	Contour ridging							
	Afforestation							
Improved quantity	Woodlots							
	Enrichment planting							
	Domestication							
Controlled harvesting	Harvesting quantities							
	Harvesting techniques							
Increase in value of resource	Commercialisation							

41. Did the management strategies contribute to livelihoods?

Management practice	1	2	3	4	5
	Reduction in access and harvestable product	Did not endure, no trace	No effect on resource and harvesting regimes	Reduced increased livelihood options	Improved food and financial security
Fire management					
Controlled access to grazing					
Controlled access products and services					
Soil erosion control					
Improved woodland quantity					
Controlled harvesting					
Increase in value of resource					

42. How many of these strategies were due to benefits and incentives (realised or perceived) from forest based enterprises? What did forest based enterprises contribute?

Management practice		Adopted due to commercialisation	Contribution from commercialisation			
			Nothing	Income	Social capital	Human capital
Fire management						
Controlled access to grazing	Zoned areas					
	Limited livestock numbers					
Controlled access products and services	Limited numbers					
	Zoned areas					
	Zoned times					
Soil erosion control	Gulley reclamation					
	Contour ridging					
	Afforestation					
Improved quantity	Woodlots					
	Enrichment planting					
	Domestication					
Controlled harvesting	Harvesting quantities					
	Harvesting techniques					
Increase in value of resource	Commercialisation					

APPENDIX 2: Transect Summary –Woody plants

Area: **Transect #** **Plot #:** **Position:**

Tree Species	Height (m)				Diameter (cm)*							
	Regeneration < 30 height	<2	2-5	>5	1	2	3	4	5	6	7	8
Tot												

*including fruits for A. digitata and S. birrea

APPENDIX 3: Decomposition Experiments: Data Sheet

Site:..... **Position**.....**Date:**.....

Period ..... ***Management area**.....

	Label	**Bag No. (Mass; g)**			
		1	**2**	**3**	**4**
Block 1					
Typical vegetation litter	SS				
Litter from intensive management	S				
Block 2					
Typical vegetation litter	SS				
Litter from intensive management	S				
Block 3					
Typical vegetation litter	SS				
Litter from intensive management	S				

***1. Minimal management area** **2. Intensive management area** **3. Crop field**

Remarks.....

.....

APPENDIX 4: *Fadogia ancylantha* Data sheet

Area.......................... **Position: ....**

Date..............................

Transect no.	Plot number	Clumps	No. of stems	Height	Leaf number	Leaf weight

APPENDIX 5: Tree species identified during ecological surveys

Species	Number of trees	Study site				
		Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
1. *Acacia karroo*	31	*	*	*	*	*
2. *Acacia nigrescens*	13	*		*		*
3. *Acacia nilotica*	16	*	*	*	*	*
4. *Acacia polyacantha*	2	*		*		
5. *Acacia schweinfurthii*	2			*		
6. *Acacia tortilis*	1	*				
7. *Adansonia digitata*	44	*		*		*
8. *Afzelia quanzensis*	1					*
9. *Albizia amara*	12	*	*	*		*
10. *Albizia* 1	2				*	
11. *Albizia antunisiana*	8		*		*	
12. *Azanza garckeana*	9		*	*	*	*
13. *Baphia massaiensis*	3		*			
14. *Bauhinia galpinii*	9	*	*	*	*	
15. *Bauhinia petersiana*	2	*				
16. *Berchemia discolor*	1	*				
17. *Brachystegia boehmii*	3		*			
18. *Brachystegia glaucescens*	5		*			
19. *Brachystegia spiciformis*	33		*		*	
20. *Brachystegia utilis*	1		*			
21. *Bridelia mollis*	2	*				*
22. *Burkea africana*	29		*		*	
23. *Carissa bispinosa*	2				*	
24. *Cassia abbreviata*	7			*		*
25. *Catunaregam 1*	1	*				
26. *Catunaregam spinosa*	6		*	*		
27. *Colophospermum mopane*	24	*		*		
28. *Combretum* 2	1		*			
29. *Combretum* 3	1		*			
30. *Combretum apiculatum*	16	*		*		*
31. *Combretum collinum*	24			*		*
32. *Combretum hereroense*	1			*		
33. *Combretum imberbe*	3	*		*		*
34. *Combretum molle*	38	*	*	*	*	*
35. *Combretum zehyeri*	1		*			
36. *Commiphora* 1	1			*		
37. *Commiphora* 2	3		*	*		
38. *Commiphora africana*	11	*		*		*
39. *Commiphora mossambicensis*	2	*		*		
40. *Commiphora pyracanthoides*	3			*		*
41. *Croton 1*	1			*		
42. *Cussonia spicata*	7		*	*	*	
43. *Dalbergia melanoxylon*	4			*		*

Species	Number of trees	Study site				
		Chimanimani	**Makoni**	**Muzarabani**	**Nyanga**	**Rushinga**
44. *Dichrostachys cinerea*	56	*	*	*	*	*
45. *Diospyros mespiliformis*	7			*	*	*
46. *Diospyros quiloensis*	23	*		*	*	*
47. *Diplorynchus cardylocarpon*	1			*		
48. *Dodonea angustifolia*	4				*	
49. *Dombeya rotundifolia*	2					*
50. *Dovyalis* 1	1				*	
51. *Elephantorrhiza goetzei*	4		*	*		
52. *Elgeodandron matabelicum*	1				*	
53. *Erythrophleum africanum*	2		*		*	
54. *Eucalyptus* 1	1		*			
55. *Euclea natalensis*	1		*			
56. *Faidherbia albida*	2	*				
57. *Faurea saligna*	7		*		*	
58. *Ficus natalensis*	1		*			
59. *Flacourtia indica*	17		*	*	*	*
60. *Flueggea virosa*	3	*	*			*
61. *Friesodielsia obovata*	2			*		*
62. *Gardenia 1*	5	*	*	*		*
63. *Grewia bicolor*	2			*		*
64. *Grewia flavescens*	3	*				*
65. *Grewia monticola*	8	*	*	*	*	*
66. *Gymnosporia senengalensis*	11		*		*	
67. *Hangamunyu*	1					*
68. *Jasminum stenolobum*	1	*				
69. *Julbernardia globiflora*	59		*		*	
70. *Kapirinego*	1					*
71. *Kirkia acuminata*	3			*		*
72. *Lannea discolor*	25		*	*	*	*
73. *Lannea stuhlmannii*	2		*			*
74. *Lochnocarpus cappasa*	7	*				*
75. *Markhamia zanzibarica*	2		*			
76. *Monotes glaber*	19		*		*	
77. *Mparamhosva*	4		*		*	
78. *Msokosiysni*	1		*			
79. *Mudyatsuro*	3					*
80. *Mugagu*	1					*
81. *Mukeyo*	1			*		
82. *Mushanje*	1	*				
83. *Muwengeza*	1		*			
84. *Nhanwa*	1				*	
85. *Njenjesikana*	1					*
86. *Ochna pulchra*	3		*		*	
87. *Olea africana*	1		*			
88. *Olea capensis*	1				*	
89. *Ozoroa insignis*	2		*		*	

Species	Number of trees	Study site				
		Chimanimani	Makoni	Muzarabani	Nyanga	Rushinga
90. *Pappea* 1	1				*	
91. *Pappea capensis*	2		*	*		
92. *Parinari curatelifolia*	14		*		*	
93. *Pavetta schumanniana*	1		*			
94. *Peltophorum africanum*	2		*		*	
95. *Piliostigma thonningii*	6		*		*	*
96. *Protea* 1.	1				*	
97. *Protea gagaudi*	13		*		*	
98. *Pseudolanchostylis maprouneifolia*	8		*			
99. *Pterocarpus angolensis*	10		*		*	
100. *Pterocarpus rotundifolius*	11		*	*	*	
101. *Pumuro*	1		*			
102. *Rhus lancea*	1		*			
103. *Schrebera trichoclada*	1					*
104. *Sclerocarya birrea*	40			*		*
105. *Strychnos madagascarensis*	1			*		
106. *Strychnos pungens*	1				*	
107. *Strychnos spinosa*	8		*	*	*	*
108. *Syzgium cordatum*	1		*			
109. *Tabernaemontana elagans*	1					*
110. *Tambatika*	1					*
111. *Terminalia prunoides*	1	*				
112. *Terminalia randaii*	4			*		
113. *Terminalia sericea*	17		*	*	*	*
114. *Terminalia stenostachya*	12		*	*		
115. Tree 1	3	*	*	*		
116. Tree 2	1			*		
117. Tree 3	1			*		
118. Tree 4	1				*	
119. Tree 5	1					*
120. Tree 6	1		*			
121. Tree 7	2			*		
122. *Uapaca kirkiana*	3		*			
123. *Uapaca nitida*	1		*			
124. *Vangueria infuasta*	11		*		*	
125. *Vitex payos*	8	*	*		*	
126. *Xanthocercis zambesiaca*	6	*			*	*
127. *Xeroderris stuhlmannii*	2			*		*
128. *Ximenia caffra*	6		*	*	*	*
129. *Zanha africana*	2				*	*
130. *Ziziphua mauritiana*	4	*		*		*
131. *Ziziphus mucronata*	4	*	*		*	
Number of species	131	31	64	52	43	**44**
Number of trees	907	**113**	**300**	**174**	**169**	**153**