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Forest beekeeping in Zambia: Analysing the nexus of sustainable forest management and commercial honey trade

Forest beekeeping in Zambia:

Analysing the nexus of sustainable forest management and commercial honey trade

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Copyright Statement

Publications

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Abstract

The need to achieve human development without harming the natural systems on which all life depends, is one of the greatest challenges of our times. The aim of this research is to deploy and develop social-ecological systems thinking to a miombo forest landscape in north west Zambia where thousands of people make a living from forest beekeeping. There exists significant critique about whether trade in non-timber forest products (NTFPs) can help deliver the dual goals of poverty alleviation and forest maintenance. Trade in forest honey appears to be an exceptional case, yet inadequately studied. This research fills a gap in understanding about the link between forest honey trade and forest maintenance. Honey trade is already commercialised in north west Zambia and so provides a case study scenario within which to ask, **Given that the market for honey is assured, do beekeepers maintain forests'?** Case study methodology found that trade is driving an increase in forest beekeeping, with income invested in education, in farming and as capital for other enterprises. Self-reported measures of economic wellbeing showed beekeepers to be slightly better off than non-beekeepers. Beekeepers negotiate *de facto* rights to hive sites and engage in 'early burning' to mitigate potential damage to flowers, bees and trees caused by dry season fires. Beekeepers apply this forest protection tool over thousands of hectares of forest. Beekeepers do not manage forests using scientific principles of inventory and planning, and features of a common-property management regime are largely absent. The study reveals entities and components of a forest beekeeping *livelisystem* – a complex, knowledge rich system where ecological elements and human elements are intricately connected in a robust social-ecological system The system is driven by trade, is productive and works with minimal external costs. The role beekeepers play in maintaining this forest system must be acknowledged and supported by development planners, local authorities and leaders and consumers who buy the honey.

Acknowledgements

This research was conceived as a result of my employment with Bees for Development. My understanding of how forest beekeeping systems in Africa function can be attributed to the expertise and experience of this excellent organisation and to Dr. Nicola Bradbear in particular. I would like to take this opportunity to personally thank Nicola for giving me the opportunity to work for Bees for Development (BfD) and for unfailingly sharing her vast knowledge of tropical apiculture, forest beekeeping and honey and beeswax trade. It was through my work with BfD that I was introduced to the forest beekeeping landscape of north western Zambia, to Forest Fruits Ltd. and to Dan Ball.

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On a more personal note I'd like to thank Jon and Jeff for putting up with my absences from home and Jeff for patiently helping with proof-reading and checking my citations and reference list. I have much more to thank you both for.

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List of acronyms

CFA Community Forestry Area

CPR Common property resource regime

DFNRMP Decentralised Forest and Other Natural Resources Management Programme

DRC Democratic Republic of Congo

FBLF Forest Beekeeping Livelisystem Framework

FGD Focus Group Discussion

FRA Food Reserve Agency

JFM Joint Forest Management

NGO Non-government organisation

NTFP Non-timber forest product

NWP North-Western Province of Zambia

PFAP Provincial Forestry Action Plan

PFM Participatory forest management

QS Questionnaire Survey

FD Zambian Forestry Department

ZK Zambian Kwacha

Glossary

Beehive	Man-made container or cavity in which a honey bee colony can nest
Chitemene	A system where trees are cut and then piled in the centre of the clearing for burning, the crop being planted in the ashes. After some years of farming, the fields are left to re-grow into forest.
Lima	Measurement of a unit of land = 0.25 hectares
Hive site	Large area of forest where many beehives are located, at distance from one another
Honey comb	Raw honey contained within wax combs, as made by the bees, before any processing. Comprises both honey and beeswax.
Forest beekeeping	An extensive system of nectar-harvesting involving the placement of many low-cost hives made from forest resources, housing wild honey bees, spread thinly throughout a large forest area
Miombo	Miombo woodlands are dry, seasonally deciduous forests that are endemic to southern Africa. They are dominated by tree species in the legume subfamily *Caesalpinioideae*, particularly in the genera *Brachystegia, Julbernardia* and *Isoberlinia.*

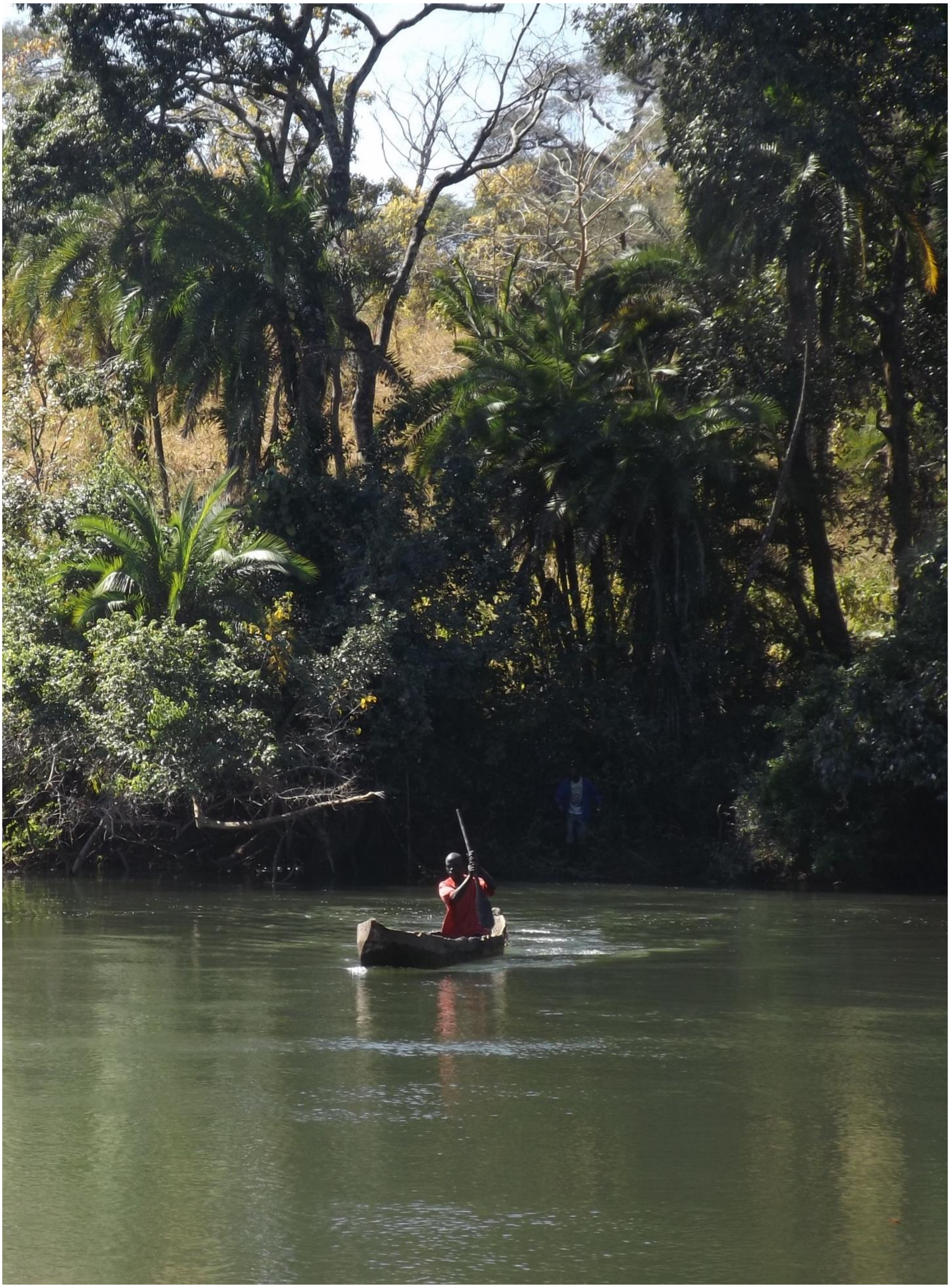

***Image 1**. Honey must be transported across rivers to get to the roadside.*

Chapter 1 Introduction

The strong link between forests and traditional beekeeping creates opportunities for promoting beekeeping as an incentive for sustainable forest management (CIFOR, 2008:p1).

1.1 Background to the research

This research has emerged out of a very particular set of circumstances which need some elaboration. It begins with my own story.

In the 1990s I worked in the forestry sector in Malawi. At that time Malawi – and indeed many other countries – were developing novel, community-based approaches to natural resource management. The impetus for these changes included an awareness that the top-down fines and fences approach to forest conservation was not working and a general shift in politics towards more decentralised governance. Malawi introduced a new National Forestry Policy in 1996 and included within this policy were commitments to promote greater participation of local communities with respect to forest access and management (Government of Malawi, 1996). The Policy was followed by a new Forestry Act in 1997 where it was stated as one of the aims of the Act, '*to promote community involvement in the conservation of trees and forests in forest reserves and protected forest areas in accordance with the provisions of this Act*' (Government of Malawi, 1997:p7). The National Forestry Programme, developed in 2001, states, '*Community-based forest management, in its broader sense covering customary lands as well as forest reserves, is a concept with major potential to realise the drive for participation of communities, NGOs and, potentially, the private sector alongside government in the management of woodland on customary land and forest reserves*' (Government of Malawi, 2001:p31). Through my work in the forestry sector I was able to follow some of the lessons learned as participatory forestry was researched, implemented and monitored. In 2000 I co-authored a publication that documented the **Journey towards collaborative forest management in Africa** (Dubois & Lowore, 2000).

The endeavour to engage communities in forest management in Malawi faced some challenges and one of these concerned the benefits which accrued to local people in return for taking on management responsibilities. The tone of the debate tended to link rights with responsibilities, a narrative embraced within the 'Four R's Framework'– an analysis tool designed to analyse the rights, responsibilities, revenues and relationships associated with community forestry (Dubois, 1998). The move to community forestry was premised on the understanding that economic benefit would provide the incentive for local people to invest in forest management. A trajectory of thinking emerged based on these issues.

It soon became apparent that local people were already benefitting economically from forests, even without putting in extra management effort. They were collecting and harvesting a whole host of woody resources and non-timber forest products (NTFPs), whether this was permitted or not (Clarke, Cavendish, & Coote, 1996). They really needed to benefit more than they were already doing, as more was being asked of them in relation to taking on new forest management responsibilities.

One way for them to benefit more would be for the Forestry Department to give away more of the forest resources, in addition to the firewood and fruits that people were already accessing. Essentially this meant timber. Yet in this regard the Forestry Department was reluctant.

Another option was posed. People could benefit more if they were able to transform the products they already collected into more valuable products. As they were already collecting NTFPs – this meant 'adding value to NTFPs'.

One of the earliest projects which endeavoured to do this was an initiative started in 1996, by the non-governmental organisation Wildlife and Environmental Society of Malawi (WESM), with support from GTZ (the German Technical Cooperation agency). This forest conservation project established indigenous tree nurseries and supported income-generating activities including beekeeping, raising guinea fowl and making cane furniture as alternatives to burning charcoal. The project also considered how to add value to the NTFPs which local people already valued. One of the most notable results was improved and commercialised Baobab juice production (Mpaka, 2011; Kambewa & Utila, 2008). This yielded some positive results. Indeed, the juice initiative indirectly gave rise to an industry in Baobab pulp, through one of the people who worked on the initial project (Jones, 2014).

Yet adding value to Baobab fruits did not bring about changes in the way natural woodlands were used. Malawian people already had a strong tendency to retain Baobab trees in the landscape and earning more money from Baobab did little to incentivise people to maintain other species of forest trees. Other initiatives looked at wild mushrooms which grow abundantly in Malawi's miombo woodlands. On the global market dried wild mushrooms were sold for prices many, many times greater than Malawian mushroom sellers could earn. It was theorised that if local people could capture more value from this NTFP then they would be incentivised to take on greater responsibility for sustainable forest management. Theory, however, could not be turned into practice. The mushrooms were too sandy and too perishable to reach higher value markets. There was even talk about domesticating miombo mushrooms and miombo wild fruits (Faulkner, Harrington, Levy, & The, 2009). This too seemed to undermine the idea that adding value to wild products could underpin wilderness management. On the contrary domestication would surely achieve the opposite – there would be no need for the wild resource.

A number of beekeeping projects were implemented, for example, the Malawi German Beekeeping Development Project (Munthali, 2006). These usually started by giving people hives. Closer reflection about these projects raised new questions about the point of intervention. It was not immediately apparent that focussing on production of honey would bring about substantial change unless the honey market was developed. An alternative approach was to focus on trade first. Just buy honey …. and the story would follow. The value of the forest would go up and investment, by the local people, in harvesting honey and conserving the primary natural resources would also increase. So, I even did that on a very tiny scale. I had a supplier just near Chimaliro Forest Reserve. I gave him buckets on my way down to Lilongwe and collected them on my way back. I put the honey in jars and sold the honey through the Mzuzu Branch of the Wildlife and Environment Society of Malawi. I even wrote on the label, '*Honey selling provides beekeepers with an economic incentive to conserve forest*'. But did I know this for a fact – or did I just wish it to be true? This is the question which underpins this research.

On leaving Malawi in 2004 I started work for UK-based charity Bees for Development. I had met the Director of Bees for Development whilst in Malawi because we were both interested in the same field – namely the role of NTFP commercialisation in forest conservation. This meeting led, many years later to me joining the organisation. Working for Bees for Development gave me the opportunity to learn much more about the apiculture sector. As I learned more, the idea that honey selling might provide beekeepers with an economic incentive to conserve forest became more and more convincing. Yet the evidence remained elusive. It was also through Bees for Development that I came to learn about Forest Fruits Ltd. operating in north west Zambia.

1.2 Commercialisation of non-timber forest products

The idea that developing the value of non-timber forest products (NTFPs) could help make the forest pay its way and become a competitive land use for forest-fringe households did not start in Malawi. The origin of these approaches can be traced to the extractive reserves of the Amazon where, it was argued, '*the sustainable exploitation of non-wood forest resources represents the most immediate and profitable method for integrating the use and conservation of Amazonian forest*' (Peters, Gentry & Mendelsohn, 1989:p656). Whilst some of the economic analyses which led to this statement were later questioned, the concept gained traction and '*it was put forward that through the harvest of NTFPs, the often marginalised forest peoples of the world might capture valuable* *income and social benefits, whilst the aim of conserving of natural forests was achieved'* (Sunderland & Ndoye, 2004:p1). NTFP harvesting is described as '*the practice of extracting economically valuable, non-timber forest products leaving the forests structurally and functionally intact*' (Nepstad & Schwartzman, 1992:pvii). Evans (1993 in Kusters, 2009) argued that increasing the monetary value of the NTFP would prevent people from converting the land into other land uses. An underlying assumption of the Market Analysis and Development approach to forest conservation is that, '*Community members will conserve and protect forest resources if they receive the economic benefits from sustainable forest use*' (Lecup & Nicholson, 2000:p4)

The enthusiasm for NTFP commercialisation led to a rich body of work and considerable understanding about both the promise and the limitations of NTFPs as drivers for sustainable natural resource management (Sills, Shanley, Paumgarten, Beer, & Pierce, 2011). There are many examples of NTFPs contributing significantly to people's livelihoods, especially for poor people (Ros-Tonen & Wiersum, 2003; Vedeld, Angelsen, Bojö, Sjaastad, & Berg, 2007). Yet instances of a demonstrable link between cause (economic benefit) and effect (positive conservation outcome) still remain relatively rare. The initial enthusiasm which led some researchers to suggest that NTFP trade could lead to positive outcomes for people and the environment waned, with rising evidence of multiple challenges. NTFP harvesting was not always benign, poor people did not always benefit and meeting the exacting requirements of high-value markets was often unachievable. Yet an analysis of forest honey harvest and trade appears to tell a different, more positive story, particularly concerning the impact of income and trade on conservation.

1.3 Forest honey in Africa

Honey provides incredibly important livelihood benefits in Africa (Bradbear, Fisher, & Jackson, 2002). Communities that engage in forest beekeeping in Africa depend heavily on income derived from selling honey and beeswax. For many households in south-west Ethiopia, honey is the primary source of cash (Endalamaw, 2005) and the number of hives is a wealth indicator, with anyone having 100+ hives considered rich. Unlike other wealth indicators, such as livestock, which the poor can rarely afford, many poor people do have small numbers of hives (van Beijnen, Mostertman, Renkema, & van Vliet, 2004). In Cameroon honey accounts for just over half of household income for thousands of beekeepers (Ingram & Njikeu, 2011). Beekeeping in Tanzania is so important (average annual export earnings of US$2.5 million) that it has a dedicated government department and 39,000 ha of forests set aside as bee reserves (Mwakalukwa, 2016). Yet, whilst there is good evidence that beekeeping delivers important income benefits to people, forest beekeeping and forest honey trade seems relatively absent from NTFP research and its forest conserving benefits are not well documented.

Beekeeping is often promoted as being forest-compatible (ICIPE, 2013) but more substantive research about the link between beekeeping and forest conservation is harder to find. Projects in Kilum-Ijim in Cameroon, Inyonga Forest in Tanzania, Mount Elgon in Uganda and Selous in Tanzania have all included beekeeping (Abbott, Neba, & Khen, 1999; Hausser & Savary, 2002; IUCN, 2012; Timmer and Juma, 2005) as activities compatible with conservation goals. In West Africa IUCN have supported beekeeping projects as components of their biodiversity conservation programme (Arsene Sanon. pers. comm. 2015) and the Tanzanian government has a policy that promotes beekeeping to support forest conservation. However, the scientific rationale for these projects and evidence on their efficacy for forest conservation is limited (Ingram, 2014) and the role of forest beekeepers as forest conservers is not understood. Mickels-Kokwe, (2006:p19) argues that in Zambia, while *'the linkage between beekeeping and forest management has been considered to be strong. … the precise nature of this relationship, however, appears not to have been researched explicitly'*. Bradbear (2009:p58) concurs, '*there has been little research to investigate how beekeepers make deliberate and conscious efforts to protect and conserve forests ... this is an area of investigation that has been neglected'*.

Within the wider beekeeping literature there is more insight into the conservation impacts of beekeeping. Clauss (1992) noted that Zambian beekeepers were worried about the impact of late fires between August and October when trees and flowers of key nectar species are particularly vulnerable to scorching. Consequently, beekeepers advocate early burning to prevent such damage. Nshama (2003) reported that Tanzanian beekeepers sustained specific bee fodder plants, and Lalika & Machangu (2008) found beekeepers protected the forest around their hives and actively discouraged people from cutting timber. Endalamaw (2005) reported that 97% of beekeepers in south west Ethiopia were involved in at least one form of forest enhancement activity, including tree planting, preserving big trees and protecting young ones. 34% helped to conserve the forest by lobbying or by entering into local agreements to reduce bushfires. (Wiersum & Endalamaw, 2013) also found that local forest governance arrangements in south west Ethiopia helped beekeepers support forest conservation that maximised honey production.

Bradbear (2009:p58) draws evidence of the positive link between beekeeping and forest management from Congo, Benin, Zambia and Tanzania and explains that '*Apiculture's unique feature as an activity is the fact that its continuation, through pollination, fosters the maintenance of an entire ecosystem, and not just a single crop or species*'. In Cameroon, Ingram & Njikeu (2011:p36) noted that '*Beekeeping can contribute to environmental integrity because some beekeepers protect the forest*', and Ingram (2014) later concluded that beekeepers rarely self-identified as active conservationists but were so as a result of their practical interventions to maintain the resources they needed. Finally, Neumann & Hirsch (2000:p88) noted *'that customary management for commercial NTFP production appears to occur least often in natural forests'* but that *'one example of commercial NTFPs that are managed in natural forests is honey and beeswax from beekeeping in Miombo woodlands in Africa'*.

Forest honey therefore holds particular interest for anyone interested in seeking a positive trade-off between forest maintenance and livelihoods and is chosen as the focus of analysis for this research for three main reasons:

(1) In some areas large volumes of forest honey are successfully traded, and commercialisation is not a hypothetical ambition or goal. This situation affords an excellent opportunity to test the link between NTFP commercialisation and outcomes for the forest outside the artificial or temporary framework of a development project. One such location is Mwinilunga in north west Zambia. It is here where Forest Fruits Ltd., the largest and longest established African honey buying company, is located, buying honey from 3000 suppliers each year (Dan Ball pers. comm. Oct 2014).

(2) Whilst the livelihood benefits of forest honey and beeswax trade are widely understood to be important, the implications for forests in Africa has not been explicitly studied. This appears to be a gap considering the wealth of research about trade in other NTFPs.

(3) The final reason to focus on forest beekeeping and honey trade is that this activity does not appear to exhibit many of the known failure factors in the field of NTFP commercialisation. Honey is both special enough to be sought after yet is not a niche product requiring expensive market development. Securing a supply of the quality and quantity demanded by buyers is achievable. An analysis of how and why forest honey trade succeeds, where trade in other NTFPs has sometimes failed, was undertaken during the course of the study and a separate paper published (Lowore, Meaton, & Wood, 2018). Elements of this are included within chapter 3.

1.4 The research questions

The focus of this research is the relationship between forest beekeepers and the African forests on which their beekeeping systems rely and how this relationship is mediated by honey trade and market access. The study emerges from the argument that NTFP commercialisation can create an economic incentive for people who benefit from forests, to maintain forests. This research focusses on a specific case in north west Zambia because honey trade is already commercialised and is not a hypothetical goal.

The main research question is asking: **Given that the market for honey is assured, do beekeepers maintain forests'?**

The investigation as a whole recognises that there is no simple 'yes/no' answer to this question and explores a range of sub-topics to build up a holistic view of the importance of forest honey for people's livelihoods, to explore beekeepers perceptions, actions and decision-making with regard to the forest, to examine a range of enabling or constraining factors and ultimately endeavour to uncover the link between honey trade and forest maintenance.

In order to explore this research question four sub-questions are posed:

1. What is the economic and functional importance of forest beekeeping for forest beekeepers?

This is important because one would expect people to be more invested in natural resources that deliver substantial benefits and the scale and nature of the benefit is likely to influence people's decision-making about the resource.

2. How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation?

This is about understanding what forest beekeepers actually do and why. To study this, questions must be asked about how the resource is used, what threats there might be and how beekeepers respond. It is also important to understand something of how they value the forest.

3. Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping?

Given that forest beekeepers are using a resource which they do not own, what are their claims to the resource? How do they relate to other people who may threaten the forest? Have beekeepers developed or do they follow socially accepted rules about forest use? Who does own the forest and who has the right to exclude?

4. How does trade drive or impact on any of the dynamics revealed in answering questions 1-3?

What has changed, if anything, as the market has become more organised and reliable over the previous decade? How does trade impact on the system as a whole?

1.5 Forest beekeeping as a social-ecological system

Human activity poses multiple environmental challenges for natural ecosystems, including forests. The gains made in human development in recent centuries have been achieved to the detriment of ecosystem integrity. The need to find approaches to development that promote effective trade-offs among biodiversity, ecosystem services, and other needs of society have never been more urgent and it is these challenges which make the NTFP commercialisation approach so attractive. It is important that humans use forests in a way that maintains their essential delivery of forests goods and services. Our ability to address the challenges of using ecosystems in a way that keeps negative trade-offs to a minimum is constrained by, '*among other things, weaknesses in cross-disciplinary understandings of interactive processes of change in social–ecological systems*' (Dorward, 2014:p1).

Social-ecological systems (SES) are complex adaptive systems composed of social and biophysical agents organized in multiple subsystems that interact at several spatial and temporal scales (Levin, 1998). SES thinking recognises that people are part of and not external to natural systems and that people not only benefit from ecosystems but impact and shape the capacity of ecosystems to generate services (Folke, Hahn, Olsson, & Norberg, 2005; Mung'ong'o, 2009; MEA 2005). This same thinking can be well applied to forest beekeeping. Forest beekeeping is a system involving multiple, interacting human components and natural components. Taking an SES perspective to the issue of resource use and forest conservation can aid greatly our understanding of systems involving people and natural resources. Traditional approaches to natural resource management, often place people as external to the system, for example, as managers or resource users (Walker *et al*., 2002; Waltner-Toews, Kay, Neudoerffer, & Gitau, 2003). The NTFP commercialisation concept whilst on the one hand actively seeking to address the problem of negative trade-offs of development versus ecosystem maintenance, on the other hand is driven by an outsider's perspective that local people need to be helped (Ostrom, 2009) to conserve their forests. The use of an SES framework as a conceptual foundation for this research will help to situate the research question in a more realistic context of multiple people-forest interactions, which are not always uni-directional. NTFP commercialisation is often advocated as a cause and effect solution to a problem, yet it is unlikely that forest beekeepers engage in honey selling *in order to add value to the forest so that they can justify maintaining it*. That particular sequence of cause and effect is an outsider's view and one promoted by development practitioners and environmental agencies.

SES thinking is broad and includes the study of the resilience of local natural resource management systems (Folke and Berkes 1998; Anderies, Janssen, & Ostrom, 2004) and the study of the "combinations of variables that affect the incentives and actions of actors under diverse governance systems" (Ostrom, 2007:p15181). SES thinking shares some concepts and constructs with livelihoods thinking, for example, both consider responses to shocks and stresses, yet the stronger focus on the ecological processes makes SES frameworks particularly useful for this research.

In this study SES thinking provides an appropriate conceptual framework for the research question because it helps us to move away from thinking of beekeepers as users or conservers, on the outside looking in, and instead helps us to situate beekeepers as being integral components of the forest and beekeeping system. SES thinking also aids multi-disciplinary study, including forest ecology, socio-economics and common-property resource management.

1.6 Structure of the thesis

Chapter One has explained the background to the main research question and how this has been informed by my own work experience spanning more than twenty years. The chapter introduces the thinking behind the 'conservation through commercialisation' idea and explains why exploitation of non-timber forest product has been seen to offer much promise in achieving the dual goals of supporting forests and livelihoods at the same time. Whilst this approach has led to much disappointment, forest honey is introduced as a possible exception and one that has been inadequately studied. The main research question is introduced. Forest beekeeping is situated in the framework of a social-ecological system, a useful construct in guiding understanding of the dynamics between the human and forest elements of this system.

Chapter Two brings together several strands of literature that underpin the research. The first part of the chapter examines some of the evolving perspectives about non-timber forest product commercialisation, takes a wider look at forest-based livelihoods in Africa. Chapter Two includes a review of what conservation means and for whom. This is important because in seeking to understand the relationship between beekeepers and forests it is important to consider what aspects of this relationship might lead to forest maintenance. For example, having the rights to exclude other users might be important and this issue, which underpins the third research sub-question, is discussed within the content of tenure and participatory forest management. This is followed by an introduction to the most extensive honey-producing forests in Africa – the miombo – with a discussion about ecology, uses and the impact of fire.

Chapter Three describes forest beekeeping in more detail and explores what is currently known about livelihood benefits of forest beekeeping, the relationship between forest beekeeping and forest management and honey and beeswax trade in Africa.

Chapter Four sets out the conceptual setting for the research. The chapter discusses one of the greatest challenges of modern times; people need nature, yet people are damaging nature. This ever-present and expanding challenge of achieving sustainable development is considered and the research question is looked at again through the lens of minimising 'trade-offs' and maximising synergies between developmental and environmental goals. The second part of this chapter examines how social-ecological systems thinking can help elucidate the complex interlinked nature of people and ecology and Dorward's *Livelisystems Framework* is introduced as a conceptual framework applicable to a forest beekeeping system. The links, feedbacks, entities and processes of a modified *Forest Beekeeping Livelisystems Framework* are presented as a conceptual construct to guide the research and the research questions are discussed through the lens of this construct.

The methodology chapter, chapter 5, introduces the overall research design and shows how the conceptual framework indicated the selection of case study methodology for this research. The data collection methods employed from 2014 to 2018 are described and a section on research validity is included. A section on limitations of the methodology concludes this chapter.

Chapter Six is the first of the four results chapters and reports on what was learned about the specific case, the forests of north west Zambia which supply the largest honey and beeswax buying company in sub-Sahara Africa. Also included in chapter Six is a section about the Lunda people and how they use and relate to the landscape in which they live. Chapters Seven, Eight and Nine present the results of the field work. Chapter Seven focuses on results concerning the livelihood benefits of forest beekeeping and addresses the first of the research questions about the functional importance of beekeeping in people's lives and helps answer questions about how forest beekeeping supports livelihood strategies and *livelisystem transitions*. Chapter Seven presents results about the attributes of the natural assets in a forest beekeeping system and shows how these are used for exchange, for saving and for consumption.

The magnitude of the economic importance of forest honey selling suggests beekeeping is more than a safety-net for people in Mwinilunga. Chapter Eight addresses the second research question about how beekeepers use and manage the forest. The strength of the *Forest Beekeeping Livelisystems Framework* is that it reveals 'emergent outcomes' derived from the accumulated sum of actions, decisions and relationships with respect to forest use and this is elaborated in chapter Eight. Chapter Nine addresses the third and fourth research questions about whether beekeepers have developed or are developing approaches to common-property resource management and how trade drives and impacts on the dynamics the forest beekeeping system as a whole. Chapter Ten discusses the findings of the research with view to advancing understanding about forest beekeeping as a complex, yet stable, social-ecological system driven by a sustained market demand for honey and beeswax. Chapter Eleven provides an overall conclusion and indicates directions for future research, policy and action.

Image 2. *Julbernardia paniculata in miombo woodland, Mwinilunga, 2018.*

Chapter 2 African forests and livelihoods

Beekeeping alone is sufficient to justify the retention of the miombo woodland forest reserve (Tesha, 1968:p240)

2.1 Introduction

This chapter begins with a discourse about forests, their value and their vulnerability. This understanding helps validate the main research question: G**iven an assured market for honey, do beekeepers maintain the forests from which they derive their honey harvests?** This question goes to the heart of the NTFP commercialisation concept i.e. that market demand drives action to maintain the supply of the NTFP. This research is situated in north west Zambia where beekeepers have had access to a reliable buyer since 1996. Attention is drawn particularly to Africa's dry forests which have historically been undervalued by foresters who have tended to overlook the non-timber forest products (NTFPs) – including honey - which these woodlands supply in greater abundance than high value timber (Dewees *et al*., 2011). After a period of neglect interest in NTFPs increased in the 1980s and 1990s when enthusiasm grew for the idea that if people could derive sufficient value from woodlands, they would be motivated to maintain them. It is this concept, sometimes called 'conservation through commercialisation' which underpins the main research question. It is useful therefore in this chapter to consider some of the lessons learned about NTFP commercialisation. These lessons necessarily inform the approach to this research and can be broadly categorised as issues to do with livelihoods, issues to do with forest conservation or management (and terminology is discussed in this chapter) and issues to do with trade. Livelihoods and forest management are explored in this chapter, whilst trade is discussed together with a more in-depth look a forest beekeeping in chapter 3. These broad categories livelihoods, forests and trade underpin the research sub-questions previously introduced in chapter 1.

2.2 African forests

African forests are rich in biodiversity and supply essential ecosystems services, such as the regulation of water flows, regulation of climate and protection of land from soil erosion. In addition, African forests provide a wealth of products, goods and services for millions of people (IPBES, 2018b).

Overall, 23 per cent of Africa's land area consists of forests and woodlands (FAO, 2010) and these forests range from areas with the least forest cover in Northern Africa to the world's second largest continuous block of tropical forest in the Congo Basin to the deciduous miombo woodlands in the east and south of the continent. In 2015 the Global Forest Resources Assessment reported there to be 600 million hectares of forest in Africa, down from nearly 700 million ha in 1990 (FAO, 2015). Africa is losing forest faster than any other continent apart from South America, although the rate of loss appears to be slowing. The fall in natural forest area is only one metric. The area of planted forest is increasing everywhere but relatively slowly in Africa at 1.34% annual increase and even where natural forests are maintained, they are degrading (FAO, 2015).

Most of the countries of West Africa were once covered in closed canopy tropical moist forests, from the coastline to the interior, but timber exploitation and agricultural and urban expansion have led to large-scale deforestation and fragmentation and the species-rich forests of the Upper Guinea zone remain only in small relict blocks (Sayer, 1993). Most of Africa's remaining rainforests are found in the Congo river basin (Butler, 2020). This research, however, is located within African dry forest.

Dry forest and woodland cover approximately 17.3 million km^2 (Chidumayo & Gumbo, 2010) compared to 3.7 million km^2 – the size of the largest rain forest, the Congo basin. Africa is, essentially, a continent of woodlands and grasslands and it contains more than twice as much open woodland as closed canopy forest (Sayer, 1993). The dry forests and woodlands of Africa are extensive and found in 31 countries in western, eastern and southern Africa and occur in climates with a dry season of three months or more (Chidumayo & Gumbo, 2010). These vegetation types include seven of the structural vegetation formations described by White in his comprehensive and much-adopted overview of African vegetation (White, 1983) and include forest, woodland, transition woodland, bushland and thicket, scrub woodland, shrubland and wooded grassland.

The major zone of crop agriculture in sub-Saharan Africa is in the dry forests and woodlands; and these areas support large populations of subsistence farmers, who in addition to their farming activities rely heavily on woodland resources to support their livelihoods. '*Most important, is the diverse range of forest products, including fruits, fish and bush meat, edible insects, beeswax and honey, and traditional medicines, that are indispensable to the lives of communities living in dry forest and woodland zones*' (Chidumayo and Gumbo, 2010:p2).

The need to meet the dual objectives of meeting human development requirements, whilst preserving the flow of ecosystem goods and services, is of pressing concern. This tension is nowhere more present than in the dry forests of Africa where the consequences of unwise forest and land management can have devastating consequences for the world's poorest people. Conversion of dry forests and woodlands to other seemingly more profitable land uses may be occurring ostensibly to meet people's needs, but there are very real fears that these changes are happening at '*the expense of the environmental and ecological services that they provide*' (Chidumayo and Gumbo, 2010:p6) and that sustainable livelihoods may be replaced by unsustainable livelihoods. Difficult questions are being raised throughout Africa's forested landscapes. It is essential that forests and woodlands are managed to support livelihoods and development whilst maintaining the vitality of these ecosystems, so achieving sustainable development. Achieving a balance between utilisation to meet current needs and conservation to meet future needs is a challenge that goes to heart of all endeavours to achieve truly sustainable development. It is the goal of this research to contribute new knowledge about the role of forest beekeeping in supporting this balance of natural resource use and conservation.

2.3 Non-timber forest products

Many millions of people rely on forest goods and services. Amongst the very many benefits afforded by woodlands and forests are non-timber forests products (NTFPs). NTFPs are harvested for both subsistence and commercial use (Falconer, 1990; Marshall, Schreckenberg and Newton, 2006; Shackleton, Shackleton and Shanley, 2011) and include nuts, fruits, gums, resins, mushrooms, fibres, honey and many other products. Historically they have formed an important component of international trade, and include spices from Asia, shea butter and gum Arabic from Africa and Brazil nuts from the Amazon (Sills *et al.*, 2011). During much of the 20th century however NTFPs were dismissed as minor forest products. The summary document of the seventh World Forestry Congress in 1972, '*made just brief reference to "the social potential of the rather neglected section of minor forest products"*', (Sills *et al*., 2011:p25).

In the 1980s the forestry sector diverted greater attention to the value of woodlands for poor people (Westoby, 1989) a shift ignited perhaps by a growing awareness of the staggering contribution of woodlands, trees and forests to the energy needs of millions of poor people (Mearns & Leach, 1989). The beam of interest on fuelwood enlarged to include other non-timber forest products and a growing number of scientific studies listed the wealth and value of NTFPs for people living in and near forests (Clark and Sunderland, 2004; Lopez, Shanley and eds, 2004; Ros-Tonen & Wiersum, 2003).

That NTFPs could play a role in conservation was first mooted in relation to the Amazon (Counsell & Rice, 1990; Peters, Gentry and Mendelsohn, 1989) where it was argued that the sum of the value of NTFPs, if successfully marketed could exceed the value of unsustainably harvested timber. This line of thinking consolidated with other emerging paradigms about sustainable development (WCED, 1990), community-based natural resource management (Roe, Nelson, & Sandbrook, 2009) and integrated development and conservation projects (Alpert, 1996) and emerged as a distinct concept based on the theory that if forests have value for local communities, they will be more inclined to maintain them. NTFP harvesting for conservation goals has been described as '*the practice of extracting economically valuable, non-timber forest products leaving the forests structurally and functionally intact'*, (Nepstad & Schwartzman, 1992:pvii). Evans (1993 in Kusters, 2009) argued that increasing the monetary value of the NTFPs would prevent people from converting the land into other land uses. Compared to South America and Asia, interest in commercialisation of the NTFPs of Africa's dry forests came late. According to (Sills *et al.*, 2011) this may have been because the HIV crisis in Africa took priority over the forestry agenda, or perhaps because Africa's anthropogenic forests did not attract the same level of attention as the 'pristine' rainforests of the Amazon and Indonesia.

NTFP commercialisation was considered a 'win-win' solution to both poverty and deforestation and resulted in significant research and action in the 1990s, with the initiation of development projects aimed at commercialising NTFPs to increase their value. These explored the potential of NTFPs as diverse as ant larvae in Indonesia (Césard, 2004) and Brazil nuts in the Amazon (Allegretti, 1990; Anderson, 1990). However, many of these – for example Rainforest Crunch (Brooke, 1990) - failed to achieve commercial viability and studies began to review and question the efficacy of the concept in safeguarding forests (Arnold and Perez, 2001; (Belcher & Schreckenberg, 2007; Kusters *et al.*, 2006). As noted by Ros-Tonen (2003:p2), '*the picture at the start of the new century is one in which optimism regarding the potential of NTFP extraction as a combined strategy for conservation of natural forests pessimism*'. Since then the pendulum has swung back to a more '*nuanced understanding*' of the importance of NTFPs (Sills *et. al.,* 2011:p23)

Some researchers suggest that the conservation through NTFP commercialisation approach often fails to deliver because many NTFPs are hard to commercialise. NTFP are very often inferior products, perishable, seasonal and rejected in favour of preferred alternatives as soon as substitutes become available (Arnold & Perez, 2001; Neumann and Hirsch, 2000; Sills *et al*., 2011). For example, bush mango *Irvingia spp* (Nigeria) and *Gnetum* leaves (Cameroon and Nigeria), are often wasted because of poor storage and inadequate transport (Babalola, 2009; Ingram, Ndumbe, & Ewane, 2012). Some NTFPs can be readily substituted by alternatives. For example, the demand for vegetable ivory (*Phytelephas macrocarpa)* fell dramatically once plastic became readily available (Barfod, Bergmann, & Pedersen, 1990), although it has experienced something of a revival in more recent years.

NTFPs are natural products and since quantity, harvest time and location are unpredictable and hard to manipulate, returns on labour can be low (Belcher and Schreckenberg, 2007; Sills *et al.*, 2011) meaning even where trade occurs, it does not alleviate poverty. Elite capture is another concern. NTFPs are accessible to poor people because no one else wants them – it could be argued. When a resource gains value, elites who previously had no interest in the product can take over extraction, processing, and trade (Dove, 1993). Meanwhile Belcher and Schreckenberg, (2007) classify NTFP activities as poverty traps where decreasing prices lead to increased harvesting to maintain income. Furthermore, the central idea that NTFP harvesting is inherently 'benign' (Myers, 1988, in Marshall and Shreckenberg) is not always borne out by the evidence. For example, the commercialization of Cameroonian *Prunus africana* bark led to degradation of the resource base and the 'bread tree' (*Encephalartos cerinus*) has been so depleted it is now subject to CITES trade prohibition (Ndibi and Kay, 1997; Stewart, 2003). The idea is that demand for products from a forest environment will translate effectively into demand for forest (Belcher and Shreckenberg 2007). Yet, it is not always the case that just because a certain NTFP is found in the forest, it necessarily follows that local people are able (or interested) to protect the whole forest, as opposed to the particular sought-after NTFP. For example, bitter cola nuts are a valuable forest product found in the coastal rainforests of Nigeria. As the forests have become depleted as a result of actions nothing to do with cola nut harvesting people have found ways to '*raise and manage the trees … and individuals and organisations alike are now actively planting Garcinia kola*'. The NTFP was maintained, but not the forest (Lopez and Shanley, 2004:p20). The boom and bust of NTFP harvesting has been well documented (Marshall and Shreckenberg 2006; Rai, 2004; Ruiz-Pérez & Arnold, 1996; Sills *et al*., 2011) where a rapid increase in trade is followed by a rapid decline. Neumann and Hirsch note that that the very reason for preserving biodiverse forests (i.e. their biodiversity) works against NTFP commercialisation. Biodiversity is high when there are many species whilst commercialisation calls for the opposite – an abundance of a standard product - to achieve economy of scale.

The NTFP commercialisation paradigm came under increasing scrutiny in the 1990s and 2000, resulting in articles such as '*Commercialisation of Non-timber Forest Products: A Reality Check*' (Belcher and Schreckenberg 2007) and warnings that NTFPs are not the 'silver bullet' (Angelsen & Wunder, 2003) that some hoped for. Scholars began to present more realistic analyses with many rightly noting that the real value of NTFPs was that they enrichened the lives of poor people, providing relatively accessible and inexpensive – yet diverse and useful - goods to people who needed them for home use and for trading. Researchers concluded that in general, NTFP commercialisation is less likely to be successful primarily as a means of achieving conservation (Arnold & Perez, 2001; Kusters *et al*., 2006). However, it remains a useful means of contributing to improved livelihoods, particularly of the marginalised forest-dependent poor (Belcher and Shreckenberg, 2007). The fact that forest honey appears to be an exceptional NTFP (Lowore et al., 2018) is one of the reasons for this research and this is elaborated further in chapter 3.

2.4 Understanding forest livelihoods and the motivation for forest conservation

Whilst NTFPs are evidently important for poor people, it does not always follow that NTFPs enable people to become less poor. This distinction is important when asking about the role of forest beekeeping in people's lives and whether beekeeping can incentivise forest maintenance. There is coincidence of poverty and forest cover as noted by Sunderlin *et. al.* who explain that '*the fact that natural forests and poverty are found in the same place in some areas of the world is no accident*' (Sunderlin, Angelsen and Wunder, 2003:p2) and reasons such as their remoteness, outmigration and undeveloped infrastructure are suggested. The 'conservation by commercialisation' argument assumes that the benefits that people derive from forests will incentivise them to protect the forest. Yet this assumes that the benefits derived are sufficient to cover the cost of management and protection. This view also leans towards an oversimplified view of rural people's livelihoods. The conventional picture of economic development following a path of specialisation and division of labour has not been borne out in sub-saharan Africa (Ellis, 1998) where people very often develop a diverse portfolio of activities to survive and thrive. Livelihood diversification is driven by a number of factors including risk reduction, opportunism, desperation, income smoothing and asset accumulation (Ellis, 1998; Loison, 2015). A mixed livelihood portfolio results from dynamic livelihood adaptation to various constraints and opportunities faced by smallholders (Ellis, 2008). Direct reliance on environmental income or natural capital is an important diversification strategy for rural households in SSA.

The value of environmental income for poor people is increasingly understood. Vedeld *et al.*'s (2004) meta-analysis of 54[1] case studies from 17 countries showed that 22% of household income[2] was derived from forest activities, compared to 37% from agriculture and 38% from off-farm activities. Their analysis further revealed that forest environmental income seemed to increase with distance to markets. The explanation for this unexpected finding was that a remote location generally means both more abundance of forest resources and fewer alternative income opportunities. This finding hints also at the importance of functioning supply chains, as without them the

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[1] 15 cases from east Africa, 18 cases from southern Africa, 14 cases from Asia and 7 from Latin America.

[2] This measure included cash income and household consumption value

riches of the forest are less easily exchanged with the riches of the market-place, a scenario which is played out in the honey supply chain of NW Zambia. Vedeld *et. al's* research showed that forest environmental incomes were particularly important for poor people, with the groups with high relative forest income (percent of total income) earning on average only half the total income of groups with lower dependence on forest income. Yet in terms of absolute income, richer households earned more from forests (Vedeld *et al*., 2004). The comparative analysis of data collected by CIFOR's Poverty Environment Network partners (CIFOR, 2020b), reported a similar figure, with forests providing an average annual household income of $US 440 from 33 samples, representing 22.2% of total income. This analysis also revealed that richer households earned more cash from forest resources, whilst poorer household relied on greater subsistence benefits from forest resources. The authors note that causality may run both ways i.e. the cash earned from the forest helps household become richer and richer household may have the financial capital needed to produce and market high-value products (e.g. woodworking) (Angelsen *et al*., 2014). The way in which poor people use forests is incredibly varied and diverse and includes fuelwood, poles, tools, handicrafts, fruits, medicines, fodder, mushrooms, meat and insects (Gumbo, Dumas-Johansen, Muir, Boerstler, & Xia, 2018).

The gendered nature of forest resource use is significant with men, women and children collecting different products. For example, studies of children in miombo areas have demonstrated how wild fruits, rodents, insects and birds can form a crucial source of foods for children from poorer households while at school or while herding (Coote, Luhanga, & Lowore, 1993; McGregor, 1995) women collect firewood, mushrooms, fruits and spinach, for home use and for sale (Jumbe *et. al*. 2008; Boa, 2002) whilst honey collection and charcoal making are largely men's activities (Clauss, 1992; Smith 2017). These different use patterns are reflected spatially. Children might have mental fruit tree maps (Wilson, 1989), women tend to collect produce from near the fields and homesteads, whilst men go further afield on 'expeditions' (Fortman, 1996). The gendered nature of forest product collection is not immune to change, as economic pressures change. Mushrooms collecting is largely a women's activity, but where there is high market demand, men join in (Boa, 2002). Charcoal making is largely a man's activity, but where women have limited alternative options they will engage in and depend on the activity (Smith, Hudson, & Schreckenberg, 2017). Considering gender differences in forest use and management has been shown to lead to more sustainable, equitable and successful outcomes (Manfre & Rubin, 2012).

Even when the percentage contribution from natural resources is relatively small, income from these resources may be of '*vital importance to people living close to the survival line*' (Sjaastad *et al.*, 2005:p38). In particular, environmental income may permit gap filling in times of predictable income shortages and act as a safety-net after shocks occur (Angelsen and Wunder, 2003; Shackleton and Shackleton, 2004). Sunderlin, Angelsen and Wunder (2003) recognised that forests contribute to poverty alleviation in two main ways; firstly serving as vital safety nets, helping rural people avoid poverty, and secondly, in some instances, actually lifting some rural people out of poverty. In addition to the safety-net function and as an aid to a pathway out of poverty, Vedeld *et al.*, (2007) identified a third function i.e. support of current consumption, maintaining the status quo and preventing the household from falling into (deeper) poverty. Vedeld *et al.,* (2007) further noted that an escape from poverty may involve moving away from a reliance on forests or may involve intensifying or specialising in relation to a forest-based activity. In helping to understand whether sale of forest products can incentivise forest management this distinction is important, because a person who steps away from needing forests is probably less inclined to invest in forest management and maintenance.

At the heart of the 'conservation by commercialisation' hypothesis is an assumption that for local forest users to become actively engaged in forest conservation actions they must be driven by an economic incentive. One of the stated assumptions supporting the Users' Manual for Market Analysis and Development (MA&D)

approach for livelihoods and forests is that '*community members will conserve and protect forest resources if they receive the economic benefits from sustainable forest use*' (Lecup & Nicholson, 2000). This remark '*receive economic benefits*', however, says nothing about the scale or function of the benefit. The phrase from Sills *et al*. (2011), is more illuminating in this regard i.e. that the NTFP (and by extension, in some cases, the forest) must be '*worth managing*' (Sills *et al*. 2011:p35). It is hard to identify one metric which determines how forest income may or may not influence decision-making. The functional importance of forest income, or in this case, forest honey income, needs to be understood and this requirement leads to the first research sub-question, **'What is the economic and functional importance of forest beekeeping for forest beekeepers'?**

It is essential to our understanding of the link between beekeeping and forests that we investigate the role that beekeeping plays in people's livelihoods and how this influences decision-making. To this end it is important to ask questions about the *types of* decisions which lead to forest maintenance. Usually forest conservation requires an action. Steps must be taken by relevant agents, which may be local forest users, landowners or authorities, to resist, reduce or halt drivers of forest loss. Examples of active conservation carried out by local forest users might be the creation of community rules to control extraction of woody resources (Agarwal, 2009) or mounting forest patrols to prevent encroachment from outsiders (Ameha, Larsen, & Lemenih, 2014). The next section discusses this is more detail and considers what 'counts' as conservation, as this is germane to the whole thesis.

2.5 Forest conservation and maintenance

In researching this link between forest beekeeping and forest conservation, it is important to consider the meaning of the term conservation and indeed question whether this is the most valid terminology. In seeking evidence about the relationship between beekeepers and forest it is necessary to know *what to look for*.

As mentioned above it is generally assumed that conservation requires deciding and acting. This needs further elaboration as conservation means different things to different people and if local people have no rights to protect their own forests, it is largely irrelevant if they wish to be able to do so. If adding value to NTFPs provides the incentive, but they have not the means, the hoped-for outcome may not be achieved. Finally, it is important to touch on the question of who sets the agenda anyway.

It is sometimes claimed that the modern conservation movement can be traced back to John Evelyn's highly influential forestry text book, Sylva, (Evelyn, 1664). Evelyn was concerned that the rate of forest depletion was undermining future timber supplies and he advocated approaches to forest conservation by balancing the rate of depletion against the rate of replenishment. His work is likely to have influenced the government of British India in the early 19th century who enacted the first formal Conservation Act, which prohibited the felling of small teak trees to ensure future timber harvests. Ideas about conservation developed slowly but by the mid-19th century the science of forest management was becoming well established in India and advocates of forest conservation, such as James Ranald Martin (Iya Iseda, 2019) contributed to the emergence of a conservation ethic that included three core principles: that human activity damaged the environment, that there was a civic duty to maintain the environment for future generations, and that scientific, empirically based methods should be applied to ensure this duty was carried out. In this context the term conservation meant to exploit for gain, but without causing long-term degradation of the resource.

In America thinking about conservation diverged. The preservationist view lauded by John Muir (1838-1914) argued that nature should be protected for its own sake. Muir expounded the value of American wilderness as part of the country's culture and identity and his influence led to the creation of the National Park Service. Muir's counterpart, but on the conservationist line of thinking was Gifford Pinchot (1865-

1946). Pinchot believed firmly that humans belong in their environment, as inhabitants and stewards. While head of the US Forest Service, he codified an ethic of use – a land ethic in which humans and nature could happily co-exist. This ethic relies heavily on scientific understanding of the connection between humans and nature (Fox, 1981). Conservationists accept that development is necessary for a better future and advocate that resources should be managed wisely and not wasted, and harvests should be managed to be within sustainable limits. Conservationists do not oppose the harnessing of nature for mankind's progression but lament its destruction. In this context conservation had a very different meaning to preservation.

In Africa conservation endeavours were initially focussed on wildlife. Excessive exploitation of natural resources by colonialists, followed - eventually - by a realisation that apparent abundance was not limitless. Hunters became conservers and large national parks, such as Kruger, Amboseli and Serengeti were created (Anderson & Grove, 1990). In Africa the political dimension is writ large. The local African population were depicted as the enemies of conservation and there is much evidence to show how the creation of reserves was also a device to assert competing land claims, '*Land grab was easier to justify when cloaked in the garb of conservation*' (Rangarajan, 2003:p80). Relocations and displacements of indigenous people was a major feature of conservation policy until very recently. Displacement was seen as a prerequisite for successful preservation (Shao, 1986).

Whilst the colonialists were executing an about turn with regard to wildlife exploitation in the 19th century, the story was somewhat different with forests. Rapid forest exploitation continued apace well into the 19th century and 20th century. African forestry was all about timber concessions and timber plantations. Forest reserves were gazetted and closed off to local people, not to preserve wilderness *per se* but so the colonialists and the subsequently the independent governments could be the sole beneficiaries of forestry resources and wealth (Conte, 2014).

After independence, most African nations that carried large forested tracts followed their colonial predecessors in their strong orientation toward exploitation. Forestry policy in general continued to emphasize logging and replanting with fast-growing, exotic tree plantations. Miombo woodland was, for example, considered unproductive and its replacement with pine and eucalyptus deemed appropriate (FAO, 1962). At the same time, conservationists had begun to establish a powerful lobby for the reservation of large tracts of African forests and savannas to preserve species richness and diversity. Philosophically, modern forest conservation followed its colonial predecessors in advocating for the separation of agrarian communities from forests. This essentially Western conservation philosophy ignored the very real problems of social inequity and poverty in developing nations. Dan Brockington has aptly referred to this stance as '*fortress conservation*'. (Conte, 2014:p11). In this context conservation as a term is becoming less clear, in some instances becoming merged with ideas about preservation and where it retains ideas about exploitation, new questions are emerging about exploitation by whom, for whom.

As the preceding paragraphs suggest, conservation, as a concept and an approach, is problematic and not static. The 'fines and fences' approach to conservation has been at the heart of forest policy across Africa for most of the post-colonial era. Yet governments rarely have the resources to properly administer the fines or maintain the fences. Crucially these policies exclude local people from accessing the forest resources they need for daily life, so rendering poor people poorer. Such policies disincentivise local people from taking actions to maintain or manage forests. Changes in policy began to emerge in the 1990s (Wily, 2002) and more people-centred approaches to forest management gave rise to community-based natural resource management (Roe *et al.*, 2009). Participatory forest management (PFM), collaborative management, community conservation and co-management are variants within the broad theme of CBNRM.

This brief glimpse at the history of conservation thinking has touched on a number of different terminologies. Preservation, conservation, management, protection. In this thesis the terms conservation, protection and management are used largely interchangeably and refer to the maintenance and use of forest whilst retaining its essential integrity and without compromising future use. Preservation which means maintaining nature in its pristine form, untouched and unused by people, is not used. Importantly the term conservation is not included within the second research sub-question, **How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation?** in order to better express a realistic relationship between beekeepers and forest.

2.6 Tenurial security and participatory forest management

Inherent in the 'conservation by commercialisation' hypothesis is an assumption or an expectation that the NTFPs being commercialised are not open access resources. If they are, then their commercialisation (and rising value) may simply lead to overexploitation and not a greater level of forest protection. It is this concern which gives rise to the third research sub-question, **Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping?**

Forests are often at risk when they are subject to competing land uses in the absence of a custodian, yet access rights of poor people to forests tend to be open or informal and difficult to protect against external interests (Wunder, 2001). This situation may form a weak foundation for community-led forest maintenance. The prevailing tenure arrangements under which NTFP resources are held are of utmost importance as they will determine and '*govern the most direct interactions between a society and living NTFP resources: harvesting and management'* (Neumann and Hirsch 2000:p17). The following definitions of forest tenure usefully underpin this discussion:

Forest tenure is a broad concept that includes ownership, tenancy and other arrangements for the use of forests. It is a combination of legally or customarily defined forest ownership and of rights and arrangements to manage and use forest resources. (FAO, 2020)

[Tenure] … determines who owns forestland and who uses, manages and makes decisions about forest resources. Sometimes property is used interchangeably with tenure. However, tenure is typically about the way rights are administered than about the estate itself (CIFOR, 2020a).

*The concept of tenure includes both the notion of ownership and a corresponding parcel of rights. The widely accepted classification of tenure systems defines four types of ownership – state, private, communal and open access – and four basic kinds of rights – use, transfer, exclusion, and enforcement. (*Neumann and Hirsch 2000:p18).

Whilst NTFPs can be found in forests governed by any type of ownership arrangement, they are in the main wild products, and found in forest reserves and in forests on customary land. Where state rules are largely absent public ownership is indistinguishable from an open access regime, and customary norms in most of Africa tend towards the view that wild resources are not-owned and hence available to anyone. Open access tenure systems are widely understood to be vulnerable to over-exploitation and predicted to succumb to the '*tragedy of the commons*' (Hardin, 1968). Yet it is important to make the distinction between tenure and tenurial security (Robinson, Holland, & Naughton-Treves, 2013). Tenure, of which there are many forms, refers to the bundle of rights whilst tenurial security refers to the level of *confidence* that a rights-holder may have that the property rights will be upheld by society (Robinson et al 2013). There is increasing recognition that how local residents perceive land tenure often has a greater impact on their land use decision-making than whether that tenure is formal or legalized (Broegaard, 2005; Unruh, Cligget and Hay, 2005). Robinson *et al*.'s (2013) comprehensive analysis of the relationship between land tenure and tropical deforestation revealed no strong relationship between form of tenure and tenurial security – or in other words, depending on the context and contrary to some views, communally-owned forests are not always less secure than private or state-owned forests. Robinson et. al. go on to discuss that whilst researchers have ever greater and more accurate information about forest extent, conditions and rates of loss, information about tenure is always much harder to obtain – especially customary and communal regimes which may be both informal and contested. Information about tenurial security is even harder to obtain. Tenure security is sometimes a perception, determined by intangible characteristics, making it hard to measure '*Further, the form of land tenure is a relatively static concept while land tenure security is inherently forward-looking, expressing an expectation that the benefits and duties provided by the rules and norms that make up land tenure will be upheld in the future*' (Sjaastad & Bromley, 2000).

To give an example of the how customary norms do not fit with standard definitions of tenure it is useful to consider beehives in Tanzanian forests. Through making and placing beehives beekeepers achieve confidence that they have the right to harvest honey from that hive and these informal rights are recognised by the society in which they live, '*Alone amongst forest products the beehive (as an object, its contents and its siting) is the private property of the beekeeper. By siting a hive in a tree, he or she gains personal use-rights over the tree for as many years as a beehive continues to be placed in it'* (Fisher, 1997: p265).

Many natural resources are held in common ownership and governed by community institutions through agreed norms, rules and negotiated rights. Ostrom's important work on the governance of common pool resources (Ostrom, 1991) generated a set of principles for how commons can be governed sustainably and equitably in a community – see Box 1. for Ostrom's principles.

Box 1. Managing the Commons - Ostrom's 8 Principles for Governance

1. Define clear group boundaries.
2. Match rules governing use of common goods to local needs and conditions.
3. Ensure that those affected by the rules can participate in modifying the rules.
4. Make sure the rule-making rights of community members are respected by outside authorities.
5. Develop a system, carried out by community members, for monitoring members' behaviour.
6. Use graduated sanctions for rule violators.
7. Provide accessible, low-cost means for dispute resolution.
8. Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

(Ostrom, 1991)

Whilst much of Ostrom's work was based on studying ancient forms of common pool resource management, her scholarship has informed significant contemporary work and have been used to inform approaches such as community-based natural resource management and participatory forest management.

During the latter part of the 20th century, and more recently still, many African nations passed legislation which paved the way for new types of tenure arrangements for their nations' forests. These arrangements are variously termed participatory forest management (PFM), collaborative management, community forestry, joint forest management and co-management (Wily, 2002). These new forms of forest tenure have been developed and promoted as an alternative to the top-down government control models of natural resource ownership and management which were the norm during the colonial era and often maintained, and sometimes strengthened post-independence (Nelson, 2010). Concerns over the negative impact of exclusion on local people, the expense and the high incidence of conservation failures are just some of the many factors which lead to emerging interest in devolving natural resource management responsibility to local people. Wiley (2002) provides an overview of the typology of PFM forms which range from local users being merely consulted to full devolution of rights. Interestingly, '*it is rarely the case that communities declare management regimes autonomously*' and usually the granting of greater tenurial rights remains within the gift of the state (Wily 2002:p10).

There is a natural intersection between PFM and NTFP commercialisation. PFM can potentially give NTFP harvesters greater control over their forest resources and the sale of NTFPs can help off-set the costs of PFM. The NTFP-PFM South West Ethiopia Project worked to secure these dual and related outcomes from 2003-2015 with some success. Local people secured government-endorsed legal rights to their PFM forests, and the valuable NTFPs within, and used proceeds from the sale of NTFPs to cover some of the costs of forest protection (Lowore & Bradbear, 2016). The integration of these dual goals is not perfect. People engage profitably in the harvest of forest honey even without the rights afforded by PFM and PFM is attractive for reasons other than NTFP harvest (LTS, 2013).

Neumann and Hirsch (2000) carried out a review of the impact of NTFP commercialisation on tenure arrangements and the impact of tenure arrangements on NTFP commercialisation. With reference to extractive reserves in the Amazon he noted that whilst security of tenure was important, it was not always enough to ensure improved forest conservation and local economic development, other factors were also necessary. On the impact of NTFP commercialisation he found cases where commercialisation both strengthened and weakened customary tenure strengthened because local people have a greater incentive to stand their ground and weakened where internal or external forces moved to privatisation (Neumann and Hirsch 2000).

In relation to commercial NTFP harvesting there are two main questions. Do the tenurial arrangements encourage NTFP harvesters to limit their offtake to sustainable levels, confident in the knowledge that they will benefit from their precautionary actions, or is there is a risk of overharvesting? Do the tenure arrangements enable the primary users to exclude others? An inability to do the latter, will impact on the usefulness of doing the former. And it is these aspects of tenure arrangements which will be considered in this research.

As the preceding sections show conservation has been a problematic construct for forest peoples. It has variably been the domain of forest planners adopting a scientific approach to securing timber supplies or used as leverage to exclude people from their lands. Policies and initiatives, such as PFM, to give people stronger rights to forest resources are encouraging, but the concept of what conservation 'looks like' tends to remain in the hands of the scientists, the planner or the government authorities. A sustainably managed PFM forest, for example, should have a boundary, be governed by a set of rules, a formal tenure arrangement and be managed by a community institution according to scientific principles for the benefit of all community members. These 'rules of engagement' may not reflect the perspective or reality of local forest users.

2.7 Managing miombo

As mentioned above Africa is, essentially, a continent of woodlands and one of the most extensive dry woodland types in Africa is miombo, the woodland type in which this research is situated. Having some understanding of this woodland type, its extent, ecology and uses is important in terms of contextualising this investigation.

Miombo woodland is an extensive tropical seasonal woodland in south and central Africa (Campbell, 1996) reaching 2.7 million km2 in Southern Africa (P. Frost, 1996). The species of the dominant genera, *Brachystegia, Julbernardia*, and *Isoberlinia*, all produce hard timber, and have fibrous, tannin-rich bark (Dewees *et al*., 2011). Miombo woodlands tend to be less interesting to conventional foresters having a relatively low proportion of commercial timber species, ((Dewees *et al.*, 2011; Endean 1967 cited in Clauss, 1992), albeit with some notable exceptions, such as *Pterocarpus angolensis* (Shackleton, 2002). Instead, the woodlands have a different kind of wealth. The forest is a source of wild meat, fruit, berries, mushrooms, honey, greens, caterpillars, thatching grass, poles and firewood (Pritchett, 2001). A number of the dominant miombo genera, have particularly fibrous bark which is widely used for weaving, rope making and for fabricating beehives (Dewees *et. al*., 2011:p20). In addition to making hives, Clauss reports bark being used for platters, sieves, bags, blankets and canoes (Clauss, 1992). Bark and the myriad other uses of miombo woodland may be considered marginal by traditional foresters but are considered essential goods to the people who live amongst them. *Brachystegia, Julbernardia, Syzygium* and *Combretum* are recognised as nectar-bearing genera and their value in sustaining beekeeping activities is well documented (Gumbo *et al.*, 2018;p7) and their flowering 'is accompanied by strong fragrance and frantic bee activity at dawn and dusk' (Bingham, 2010). The fact that *Brachystegia* species flower in succession (Bingham, 2010) means that the nectar flow season persists for several months, a reason no doubt for these forests being renowned for honey production (Fischer, 1993). Miombo has other outstanding features. They can be hugely productive and resilient and '*can remain so over time, even when highly degraded (at least from a conventional forester's perspective)*' (Dewees *et. al*. 2011:p20). Miombo recovers well from harvesting because of its ability to easily regenerate (Chidumayo, 2013). Miombo woodland does not fit easily with the traditional view of forest for timber, instead miombo woodlands are about 'honey, mushrooms, wildlife, and a diverse range of other natural products' (Campbell *et al*. 2007:p26).

Firewood, poles, charcoal, forest foods, medicinal plants and honey are just some of the forest products which are used and traded (Campbell, 1996; Chidumayo and Gumbo, 2010; Gumbo *et al.* 2018) and it is suggested these benefits accrue to over 100 million people (Dewees *et al*. 2011). Despite these benefits, wellbeing indicators for the main miombo countries suggest widespread poverty, and whilst miombo woodlands are important for poverty mitigation, it is harder to make the case for their contribution to poverty elimination (Campbell & Angelsen, 2007). This sober analysis is compounded by the fact that forest degradation and deforestation rates in the miombo zone are high (Ryan *et al.*, 2016). What does the future hold? Is there a scenario where miombo woodland maintenance can be achieved concurrently with poverty reduction?

One forest-based route to poverty alleviation identified by Sunderlin, Angelsen and Wunder, (2003) and discussed by Campbell *et al*. (2007) in relation to miombo woodland is commercialising forest products and developing markets. This approach is closely related to the strategy of NTFP commercialisation, as a possible means of securing the dual outcomes of poverty reduction and forest maintenance (Evans, 1993; Nepstad and Schwartzman, 1992; Peters *et al.*, 1989). The honey and beeswax which are harvested by forest beekeepers in Africa's dry woodlands are some of the outstanding NTFPs which have the potential to contribute to poverty alleviation of people living in or near forests. The strategy of NTFP commercialisation as a route out of poverty is discussed in more detail below.

Another forest-based route out of poverty recognised by Sunderlin *et al.* (2005) and considered by Campbell *et al.* (2007) in relation to miombo, concerns payment for environmental services. Whilst recognising significant barriers, Campbell notes the potential opportunity that fire management could be rewarded by carbon payments. Miombo fires make a significant contribution to greenhouse gas emissions (Silva *et al.*, 2003; Sinha, 2004) and have a deleterious effect on woodland condition. Fire in dry woodlands, the implications and impact is discussed more below. This is important because as this research shows there is a relationship between forest beekeeping and fire management.

Honey is an important miombo NTFP. Forest beekeeping requires nectar, bees and materials to make beehives, and this dependence on forest resources underpins an intimate relationship between beekeepers and forests (Bradbear, 2009). In Zambia hives are made from bark, which are then dispersed throughout the forest, in trees.

The scale of this economic activity is influenced by the strength of beekeepers' links to market. Forest beekeeping is discussed in detail in chapter 4.

2.8 Fire

Fires have profound consequences on global climate, air quality, and vegetation structure and function (Secretariat of the Convention on Biological Diversity, 2001). The WWF Living Planet Report notes fires are a '*primary cause of forest loss and/or degradation*' in East Africa (WWF, 2018:p28). The widespread occurrence of fires in Africa's forests prompts a number of concerns. Fire destroys vegetation and prevents natural forest regrowth and regeneration (Frost, 1999) and fire can also have adverse effects on soil fertility (Frost & Robertson, 1987). Despite some historical debate it is generally understood that African savanna woodlands represent fire-maintained sub-climax vegetation formations (Frost, 1999) and that less fire, means more forest. Special attention is paid to the topic of fire in miombo because it is a leading cause of miombo forest degradation and fire management is one of the most important miombo forest management tools. Also, whilst smoke is a tool used by beekeepers to protect themselves from bee stings during harvest, late season forest fires are a threat to forest beekeeping.

The causes of fire have been well documented and are largely man-made. The most common uses are to clear land or to remove unwanted debris; improve grazing for domestic livestock and, in some nature reserves, for wildlife; manage vegetation structure and composition; improve conditions for hunting; and reduce potentially hazardous fuel loads (Eriksen, 2007). Wildfires are also started accidentally, for example from roadside cooking or heating fires, or during charcoal production, smoking out bees during honey hunting, or burning firebreaks. (Frost, 1999). In Zambia, paleoecological studies and the presence of fire-tolerant species provide evidence that people, landscapes and fire '*are inextricably linked*' (Hollingsworth, 2015:p6) and fire is a tool widely used to hunt, to cultivate crops and to manage forests (Hollingsworth, 2015).

Fire is a characteristic feature of miombo woodlands (Campbell, 1996) and is one of the most important ecological factors affecting this woodland type (Chidumayo, 1997). In Africa, the infertile savanna (mostly miombo) is the vegetation type most impacted by fire in terms of the area burned and the amount of biomass consumed (Frost 1999). Miombo woodland has a complex relationship with fire. Is it a natural part of the miombo ecology or a man-induced influence? The answer, as is so often the case, is both. People deliberately and accidentally ignite fires in miombo woodland (Frost 1999, Hollingsworth, 2015) and have done so for thousands of years (Phillipson 1971 in Chidumayo 1997) and lightening is also a factor (Frost 1999). Yet, the consequence of that fire is determined by the nature and ecology of the forest. The well-known Ndola fire experiments in Zambia, analysed by Trapnell in 1959, showed that miombo species differ in their fire-tolerance, ranging from highly fire tolerant e.g. *Diplorhynchus condylocarpon*, to highly fire sensitive e.g. *Syzigium guineense. Brachystegia* and *Julbernardia species* were found to be fire tender, thriving without fire, dwindling slowly with (Trapnell, 1959 in Campbell, 1996). Trees vary in their vulnerability to fire depending on other factors also. Trees that are physiologically active or stressed are generally less tolerant than those burnt when they are dormant (Frost & Robertson, 1987). Under annual dry season burning miombo is converted to grassland (Furley, Rees, Ryan, & Saiz, 2008). There are multiple dynamics at play with interactions and feedbacks between the woody components of the woodland, grass, herbivores and fire.

Notwithstanding the complexity of interactions and imperfect understanding of forest/fire dynamics ecologists agree that fire causes a reduction in species richness and wood biomass accumulation in dry forests and woodlands in Africa (Campbell, 1996; Chidumayo, 2013). A long-term fire experiment at Marondera, Zimbabwe in the 1950s showed that frequent fires suppress tree growth and maintain an open canopy which in turn allows more grass to grow, providing a higher fuel load, so creating a feedback mechanism (Campbell, 1996). A long-term burning experiment at

Henderson Research Station, Zimbabwe, showed that herbivores make a difference. Grazing pressure can reduce a build-up of a standing crop of dry grass, hence the fuel for fire, yet overall the study showed that '*fire was the dominant influence*' (Campbell, 1996:p52). The miombo forest ecologist Chidumayo studied the impacts of different forest practices on forest degradation from 1990 to 2012 in a miombo woodland landscape in central Zambia. His results showed that fire alone was responsible for between 25% and 77% of the biomass losses at five study sites and he concluded that fire was the most important single factor of forest degradation and was responsible for nearly half of tree loses at the study sites (Chidumayo, 2013). Ryan and Williams's study in 2015 combined an analysis of results from field studies in miombo in Zimbabwe and Mozambique with an ecological model considering varying fire intensities and frequencies. They concluded that miombo tree populations and biomass are very sensitive to fire intensity and that no tree biomass can be sustained under annual fires. They recommended that reducing fire intensity should underpin approaches to management, since total prevention of fire is not achievable (Ryan & Williams, 2015).

The timing and the intensity of fire is important. Late dry-season fires in miombo woodland are more intense and destructive than fires burning in the early dry season when much of the vegetation is still green and moist (Frost, 1999; Trapnell, 1959 in Campbell, 1996). In Zambia, the highest temperatures and lowest relative humidity occur during the hot, dry season from August to November and the amount of biomass fuel in miombo increases as the dry season progresses and the moisture content falls (Chidumayo, 1997). These factors contribute to the intensity of fires during the dry season which spread fast and burn hot. Grass is the fuel that causes the ignitions in miombo, not woody material (Shea *et al.*, 1996). Frequent late dry season fires transform woodland into open, tall grass savanna with only isolated fire-tolerant canopy trees and scattered understorey trees and shrubs (Frost, 1999).

The damage caused by frequent, hot burns has led foresters to note that '*fire is probably the most important management problem in miombo*' (Chidumayo, 1997:p132). The management regime advocated by foresters revolves around managing the heat of the burn. Given the impossibility of total fire prevention and the damage caused by uncontrolled burning, the third option is to promote a policy of planned and controlled burning ' …*what is needed is to influence and encourage people to use fire in a more responsible, controlled, and beneficial manner so that they obtain the benefits while reducing the environmental, economic and social costs'*. (Frost, 1999:p199). The main fire mitigation measure at the disposal of forest managers is to reduce the intensity of burns and this is best achieved through the practice of early burning. Trapnell's research in Ndola, Zambia 1933-1956 showed that most of the dominant miombo suffered a 2.5% per year mortality under late dry-season burning compared to mortality rates of between 0.2% and 0.5% under completed protection or early dry-season burning regimes (Trapnell, 1959 in Campbell, 1996). Early burning involves the setting of fire early in the season when the grass is only just dry, the daytime temperatures are low and there is residual moisture in the forest undergrowth and litter (Trapnell, 1959 in Campbell, 1996). Early burning creates patches of burned areas and these reduce the intensity of fires in the dry season when large, destructive fires would otherwise occur (Frost, 1999; Eriksen, 2007).

It is also important to set fire against other pressures on miombo woodland. Chidumayo studied the impact of pressure on miombo woodland and noted that fire was the main cause of tree mortality at all the study sites and often trees died gradually over a period of one or more years following serious or cumulative damage by fire and such trees never coppiced, *'in contrast, few trees died after cutting'* (Chidumayo, 1993 in Chidumayo, 2002: p1623). Others concur reporting that miombo woodland actually regenerates fairly easily and prolifically, provided that regeneration is not inhibited by *late dry season fires* or *by cultivation* (Dewees *et al.*, 2011).

There is a connection between burning and *chitemene* – the system of slash and burn agriculture practiced in northern Zambia. The burning of piles of wood to create ash to fertilise the soil is done just before the rains, at the end of the hot dry season. There is a tendency for deliberate burning to be done at this time and such burns can spread as wild fires. Early burning by contrast, is discouraged by *chitemene* farmers because the early burns could accidentally damage crops still to be harvested or inadvertently alight the woodpiles needed for next year's farming. Thus, hot dry season coincides with the traditional bush burning period in Zambia (Chidumayo, 1997). Yet should fires extend into the wider forest, this is the time when such burns are most harmful to forest regeneration and to beekeeping. Early burning undertaken to mitigate the impact of late season fires must therefore be a deliberate act in contrast to the traditional time of burning.

2.9 Conclusion

In pursuit of human development goals biodiversity is being eroded and ecosystem services are being damaged. Forests are one just one of nature's spaces that are under threat and are the focus of this research. More than 1 billion people depend to varying degrees on forests for their livelihoods (Forest Peoples Programme, 2012) and this understanding frames the importance of the main research question. Africa's extensive dry woodlands are valued less for their timber and more for their non-timber forest products. The importance of NTFPs for forest livelihoods has given rise to conservation approaches based on adding value to NTFPs in the hope that increased value for people can generate increased incentives to conserve. The flaws in this thinking are now better understood. These issues were discussed and give rise to the research questions underpinning this research which seek to explore how and whether honey trade offers a different narrative. The discussion on forest livelihoods will help inform the first research question which asks about the functional importance of beekeeping in people's lives in recognition of the fact that there is an assumed association between the scale of forest benefits and the type of decisions taken about forests. The chapter discusses terms such as conservation, preservation and sustainable management and explores what these concepts mean and for whom. This discussion explains the framing of the second research question which asks how beekeepers interact with forests, in order to avoid pre-judging the nature of this interaction. The tenurial arrangements which need to be in place to empower local people to take control of the forests on which they rely for their survival are considered in order to inform the third research sub-question about common-property resource management. The chapter concludes with a closer look at miombo woodlands. From an ecological perspective most miombo has been heavily disturbed by people, yet they continue to provide myriad benefits and provided certain conditions prevail are able to regenerate. Attention is paid to fire management in miombo woodland to counter the misunderstanding that miombo is a fire-climax forest and because fire is of concern to beekeepers.

***Image 3**. Abundant nectar sources, Muweji, Zambia, 2015.*

Chapter 3 Forest beekeeping in Africa

Using locally available, renewable resources, forest beekeeping is an environmentally sound activity, yet one that enables forest – dwelling people to harvest products that can be of world quality (Bradbear, 2009:p3).

3.1 What is forest beekeeping

This research focuses specifically on forest beekeeping in Africa, a system which is quite different from other beekeeping systems used worldwide, including large-scale bee farming and small-scale back-yard beekeeping. Whilst there is no unifying definition of African forest beekeeping it has been well described (Wainwright, 1989; Clauss, 1992; Crane, 1999; Bradbear, 2009; Lowore & Bradbear, 2016). African forest beekeeping utilises the wild honey bee population as a resource and does not involve manipulating this natural population. The bee colonies of the indigenous African honey bee *Apis mellifera* live within the forest and forage on nectar and pollen from a very wide range of floral species. Forest beekeeping involves the construction and siting of man-made beehives thus increasing the number of bee nest sites in a given area. Hives are made from locally available resources, sourced from the forest and vary in materials and design (e.g. where the entrance is) but the basic structure is a hollow cylinder. These well-designed hives appear simple, yet their shape, size, materials and design has been perfected by beekeepers to maximise the chance of being occupied and of affording a safe and attractive nest cavity for bees. They are practical to use and inexpensive to make. The hives are placed in forest trees and occupied by wild swarms of bees that are genetically undistinguishable from the wild population. Once or twice a year, depending on local seasonal cycles, beekeepers harvest honey comb, comprising two products in one, honey and beeswax.

Forest beekeeping is not honey hunting, which involves taking honey comb from wild bee nests located in natural cavities (e.g. hollow trees and cavities in rocks). It also does not include the use of frame hives or top-bar hives, even if these are located in forests, since they are movable comb beekeeping systems that allow colony manipulation. In movable-comb systems beekeepers tend to focus on individual bee colonies as productive units with hives kept relatively close to home, to manage and protect the colonies and hives. In forest beekeeping the productive unit is the forest and its whole bee population and the system utilises large forest areas that are unpredictable, indefensible and distant, hence making individual colony management impractical. Forest beekeeping is an extensive, low-input system (Lowore & Bradbear, 2012; Lowore & Bradbear, 2013). Further details about the forest beekeeping system employed in the study area is described in chapter 6, the first of the results chapters.

3.2 The importance of forest beekeeping in Africa

Honey is an important non-timber forest product harvested from forests across Africa and is sourced sometimes by plunder of wild bee colonies, but in greater quantity from well-developed and established forest beekeeping systems employing the use of simple, well-designed beehives, as described above. Honey provides food, an ingredient for making beer and wine and is used as a medicine. Honey and beeswax are widely traded and highly valued. Forest beekeeping occurs in most countries in Africa and has been documented for parts of Ethiopia (Endalamaw, 2005; Hartmann, 2004) Tanzania (Bradbear, 2009; Fisher, 1997), Zambia (Clauss, 1992; Mickels-Kokwe, 2006) and Cameroon. Its importance is not new. Arnold Landor, the 19th century English explorer wrote of his travels in Ethiopia:

One great industry in this country was the collection of honey in cylinders made of tree-bark, strengthened by basket-work all round, and enclosing the beehives. Many of these cylinders could be seen suspended from the most inaccessible top branches of the highest trees. The honey produced was quite good, but dark in colour (Landor, 1907 in Ito, 2014:p198)

Documentary research done by Pesa in 2014 draws attention to the importance of apiculture for income generation in Zambia in the 19th century:

Whole villages sometimes find their tax money by sale of beeswax alone (N.S. Price, Mwinilunga District Annual Report, 31 December 1935 in Pesa, 2014:p92)

Access to scarce commodities, such as clothing, pots and even bicycles, could be provided by means of the beeswax trade (Note on Resources of Mwinilunga District, February 1937 in Pesa 2014:p92).

Historical records from the nineteenth century in Tanzania mention that '*honey was consumed by itself, as a sweet porridge, or combined with millet in a calabash to be stored for times of hunger or warfare. It was also a key ingredient in a type of beer known as kangara, whose value as a food and as a medium for social interaction was significant*' and was also an important trade commodity, '*Along these routes, honey was traded as food and in beer; and calabashes of honey were provided in return for the tribute travellers paid for safe passage through the chiefdom'* (Fisher, 1997:pp302-303).

The importance of forest beekeeping persists and is widely appreciated as playing a role in supporting millions of livelihoods (Bradbear, Fisher & Jackson, 2002; Bradbear, 2009). In a comprehensive report about Zambian beekeeping, Mickels-Kokwe (2006) reported, '*During field visits in September 2004, beekeepers unanimously confirmed the relative profitability of beekeeping to farming, saying that more resources were now allocated to expanding beekeeping rather than farming*', (Mickels-Kokwe, 2006: p15). In some parts of south-west Ethiopia, forest honey is the primary source of cash for households (Endalamaw, 2005; Hartmann, 2004). Work done by van Beijnen, Mosterman, Renkema & van Vliet (2004) in Bench-Maji, Kefa and Sheka in Ethiopia shows that the sale of forest honey contributed from between 12% to 27% to people's total livelihood portfolio, at the time of the research in 2003, and the number of hives is a wealth indicator. Also in south west Ethiopia Hartmann writes, '*Honey marketing … is the main cash-income source for the men in the Sheka zone. Almost every payment is done during the honey harvest from the returns of honey marketing*', (Hartmann 2004:p7). In Cameroon, Ingram reports that in Adamaoua 68% of households keep bees earning 48% of household income in the process, with data from the Northwest region being 55% of households and 45% of household income (Ingram, 2014). In Tanzania, in Babati district honey was traded in exchange for cattle (Ntenga & Mugongo, 1991) and research done by Mwakatobe and Machumu showed that in the Manyoni district of Tanzania, beekeeping accounted for 27.4% of household income with proceeds being used to, '*enable beekeepers to acquire social services, meet school fees, buy clothes, build houses, buy bicycles, supplement food* …' (Mwakatobe & Machumu, 2010:p6). For people living near Niassa National Reserve in Mozambique honey is a major source of income and nutrition (Ribeiro, Snook, Nunes de Carvalho Vaz, & Alves, 2019). In Zimbabwe, Mudekwe's (2017) research showed that honey was the third most important forest product for home-use and was the sixth most important forest product for income. In Zambia one study of the contribution of dry forests to people's livelihood reported that 47% of people in one community derived income from honey, and honey was the first or second most important forest product in four out of eight communities[3] in the study (Jumbe, Bwalya & Husselman, 2008). In Zambia income is derived through selling whole honey comb to traders and exporters and it is estimated that nationally 600- 700 metric tons of honey is transformed into honey beer and sold by homestead traders in rural and urban areas (Mulenga & Chizuka, 2003 in Mickels-Kokwe, 2006). Jumbe et al. (2008: p20) noted that in contrast to many other forest resources honey was an 'exception' in that its value was appreciated at national, as well as local levels. This same study reported that income from honey sales from the Central Province in Zambia, ranged from 1% in a village in Kasama District to 47% in a village in Mumbwa District (Jumbe *et al*., 2008).

Men and women participate differently in forest beekeeping. Mickels-Kokwe reported there to be no restrictions on women keeping bees but that they are constrained by the

[3] This study did not include the north-western province of Zambia which is Zambia's leading honey production area

fact that hives need to be located in remote forest areas and, '*It was also considered impossible for them to leave the homestead chores to go and camp in the forest. Male beekeepers suggested that women should be owners of hives and hire men to manage forest hives on their behalf*', (Mickels-Kokwe 2006: p50). Another study reported beekeeping in Zambia to be a male dominated sector with 34.4% female participation, and that because women must pay men to do some of the beekeeping tasks, production costs are 28% higher for women than for men (Simukoko, 2008). Jumbe et al., reported that men and women engaged in different forest activities noting that the, '*collection and trade of other commercialized forest products, such as honey and charcoal, is controlled by men, mushrooms, fruits, vegetables and insects are considered activities for women and children',* (Jumbe et al., 2008).

3.3 The relationship between beekeeping and forests

Despite the fact that forest beekeeping appears both widespread and important, honey and beeswax are surprisingly absent from the literature about NTFP commercialisation. For example, a number of notable NTFP research collections barely mention honey (Table 1).

Table 1. List of notable NTFP research collections

Research	Reference to honey?
CIFOR's 61 comparative case studies of commercial production and trade of non-timber forest products (Ruiz-Pérez, Belcher & Achdiawan, 2004).	None of the 61 cases concerned honey. The word honey appears once in the document in a list of categories of different types of NTFPs.
Riches of the forest series (López, Shanley, & Fantini, 2004; López & Shanley, 2004a; Lopez & Shanley, 2004b). Three volumes from Latin America, Asia and Africa[4].	These three volumes include 61 cases. One case from the Philippines describes the practice of harvesting honey by the Batak people.
Forest products livelihoods and conservation, three volumes from Latin America, Asia and Africa[5]. (Alexiades & Shanley, 2005; Kusters & Belcher, 2004; Sunderland & Ndoye, 2004).	These three volumes include 61 cases. No cases specifically concern honey, although two separate cases mention that rattan collectors collect honey from the forest.
The bibliographic database of the Poverty and Conservation Learning Group (PCLG, 2020).	Out of 2127 articles only three mention honey in their titles or abstracts.
Study of 10 NTFP products from 18 marginalised communities in Bolivia and Mexico (Marshall, Schreckenberg & Newton, 2006)	Honey not mentioned
NTFPs in the global context (Shackleton, Shackleton & Shanley, 2011)	In this 286-page book honey is mentioned six times, including a record of Zambian and Tanzanian honey export statistics and a mention of the Zambian honey company Forest Fruits Ltd.

Notwithstanding its apparent marginalisation within the NTFP literature, the development community have been actively promoting beekeeping as a forest-

[4] Part of CIFOR's NTFP Case Comparison study – not all the same 61 cases

[5] Part of CIFOR's NTFP Case Comparison study – not all the same 61 cases

compatible income-generating activity for rural communities. For example, conservation projects in Kilum-Ijim in Cameroon, Sheka Biosphere Reserve in Ethiopia, Inyonga Forest in Tanzania, Mount Elgon in Uganda and Selous in Tanzania have all included beekeeping (Abbott, Neba & Khen, 1999; Sutcliffe, Wood, & Meaton, 2012; Hausser & Savary, 2002; IUCN, 2012; Timmer and Juma, 2005 *citations in country order*) and in West Africa IUCN have supported a number of beekeeping projects as components of their biodiversity conservation programme (Arsene Sanon. pers. comm. 2015). The Government of Tanzania has a stated policy that beekeeping should be promoted to contribute to the country's forest conservation goals. However, the scientific rationale for these projects and evidence on their efficacy for forest conservation is limited. As noted by Ingram, '*Evaluations of whether the dual aims have been met are not positive and the evidence presented is general and does not enable conservation 'successes' to be attributed directly, or only, to apiculture', (*Ingram, 2014:p186).

There is a lack of understanding of the role forest beekeepers play as forest conservers and Mickels-Kokwe (2006) touched on this subject in her comprehensive review of Zambia beekeeping. Mickels-Kokwe presented an overview (Table 2.) of perceived positive and negative linkages between beekeeping and forest management.

Table 2. Perceived linkages between beekeeping and forest management in Zambia.

Scale	Perceived positive linkages	Perceived negative linkages
Ecosystem level	Bees as pollinators contribute to miombo woodland regeneration	Aggregate effect of bark and fibre harvesting changes woodland composition and reduced species regeneration
Forest	Improved forest and woodland management arising from beekeeping concerns will improve bee forage availability	Localised forest degradation and loss of bee forage due to bark and fibre harvesting, and fires during honey collection
Village/ community	Economic benefits from beekeeping encourage community to look after forest.	Competition between beekeeping and other forms of land use (e.g. agriculture)
Household	Economic benefit from honey production translates into better natural resource management practices at basic management unit level (household)	Poor households strive to increase number of bark hives beyond sustainable levels of out-take (off-take) in order to reap short-term benefits
Individual	Beekeepers aware of importance of fire management, forest conservation and other sustainable woodland management practices	Beekeepers not aware of aggregate effect of bark-hive harvesting

Source: Mickels-Kokwe, 2006:p20

The table above which is reproduced verbatim from Mickels-Kokwe can be summarised. On the positive side there is mention of '*improved management*' and the community '*looking after*' forest, but with little detail as to what the actual management practices might be. On the negative side the main concern appears to be the aggregate effect of bark and fibre harvesting in the forest. Mickels-Kokwe concluded that the '*the linkage between beekeeping and forest management has been considered to be strong… the precise nature of this relationship, however, appears not to have been researched explicitly*' (Mickels-Kokwe 2006:p19). A sentiment expressed also by Bradbear, who writes, '*there has been little research to investigate how beekeepers make deliberate and conscious efforts to* *protect and conserve forests ….. this is an area of investigation that has been neglected and yet holds significant potential'* (Bradbear, 2009:p58)

A structured review of the literature using the search terms 'NTFP' and 'honey' and 'forest conservation' and 'commercialisation' revealed little analysis of the link between forest honey trade and forest conservation. A notable exception concerned the case of honey and forest conservation in West Kalimantan (de Jong, 2000) and referred to honey collected from wild colonies of *Apis dorsata* bees. Honey has long been traded in West Kalimantan, with documented reports of '*commercial honey collecting since the 1930s*', (de Mol 1934 in de Jong, 2000). Strong customary rules to protect honey trees and honey forests are found amongst the various communities engaged in forest beekeeping. For example, the '*one 'mate-mate´ rule is that no person except the owner of the honey tree may slash the forest within a radius of about 100 m, unless given permission by the owner. This rule ensures that the forest surrounding a honey tree is maintained and the habitat for bees is preserved*', (de Jong 2000:p636). These rules are not robust enough, however, to withstand population pressure and the logging industry, and honey tree 'owners' find it increasingly difficult to protect forests.

Several authors make reference to the general idea that the exploitation of NTFPs might contribute to the goal of sustainable forest management, but only a few considered the role of honey. Guilherme (2004:p186) referred to beekeeping being promoted in Kenya to '*help protect species-rich natural areas*', but no evidence was provided to support this claim. Croitoru, (2007) explored the value of NTFPs, including honey, in the Mediterranean and suggested policy tools to link conservation and income but did not report specifically on forest beekeeping. The literature clearly recognises honey as a useful NTFP, but the focus tends to be on the role honey can play in enhancing income. For example, Ahenkan & Boon (2011) highlight the importance of NTFPs (including honey) for women's empowerment in Ghana, but make no direct link to forest conservation.

Various authors discuss the possibility that beekeeping can be promoted as a livelihood alternative to other activities that cause forest loss, but most of these focus on farm-based rather than forest beekeeping (Appiah, Blay & Damnyag, 2009; Bonilla-Moheno & García-Frapolli, 2012; Tomaselli, Timko & Kozak, 2012). Many agree that beekeeping is compatible with forest conservation objectives but do not consider how it could be a driver of forest conservation (Andrews, 2006; Labouisse, Bellachew, Kotecha & Bertrand, 2008). It is important to note that there is a very significant conceptual difference between an alternative livelihood activity which replaces one which damages forests, and a livelihood which encourages forest conservation because it depends on forests. This distinction was recognised during the mid-term review of the second phase of the NTFP-PFM project[6] in south west Ethiopia, a project which aimed to secure a forested landscape and support livelihoods for local people. During the MTR the evaluators recommended the project took a 'strategic shift' in approach and instead of delivering interventions to take pressure away from the forest, activities should be directed at adding tangible value to the forest in the eyes of local people (Abebe, 2013:p4). To this end renewed focus was placed on adding value to forest honey.

Within the wider beekeeping literature, as opposed to that looking specifically at the NTFP commercialisation angle, there is more insight into the conservation impacts of beekeeping. In Tanzania it was noted that beekeeping has the great advantage that it can be carried out in miombo woodlands without conflict with any other form of land use (Boaler, 1966) and that beekeepers and foresters have a common interest in forest conservation. Smith suggested the beekeepers should be included in a strategy for fire protection and the preservation of the miombo woodlands (F. Smith, 1962). Clauss (1992) noted that beekeepers advocated specific practices designed to support

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[6] Full title: Forest landscape sustainability and improved livelihoods through non-timber forest product development and payment for environmental services.

beekeeping that also had benefits for the forest. He found that Zambian beekeepers were worried about the impact of late fires between August and October. These fires scorch the trees and damage many of the flowers of key nectar species such as *Cryptosepalum exfoliatum pseudotaxus, Brachystegia spp.* and *Copaifera*. The beekeepers advocate early burning to prevent late season wildfires. Nshama, (2003) reported that beekeepers in Tanzania were aware of the importance of sustaining biodiversity and bee fodder plants and Lalika & Machangu (2008) found beekeepers protected the forest around their hives and actively discouraged people from cutting timber.

Endalamaw (2005) reports that Ethiopian beekeepers know the best tree species for foraging bees and make efforts to maintain the ecosystem that supports the whole process of beekeeping. 97% of beekeepers were involved in at least one form of forest enhancement activity ranging from protecting and preserving big trees, tending and protection of younger trees and tree planting. 34% of beekeepers reported that they work for the conservation of the forest by lobby, local discussion and in some cases by reporting free riders to officials and in some areas beekeepers entered into local agreements to reduce the causes of bushfires (Endalamaw 2005). Endalamaw also elaborates on a customary tenure system called *kobo*.

'*In kobo ……. trees are properly managed and promising trees that could be a good nest tree will be tended and protected from damage. Beekeepers remove less vigorous trees to avoid competition on potential hive hanging trees. Maximum protection is made to avoid damage to standing trees while felling trees for hive making or other purposes*', (Endalamaw, 2005:p51).

In Tanzania beekeepers in the Ugalla Game Reserve argued against the Reserve managers that forest beekeeping damaged the forest. In making their case they explained that they were selective in the use of trees:

"We have been told that we kill trees, but a beekeeper does not take the bark of every tree. A skilled beekeeper will know which trees will agree to let him debark. He can examine the tree, if it is good he starts to debark, if it is not he doesn't. When he has made the rope he closes the

hive and re-hangs it. Hanging beehives will not finish the forest because it is really hard work, really hard work" (beekeeper Ugalla Game Reserve, in Fisher 1997:p291).

In elaborating their argument the beekeepers did not put forward examples of purposeful conservation actions rather they compared their activities with other more forest-harming activities such as tobacco farming, charcoal making, lumbering, agriculture, cattle-keeping and firewood collection (Fisher 1997).

Bradbear (2009) draws together evidence of the positive link between beekeeping and management of forests from Congo, Benin, Zambia and Tanzania. In Tanzania, a policy to exclude beekeepers from a protected area was reversed after it was better understood that, '*beekeeping … contributes directly to the effective protection of the whole ecosystem by ensuring long-term protection of the forest,*' (Hausser 2002 in Bradbear 2009). Bradbear goes on to explain, '*Apiculture's unique feature as an activity is the fact that its continuation, through pollination, fosters the maintenance of an entire ecosystem, and not just a single crop or specie*s', (Bradbear 2009: p58).

In Cameroon, Ingram & Njikeu, (2011) state that, '*Beekeeping can contribute to environmental integrity because some beekeepers protect the forest*' (Ingram and Njikeu 2011:p36). A later article presents a more nuanced understanding of the role of beekeeping, '*Few beekeepers reported actively protecting or conserving forests to support beekeeping. Thus most beekeepers and their organisations are not conservationists per se, but pragmatic interventionists …*', (Ingram, 2014:p205).

The literature on forest beekeeping in Africa shows it to be a widespread and important activity, yet the connection between forest maintenance and beekeeping, whilst indicated, remains inadequately explained. This research uses a case in Zambia to fill a significant gap in our understanding about whether and how the livelihood benefits of honey selling feedback to beekeepers' forest management actions.

3.4 Honey and beeswax trade

'*Traditional beekeeping became a commercial activity as trading in beeswax commenced in the 1890s with Portuguese traders from Angola', (*Mickels-Kokwe, 2006:p33*).* This statement, referring to forest beekeeping in Zambia, reveals a great deal. Firstly, it links forest beekeeping with commercialisation and helps to dispel the idea that commercialisation in the African apiculture sector is a new phenomenon as reported in a 2017 media article entitled '*Honey exports take off in Africa*' (Châtel, 2017) and hence helps also to dispel the idea that trade in bee products requires the support of development projects to occur (Simukoko, 2008) as 1890 pre-dates development projects. The statement is also revealing in that it makes the clear link between forest beekeeping and trade. Trade may not have been the driver which first enticed forest people to harvest honey or craft beehives, which was for local consumption of honey (Crane, 1999) but it has undoubtedly driven the spread and scale of the activity. Finally, this sentence is interesting because it mentions trade in beeswax rather than honey, whereas many more recent documents about trade in bee products focus on honey (Kommerskollegium, 2009; SNV, 2012). Historically honey was consumed and traded locally, whilst beeswax without significant local uses, was traded to distant markets (Fisher, 1997; Pesa, 2014; Pritchett, 2001) . It is further interesting to contrast the above statement with a quite obviously wrong statement which appeared in a magazine in 2017, '*Historically, beekeeping in Africa has been practiced for hundreds of years, which is a strength in itself. Unfortunately, it was just for food, passion and hobby, and no one intentionally made money out of sale of honey or other bee products*' (Okello, 2017:p3). This is quite wrong. Beekeepers have been intentionally making money out of the sale of bee products for a long time. The historically important role of beeswax trade in the research target area is elaborated further in section 6.4

Ethiopia is widely reported to be Africa's leading honey producing country (Agonafir, 2005; Sahle, Enbiyale, & Negash, 2018) with an estimated annual production reported to be 39660 MT in 2008/9 (Drost & van Wijk, 2011) and 46000 MT in 2017 (Okello, 2017).

In Ethiopia honey has long been valued as a food – but primarily as the raw material to make *tej* – honey wine (Hartmann, 2004). Formal reports about honey trade and honey marketing in Ethiopia are relatively recent phenomena, for example Agonafir, (2005) and Tadesse & Phillips, (2007) yet many articles mention the importance of beekeeping as a source of income – thereby immediately relating the fact that honey is traded – as exchange for income *is* trade. Interestingly a number of reports juxtapose the importance of honey as a source of income whilst at the same time downplaying the importance of trade. This seems a contradiction. One example is an article by Hartmann (2004) who reports honey to be the main source of income in the Ethiopian Highlands, whilst at the same time writing, '*only a small portion of this is marketed. Beside poor marketing conditions the main reason is, that about 80% of the total Ethiopian honey-production goes into the local Tej-preparation*' (Hartmann, 2004:p2). This narrative suggests that selling honey to make wine is a form of 'lesser trade', and does not consider the importance of the trade from the point of view of the beekeeper.

Another article from Tanzania reports that '*Beekeeping is a long established economic activity in Tanzania. It contributes to the national economy by generating some US$ 19 million per annum and employing more than two million people*' but then goes on to say that '*the sector is non-commercial*' (Tutuba & Vanhaverbeke, 2018).

Other reports (and indeed in some cases the same reports) more accurately report that honey is a traded product, '*beekeeping is traditionally a well-established activity of farm households. They produce [organic] honey and mainly for market. Almost all farmers in Bore and over 20% of the farmers in Dangla districts were participating in the beekeeping business*', (Tadesse and Phillips, 2007:pvi). Hartmann emphasises the importance of honey selling and honey trade in south-west Ethiopia, '*As their main income is from honey production, but Shekacho would not buy it, Manjo sell it to foreign traders. These act also as middlemen, who first buy the honey from the Manjo and sell it to the Shekacho. As also the main income for Shekacho is from honey, this arrangement possibly could give them the first chances for selling*', (Hartmann, 2004:p10).

Phillip and Tadesse provide considerable detail about Ethiopian honey trading activities, players and practices. Honey is generally sold in the crude form i.e. honey comb. Gourds, animal skins and tins are all used as honey containers – although plastic is now common and demanded by many buyers. Tadesse & Phillips (2007) report little differentiation for quality although other authors report that Ethiopian honey sellers and buyers are very sensitive to differences in honey types and quality (Lowore, Bradbear, & Gebey, 2013; Pankhurst & Yirgu, 2009). Interestingly whilst Ethiopia is a leading beeswax exporter many beekeepers are unaware that beeswax is a marketable product. This is because most honey is sold in the raw to *tej* producers and it is the *tej* producers who sell the beeswax – essentially a by-product of tej-making – into the beeswax trade.

The majority of Africa's honey is consumed and traded locally and does not enter formal statistics making it hard to quantify. ApiTrade Africa Company Limited is a not-for-profit company formed in 2008 with a mission *To promote trade in African bee products by coordinating marketing initiatives*. The trade magazine of ApiTrade Africa, The African Honey Magazine, lists 31 honey trading companies and cooperatives across 14 African nations, but this is certainly an under-representation of the industry actors. In 2006 at the 2nd African Honey Trade Workshop (Bees for Development, 2006) a representative from the major UK honey buyer Rowse Honey explained that for African honey to compete on the world market it would have to be competitive on price with other world honeys e.g. that from Argentina or be recognised as a speciality honey (Marshall, 2006).

Good honey and beeswax data is hard to find. A recent article about honey trade statistics in Uganda reports a huge discrepancy between data sources. The oft-quoted 'official' statistic that Uganda has the potential to produce 500,000 tonnes of honey cannot be substantiated and makes little sense when set against the verifiable evidence (Lowore & Bradbear, 2018). Uganda is not alone in struggling with unrealistic ambitions. African Honey Magazine (Ibe, 2016) reports, '*Nigeria currently produces* *about 200,000 tons of honey less than 30% of her potential of 800,000 tonnes'*. The article which quotes this figure then laments the under-development of the sector. To put things into perspective, 200,000 tons is more than twice the production of Russia's 60,000 tonnes (Russian National Union of Beekeepers, 2020) yet Russia is the largest country in the world by land area. If Nigeria really is producing this volume of honey, this should be applauded, not lamented. Interestingly the same article reports that, '*In 2013, FAO estimated that Africa accounted for roughly 9% of global honey production (155,789 t*)'. That one article could report Africa's total honey production (155,789 t) to be in excess of Nigeria's honey production (200,000 t) emphasises again that the sector suffers from inaccurate trade data.

National or regional honey trade data is of little interest to individual beekeepers. Beekeepers are much more concerned with the price they receive for honey and beeswax, the ease of market access, the reliability of the market and, often, the relationship they have with their buyers (Lowore *et al*., 2013). To this end development initiatives have purposefully tried to improve the situation for beekeepers. In Zambia this support took the form of the Beekeeping Division, of the Forestry Department, established in 1959, taking direct responsibility for honey buying for a number of years post-independence and honey processing factories being established in the 1970s and 1980s with donor support (Mickels-Kokwe, 2006). In Tanzania the Tabora Beekeepers Co-operative Society Ltd served as a reliable buyer for 6000 beekeepers in the Tabora Region from the 1950s until the 1990s, with the Co-operative receiving financial support from its UK-based trading partner, Traidcraft (Fisher, 1997a). In the 2000s support for the sector took a 'value chain development approach' epitomised by the work of SNV in several nations, including Zambia, Ethiopia and Rwanda. In Rwanda this approach included '*awareness campaigns on the importance of farmers working in cooperatives to capitalise on collective labour'* (SNV, 2016:p4) and in Zambia involved the provision of advisory services including, '*market support systems that enhanced private sector market performance, marketing strategies, building relationships with customers'*

(Simukoko, 2008:p4). Beekeepers in Africa are often advised, encouraged or helped to form co-operatives but evidence about the success and sustainability of this approach is mixed (Mugoya *et al*., 2018; Wagner, Meilby, & Cross, 2019). In Ethiopia one study showed that beekeepers that were contracted to supply organic honey to an exporting company earned more income than non-contracted farmers, but the results did not clearly explain whether this was due to the organic status afforded to the contracted farmers or because the reliability of the market induced the beekeepers to increase their harvests (Girma & Gardebroek, 2015). A study in Kenya showed that beekeepers made choices about market channels based on the cost of transport to reach the market, the readiness of the buyer to pay in cash, the quality expectations of the buyers and price (Musinguzi, 2016). In Mwingi where this study was conducted beekeepers were found to be turning away from the organic-certified cooperative because they were late payers and in response the cooperative was obliged to buy honey on the open market rather than from members, demonstrating a failure in beekeeper-cooperative relations. For beekeepers, the 'first link in the chain' is the most crucial and reliability, transaction costs and price are some of the most important factors.

3.5 Forest honey as an exceptional, yet overlooked NTFP

As mentioned above honey and beeswax has been derived from Africa's forest across many countries and for many years, with much of the produce being sold to generate useful income for forest adjacent communities. Also mentioned above is the fact that forest honey is largely missing from the NTFP literature, so raising unanswered questions about whether forest honey can deliver both livelihood and conservation goals. During the course of this research work was done to throw light on this question by analysing evidence from a project in south west Ethiopia. The analytical process sought to review the wider NTFP literature to identify and discuss those factors which contributed to the success and/or failure of NTFP commercialisation and then compare forest honey against these factors factors, using evidence from the case in south west Ethiopia. The remainder of this section is drawn from the article **African Forest Honey: an Overlooked NTFP with Potential to Support Livelihoods and Forests** (Lowore *et al*., 2018).

The features of NTFP trade that have been shown to aid or hinder positive outcomes can be termed 'success' and 'failure' factors and these can be categorised according to whether they concern processes related to commercial trade, livelihood benefits or conservation outcomes. For example, NTFPs are generally wild and harvests can be unpredictable. This factor can make commercial trade problematic, as commercial buyers usually require guaranteed supply. Unpredictability of harvests is therefore a failure factor. Table 3. shows the list of success and failure factors, with the first concerning perishability, seasonality and economic inferiority. Analysis of honey trade in Ethiopia demonstrated that the honey can be bulked at collection centres with no time constraints or need for specialist storage, beyond basic hygiene. This allows the product to be accumulated in economically viable volumes for transport. Some beekeepers chose to store the product at home, to avoid selling at peak harvest time when prices are at their lowest. In these ways, the non-perishability of honey aids commercial trade and livelihood benefits. In this respect, honey compares well with perishable NTFPs, such as bush mango *Irvingia spp* (Nigeria) and *Gnetum* leaves (Cameroon and Nigeria), which are often wasted because of inadequate transport, leading transporters, knowing the urgency of sales, to take advantage of the producers (Babalola, 2009; V. Ingram *et al*., 2012). Another failure factor which besets commercial NTFP trade is over-exploitation. For example, the commercialisation of *Prunus africana* bark led to degradation of the resource (Stewart, 2003). By contrast forest beekeeping does not cause resource depletion; the primary resource is nectar, a readily replenished plant product. There is no evidence that increasing honey trade is harming the bee population (Lowore & Bradbear, 2016). Success factors indicate that honey is regarded as sufficiently special by consumers to be considered a high-value product, yet not so rare as to be in short supply. NTFP commercialisation can harm local livelihoods if demand causes prices to rise to such an extent that local people can no longer afford to buy the product, as occurred with the Acai berry in Brazil (Brasileiro, 2009). Evidence from Ethiopia shows that the honey wine shops buy second-grade honey, and do not experience shortages.

One particularly outstanding 'success' factor of forest honey concerns the production system itself. Unlike the collection of wild mushrooms (for example) it is possible for beekeepers to own a wild resource within a natural landscape. The transaction costs of managing common resources can be high, and the unpredictability of wild harvest can undermine returns on labour investment. These problems (associated with honey hunting), are overcome by beehive ownership. The placing of beehives affords ownership over the bees that choose to settle there, and the honey they subsequently store. This ownership is universally understood. This simple and inexpensive action removes uncertainty, reduces time-costs, and overcomes the unpredictability of honey hunting, and is a key reason for the economically rewarding nature of forest beekeeping.

An analysis of forest beekeeping and forest honey trade against these success and failure factors showed that forest honey does not share many of the problematic attributes which beset other NTFPs, whilst enjoying some relatively special attributes which favour its ability to meet multiple aims. It is a high-value product, non-perishable, with demand in local, regional and international markets. The pre-existence of local trade routes, local knowledge and local controls provides a springboard for new market opportunities.

Table 3. Success and failure factors which have been shown to impact on the outcomes of NTFP trade

T = aids or constrains commercialisation and trade. L = aids or constrains livelihood benefits. C = aids or constrains conservation outcomes.

'Failure' Factors	Reference	T/L/C
Inferior. This concerns perishability, seasonality, and economic inferiority i.e. product is rejected when incomes rise.	Neumann & Hirsch, 2000; Arnold & Perez, 2001; Sills, Shanley, Paumgarten, De Beer & Pierce, 2011	T
Substitutable. NTFPS can be easily replaced by manufactured or farmed alternatives, undermining sustainable trade.	Arnold and Perez 2001, Sills, et al., 2011	T
Unmanageable. Hard to manipulate quantity or quality of product.	Belcher & Schreckenberg, 2007; Sills, et al., 2011	T
Elite capture. As a product increases in value, more powerful actors displace the original NTFP harvesters, and capture the benefits.	Dove, 1993; Sills, et al., 2011	L
Poverty trap. Decreasing prices force NTFP harvesters to collect more to earn the same.	Belcher, Ruíz-Pérez & Achdiawan, 2005; Belcher and Shreckenberg, 2007, Sills, et al., 2011	L
Boom and bust. Product is commercialised bringing income benefits until the resource becomes scarce, expensive and ultimately replaced.	Homma, 1992	T
Over-exploitation. Resource is over-harvested, causing depletion or extinction.	Cunningham, 1993; Neumann and Hirsch, 2000; Ticktin, 2004	C
Diversity in the forest works against commercialisation because not enough of the desired product.	Neumann and Hirsch, 2000	T

Product development, for new special products, can take a long time.	Belcher and Shreckenberg, 2007	T
'Success' Factors		
The natural resource base must be abundant to sustain viable trade.	Cunningham, 2011	T
Sustaining a market requires quality, quantity and timeliness.	Cunningham, 2011	T
Adding value, if possible, can help grow and sustain beneficial trade.	Cunningham, 2011	L
Clear rights to land / not an open access situation aids positive outcomes.	Neumann and Hirsch, 2000; Cunningham, 2011	L and C
Local self-sufficiency should not be undermined.	Ogle, 1996; Cunningham 2011	L
Conflict resolution mechanisms are necessary.	Cunningham, 2011	T, L, C
Price incentives must be right.	Cunningham, 2011	T
Visionary champions make a difference.	Cunningham, 2011	T
Niche markets can reduce competition.	Cunningham, 2011	T
Strategic partnerships are important.	Cunningham, 2011.	T
Additional Factors		
Where earlier forms of trade precede an increase in demand, existing control systems may protect the resource from being plundered.	Neumann and Hirsch, 2000	T,L,C
The NTFP harvest must make the forest worth more than the alternative land use.	Evans, 1993	T,L,C

NTFP specialisation can lead to forest modification which may be inconsistent with the objective of maintaining biodiversity but may be good for livelihoods.	Neumann and Hirsch 2000; Ros-Tonen & Wiersum, 2003; Belcher, Ruíz-Pérez & Achdiawan, 2005; Ruiz-Pérez, Belcher, Achdiawan & Alexiades, 2004; Kusters, Achdiawan, Belcher & Ruíz-Pérez, 2006; Belcher and Shreckenberg 2007; Sills, Shanley, Paumgarten, De Beer & Pierce, 2011	T,C
Biological characteristics of the NTFP determines likelihood and ease of sustainable harvest.	Neumann and Hirsch, 2000	C
Conservation logic, direct and tangible link between conservation action and benefit.	Elliott & Sumba, 2012	C

Source: Authors own work previously published in (Lowore *et al*. 2018).

3.6 Conclusion

Forest beekeeping is widespread and important in Africa, yet oddly overlooked. The scholars, development workers and scientists who have investigated forest beekeeping have found evidence that it's persistence as a natural resource harvesting system lies in the skills and knowledge of beekeepers, in the desirability and marketability of honey and beeswax and in the relative ease with which beekeepers can reliably generate useful income. Literature review provides insights which suggest that forest beekeeping is an example of an NTFP with strong pro-poor and pro-forest credentials, and that it is not susceptible to a number of the failure factors which beset endeavours to commercialise other NTFPs. Honey and beeswax are widely traded. These findings suggest that beekeepers have a motivation, a reason, to maintain the forest resource on which their forest beekeeping relies. This finding will be tested by asking the first research question about the economic and functional importance of forest beekeeping. Beekeeping is useful yes, but is it important enough to make forest management 'worth it'? The literature has also revealed important gaps in our knowledge about how this motivation manifests itself in terms of forest management, and the literature says little about whether beekeepers protect forest by excluding other users. Answers to the second research question about how beekeeper interact with the forest and to the third research question about common-property resource management regimes will begin to fill these knowledge gaps.

Image 4. *Miombo in flush, Nchila Farm, Mwinilunga, Zambia, 2015.*

Chapter 4 Forest beekeeping as a social-ecological system

Social-ecological systems are linked systems of people and nature, emphasising that humans must be seen as a part of, not apart from, nature (Berkes & Folke, 1998).

4.1 Introduction

In chapter 2 the meaning of conservation was discussed with respect to sustainable livelihoods, and it was noted that there are divergent views about the extent to which conservation is about managing nature for people's gain or for nature's benefit. Partly because of this, and also because in some instances conservation programmes appear to have been imposed on landscapes by outsiders, the term conservation is deliberately avoided in the research questions. In this chapter we consider alternative, and hopefully more accurate, constructs for exploring the relationship between people and nature. The alternative perspective looks at a landscape, its people and its processes as a system, where outcomes, for nature and for people, are the sum of many interactions.

4.2 Nature and sustainable development

The need to achieve human development without harming the natural systems on which all life depends gained traction in 1987 with the publication of the Bruntland Report and the coining of the term sustainable development (WCED, 1990). The 2016 declaration of the UN's Sustainable Development Gaols (SDGs) is a more recent statement of the world's intention to achieve human development whilst maintaining ecosystem service provision. Yet the decline in the health and integrity of the natural world is becoming ever more apparent. Reports such as The Millennium Ecosystem Assessment (Millenium Ecosystem Assessment, 2005), the IPBES assessments (IPBES, 2018b; IPBES, 2018a) and the Living Planet Report (WWF, 2018), draw attention to the relentless impact of human activity on biodiversity and natural ecosystems.

The Millennium Ecosystem Assessment found that human activity has resulted in a, '*substantial and largely irreversible loss in the diversity of life on Earth*' (MEA 2005:p2) and offers evidence that the degradation of ecosystems is already, '*causing significant harm to some people,* *particularly the poor'*, (MEA 2005:p1). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), is an independent intergovernmental body, providing objective scientific assessments about the state of the planet's biodiversity, ecosystems and the benefits they provide to people. The IPBES Assessment on Biodiversity and Ecosystem services for Africa (IPBES, 2018b) reports that 62% of the rural population across Africa depend directly on essential goods and services provided by the continent's diverse ecosystems, yet these ecosystems are under increasing pressure. Unmanaged land cover change is occurring rapidly and is affecting forests, rangelands and wetlands, and the assessment concludes that, '*unregulated land cover change is detrimental to biodiversity, which in turn is detrimental to Africa's long-term sustainable development'* (IPBES, 2018b:p12). The IPBES Assessment of land degradation and restoration draws particular attention to the fact that habitat loss through transformation, land-use change and land degradation are the leading causes of biodiversity loss, reporting that, '*Between 1970 and 2012, the index of the average population size of wild terrestrial vertebrate species declined by 38 per cent and that of freshwater vertebrate species by 81%*', (IPBES, 2018a:p21). The report calls for urgent action to combat land degradation and to restore degraded land in order to protect the biodiversity and ecosystem services vital to all life on Earth and to ensure human well-being. The Living Planet Report (WWF, 2018) further emphasises the dramatic and continued loss of biodiversity and reports that, '*the Living Planet Index*[7] *shows an overall decline of 60% in population sizes between 1970 and 2014 and that current rates of species extinction are 100 to 1,000 times higher than the background rate*,' (WWF, 2018:p89) and attributes much of this loss to overexploitation and agriculture.

In addition to presenting information about the scale of human impact on biodiversity and ecosystems, these reports also recognise that these same actions, that harm nature, are undertaken with the intention of helping people. The Millennium Ecosystem Assessment Report notes that trade-offs among ecosystem services are common-place and actions to

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[7] The Living Planet Index is an indicator of the state of global biological diversity, based on trends in vertebrate populations of species from around the world.

increase food production often increase water use, reduce biodiversity and reduce forest cover and yet concludes, '*Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative trade-offs*' (MEA 2005:p18). The IPBES land degradation report discusses the benefits to society which can be gained through transforming natural ecosystems into production-oriented ecosystems and notes that, '*Valuing and balancing these trade-offs is a challenge for society as a whole*' (IPBES, 2018a:p18) . The Living Planet Report also recognises that the period which has seen the most environmentally damaging actions also coincides with a period that has seen huge improvements in human development, but at what cost? As the authors conclude, '*What is increasingly clear is that human development and wellbeing are reliant on healthy natural systems, and we cannot continue to enjoy the former without the latter*', (WWF, 2018:p24).

This research concerns one particular case which appears – at least at first glance – to contribute to human development without causing significant harm to nature. This investigation aims to understand to what extent forest beekeepers are deliberately managing the trade-offs inherent in their landscape and whether and how their decisions are influenced by honey and beeswax trade, and consequently impacting on forests.

Globally, the world is losing forests with tropical countries and low-income countries losing forests fastest (World Bank, 2016). Most of the forest converted to other land uses between 1990 and 2015 was in the tropical domain (FAO, 2015) with 6 million ha of tropical forest land being converted to other uses in the five years preceding 2015 (FAO, 2015). The fact that poorer countries are losing forests goes to the heart of the challenge of sustainable development. Forests support the livelihoods of millions of the world's poorest people and poor people need forests. The livelihoods and food security of many of the world's rural poor depend on vibrant forests and trees. FAO's State of the World's Forests Report (SWF) provides evidence that, '*around 40 percent of the extreme rural poor – around 250 million people – live in forest and savannah areas'*, and that forest products, goods and services are vital for their wellbeing, for providing income and for preventing even worse poverty (FAO, 2018).

The Report goes on to recognise the need to manage trade-offs, '*To accomplish the historic ambition of ending hunger and poverty and transforming to a sustainable world*', (FAO, 2018:pxv) and draws attention to the tension between farm and forest. The report presents evidence that the conversion of forest land to agriculture and livestock rearing is a chief driver of deforestation, and notes that increasing agricultural production and improving food security without reducing forest area, '*is one of the great challenges of our times*' (FAO, 2018:px). Yet the report ably explains where the synergies lie between forests and sustainable development and explains in some detail the interconnectedness between forest goods and services and ten out of the 17 SDGs.

SDG 15 tends to be abbreviated to 'Life on Land', but in full SDG 15 reads, **Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss**. It is clear then that SDG 15 is directly concerned with forests. The SWF report goes on to analyse the interconnectedness between trees and forests and nine other SDGs, putting forward a strong case that forests and trees support human wellbeing and are not, in a phrase used in the Living Planet report, '*nice to have*' (WWF, 2018:p126). Forests and trees are an essential part of sustainable development because forests and trees generate income for poor people and have a role to play in poverty alleviation (SDG 1). The sale of forest products provides households with cash that can be used to meet food and other needs, while direct consumption of woodfuel, fodder, building material, food, medicinal plants and other products can equate to between three and five times the cash generated through the sale of forest products (Agrawal *et al.,* 2013). Wide-reaching research done by the Poverty Environment Network sites, showed that 9 percent of the sampled 7978 households from 24 countries would fall below the extreme poverty line if they lost their forest income (CIFOR, 2020b; Noack, Wunder, Angelsen, & Börner, 2015). Forests and trees also help to combat hunger (SDG 2) by providing food and dietary diversity, supplying wood energy for cooking food, and enhancing the resilience of the ecological and social systems surrounding agriculture (Wheeler & Von Braun, 2013). Direct consumption of forest foods provides staples, micro-nutrients and famine foods. Estimates from India, indicate that up to 50 million households consume forest-harvested fruits (FAO, 2011) whilst some Nepalese households collect as much as 160 kilograms of forest mushrooms for home consumption per year (Christensen, Bhattarai, & Larson, 2008) and in Africa, edible leaves of wild trees such as baobab and tamarind are important sources of protein, iron and calcium (IUFRO, 2015). Women are heavily involved in the collection of forest foods and firewood, and this creates an important linkage between forests and SDG 5. Efforts to empower women and enhance their rights of access to economic resources such as forests, has strong potential to improve gender equality across the developing world. Over 75 percent of the world's accessible freshwater comes from forested watersheds (FAO, 2018:p24) (SDG 6 Water availability), woodfuel provides basic energy services to one-third of the world's population (FAO, 2014) (SDG 7 Access to energy), forests have the potential to generate formal and informal employment, particularly in rural areas (SDG 8 Decent work for all) and trees contribute hugely to the quality of urban living (SDG 11 Sustainable cities). Managed sustainably trees create valuable renewable materials which when processed, used and recycled efficiently can contribute to SDG 12, Sustainable production and consumption. Forests absorb carbon dioxide and hence have an integral role to play in combatting climate change (SDG 13). Around 1.6 billion people - including more than 2,000 indigenous cultures - depend on forests for their livelihood. Forests are the most biologically-diverse ecosystems on land, home to more than 80% of the terrestrial species of animals, plants and insects. They also provide shelter, jobs and security for forest-dependent communities. SDG 15 recognises that investing in forests '*represents an investment in people and their livelihoods*', (United Nations, 2020)

As this section shows forests are important but are not safe. And it is in the tropics where biodiverse indigenous forests are disappearing fastest. In Africa, where this research is focussed, the goods and services which flow from forests contribute to the success, security and sustainability of millions of livelihoods. Chapter 2 included a discussion about the meaning of conservation. The beginning of chapter 4 (above) begins to re-frame this discussion and consider forest conservation from a different perspective. It seems less appropriate to talk about forest conservation (although the ubiquity and breadth of meaning of the term makes it hard to avoid) and more appropriate to talk about linkages and trade-offs between ecosystem services. In light of the need to understand these trade-offs and the need to recognises that it is local people's realities that are important, the term forest conservation can be problematic. There is a danger that forest conservation outcomes and the means to achieve them are concepts externally imposed on forest people. The remainder of this chapter elaborates on a more flexible, dynamic and complex construct: The Social-Ecological System. The chapter considers how seeking to understand forest beekeeping through the lens social-ecological system thinking might be more illuminating than focussing on forest conservation in a narrow sense.

It is particularly important to stress that the 'conservation by commercialisation' thesis is an artificial construct in the sense that it aims to add value to forests *in order to save forests*, albeit in a way that meets people's multiple needs. Forest beekeepers undoubtedly recognise the link between forest maintenance and the benefits that accrue to themselves. Yet it is unlikely that they sell honey *in order to justify* forest maintenance. They sell honey because it is a useful and important way to use the forest to support their livelihoods. This distinction might seem convoluted, but it is important to examine the research questions from the beekeepers' perspective. Social-ecological systems thinking helps also in this regard.

4.3 Social-ecological systems

Humans and nature are interconnected. People use and benefit from ecosystems and in doing so have an impact on nature and natural systems. Changes in the natural world also impact on people, in terms of the provision of ecosystem services. Humans not only benefit from ecosystems but impact and shape the capacity of ecosystems to generate services (Folke, Hahn, Olsson, & Norberg, 2005), creating a dynamic mutual and reciprocal relationship between humans and ecosystems (Mung'ong'o, 2009) which alters the capabilities of ecosystems to continue to provide many of their services (MEA 2005). The inseparability of social systems and ecological systems gave rise to the concept of the social-ecological system, which was defined by leaders in this field, Berkes and Folke as follows:

'*Social-ecological systems are linked systems of people and nature, emphasising that humans must be seen as a part of, not apart from, nature*', (Berkes & Folke, 1998).

The construct of the social-ecological system (SES) and approaches to studying SESs helps us to understand the complex interlinked nature of people and ecology, which cannot be understood if the two systems are approached independently (Figueiredo & Pereira, 2011). Social-ecological systems thinking has gained considerable traction in recent years. A Scopus review undertaken by Colding & Barthel (2019) showed that the number of publications relating to SES science rose from less than 10 between the years of 1998-2001 to 5935 between the years 2014-2016. Social-ecological system thinking emerged as a school of thought to help elucidate the complex relationships between people and nature.

The idea that the human dimension must be studied as integral to natural systems goes to the heart of SES thinking. Traditional approaches to natural resource management very often set people as external actors, for example, as users, conservers, destroyers or managers (Liu et al., 2007; Walker et al., 2002) . SES frameworks enable an alternative view and make it explicit that humans are integral parts of these systems, affecting them, and being affected by them (Anderies et al., 2004).

This interaction is made clear also in this more recent definition: '*Social ecological systems are complex adaptive systems composed of many diverse human and non-human entities that interact. They adapt to changes in their environment and their environment changes as a result*', (Stockholm Resilience Centre, n.d.).

SES thinking emerged from study of complex adaptive systems, partly as a result of work done by Levin (1998) who identified that ecosystems are 'prototypical examples' of complex adaptive systems, in which macro-level system properties are derived from the interactions of smaller components and may feedback to change the nature of these interactions (Levin, 1998).

Understanding feedback mechanisms between social and ecological processes is an important part of understanding SESs. Feedback denotes a mutual causality wherein the secondary effects of a direct effect of one variable on another, '*causing a change in the magnitude* *of that effect. A positive feedback enhances the effect; a negative feedback dampens it'* (Walker & Salt 2006 in Miller *et al*., 2012:p219). Many feedbacks between the social and ecological elements of an SES are fundamental to maintaining system structure and function in the face of disturbance and underpin robustness and resilience (Kerner and Thomas, 2014). Feedbacks are a particularly strong feature in forest SESs (Fischer, 2018) and it is through feedbacks that forests self-organise (Filotas *et al*., 2014). An example of a positive feedback mechanism (with negative consequences) in forests is fire suppression. In fire prone forests fire suppression has allowed the build-up of flammable material leading to more intense wildfires, when they do occur. In this way an action that was intended to increase productivity had the opposite effect (Fischer, 2018).

Another important feature of SESs is their unpredictable and non-linear dynamics. Non-linearity refers to processes which do not follow a simple cause and effect pathway; instead local rules of interaction change as the system evolves and develops. As stated by Carpenter '*It is rare to find a linear causal path from changes in drivers → biodiversity → ecosystem processes → ecosystem services → human well-being to human responses to feedbacks to drivers and biodiversity*' (S. Carpenter, 2008). This has implications for my research questions as I ask about the causal relationship between honey sales and conservation actions by beekeepers. Instead of linear relationships it is not unusual that 'linkages may jump forward or backward over steps' (Carpenter, 2008). The non-linearity of the processes within a social-ecological system is one of the reasons why these systems are so complex and resist modelling based on linear causality (Berkes & Folke, 1998; Rounsevell, Dawson, & Harrison, 2010).

An additional characteristic of social and ecological systems is that they operate across different spatial and temporal scales, for example from the local to global and from the present to the future (Berkes & Folke, 1998; Carpenter, 2008). One of the challenges facing those who wish to understand or influence SESs is to understand the dynamics of ecosystem services and human well-being as they interact across scales; social-ecological systems have links spatial and temporal scales, and decisions in one place affect people elsewhere (Keane 2016). In the case of forest honey exported to the EU, the buying preference of consumers in

Europe can have an impact on what forest beekeepers do in a remote forest on the border of Zambia and Angola.

The issue of multiple inter-linked scales is within Redman, Grove, & Kuby's (2004) definition of a social-ecological systems:

- *A coherent system of biophysical and social factors that regularly interact in a resilient, sustained manner;*
- *A system that is defined at several spatial, temporal, and organisational scales, which may be hierarchically linked;*
- *A set of critical resources (natural, socioeconomic, and cultural) whose flow and use is regulated by a combination of ecological and social systems; and*
- *A perpetually dynamic, complex system with continuous adaptation'*

(Redman *et al.*, 2004)

These across-scale interactions are a particularly important part of understanding forest SESs. Forests may be impacted on by people acting as individuals or by many people carrying out many small similar acts. The forest management actions of individual people which might be implemented on a '*specific landscape at a specific time might have impacts in aggregation that are far reaching in space and time*' (Fischer, 2018:p141). Burning is an example of this. A fire that is prevented today may, for example, not burn a beehive, so save the honey crop. It may also not burn a sapling that twenty years hence will become a mature tree. This fire prevention act, for example, can have implications across multiple time-frames. Forests are extensive and they tend to comprise territories where the ecological boundaries do not conform to the administrative boundaries, again highlighting the importance of cross-scale interactions.

By their very nature SES are complex and the components embedded within the systems are too often studied by different disciplines, which does nothing to aid understanding. It is necessary instead to '*dissect and harness complexity, rather than eliminate it from such systems*' (Alexrod and Cohen 2001 in Ostrom, 2009:p420). Yet a recent assessment of the 20-year evolution of the social-ecological systems framework revealed the lack of a common analytical framework for the analysis of SESs (Colding & Barthel, 2019), instead noting that the science is served by a range of different conceptual frameworks.

4.4 Conceptual frameworks for social-ecological systems

The utility of social-ecological systems thinking is demonstrated by its wide adoption. Since the introductory work by Berkes and Folke in 1998 the SES concept has been used in both the environmental and social sciences, as well as in economics, in medicine, psychology, and the arts and humanities (Colding and Barthel, 2019). The conceptual framework developed by Berkes and Folke (Figure 1.) remains important and widely used and was intended to provide structure for studying local resource management systems and to guide understanding about dynamic connections between knowledge, practices, institutions, and ecosystems. At the heart of the framework is the relationship between a local ecosystem (natural system) and local management practices (human system). The local, is always set within a wider context. A local ecosystem is always part of something larger, and the way people act locally, is determined by the institutions in which they are embedded. In relation to natural resource management these institutions concern property rights, laws, regulations and cultural norms. Berkes and Folke sought to emphasise that the linkage between ecosystem and management practice was provided by ecological knowledge about the resource base on which they depended. This knowledge linkage was deemed critical (Colding and Barthel, 2019; Folke and Berkes, 1998).

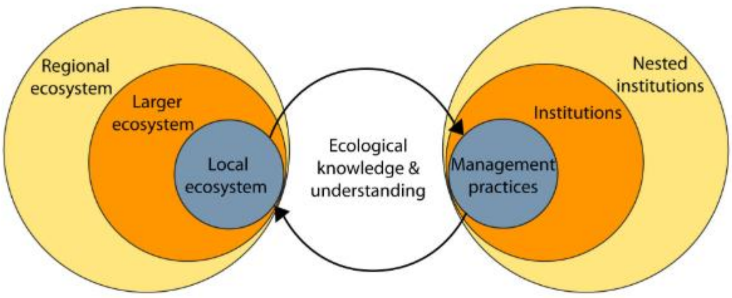

Figure 1. A conceptual framework for the analysis of linked social-ecological systems. *Source: Based on Folke and Berkes (1998) and modified by Colding and Barthel (2019).*

Anderies, Janssen, & Ostrom (2004) and Ostrom (2009) developed SES models that highlighted key interactions that were especially important with regard to system robustness. The key feature of Anderies *et al.*'s model (2004) was to '*recognize both the designed and self-organizing components of a SES and to study how they interact*' (Anderies *et al.*, 2004). Ostrom modified Anderies model with the aim of creating a multitiered framework that could handle the complexity of real SESs and yet could provide clarity for those seeking to manage natural resource systems. Her sub-systems framework was developed to counter an unhelpful tendency for scholars '*to develop simple theoretical models to analyse aspects of resource problems and to prescribe universal solutions*' (Ostrom, 2009:p419). Her framework comprised four first-level core subsystems, the relationships between them and their multiple second-level variables. The four core sub-systems are (i) resource systems e.g. forests (ii) resource units e.g. trees (iii) governance systems e.g. government rules and (iv) users. Of particular interest is that, building on her previous scholarship on common-property resource regimes Ostrom identifies a sub-set of variables, within the broader framework, that are found to be associated with self-organisation to sustain a resource. Amongst these variables she includes the size of the resource (smaller is better), the productivity of the resource (not too little, and not too much), predictability of system dynamics and number of users (Ostrom, 2009).

In their review of SES evolution Colding and Barthel (2019) refer to these three frameworks as the original (Berkes and Folke, 1998), the robustness (Anderies et al., 2004), and the multitier (Ostrom, 2009) frameworks. The latter two have a more diagnostic focus, compatible for SES modelling whilst the framework developed by Berkes and Folke '*could more adequately be described as a descriptive framework, primarily dealing with the linkages among institutions, management practices, and different environmental knowledge systems*' (Colding & Barthel, 2019: p23).

SES thinking shares a scholarly venn diagram with a broad and evolving research around the wider linkages between ecosystem services, poverty alleviation and sustainable livelihoods. A useful evaluation of various conceptual frameworks developed to support analysis of the poverty/environment nexus was undertaken by Fisher *et al.*, (2013). In their evaluation the authors make a distinction between different kinds of frameworks depending upon how they handle data and ideas. Some frameworks, the authors posit, are designed to support data collection, and these are most often used by empirically-oriented research. They cite Ostrom's multitiered SES framework (see above) as an example of this. A second tradition of framework usage is as a presentation of key concepts and relationships, as a 'thinking-tool'. This latter group of frameworks are primarily conceptual, they show relationships between entities and inform data collection in a less strict way than other frameworks. Their review purposefully focussed on dynamic frameworks because they considered that dynamic frameworks were better able to represent meaningful relationships between entities and that the use of dynamic frameworks is more aligned with Social–Ecological Systems thinking. The review analysed nine frameworks including Environmental Entitlements (Leach, Mearns & Scoones, 1997), Framework for Ecosystem Services Provision (Fisher *et al.*, 2013; Rounsevell, Dawson & Harrison, 2010), Millennium Ecosystem Assessment (MEA, 2005) and Sustainable Livelihoods (Chambers and Conway, 1992; Scoones, 1998).

The framework which deals with ideas most closely related to the feedback relationship between how people benefit from nature and what people do to nature is the Framework for Ecosystem Services Provision (Rounsevell, Dawson & Harrison, 2010). This framework represents a Social–Ecological System, with directional social and environmental dynamism and feedbacks, making this a more dynamic framework than many others.

The Sustainable Livelihoods Approach articulates a livelihood as 'compris[ing] people, their capabilities and their means of living, including food, income and assets' (Chambers & Conway, 1992:1). The framework assists with the analysis of what makes a livelihood sustainable, with livelihood outcomes being determined by livelihood strategies, institutional processes and organizational structures and access to resources and capitals, including natural capital, which could include ecosystem services (Ashley & Carney, 1999; DFID, 2001). The SLA includes important discussion about how assets can be "combined, substituted and switched, with different portfolios emerging over time for different people in different places, and linking changes in natural capital ('the environment') with social and economic dimensions" (Scoones, 2009). The strength of the SLA lies in its ability to present various entry points for thinking holistically about the contribution of ecosystem services to livelihoods and the flexibility of the framework means it is highly compatible with other frameworks (Fisher et al., 2013). Concerning its weaknesses, Scoones (2009) argues that the use of the framework has tended to focus disproportionately on quantifiable aspects, such as the 'asset pentagon'[8] rather than facilitating a holistic combination of quantitative and qualitative analyses, as intended. Others consider this framework to be relatively weak for analyzing the influence of policies and political economy processes, partly because it tends towards a micro household, rather than cross-scale focus (Clark & Carney, 2008).

A subsequent review of SES-related conceptual frameworks was undertaken by Keane in 2016. The ESPA programme delivered high-quality research aimed at improving understanding of the way ecosystems function and of the linkages between ecosystem services and wellbeing (Keane, 2016). The programme invested effort in the creation of conceptual frameworks which served to guide and organise thinking and clarify understanding of the links between ecosystem services and wellbeing. Of the eighteen conceptual frameworks arising from the ESPA programme and reviewed by Keane in 2016, three are described as being able to inform 'the bigger picture' whilst others focussed on particular thematic areas such as fairness, equity, justice and human well-being. Of particular interest is the *Livelisystems Framework* developed by Dorward, (2012, 2014), as a means of '*understanding multi-scale, dynamic change across social and biological systems*'. This framework appears relevant to the forest beekeeping system because it accommodates the fact that ecosystem services contribute to transitions between different levels and types of livelihood activity and these changes can, in turn interact with the natural resource assets. One of the strengths of the *Livelisystems Framework* is that it includes an analysis of the functional

[8] Diagrammatic representation of five key assets underpinning sustainable livelihoods; natural, financial, social, physical and human.

importance of assets and how these function e.g. direct use, exchange affect Livelisystem transitions. The *Livelisystems Framework* could be said to be a dynamic framework that aids conceptual thinking.

4.5 Livelisystems: a conceptual framework

The tensions between people and the environment which have been described in the first part of this chapter are played out within social-ecological systems which are complex, dynamic and multidisciplinary. These characteristics make them difficult to understand and to address. In developing the *Livelisystems Framework* Dorward identified that a truly transdisciplinary and valid framework should have the following characteristics:

- It must be able to represent the characteristics of complex, coupled systems,
- It should draw on and develop insights, concepts and language from a range of social and natural science disciplines,
- It should be able to accommodate and mediate a variety of different disciplinary perspective and investigational approaches and
- It should stimulate innovative and valid conceptual and researchable questions and investigations as well direct researchers and practitioners toward key interventions and intervention points in SESs.

The framework postulated by Dorward sets out elements and processes that constitute a '*livelisystem*', defined as:

A combination of functions provided by assets (or resources) and activities undertaken in and by open, structured, and actively self-regulating systems in maintaining negentropy[9] *and/or increasing it with informational, material, and relational mechanisms for maintenance, growth, or multiplication.*

The processes and elements of the *Livelisystem Framework* developed by Dorward (2012, 2014) are shown diagrammatically in Figure 2.

[9] Order, organisation, structure, useful function

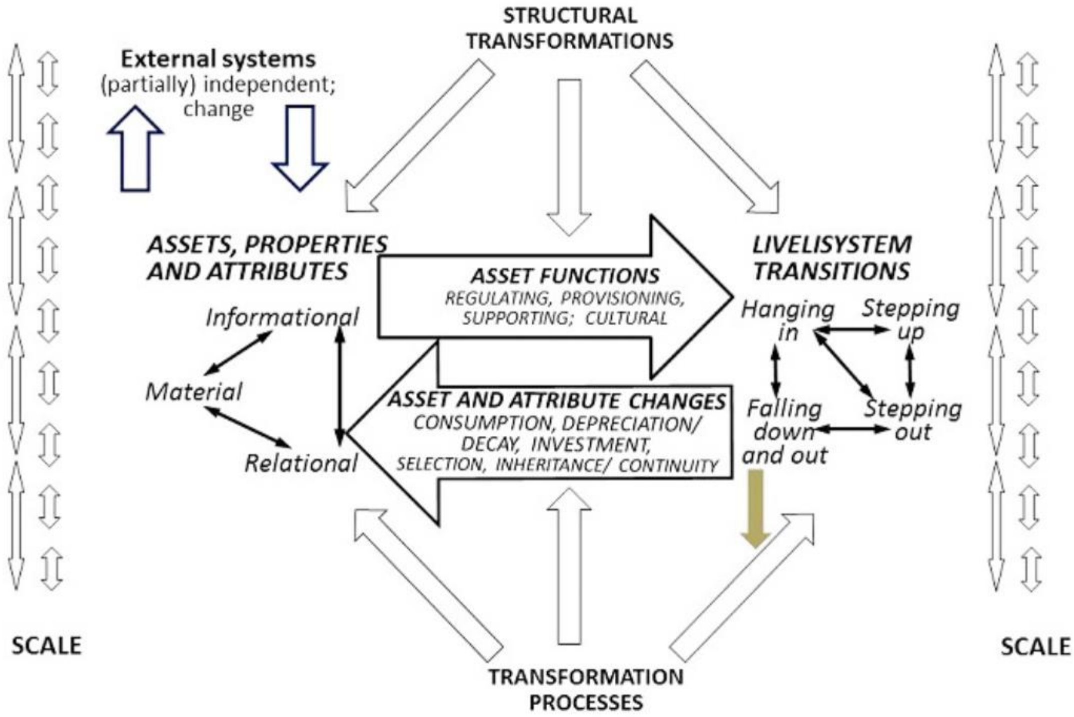

Figure 2. Livelisystems: broad processes and elements. Source: Dorward 2014.

The *Livelisystems Framework* focusses attention on a range of entities within a broad system, the links between these entities, the processes which maintain or increase system order and the relationships between the system and external forces. As the diagram in Figure 2. shows the 'livelisystem' comprises a two-way relationship between 'livelisystem transitions' (on the right) and 'assets, properties and attributes' (on the left). The right-pointing arrow in the centre of the diagram shows that assets have asset functions which affect the livelisystem transitions, and as a consequence of these transitions can cause changes to the assets – as shown by the left-pointing arrow. All these elements and the relationships between them may be transformed by a variety of related structures and processes.

The four possible livelisystem transitions are those previously developed by Dorward, Anderson, Bernal, Vera, Rushton, Pattison & Paz, (2009) and referred to above. These are defined as: hanging in (maintaining the status quo), stepping up (increasing assets or activities), stepping out (different activities) and falling down (failing to maintain the status quo and falling to a level with a lower attainment of assets, or failing to maintain the livelisystem). These transitions draw on asset functions which may cause the transitions to take place and the consequence of these transitions may cause asset and attribute changes. Different types of asset functions include consumption (assets which are consumed), exchange (assets which are exchanged), savings (assets which can be accumulated and cashed in when needed) or protection (assets which protect from shocks). Asset depletion may occur where asset stocks are directly consumed, at a faster rate than they are re-generated. Assets may also accumulate where 'investment' or other positive effects lead to faster generation.

The *Livelisystems Framework* is deliberately adaptable and all-encompassing so that it may be applicable to a range of disciplines. The framework allows for a wide range of different asset attributes depending upon the different social and ecological processes within different systems. The framework allows that assets and attributes can be caused to change by both internal and external factors. The framework also allows for relationships between different systems and this raises questions about how to define boundaries of open systems.

4.6 The *Forest Beekeeping Livelisystems Framework*

The *Livelisystems Framework* enables the analysis of complex social-ecological systems by examining a wide variety of processes and system characteristics. These characteristics include such SES features as thresholds and tipping points, and a wide range of structural transformations (e.g. economic, ecological changes) and transforming processes (e.g. accumulation). The framework does not need to be applied in its entirety; it can provide a valuable starting point, '*for investigation of particular parts of a livelisystem by defining core research questions within an integrating structure*' (Dorward 2014:p7).

The *Livelisystems Framework* can be applied to forest beekeeping. In its simplest form my research question is asking, *do forest beekeepers maintain forest*? Yet, there is no simple answer. There are many different factors which influence beekeepers' decisions and resource use patterns and some of these factors interact. Forest maintenance might be an emergent outcome of the system, not the planned outcome resulting from linear cause and effect. A *Forest Beekeeping Livelisystem Framework* may help demonstrate the connections between the components parts of the overall system and show the link between the forest condition and forest beekeeping activities.

That forest beekeeping is a good example of a social-ecological system was also indicated by research done in Tanzania. In a study of forest beekeeping in Ugalla Game Reserve in Tanzania, Fisher, (1997:p252) described the way beekeepers 'order, classify and represent their use of forest resources, claim ownership of bee-hives, link themselves to international demands for produce, transmit beekeeping skills, and make honey and beeswax production part of their daily existence' and noted that beekeepers maintained social environments or 'social spaces', within the forests where they worked. The way beekeepers interacted with these 'social spaces' was contrasted with the perspectives of conservation planners which endeavoured to remove the human dimension from protected area management. The research revealed how beekeepers organised their environment culturally, socially and technically so as to produce honey and beeswax for sale on international commodity markets (Fisher 1997) and in doing so described a social-ecological system.

The *Livelisystems Framework* can help represent the complexity of the social-ecological system in which forest beekeepers are living and acting. In order to help steer the research activity the *Livelisystems Framework* is used to develop a specific conceptual framework for investigating how beekeeping impacts on people's livelihoods and the basis for people's decisions about resource use and management. The core elements and relationships were identified by drawing from the *Livelisystems Framework* particular elements that were perceived to be critically relevant to the problem being researched: the way honey income supports livelihoods, beekeepers actions towards the forest resource, the influence of honey trade, the impact of external factors, The *Livelisystems Framework* re-interpreted for a forest beekeeping system is presented in Figure 3.

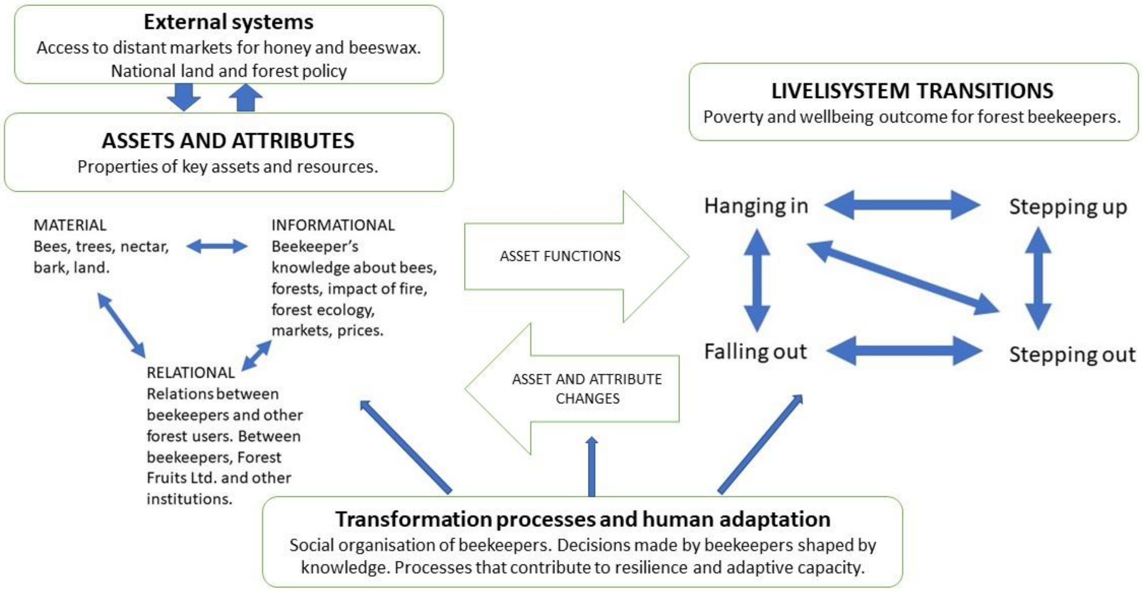

Figure 3. *Forest Beekeeping Livelisystems Framework.*

Developed by the author after Dorward 2014.

The *Forest Beekeeping Livelisystems Framework* focuses attention on the functions of resources or assets, on livelisystem transitions, on transformation processes and human adaptation and on the impact of external drivers, such as trade. Looking at each of these in turn will help guide the research.

Resources and assets

The first research sub-question is asking about **the economic and functional importance of forest beekeeping for forest beekeepers**. Analysing the asset functions and attributes of the natural assets which underpin the *Forest Beekeeping Livelisystem* will help inform and answer this research question

If we look at the *Livelisystems Framework* as it could be applied to forest beekeeping we see that the natural assets which beekeepers are using are bees, bee-hive making materials (bark), nectar and the wider forest habitat which supports a healthy bee population. These assets have functions and attributes. Bark is useful as a tool without which it would be harder to provide a practical nest sites for bees. Bees are agents – collecting and processing nectar. When bark is transformed into bark-hives, this changes a common-property resource into an owned asset. When honey bees enter a hive, they too – or rather the honey they make – becomes owned. The function of these natural assets for beekeepers is a provisioning function, providing a good which can be both eaten and sold. Questions about asset functions and attributes for the Forest Beekeeping Livelisystem are shown in Box 2.

Box 2. Asset functions and attributes – questions for the *Forest Beekeeping Livelisystems Framework*
Functions

Consumption – is honey eaten?
Exchange – is honey sold for cash or exchanged for labour?
Production – what primary assets are needed to produce honey? E.g. bark, bees and flowers
Protection – does the sale of honey help in times of stress?
Savings – does honey allow families to accumulate?
Social – does honey have a social value?
Attributes
Convertibility – how easy is it to convert honey into cash?
Use costs – what does it cost to access and harvest honey?
Productivity – in normal times, is the forest productive in terms of honey yield?
Rules of access – what are the rules of access to the asset?
Dorward, 2012

NTFPs that do not enter international markets are often conceived of as '*famine foods'* that are inferior and substitutable, and by corollary, not worth managing (Sills *et. al*., 2011). Many authors have emphasised the critical safety net function of NTFPs (Falconer and Koppel, 1990; Koppert, Dounias, Froment & Pasquet, 1993).

Livelisystems transitions

As with understanding the resources and assets of the system, exploring the livelihood transitions occurring within a *Forest Beekeeping Livelisystem* will help answer the first research sub-question **about the economic and functional role of forest beekeeping in beekeepers' livelihoods.**

Here we ask, what is the function of forest beekeeping in terms of impact on livelisystem transitions? The four livelisystem transitions described by Doward (2009, 2014) have been included in the *Forest Beekeeping Livelisystems Framework.* These four broad types of strategy pursued by poor people 'hanging in'; 'stepping up'; 'stepping out' and 'falling out and down' have been explained above.

For forest beekeepers a 'stepping up' strategy would involve doing more beekeeping to improve livelihoods, a 'stepping out' strategy would involve doing something else and leaving beekeeping. The role of the livelisystem transitions is important. It is by understanding how forest honey supports (or otherwise) these transitions that we can understand whether forest honey serves as a safety net function, a poverty reduction function or a diversification function. If people are using forest income to transition away from forest beekeeping altogether, their inclination to invest in the natural assets of the system, e.g. the forest, may be weakened. One could make the argument that forest is 'worth managing' when people are engaged in 'stepping up' activities. Those who are 'hanging in' may be in an adverse situation from which they want to escape. They have neither the resources nor the motivation to manage a resource which is merely maintaining their adverse situation, whilst those who are 'stepping out' see their future as depending on something other than forest resources. We do not know that those who are 'stepping up' are always motivated or able to manage forest, but they are possibly the most likely group to do so.

Understanding the livelihood function of forest beekeeping is important because the review of NTFP literature indicated that NTFPs, whilst being very useful for poor people do not always offer a pathway out of poverty. For example, many NTFP commercialisation projects disappoint because the income gains which are theorised in the planning stages do not materialise for a number of reasons (Arnold & Perez, 2001; Belcher & Schreckenberg, 2007). Some instances of participatory forest management projects have also failed to meet people's promised expectations in terms of livelihood gains (Bwalya, 2007; Zulu, 2013).

Ostrom, (2009) explains that effort is more likely to be invested in managing natural resources '*when expected benefits … exceed the perceived costs*' (Ostrom, 2009:p420) further underlying the necessity of understanding the scale of the benefits. Ostrom identifies that the economic value of the resource and the importance of the resource for users as variables within her framework for analysing social-ecological systems (Ostrom, 2009:p421). It is against this background that this research must expose the economic importance of forest beekeeping for the beekeepers concerned; absolutely, relatively and functionally. If forest beekeeping is serving a safety-net role in people's lives, as many NTFPs do, this might not provide sufficient incentive to make the forest 'worth managing'.

When considering livelihood transitions it is important to consider dynamics over time. As noted by Mushongah & Scoones (2012) in their longitudinal study of livelihoods in Zimbabwe, not only do the fortunes and status of households change over time, but so does the relative importance of different livelihood activities. Within the time constraints of this study this temporality is explored by considering beekeeping adoption trends and by comparing the importance of beekeeping to other activities, noting that these comparisons might change, for example, as commodity prices fluctuate.

Using the livelihood transitions of the *Forest Beekeeping Livelisystems Framework* will underpin a discussion about people's inclination and/or ability to invest in forest maintenance. It is the need for this understanding which gives rise to the first of the research sub-questions: **What is the economic and functional importance of forest beekeeping for forest beekeepers?**

Transformation processes and human adaptation

The second research sub-question asks **how do forest beekeepers in north-west Zambia interact with the forest on which their bees rely** in terms of causing or preventing forest loss or degradation?

The *Livelisystems Framework* shows the linkages between the social and ecological domains. Each may be transformed or modified by beekeepers' actions and decisions as they pursue their endeavour and adapt to change. The ecological domain may be transformed by depletion caused by over-use of natural resources, may be enriched through management or maintained through protection. To help answer this question about the relationship to the forest, it is necessary to consider how beekeepers impact on, adapt to and respond to the natural and societal processes occurring in the system. The enquiry will seek to understand whether beekeepers use the natural assets at the heart of the system in a way that changes – transforms - the asset-base or ecological processes. It is necessary to investigate whether forest beekeepers consume the resources and cause depletion or whether they make a determined effort to nurture, maintain or husband the resource. This line of enquiry will ask how beekeepers impact on the natural ecological processes and whether their actions stabilise or undermine the resilience of the system. The *Livelisystems Framework* also permits understanding about emergent, unplanned outcomes. The result of the cumulation of system processes may be a state of order or a state of flux regardless of intention.

Causes of forest degradation may be inherent to the activity of forest beekeeping (e.g. unsustainable exploitation of bark), may be linked to the actions of forest beekeepers in other ways (e.g. removal of trees to grow crops) or may be external to the local system (e.g. transfer of ownership of forest to private investors). The transformative processes element of the *Livelisystems Framework* allows all these different processes to be considered.

Mickels-Kokwe presented an overview of perceived positive and negative linkages between beekeeping and forest management [see Table 2 in chapter 3]. Her overview can be summarised. On the positive side there is mention of '*improved management*' and the community '*looking after*' forest, but with little detail as to what the actual management practices might be. On the negative side the main concern appears to be the aggregate effect of bark and fibre harvesting in the forest.

It could be argued that the outcome or the result of the FBL system in terms of the forest must be a sum of positive and negative impacts caused by the actions of beekeepers, assuming of course that they do have an impact. This research must seek to understand what the actions might be and the consequent impacts.

The much hoped for 'win–win' for sustainable development (Elliott & Sumba, 2012; Howe, Suich, Vira, & Mace 2014; Ingram, 2014; Sunderland & Ndoye, 2004) seeks a win for people and a win for the environment at the same time. Yet it is important to consider what this second 'win' looks like in the context of this research. Development planners, the Zambia Forestry Department, wildlife conservationists and local forest users may have very different perceptions. Does it mean forest conservation, sustainable forest management or to use the phrase preferred by the REDD+ community, 'avoided forest loss'? This enquiry does not need to list and define all these various options. It is necessary however to recognise 'it' when we see it. This study takes a very broad interpretation to include any of the following:

- Evidence of an action or decision that results in avoiding or slowing-down a driver of forest loss or degradation [an action which may be taken deliberately with a forest outcome in mind, or coincidentally]
- Evidence of a maintained, functionally intact and healthy forest ecosystem [a result]

There is no expectation that the forest will be preserved in a state of pristine wilderness and when the term conserve or conservation is used, it should not be interpreted in this way. The term management is probably best understood as a planned action undertaken for a specific purpose. It is questionable therefore whether a forest that is maintained because the causes of forest loss are absent, is managed. It is easier to argue that a forest that is maintained because the causes of forest loss are *mitigated*, is indeed managed. This distinction does not matter from the point of view of outcome – but poses additional terminology problems.

Given that the 'win' for the forest is largely achieved through the sum of beekeepers' actions – positive and negative – all will be explored in this study. Given that the 'win' for the forest might be judged differently by different stakeholders, this enquiry must be open. It is against this background that the second research sub-question is posed; **How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation?**

The third research sub-question asks, **is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping?**

This question is also answered by considering transformation processes and human adaptation. The emergence of a common-property regime, should it exist, falls within the social domain of the social-ecological system and encompasses transformations involving governance arrangements, institutions and perhaps altered norms and practices. Given that forest beekeepers are using a resource which they do not own, it is pertinent to ask about their claims to the resource and how do they relate to other people who may threaten the forest. Have beekeepers developed or do they follow socially accepted rules about forest use? Who does own the forest and who has the right to exclude?

Ostrom has shown that the prediction that non-privately owned natural resource systems will inevitably be over-used is a false one and has elaborated the conditions which favour users and leaders to self-organize and create rules to manage a resource (Ostrom 1991; Ostrom and Nagendra 2006). In her multi-level nested framework for analysing SES she includes a number of variables which she explains can influence the SES outcome. These include collective-choice rules, leadership, size of the resource system, productivity of the system and importance of the resource.

The forest in which Zambian beekeepers place their hives is on customary land and is governed by statutory legislation including the Zambian Land Act 1995 and the Zambian Forestry Act. Ownership is vested in the state, whilst day to day decision making, with regard to use and problem solving is the responsibility of the Chief. The *Forest Beekeeping Livelisystems Framework* allows for investigation of the influence of the external legal and tenure structure in which the system is located. The Framework will be used to ask questions about variables which could have a bearing on societal transformations, such as, rights, community institutions, forest policy and community norms.

Trade as a driver

Trade to distant markets impacts on the strength and direction of links between processes in the *Forest Beekeeping Livelisystem.* The nature of this impact will help answer the fourth research sub-question about **the way trade drives and impacts on the dynamics of the relationships and processes revealed in answering the first three research questions.**

The north-west province of Zambia was selected because honey trade is well-established and the market for honey has grown and become more reliable. The final part of the conceptual framework needs to consider how honey trade is driving these other processes. If honey trade was interrupted for whatever reason – would there be a change? Would people be obliged to engage in other less forest-friendly activities to survive?

One of the strengths of the *Forest Beekeeping Livelisystems Framework* is that it can demonstrate how indirect processes can result in emergent outcomes. One of the indirect outcomes of improving honey trade might be a tilt in the balance between farming and beekeeping. Reduced effort in farming might cause a decrease in one of the drivers of forest loss i.e. conversion of forest land to farmland. One major cause of forest loss in Zambia is removal of forest for permanent agriculture. There may be a relationship between the expansion of crop farming and forest beekeeping. If the price of honey falls, for example, and the price of maize rises this may cause some people to put more effort into clearing forest for maize. Other livelihood scenarios are possible – income from honey may motivate beekeepers to stay in beekeeping – or it may give them the capital needed to engage in more crop and livestock farming – which may lead to forest conversion.

4.7 Conceptual overview and conclusion

The *Forest Beekeeping Livelisystem Framework* provides a conceptual overview and thinking tool which helps draw together the four sub-questions into a coherent whole. This mapping is shown in Table 4.

Table 4. Mapping to the research questions to the *Forest Beekeeping Livelisystems Framework*

Research sub-question	
1. What is the economic and functional importance of forest beekeeping for forest beekeepers? This is important because one would expect people to be more invested in natural resources that deliver substantial benefits and the scale and nature of the benefit – one could argue – influences people's decision-making about the resource.	Using the *Livelisystems Framework* to guide the research to answer this question attention will be paid to understanding the functions and attributes of the assets which underpin forest beekeeping and how these impact on the livelisystem transitions
2. How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation? This is about understanding what forest beekeepers actually do and why. To study this, questions must be asked about how the resource is used, what threats there might be and how do beekeepers respond. It is also important to understand something of how they value the forest.	Transformation processes and human adaptation may manifest as ecological changes wrought by people as they negotiate their natural environment. The Livelisystem Framework enables consideration of a whole range of processes – harvesting, exploiting, nurturing, managing, mitigating, adapting.
3. Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping? Given that forest beekeepers are using a resource which they do not own, what are their claims to the resource in terms of tenure? How do they relate to other people who may threaten the forest? Have beekeepers developed or do they follow socially accepted rules about forest use? Who does own the forest and who has the right to exclude? How do beekeepers respond to ideas about PFM?	Transformation processes and human adaptation may manifest as societal changes also, as people negotiate institutions, tenure arrangements and relationships with other people, as these relate to forests. The Livelisystem Framework enables consideration of these evolving relations, norms, rules and institutions.
4. How does trade drive or impact on any of the dynamics revealed in answering questions 1-3?	Using the *Livelisystems Framework* to answer this question calls for an understanding of the external influences on the system, particularly trade. The source of trade is

	ultimately very distant from the beekeepers and their forests, yet these distant forces drive many elements within the local system. The impact of these external drivers needs to be understood.

This chapter has drawn attention to the challenges facing humanity as it struggles to develop and progress without undermining the ability of natural ecosystems to provide essential goods and services. It is important to find ways to understand the nature and direction of these trade-offs and to analyse the impact of specific management practices on natural resources. Thinking about people and nature as being inter-linked, with each domain having impacts on the other seems to offer a more powerful way of addressing the problem, compared to the somewhat constraining, and uni-directional concept of conservation. Social-ecological systems thinking offers a more useful framework for understanding the complex systems involving people and natural resources than focusing only on the impact of people on the environment and is used to guide this research process. Social-ecological systems frameworks enable multi-disciplinary integration of theory, science and information and help to harness rather than eliminate complexity. In this research attention must be paid to livelihood diversification, to forest ecology, to socio-economics and to society, institutions and governance. To this end the *Livelisystems Framework* has been modified to the particular case of forest beekeeping and is used to map out the research process.

Image 5. *Processed beeswax, Forest Fruits Ltd., Mwinilunga, 2014*

Chapter 5 Research methodology

The relevant information needed to analyze social–ecological systems is both vast and fragmented, encompassing most of the natural and social sciences as well as the humanities (Carpenter *et al.*, 2009:p1307)

5.1 Introduction

Chapter 1 explained the origins to this research and how the main research question came to be asked. Chapters 2 and 3 comprised a review of the literature exploring African woodlands, their importance for people, non-timber forest products and forest beekeeping. In chapter 4 these topics were brought together and considered within the framework of a social-ecological system. The research questions which emerged from the literature review were articulated within a modified *Livelisystems Framework*. This chapter presents the methodological approach and data collection methods determined as the most appropriate for answering the research questions.

5.2 Methodological approach

The original primary question appears, on the face of it, to encourage a deductive type of enquiry which seeks to test the theory that commercialisation of forest honey can cause forest maintenance. A deductive approach could then test this by hypothesizing that where there is commercial honey trade there will be maintained forest and evidence of actions by beekeepers to this achieve this end. However, preliminary field visits and consultations with key informants quickly suggested that this was too simplistic a starting point. Furthermore, it was not feasible to test this hypothesis by comparing a landscape where there is commercial honey trade and where there is not. The literature review led to a conceptual framework based around Social-Ecological Systems thinking. The goal of the research is to understand the different components and processes of a forest beekeeping system and this called for a methodological approach capable of investigating the parts of a complex whole. This led to the emergence of a more inductive approach. Instead of handing down a question laden with assumptions about the logical connection between forest benefits and incentives to conserve, it was necessary to take a step back and ask a broader series of questions about the relationship between forest beekeepers, forests, livelihoods, governance institutions and other forest uses and users. *How important is beekeeping? How do beekeepers relate to the forest? How do they perceive and counter threats to the resources?* The literature review had already pointed to the complexity of the question and it was necessary to design a methodology that would allow for the re-formulation of questions as new information and insights emerged. To this end an inductive approach to research was necessary.

SES systems are complex intersections of multiple processes and cannot be analysed by limiting focus to discipline-bound sectors. Information must be drawn into an analysis of an SES from many different disciplines. The *Forest Beekeeping Livelisystems Framework (FBLF),* a conceptual framework developed to support this study requires a multidisciplinary research approach to encompass livelihood analysis, common-property resource management and forest ecology.

Using an SES framework, such as the FBLF, can support the design of the research methodology by providing '*a checklist for what issues are considered, and by extension, what does not reach the agenda*' (Fisher, Patenaude *et al*., 2013: p1098). Understanding the processes, the elements and the feedback mechanisms within the system will help answer the research question about the relationship between forest beekeepers and the natural resources which underpin the production system on which they depend for their valuable honey harvest. The *Forest Beekeeping Livelisystems Framework* is a modification of the *Livelisystems Framework*, and belongs to the '*thinking-tool*' (Fisher, Patenaude *et al*., 2013) tradition of conceptual frameworks, the strength of which '*is that they are primarily conceptual, and loosely inform, rather than being a template for data collection*' (Fisher, Patenaude *et al*., 2013:p1099).

The research seeks to understand elements and processes of this system and lends itself to case study methodology. The unit of analysis for the case study is the forest beekeeping system in Mwinilunga, embracing – as depicted in the *Forest Beekeeping Livelisystem Framework,* – the beekeepers, the forest from which they harvest honey, beekeeping as an economic activity and the processes and interactions which determine how the beekeepers make decisions in their particular environment in a real-life situation. The case also includes the external factors impinging on the systems particularly, external trade links and national policies and local norms governing land and forest tenure.

In determining the appropriateness of case study methodology Yin's, (2009) explanation of when to use this approach was considered. He explains that case studies are appropriate when one is seeking to find out what is happening in a specific real-world context, in real-time and where the form of the research questions are 'how?' questions. Creswell also describes the approach as an investigation of '*a bounded system (a case) … through detailed, in-depth data collection involving multiple sources of information … and reports a case description and case-based themes*' (Creswell, 1997:p73). Elucidating the *Livelisystem Framework* as applied to forest beekeeping is a complex process. The research required a methodology with sufficient flexibility to permit a re-framing of the questions and the research strategy, as understanding of the situation advanced. Case study methodology affords this flexibility. Social-ecological systems are multidisciplinary by nature and are best studied by drawing on different sources of evidence including interviews, measurement and direct observation. The case study's 'unique strength is its ability to deal with a full variety of evidence' (Yin 2009:p11). The unit of analysis of a SES goes beyond a group of people, a community, a landscape or a company. It is the whole and it is the relationships between them. Studying this complex whole using a survey alone or an experimental approach would not 'dissect the complexity' (Ostrom, 2009:p420). Furthermore Kent & Dorward, (2014) used a case study approach when they applied the *Livelisystems Framework* to an investigation of livelihood responses to change in forest biodiversity in India.

5.3 Selection of the case

Much of the literature about NTFP commercialisation and CBNRM has emerged out of development projects or programmes where an intervention was implemented in order to achieve a certain conservation or poverty reduction outcome. For example, in 1996 a GTZ-funded project sought to help support forest maintenance in Malawi by commercialising NTFPs as alternatives to charcoal making (Kambewa & Utila, 2008) and the African Wildlife

Foundation supports NTFP commercialisation as one strategy to attain conservation objectives (Elliott & Sumba, 2012). Component 3 of the Decentralised Forest and other Natural Resources Management Programme (DFNRMP) project in Zambia, essentially a forestry project, included natural resource enterprise development in order to '*reduce the drivers of natural resource degradation*' (DFNRMP, 2018).

In this case, Mwinilunga was selected because the NTFP (i.e. forest honey) was *already* commercialised, for private business purposes and not for project-led reasons. Many NTFP commercialisation projects have put forward the logical argument, 'if NTFPs were worth more, then we believe NTFP collectors will be incentivised to manage/protect the forest from which they harvest the NTFPs'. This research tests this idea in reverse. The NTFP (forest honey) is becoming more valuable because the market (from the beekeepers' perspective) is good and reliable – not driven by a conservation and development project – but driven by a demand for the NTFP. Given this scenario it is possible to ask the question, "so what?" "how is this demand for the NTFP impacting beekeepers' relationships to the forest"? Above all else the aim of the research is to find out what beekeepers *actually do* in relation to forest management and protection when a forest product becomes commercialised, even if they do not do what *the theory* suggests they might do.

The case for this case study comprises the forests and the beekeepers in the supply area of Forest Fruits Ltd. The case is selected not because it is typical but because it is the 'best case'. Forest Fruits Ltd. is the largest and longest established honey and beeswax buying company in Africa and therefore affords an opportunity to study the relationship between beekeepers and the forest, in a location where, if they exist, they should be most evident. Forest Fruits Ltd. is an example of a critical case, i.e. a case that has all the circumstances or conditions which allow the theory to be tested, confirmed or challenged. See chapter 6 for more details about the study area and the selected case.

5.4 Research design

A research design links the data to be collected to the initial questions of study and contains within it a theory about what to study and what to learn. The design for this research is informed by Maxwell's Interactive Model of Research Design (Figure 4.).

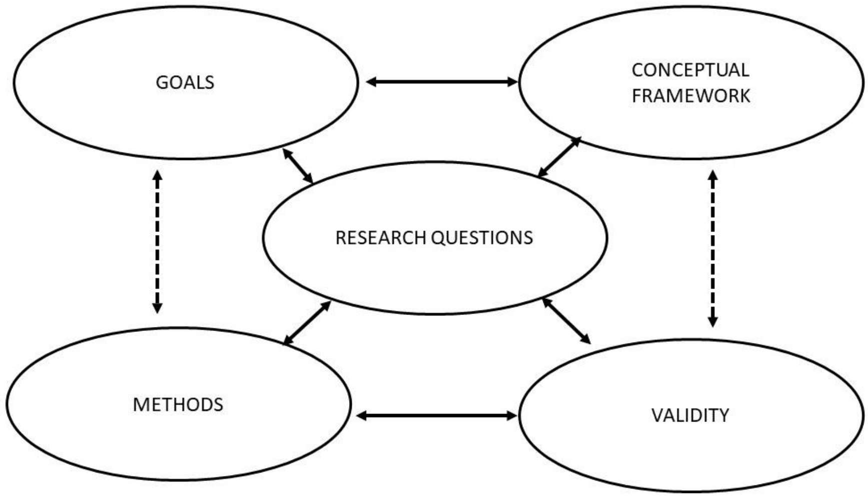

Figure 4. An interactive model of research design (Maxwell 2005 page 5)

The usefulness of the research design as shown above is that the different parts of the design form an '… *integrated and interacting whole, with each component closely tied to several others, rather than being linked in a linear or cyclic sequence*' (Maxwell, 2005:p4).

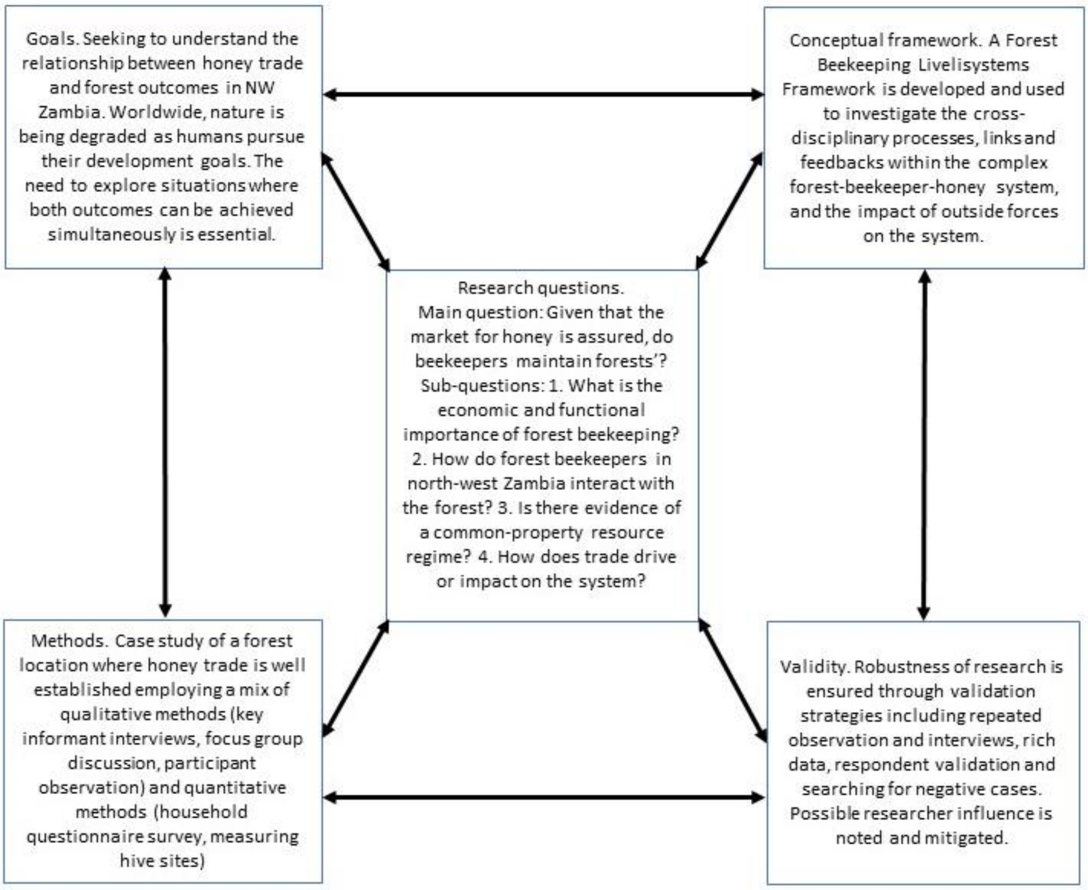

Figure 5. Research design for this study of the *Forest Beekeeping Livelisystem* in Zambia

The research design in Figure 5. shows the five components of this research and helps progress from the research goal (chapter 1) to the specific research questions and conceptual framework (chapter 4) to the methods (this chapter).

5.5 Selected methods for data collection

Taking a case study approach to understanding the complexity of the Forest Beekeeping Livelisystem called for a range of data collection methods. Different methods are needed to answer the many sub-questions in order to put together a comprehensive understanding of the relationship between beekeepers and the forest, and the contributing factors. Different sub-questions were best answered through different methods. Whilst the case study method is often recognized among the array of qualitative research choices some case study research uses a mix of quantitative and qualitative evidence (Yin, 2009:p19). In this research a quantitative element was deemed necessary to understand the scale and extent of the situation – how many beehives? how much income? how much forest? – whilst qualitative methods were necessary to reveal the processes, the relationships and the reasons. The data collected using different methods is complementary and is answering the same overall research question. Using different methods allows the 'collection of a richer and stronger array of evidence than can be achieved by any single method alone' (Yin 2009:p63) and is consistent with case study research.

In addition to the main fieldwork activities which I undertook in the North-Western Province of Zambia in 2015, 2016 and 2018, I also undertook a planning visit to Forest Fruits Ltd. and Mwinilunga in 2014 and met with a wide range of interested stakeholders in Zambia to consult views, to collect background information and to test ideas. A structured and comprehensive review and analysis of secondary data from reports, articles, historical evidence and government policy was also carried out to collect data to support the research. Table 5. summarises the main stages of the field work and the methods employed, and these are further described subsequently.

Table 5. Overview of data collection methods

	Data collection methods				
	Document research	**Initial site visit**	**Focus Group Discussions**	**Questionnaire Survey**	**Hive site visits / Participant Observation**
Purpose	Collecting information about the selected case and the contextual setting	Collecting background and contextual information, validating research goal. Collecting basic information about location and logistics	Investigating the four research questions using qualitative approach	Respondent validation of earlier findings Investigating the four research questions using quantitative approach	Respondent validation of earlier findings Quantifying the scale and extent of hives sites
Method	Document research	Site visit Key informant interview	Focus Group Discussions Key informant interviews	Household Questionnaire Survey Key informant interviews Focus Group Discussions	Participant observation, two camping trips were made to two distant forest hive sites. In-depth interviews and key informant interviews.

Respondents		Key people from Forest Fruits Ltd. Forest beekeepers in Mwinilunga CIFOR Zambia Forestry Department officials Chief Kanongesha Zambia Honey Council	FGDs[10]: All respondents were beekeepers registered as suppliers to Forest Fruits Ltd. 19 groups of beekeepers. KII[11]: see Appendix 1	QS[12]: 229 respondents comprising 165 practising beekeepers, 12 former-beekeepers and 52 non-beekeepers KII and FGDs: see Appendix 1	Site 1: two beekeepers and one guide. Site 2: three beekeepers INT[13] and KII: see Appendix 1
Gender		Predominantly male respondents	Approximately 95% were men	203 men and 26 women	Predominantly male respondents
Locations		Lusaka Mwinilunga	20 meetings in 20 separate locations spread throughout the Districts of Mwinilunga and Ikelenge. Each meeting was held at or near a	1. Chibwika – near the palace of Chief Chibwika 2. Ikelenge – near Kasochi	Starting from Chibwika Starting from near Kasochi Central

[10] FGD = Focus Group Discussion

[11] KII = Key Informant Interview

[12] QS = Household Questionnaire Survey

[13] INT = Interviews

			location of a Forest Fruits' beekeepers' group.	3. Kachikula 4. Muzhila	
How locations were selected		NW Zambia was selected as a case where forest beekeepers were well-connected to a large and reliable honey buyer, Forest Fruits Ltd., and had been for some time.	Forest Fruits Ltd. had already planned and were undertaking a training activity to their groups of registered beekeepers. This study took advantage of the already-arranged beekeeper meetings and met with beekeepers before the Forest Fruits Ltd. team arrived for the training.	The four locations are a sub-set of the places visited in 2015 and were selected based on contrasting characteristics. 1. Chibwika – maize growing area 2. Ikelenge – pineapple growing area 3. Kachikula – near the main highway 4. Muzhila – none of the above	The two locations are a sub-set of the four locations studied in 2016. One site was selected from each of the two districts.
Year	2014-2019	2014	2015	2016	2018
Referencing in the results chapters	Results from the Questionnaire Survey are indicated as such or the abbreviation QS is used. Results from the Focus Group Discussions are prefixed with FGD, followed by the first three or four letters of the place name, followed by the date. Results from interviews are prefixed with KII = Key Informant Interview or INT = one to one interview, followed by initials of the respondent, followed by the date. The full list of referenced interviews and discussions is shown in Appendix 1.				

Planning and familiarisation visit

A planning and familiarisation visit was undertaken in 2014. Meetings were held with Forest Fruits Ltd. in Lusaka and in Mwinilunga and a number of key stakeholders, including beekeepers, Chief Kanongesha and the Provincial Forestry Officer. The purpose was to gain some background information, to understand the context and test the main research question. This visit also afforded an opportunity to collect information necessary for planning field work such as distances involved, how to hire a car, how to find a translator and the seasons. Meetings were held with five beekeepers in Mayimba. Questions were asked about beekeeping, honey trade, forest issues and livelihoods. The intention was to begin to understand what was going on in order to frame subsequent more searching questions

Focus group discussions

Focus group discussions (FGDs) were held with 20 groups of beekeepers, of between 3-15 beekeepers, during the month of August 2015. The objectives of these FGDs were as follows:

- To collect data about the importance of beekeeping and honey selling for people's livelihoods, with emphasis on the functions and attributes of beekeeping as an activity
- To collect information about the economics of forest beekeeping and how it compared with other livelihood options
- To investigate beekeepers' perceptions about the forest, their hive sites, threats and how they countered these threats
- To explore issue concerning the implication of changes in the honey market and the relationships between different land uses and users

The FGD interviews were informal and conversational in style, guided by a checklist which covered benefits of beekeeping, livelihood implications of honey selling, attitude and practices towards forest conservation and beekeeping economics. Starter questions included, 'What is the benefit of beekeeping?', 'Why did you start beekeeping?', 'In a good year do you fear being left with unsold honey?', 'How do you use the money from honey selling?' and 'Are people putting more effort into beekeeping these days, or less – and why?'. Discussions varied, so for example, if discussions about livelihoods took up much time, then the discussion on economics had to be reduced to avoid overly long interviews. The main purpose of these interviews was to gain a general sense of the importance of beekeeping for people's livelihoods and to begin to learn about how beekeepers perceive and manage forest resources. The results of these interviews were used to help frame the questions which were included in the Questionnaire Survey which was conducted in 2016. During the informal discussions I was assisted by a translator. I was present in all discussions, I asked questions and the translator translated my questions and the beekeepers' responses. Notes were recorded on a notebook by myself in English, and these were later transcribed into typed script. The information was analysed by highlighting responses according to the following categories of information:

- About the benefits of beekeeping
- About how cash generated from beekeeping 'revolves' or 'multiplies' through other activities
- About feelings of ownership about the forest
- About beekeeping economics
- About comparisons between beekeeping and other activities

My arrival in Mwinilunga coincided with a Forest Fruits beekeeping training programme which meant that beekeepers had already been informed to gather at their meeting places at a particular day and time. The staff of Forest Fruits suggested that I aimed to meet with the beekeepers at the same time. They suggested I went ahead and carry out the FGD before the FF Ltd. training and take advantage of their schedule. It was this schedule which determined which groups I met on which days. For several reasons, I did not follow their schedule exactly and I also made independent arrangements to meet other beekeepers on other days. In all instances the beekeeper groups were registered with FF Ltd. The groups visited, number of beekeepers and places are listed in Appendix 1.

Meetings and conversations were also held with FF Ltd. staff to obtain corroboration or otherwise of what beekeepers were telling.

The results from the Focus Group Discussions were written up verbatim and included here in Appendix 2. Review of the FGD interviews revealed themes and ideas which occurred repeatedly. These themes informed the Questionnaire Survey questions. The results chapters present findings based on these themes and verbatim extracts from the FGDs are included in the results chapters as evidence of ideas and views expressed. Themes are derived from ideas often repeated, whilst the specific extracts selected for inclusion in the results chapters are those which are most insightful and revealing.

Household Questionnaire Survey

The results of the FGDs were illuminating and revealed important insights. Although the FGDs were strong in content it was hard to quantify some of the information. Consequently, a Questionnaire Survey (QS) was conducted in September – October 2016. Four sites were selected with differing features. The site selection was undertaken with the help of FF Ltd. who were able to able to suggest sites that fitted with my criteria. These were:

- Somewhere where beekeeping was main cash source
- Somewhere with alternative cash sources
- Somewhere relatively new to honey selling to FF Ltd.
- Somewhere more accessible, near the main road.

The four sites were Chibwika, Ikelenge, Kachikula and Muzhila. Enumerators, with appropriate educational qualifications, were hired from within the target communities, two women and four men. A Research Coordinator, AM, was also hired to help test the questionnaire, oversee the enumerators and provide guidance about local norms. Once engaged the enumerators were trained and given all the necessary information and instruction they needed to complete the work. The questionnaires were written in English and the enumerators wrote the answers in English. They translated 'on-the-spot'. Much of the training concerned ensuring that they were sufficiently familiar with the questionnaire to translate effectively and consistently. The enumerators were constantly supervised by AM and myself. At the end of each day or every other day we scrutinised the completed questionnaire for completeness, clarity, English, and we checked that the responses were consistent with the questions, hence showing that the translation was done well. The purpose of the Questionnaire Survey was three-fold:

- to collect some basic metrics about beekeeping in the target area
- to understand and quantify the livelihood implications of income from honey

- to explore how the honey economy influences the relationship between beekeepers and forest.

The dataset comprised 229 cases and 295 variables. All data was entered into SPSS and analysed using frequencies and descriptive statistics. Excel was also used. The 226 respondents included 165 beekeepers, 12 former beekeepers and 52 non-beekeepers. Non-beekeepers were included because one of the test assumptions was that beekeepers have a strong incentive to conserve forest and therefore it might be possible to discern a difference between the attitudes and action of beekeepers v non-beekeepers. The main research questions nevertheless concerned beekeepers' actions and decision-making therefore it was necessary to ensure enough beekeepers were included. This need for the QS to serve several purposes and the always-present practical constraints resulted in more beekeepers being interviewed than non-beekeepers. Table 6 provides a summary of the main demographics.

Table 6. Respondents and demographics, disaggregated by site

Site	Beekeepers	Former beekeepers	Non-beekeepers	M	F	Mean no. in household	Mean age (yrs)
Chibwika	48	1	16	56	9	7.8	43
Ikelenge	40	6	16	54	8	7.9	48
Kachikula	39	1	11	47	4	7.0	42
Muzhila	38	4	9	46	5	8.2	45
Totals	165	12	52	203	26		

Source: Data collected from Questionnaire Survey in 2016.

A copy of the household questionnaire is included in Appendix 3. Descriptive statistics are used to present the results of the Questionnaire Survey, and these are shown in tables and charts in chapters 7, 8 and 9.

Key informant interviews

In addition to meeting with Forest Fruits Ltd. consultations were made with other stakeholders in 2015, 2016 and 2018 to cross-check and validate emerging results, to obtain background information and test ideas. Amongst those interviewed included officials from the Forestry Department and stakeholders from national organisations working in honey trade, forestry and environmental conservation. Paramount Chief Kanongesha and Chief Chibwika provided important insights into land use issues, development in the local area and their perspective about forest beekeeping and honey trade. See Appendix 1 for list of KIIs.

Visits to hive sites

Visits to hive sites (Table 7.) were made in 2014 (one nearby hive site), 2015 (2 nearby hives sites) 2016 (three nearby and one distant hive site) and 2018 (two longer camping trips to distant hives sites).

Table 7. Hive site visits

Year	Nature of visit	Location
2014	One nearby hive site (15 minutes walk)	Near Mayimba
2015	Three nearby hives sites (15 minutes walk)	Kalwisha Kanongesha
2016	Three nearby (15 minutes walk) One distant (five hours walk)	Kachikula Kanyama (5 hours) Kasochi Muzhila
2018	Two distant sites (a) four-night camping trip (b) three-night camping trip	Chibwika and across the Lunga River Kasochi Central towards DRC

During the 2018 hive site visits GPS waypoints were taken using a free app for an android phone, called GPS Waypoints and subsequently plotted using the free GIS software QGIS. Waypoints were taken of various points and activities of interest including setting of fire, existing hives already sited in trees, new hives raised into trees, new-made hives, trees with bark removed and other points of interest such as cassava fields, rivers. These camping trips afforded the opportunity to see how beekeepers carried out some of their forest activities and afforded opportunity for in-depth discussion and questioning over a period of several days of being constantly together. These two camping trips provided opportunity to spontaneously observe and learn new things which I would have never thought of asking if they had not come up in conversation or been directly observed. For example, whilst walking back to the village after one of the camping trips the lead beekeeper exclaimed when he saw a tree that had been debarked for a reason that was not apparent. De-barking kills trees, yet when he removes bark to make a hive he perceived this to be a good use of resources. In this instance it was clear that no beehive had been made and so it appeared that the tree had been killed for no purpose. He perceived this as 'waste'. Most importantly he did not express this sentiment in response to a question from myself. His reaction was spontaneous. This accidental and perhaps unsurprising incident revealed extremely clearly his standpoint on forest conservation i.e. forest resources should be used for gain and used wisely. Waste was an anathema.

Importantly the mapping also allowed a way to roughly estimate the size of hive sites. The areas of both hive sites were estimated by creating a polygon in QGIS by using the most exterior GPS points where fires were set, as external vertices (method a). In each case a second area estimate was made by using, as the vertices, the most exterior fire ignitions and the most exterior hives i.e. more points (method b). Method a gave lower estimates of hive site sizes. The size of the polygon was assumed to be the size of the hive site even though the hive were sparsely and non-uniformly distributed within the most external points. All points were collected in the course of following the beekeepers as they worked.

During the hive site visits a spontaneous decision was made to measure the girth of the trees being used to make hives. As this data collection activity was not planned an improvised measure was used, not a measuring tape.

5.6 Validity

Validity was achieved by repeated investigation, the collection of rich data, respondent validation, searching for negative cases and triangulation.

Repeated investigation

A number of different research methods were employed over a number of years. This approach was intended to provide sufficient data, collected over time and collected in different ways. The intention was to support research validity by providing as complete a data set as possible about the specific case. This afforded possibilities to quantify data collected through group discussion and add narrative and explanation to data collected through formal questionnaire. Repeated investigation helped to rule out spurious associations and correct misunderstandings. It was also possible to test out alternative scenarios and re-examine emerging information. Collecting sufficient data also supports validity. In 2015 twenty Focus Group Discussions were held in a period of about two weeks. Many of the themes and sentiments expressed by the beekeepers, were consistent throughout and this consistency added weight to their veracity.

Rich data

The Focus Group Discussions and Hive Site Visits allowed for the collection of rich and detailed data which was sufficiently descriptive and wide-ranging to provide a very 'real' picture of the complexity and dynamics of the activity of forest beekeeping and its importance in peoples' lives. This approach made it possible to see, what people did not tell. For example, it was only by walking to hive sites was it possible to observe how far fields extended into the forest against what people usually tell about farms being near the villages.

Respondent validation

Maxwell (2005:p111) argues that respondent validation or asking people for feedback about research results is the '*single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do*' (Maxwell 2005:p111). Throughout this research study opportunities were created for seeking feedback on results as a way to validate conclusions. Sometimes this was within the same interview, 'earlier on you said … does this mean that?', sometimes during the following years' field work. The same care was taken with respondent validation as with initial interviews. Judgements were sometimes made about the information provided, with not all information taken at face value. For example, in one notable interview the respondent was asked, '*Some people say beekeepers destroy forests – what do you think*?' – to which the respondent replied that he agreed. When this view was challenged and the researcher said that they had seen no evidence of this the beekeeper changed his response, *'No, that is right. We don't destroy forests'*. This exchange provided a starter for a subsequent, fruitful discussion.

Searching for negative cases

Where possible particular attention was paid to evidence, to indications and to clues that were contrary to the overall thesis. This was achieved through questioning and through observation. For example, on being asked about hive sites beekeepers readily explained that they protected their sites from other users. During discussions conducted whilst walking to and visiting hive sites the question was asked again. At these times beekeepers tended to admit that there was little they could do should someone wish to open a garden to grow cassava in their hive site.

In addition to the above, particular attention was paid to avoiding, or at least being aware of, researcher bias. This research came from a particular perspective. The NTFP conservation through commercialisation argument has been shown to be harder to achieve than originally hoped for when lauded in the 1980s and 1990s. Yet – my argument went – '*surely forest honey is an outstanding example of when it works*?' As mentioned in the introduction I wrote 'the sale of this honey incentivises the conservation of forests' on honey labels sold by the Wildlife and Environment Society of Malawi in 2002. Whilst acknowledging the lack of strong evidence to prove this to be the case, I nevertheless wished it to be so. This expectation posed a risk of researcher bias. The main strategy for dealing with it was being aware of it and approaching the research as rigorously as possible – employing the validity strategies above and being open to alternative explanations.

Another possible cause of incorrect results is the 'influence of the researcher on the setting or individuals studied' (Maxwell:p108). It is a common problem that the presence of the researcher can influence what people tell and the way they behave and eliminating the influence of the researcher cannot be wholly achieved (Hammersley & Atkinson, 1995). In the study it was clear that discussants sometimes imposed their own ideas and objectives on the interview. Many assumed the researcher was planning to buy honey or to bring a project. In those instances where the research was piggy-backing on meetings called by Forest Fruits

Ltd., beekeepers used to opportunity to send feedback to Forest Fruits Ltd., for example asking the company to build honey storage sheds or to bring more buckets. This was managed as far as possible by pre-empting these questions and instead telling that one of the purposes of the research was to convey information about forest beekeeping to the eventual customers in Europe. As far as possible interviews and participant observation was done in natural settings. The QS interviews were conducted by enumerators from within the local community. This may have put people at ease – a familiar face – it may also have created other influences, for example, reluctance to share details about income. The enumerators were trained and supervised by an experienced Zambian research coordinator, Alick Mbewe, engaged for the purpose. Alick's experience over ten years of field work and his local knowledge helped secure valid responses. The main researcher has considerable experience of living and working in Africa and conducting research. This meant that personal judgement was brought to bear (with some success it is hoped) in identifying the difference between accurate and useful information, and exaggerated or inaccurate responses.

Triangulation

Research validity was also achieved through triangulation. Data was collected using several different methods including interviews, observations, a questionnaire and through document review. Data triangulation was also achieved through asking the same questions to many different people, in different places and across different years. Given the inductive nature of the research enquiry this approach was necessary to accumulate sufficient observations from which to draw conclusions.

5.7 Ethical considerations

All participant interaction was done through face-to-face discussions and interviews and all participants were asked at the time of the discussion / interview whether they gave consent. All participants were made aware at the start of every interview and meeting that they were not required to answer any question and were under no obligation and they were free to withdraw from the process at any time. Data was recorded in paper notebooks and on paper questionnaire forms. These were not copied and are kept securely at the home of the principal researcher. All narrative results were transcribed into word and all questionnaire results were entered into SPSS, all is stored on the computer of the principal researcher and only accessible to the principal researcher. Summaries of quantitative data are presented with no names. Extracts from interviews are presented verbatim in many cases and attributed to the respondent by using their initials of their name. Where names are used, this is only done so when permission was given and the nature of the material is not sensitive. Participants were asked if they are willing for their names to be recorded against the information they provide, or not.

There are ethical questions about taking up people's time and 'extracting' information when the benefit to the participants is intangible. These issues were addressed in the following ways:

- Full disclosure at outset, so people were not misled about why they are being asked questions and how they might gain i.e. no false promises/ expectations.
- Avoiding taking up a lot of people's time which may impinge on their livelihoods. Due consideration was given at all times.
- Where possible findings and results were shared back to beekeepers/ other stakeholders so they understood what information had been collected and were able to validate / contradict. Anonymity was protected in this feedback.
- Useful and practical application of research findings. For example, I had the opportunity to share some of the results / findings with a honey buyer in the UK who successfully managed to market the product (Zambian honey) in Oxfam shops. In this way I hope my research will have helped secure stronger livelihoods for the research participants.

5.8 Positionality statement

Researcher positionality can shape different aspects of the research process including interpretation, understanding, and the validity of findings. Attempts at objectivity are rarely absolute. It is inevitable that social research cannot be conducted separately from wider society or without influence from the individual researcher's biography. Rather than trying to eliminate the effect of positionality, researchers should acknowledge and disclose their selves in their work, and aim to understand their influence on the research process. I consider three aspects of positionality; in relation to the subject, in relation to the people and in relation to the research process.

As already elaborated in Chapter 1 I approached the subject of this research from the point of view of having an interest in forest maintenance. I am not neutral on the subject of woodlands. I like trees and I care about forests. This stems from an academic understanding of their importance for ecosystem functioning, for the provision of goods and services, as a habitat for wildlife and for mitigating climate change. Yet I also have a sentimental regard for nature, which is not always wholly objective or without hypocrisy. In the case of this research I tried to design research questions which did not lead respondents to affirm my natural inclinations. For example, I know that it easy for many people to assert their regard for forest conservation when no negative trade-offs are in play. It is for this reason that when asking forest beekeepers how they valued forests, I deliberately asked them to agree/disagree to statements about the value of forests, compared to farmland and to compare the importance of forests to the importance of jobs. When some forest beekeepers said they wished for chainsaws to make better use of forest resources and others hunted wild birds for food, I knew that my personal feelings about these activities were inappropriate in the context and need not be revealed.

Probably the most important dimension of researcher positionality in this study stemmed from my relationship with the people. I am a white, European woman whilst most of the people I spoke to were black, African men. I am financially secure in comparison to their poverty. I was an outsider. The way I live is markedly different. My resource-use footprint on the world is driven by my position as a consumer and oil-user in a globalised world, rather than as a direct harvester of natural resources. In the context of this research this had a number of implications which needed to be understood and mitigated. Zambians sometimes assume Europeans are 'bringing projects' and it was necessary for me to clearly state that this was not my role, to avoid misunderstanding and to clear the table for the topics I did wish to enquire about. My obvious interest in beekeeping led some people to assume I was a honey buyer, another misunderstanding that I needed to avoid. I presented myself to the people I met as a researcher, but that alone did not seem sufficient. What, after all, was the purpose of the research? I chose instead to present myself as someone researching on behalf of honey consumers in Europe. My intention was that this would explain why this research topic was of interest to a European and it created a slightly tenuous link – but a link all the same – between their interests and my interests. To this end I often explained that the honey they sold to Forest Fruits ended up in shops in the UK, alongside honeys from other places. Consumers wished to understand where Zambia honey came from, who produced it and how, and that this information helped consumers make informed choices. This narrative was part true and part artifice. I felt it was a realistic and plausible explanation. As it was inevitable that the beekeepers I met would form some conceptions about the reasons for my questions, I felt this narrative would not steer their answers along any 'wrong' paths.

Positionality also has a bearing on the research process itself. My natural inclination when approaching research is to believe there is a truth, an answer 'out there' – I just have to find it, if only I adopt the correct methodology. I try always to be detached from the subject and try not to influence what people say and do, either by my presence or the type of questions that I ask. This attempt at neutrality was embodied in the design of the questionnaire and my discussion techniques. However, I knew that this aspiration towards complete neutrality is impossible. I opted to present myself as someone researching on behalf of honey consumers in the UK because I felt that achieving a position as a wholly detached observer would not be possible, therefore I deliberately chose an identity which I felt would either have a neutral impact on the research process or a useful impact on the research process. I employed other approaches also. I was aware that research findings which are revealed through questioning are inevitably influenced by the questions being asked. For this reason, I sought out opportunities for spontaneous or accidental learning and as these cannot, by their nature, be planned, I increased the likelihood of their happening by investing more time. To give one example; during a day long walk to a hive site the beekeeper guide remarked on a tree which had been damaged, its bark removed but not for hive-making. The beekeeper could not understand the reason for the tree being damaged and was angry, whilst trees felled to make fields, for slash and burn or for charcoal elicited no such response. This revealed much about the beekeeper's attitude about resource utilisation. Efficient use is acceptable, waste an anathema. On other occasions, where appropriate, I deliberately departed from the detached approach and engaged in debate to advance understanding – with the respondent an active contributor to the learning process. Again, an example; on one occasion I challenged a beekeeper, putting it to him that 'some people say beekeepers destroy forests', to which he initially agreed. It was only after I gave my reasons for disagreeing with this statement, that we together discussed and agreed that, no, beekeepers do not destroy forests. Whilst this may seem like leading the respondent to my way of thinking, in this instance, I see this instead as together finding the most accurate answer.

In summary therefore I see myself as a trying-to-be-neutral outsider, striving to avoid conscious, or systematic bias, but recognising also that I am not detached from the subject, the people or the process.

5.9 Limitations of the methodology

The Household Questionnaire Survey was intended to be just that – surveys about the household. Yet in almost all cases only one member of the household responded – and is likely to have resulted in an underreporting of income. Men and women earn separate income. '*Each is free to pursue whatever cash-earning strategies he or she desires, and cash obtained is under the exclusive control of the individual who earned it. As Turner noted in the 1950s, and as is still true today, husbands and wives are frequently unaware of each other's cash holdings, and it is considered inappropriate even to inquire*' (Pritchett, 2001: p133). It is likely therefore that a single respondent, husband or wife, may not have answered on behalf of the other.

Forest beekeeping is almost solely the preserve of men which has resulted in a gender bias in this investigation. The gender dimension of the FBL is touched on and discussed in chapter 7, but not adequately. There are any number of possible intersections. Women can earn a lot of money from brewing alcohol made from honey (Clauss, 1992, Pritchett 2001). Both men and women value highly their children's education, … ' *it is the hope of almost every parent that at least one of their children will receive enough education to get a good job*' and '*Toward that end both men and women spend a large portion of their cash on school-related fees for their children*' (Pritchett 2001:p198). Given that both men and women value their children's education, women's aspirations are being met in instances where a man spends honey income on school costs. So even though the women are not earning directly, they are relieved of having to find this income by themselves. During one FGD a woman participant mentioned that mushroom harvests are better if an area of forest is burned early in the year. This provides a hint that there might be a link between fire management for beekeeping and the mushroom harvest, an activity undertaken by women.

The research results yielded substantial indicative evidence of the multiplier effects of honey income, within the beekeepers' household and in the wider community. Beekeeper use honey income to fund their other activities, possibly increasing the total sum earned. Beekeepers pay non-beekeepers to dig their fields and build their houses. Beekeepers lend money to other people and buy beer from their bars. This multiplier effect was not fully explored.

More attention could have been paid to non-beekeepers. It would be interesting to learn whether non-beekeepers felt that beekeepers were disproportionately enjoying the fruits of a forest which was not theirs alone or perhaps they valued the income they brought to the community, and benefited from also, via the multiplier effects mentioned above.

During the Questionnaire Survey data was collected about the size of fields used by the respondents, the area of land 'opened' in the preceding year and left fallow. The intention was to estimate the net rate of forest clearance with view to possibly correlating this to numbers of hive owned. This might have helped answer questions about whether beekeepers clear more forest because they can afford the labour to do so, or less because they found putting their effort into beekeeping more rewarding than farming. A confusion arose about the unit of measurement for land and despite trying to standardise the unit as lima (0.25 ha) it transpired that some people answered for hectares. This data was not usable.

The investigation would have been stronger if it had been possible to carry out some research at another site, with different contextual criteria. For example, some of the key informants mentioned forest beekeeping areas in Zambia which are facing much greater forest threats than in Mwinilunga and Ikelenge, such as timber harvesting in Kabompo, mineral mining in Kalumbila and charcoal making in Kapiri Moshi. Notwithstanding the practical and financial challenges of extending the research to another site, the other variables would have differed also. But it would have been interesting.

5.8 Presentation of the results

The results are analysed against the four research questions (see chapter 4) and reported in the results chapters. Chapter 6 provides background and contextual information to support chapters 7,8 and 9. Chapter 7 answers the first research sub-question; **What is the economic and functional importance of forest beekeeping for forest beekeepers**? Chapter 8 answers the second research sub-question; **How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation? How does trade drive or impact on the Forest Beekeeping Livelisystem?** is answered in chapter 9. The third research sub-question, **Is there evidence that beekeepers are actors in a common-property resource regime?** straddles chapters 8 and 9. This question is answered in relation to the interaction between beekeepers and the forest (chapter 8) and in relation to the wider tenurial framework which is partly determined by external factors (chapter 9).

The data collection methods cannot easily be mapped to specific research questions, with all research questions drawing information and data from many different data sources. Furthermore, it is inevitable that the data and the analysis cannot be neatly 'divided up' into discrete topics. The linkages between people, their livelihoods and their environment are connected in many ways.


Image 6. *Zambezi River, Ikelenge, Zambia, 2015.*

Chapter 6 The Case Study: beekeeping, honey trade and forests in Zambia and in the study area

The Lunda-Ndembu complex of beliefs about the environment extends from a deeply ingrained perception of dwelling in a place of unlimited land, of easily traversed space (Pritchett, 2001:p79)

6.1 Introduction

This chapter is the first of four results chapters and presents the findings from document research, from secondary data review and from information provided by key informants, particularly the owner and the staff of Forest Fruits Ltd. The chapter provides context, background and also explains why the particular case of forest beekeeping in Mwinilunga was selected as the unit of analysis for the case study for this research. Information about the Lunda people and honey and beeswax trade in Mwinilunga and Zambia is presented. The study area and the wider honey sector in Zambia is described in this chapter which starts with an introduction about the people of Mwinilunga and some historical notes about beeswax trade before explaining more about forest beekeeping methods and the status of forests in Zambia.

6.2 Selection of the case

The study area for this research is within the largely forested districts of Mwinilunga and Ikelenge in Zambia. These locations are the main honey supply districts of the largest and longest-established honey buying company in sub-saharan Africa, Forest Fruits Ltd. Mwinilunga district, and the more recently created Ikelenge[14] district, are in the North-Western Province of Zambia, bordering with DRC to the north east and with Angola to the north west (Figure 6.). The honey buying company Forest Fruits Ltd provides a reliable market for honey for forest beekeepers and has done so for more than 20 years.

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[14] From an area that was formerly Mwinilunga

Figure 6. Map of the study area.

The case was selected because honey trade is well-established, thanks in the main to the presence of Forest Fruits Ltd. The company started buying honey in 1996 and apart from some years with lower than usual honey harvests the company has been buying more honey each year. In the 12 months preceding July 2016 FF Ltd. purchased 1000 tonnes of honey. FF Ltd. provides beekeepers with a high level of confidence that they will be able to sell their honey for a fair price. The company has a permanent factory and office in Mwinilunga town and good capacity in extension, training, organisational support and logistics. The company communicates its expectations, in terms of honey handling and storage, hygiene, honey quality and bucket logistics, to the beekeepers and provided these are met will buy all honey that beekeepers wish to sell.

Forest Fruits Ltd. has invested in organising beekeepers into groups to aid coordination of training, communication, bucket delivery and collection of harvest. There are about 120 groups, of about twenty beekeepers, each headed by their selected Contact Beekeeper (CBs) who is supported also by agents who supervise the CBs provide a point of liaison between the CBs and FF Ltd. Starting in October FF Ltd. distributes buckets to the groups, some of whom are over 100km away from the factory. When filled, the company then weighs each bucket and pays the beekeepers before transporting the raw honey back to the factory in

Mwinilunga. Each season may comprise several rounds of bucket delivery and collection, as the honey cropping continues for some months, from October to January. The CBs are held accountable for the buckets they receive on behalf of their groups and if buckets go missing this will affect the commission they receive on each bucket of honey they supply. Transporting honey from distant locations can be challenging and it sometimes occurs that honey is paid for but not collected for some months, until the roads become dry and passable. The company has secured organic certification for all its supply areas and has put in place a traceability system from collection centre to export.

The longevity and reliability of Forest Fruits Ltd. gives beekeepers confidence that their future honey harvests will find a ready market and this in turn makes forest beekeeping attractive as a livelihood activity. The Mwinilunga beekeeping and honey economy is an example of a critical case (see chapter 5, section 5.3). There is a high level of market confidence and honey is very important for the local economy. The honey is a wholly forest-derived product. It is an important test case for the 'conservation through commercialisation' hypothesis.

6.3 Lunda

Mwinilunga is home to the Lunda people, a tribe with historic roots spanning what is now DRC, Angola and Zambia. Box 3. gives a brief note about their history.

Box 3. History of the Lunda.

When asked to recount their history, the inhabitants of Mwinilunga District will generally start by saying: 'We the Lunda, we have come from Mwantianvwa.' With this statement they refer to the figurehead of the Lunda entity, a polity which was established between the beginning of the sixteenth and the beginning of the seventeenth century. From its heartland surrounding the capital city Musumba, located along the Bushimaie-Nkalanyi River in present-day Congo, the Lunda entity gained influence and spread across large parts of the Central African plateau.

The Lunda-Ndembu, as the inhabitants of Mwinilunga District are occasionally referred to, trace back their settlement of the present area to a migration from the core Lunda polity. The causes for this migration are to be sought in internal power struggles at the centre and in a desire to extend Lunda influence to outlying areas. Propelled by the penetration of Luba influences from the east, Lunda emissaries set out to secure access to scarce salt pans, hunting grounds and agricultural land beyond the established

boundaries of the polity. Evidence suggests that Chief Kanongesha, one of the main chiefs who came to settle along the Upper Zambezi, reached the present area between 1740 and 1755. According to oral tradition, his following comprised of 12 members of matrilineal kin, some of whose descendants are still important chiefs in Mwinilunga district today.
Extract from Pesa, 2014:p30

Portuguese travellers reported that Mwantianvwa's court was rich in valuable and tradeable goods, and that a framework of long-distance trade and tribute, marriage, alliance, friendship and ritual connected the disparate Lunda people into an interdependent entity. Exchange and trade have long played a part in the region. Distant trade connected distant communities through extensive networks facilitated by occupational specialisation and environmental variation. Overall, trade served to complement individual and household production, offered people access to a wide range of goods and enabled the diversification of individual livelihood strategies. Trade provided connections between local, regional and occasionally even global actors (Pesa, 2014).

Strong trading relations developed between the Portuguese of the Angolan coast and the Lunda people, a connection that provided access to new food crops, industrially manufactured cloth, firearms, gunpowder, beads, tobacco and liquor, among other things, in exchange for skins, rubber, ivory, slaves, dried meat, honey and beeswax (Pritchett 2001, Pesa 2014). The long-distance caravan trade system of the eighteenth and nineteenth centuries promoted '*increasing commoditization and montetization in Central Africa*' (Pritchett 2001:p62).

6.4 Beeswax trade

The colonial period brought change and disruption to the old caravan trade routes, but beeswax remained an incredibly important trade commodity. This is well described in Box 4 in the form of extracts from the district annual reports of the colonial administration, researched and documented by Pesa (2014).

Box 4. Beeswax trade in Mwinilunga

Beeswax in particular proved a lucrative commodity, firmly embedded in networks of trade, as its local use-value was practically non-existent. Production was highly dynamic and market-oriented long before the establishment of colonial rule.

Beeswax has long been traded by the (…) Lunda, formerly to Angola, and now to traders in Balovale and Mwinilunga. In Mwinilunga the successive flowering of species of Isoberlinia, Marquesia and Brachystegia from early winter to early rains, provides a sequence of supplies in normal years. Bark hives are employed, and methods of preparation of the wax appear usually to be adequate. It is purchased by the trader in 2 ½ or 3 lb. balls at 2 ½ to 3 d. per lb., and finds a ready market either in London or Johannesburg. The current price c.i.f. London is 83 s. to 90 s. per cwt (Trapnell, C.G. and J.N. Clothier, The soils, vegetation, and agricultural systems of Northwestern Rhodesia: Report of the ecological survey, 2nd edn., Lusaka, 1957)

From the eighteenth century onwards beeswax became an export product shipped from the Angolan coast. Initially, beeswax supplemented exports of ivory and slaves, in return for which scarce consumer goods could be obtained. In the 1850s this trade was vividly described:

The native traders generally carry salt and a few pieces of cloth, a few beads, and cartouches with iron balls (…) The great article of search is beeswax, and from their eagerness to obtain it I suspect it fetches a high price in the market (Schapera, Livingstone's African journal, 1853-1856, London, 1963, p121).

The beeswax trade ran well into the colonial period and beyond. Beeswax would be shipped from Angolan ports. Local traders [were motivated] to engage in the beeswax trade. Pricing could even prompt traders to circumvent prohibitive colonial legislation: '*We decided to take the risk as the traders in Angola give us a lot of money for any beeswax we take to them*'. Expatriate traders, most notably Ffolliott Fisher, started buying beeswax from Mwinilunga in 1926. The end product, transported by the Benguela railway to Angola, was destined for export to either Johannesburg or London, where it fetched prices of up to £170 per landed ton.

Favourable marketing opportunities enticed individuals to step up beeswax production. With prices fluctuating up to a high of 6d. per lb., beeswax production reached levels of 30-40 tons per annum. Honey collecting became so popular that it was described in terms of a '*seasonal exodus*', even drawing '*the people away from their gardens*!' Yet rather than obstructing agricultural production, it was exactly the compatibility between apiculture and agricultural production that caused beeswax to become such a popular commodity. Instead, producers regard apiculture as a lucrative, low-risk side activity, which can complement agricultural production. The sale of beeswax provided distinct benefits and in the 1930s it was reported that: '*whole villages sometimes find their tax money by sale of beeswax alone*.' Access to scarce commodities, such as clothing, pots and even bicycles, could be provided by means of the beeswax trade. As a result, producers preferred beeswax over other produce. The popularity of apiculture was virtually unsurpassed, as it was an activity which required low labour inputs but could provide high monetary returns. Factors such as profitability, marketability and labour input enticed beeswax production and trade.

Extracts from Peša 2014: pp91-92 and p203

The long-distance trade in bee products was dominated by beeswax, not honey. There were probably two or three main reasons for this – beeswax had almost no local use, unlike honey, which could be eaten or used to make beer. Beeswax is easy to store and transport over long distances without risk of spoilage, and no containers are required. The importance of containers was emphasised by Wainwright writing about honey trade in Zambia in 2002, '*the old beekeepers talk of times when they had a bumper harvest but all their containers were full so they were forced to just squeeze the honey from the combs and let it fall to the forest floor so that they remained with only the more valuable beeswax*' (Bradbear, Fisher & Jackson, 2002:p60). As Fisher noted with reference to trade in Tanzania, *'Honey is difficult to transport, being heavy and sticky ... Wax, in contrast, can easily be moulded and carried from the forest, it can then be remoulded at a later stage of the journey, while its quality remains unaffected by transportation*' (Fisher, 1997:p302)

6.5 Honey trade in Zambia

With independence in 1964 the network of private honey and beeswax buyers operating in the North-Western Province (NWP) and in the Western Province was closed down. Nationalist economic policies determined that marketing of honey and beeswax should be undertaken by government and the Beekeeping Division of the Forestry Department established honey processing factories at Mwekera, Kabompo and Mwinilunga with a total capacity of 500 tonnes. Between 1970 and 1996, Beekeeping Division bought an average of 14,000 to 18,000 kg of beeswax and 17,000 to 114,000 kg of honey annually thereafter. Purchases peaked in 1990 with 57,000 kg of beeswax and 205,000 kg honey bought from village beekeepers. Even the National Agricultural Marketing Board at one time engaged in buying of beeswax. Government involvement in the honey came to an end with the advent of economic liberalisation in 1991 (Mickels-Kokwe, 2006).

Although beeswax had been exported from Zambia during the 18th and 19th centuries, significant honey export did not begin until the 1990s when the producer-owned company North Western Bee Products (NWBP), based in Kabompo, grew in capacity and scale. The origins of NWBP began with a donor-funded government project in 1979 where the project staff were civil servants and the finances were managed using government procedures. The project evolved into a private trading company in 1986 with beekeepers and District Councils as shareholders. By 1989 the company was buying hundreds of tonnes of honey, more than it could sell locally. David Wainwright who worked for NWBP in Zambia in the 1980s, helped change this by establishing his own company in the UK, Tropical Forest Products Ltd., deliberately to provide a high-value export market for Zambian honey. Organic certification helped Zambia muscle its way into the initially reluctant European market, unused as it was to African honey flavours. The trade was a success and to this day hundreds of tonnes of Zambian honey are purchased by Tropical Forest Products Ltd. although no longer from NWBP (Wainwright pers. comm. 2019).

Table 8 shows some recent data about honey trade in Zambia, from various sources. The data is mixed which demonstrates the difficulty of sourcing accurate statistics about Zambia honey production and trade. Yet the sources agree that the North-Western Province is the major honey producing part of Zambia and Forest Fruits Ltd is currently the major player having succeeded to this position after NWBP ceased trading in 2008 (Kommerskollegium, 2009:p8).

Table 8. Some Zambia honey production and export data from various sources

<table>
<tr><th>Year</th><th>Honey exports</th><th>Estimated honey production</th><th>Source and attribution</th></tr>
<tr><td>1998</td><td>NWBP exported 100 MT, 100% of export</td><td></td><td rowspan="2">In Mickels-Kokwe 2006 using data sourced from FAOSTAT 2004, Export Board 2003, NWBP 2004, Mulenga and Katisha 2003</td></tr>
<tr><td>2003</td><td>NWBP exported 120 MT, about 50% of total</td><td>1500 MT</td></tr>
<tr><td>2004</td><td>Total exports, for the whole nation 400 MT</td><td></td><td>In CIFOR 2008, data sourced from Export Board of Zambia 2006</td></tr>
<tr><td>2008</td><td>Total exports, for the whole nation 173 MT</td><td>600 MT</td><td>In Kommerskollegium 2009, data attributed to ‘official statistics’</td></tr>
<tr><td>2014</td><td colspan="2">NWP currently producing 1000-1200 tons. Usually more than 50 % of this is exported</td><td>In ITC, 2015, source not stated.</td></tr>
</table>

Sources: various

Forest Fruits Ltd. started buying in 1996 and data about the scale of their operation in the early 2000s is shown in Table 9. In the 2015/2016 season they purchased 1000 tonnes (Dan Ball. pers. comm 2016). More recently still this volume has reached nearly 1500 tonnes (Chris Nawej pers. comm 2019).

Table 9. *Forest Fruits production and export of organic certified honey and wax 2009-13*

Year	Purchase	Honey export	Beeswax export
2009	750 MT	551 MT	16 MT
2010	215 MT	174 MT	10 MT
2011	693 MT	367 MT	16 MT
2012	502 MT	302 MT	16 MT
2013	380 MT	151 MT	13 MT

Data reported in ITC, 2015

A number of sector studies have reported on the Zambian honey market as a whole and show that in addition to export there is considerable domestic trade. Honey is purchased to make honey beer, by opportunistic honey traders and by a number of smaller businesses which process, pack and retail the honey within Zambia (Kommerskollegium 2009; Mickels-Kokwe, 2006)). Other companies and organisations of note include Lua Lua Cooperative in the Northern Province (Kancheya, 2010), COMACO in the Eastern Province, Bee Sweet in Luanshya (ITC, 2015) Mama Buci in Central Province ("Mama Buci," 2020) and Mpongwe Beekeepers in the Copperbelt (Simukoko, 2008).

The honey sector has long been recognised in Zambia for its ability to put money into the pockets of poor, remote and rural people. Using data derived from various sources Mickels-Kokwe reports there to be 20,000 beekeepers in Zambia and puts the average annual earnings of beekeepers in NWP at about 100 USD per year. Jumbe, Bwalya, & Husselman (2008) suggest a much higher number of beekeepers, estimating a quarter of a million honey producers in Zambia and data collected from Mumbwa district and Katanino showed that beekeepers earn between USD67 and USD93 per year (Jumbe, Bwalya, & Husselman, 2008)

The pro-poor potential of the beekeeping sector has attracted development support and schemes to 'improve' and 'develop' beekeeping. These efforts began during the colonial period as reported by Pesa (2014) who notes that schemes in the 1930s '*focused on instruction and demonstration, promoting methods of wax making in saucers instead of balls and encouraging the construction of hives, instead of honey hunting. In the 1960s emphasis was placed on marketing, through the formation of honey and beekeeping co-operative societies. Official schemes sought to 'improve' and 'develop' existing apicultural practices. Producers only adopted suggestions, however, if these did not involve extra labour or capital inputs*' (Pesa, 2014:p92).

The goal of modernising the sector by changing the types of hives used has been an ever-present theme. Wainwright investigated the profitability and labour demands of different hive types in NWP, in Zambia, in the 1980s. Taking into account the capital costs, yields and labour invested Wainwright concluded, '*a bark hive producing 7.5 kg of honey per year gives a better net income to the peasant farmer than a box hive producing 50 kg at usual levels of occupation*' (Wainwright, 1989:p365). Elaborating further the study noted that the high cost of box hives would necessitate beekeepers to take out a loan which, considering the numerous factors outside the control of the beekeeper, would be risky and they may never repay the loan. The greatest investment in bark hive beekeeping is the labour needed for harvest, yet investing in harvest can never result in a loss. In bad years the harvest may be lower, but so is the labour needed to bring it to point of sale.

Despite the strongly evidenced arguments in favour of bark hives donor-funded programmes have persisted to try and introduce box hives, '*The NGOs operate on a principle of introducing "modern beekeeping" using the frame or top bar hives*' (Mickels-Kokwe 2006:p53). The ill-informed discussion about modern hives versus bark hives reported in the ITC report (ITC 2015:p32) makes the claims that modern hives are more efficient, but does not touch on profitability or sustainability. Yet, as other reports state modern hives are too expensive, '… *the high cost of the technology was unaffordable for individual group members*' (der Kleij and Simukoko, 2012). The solution to this high cost proposed by the project referred to by these authors was to advocate group ownership instead of individual ownership, a mis-guided approach that seems not to notice that if one hive must be shared between several people, so must the income.

A return to the history books is more illuminating as reported by Pesa (2014). Evaluators of apiculture development schemes promoted in the 1930s noted the following:

'*It is axiomatic that the success of any scheme to improve the quality of a product depends on securing to the producer a premium for his extra trouble [in the form of good prices]. The success of a scheme was premised not on scientifically defined principles advocated by government officials, but rather on labour and capital inputs and returns. Producers considered whether the requisite extra labour and capital inputs would pay off, but also took into account whether market involvement would not jeopardise foundations of production and livelihood security*' (Pesa, 2014:p93)

Or in other words, beekeepers make choices based on labour and capital inputs and returns. It would serve all modern-day beekeeping projects to analyse their recommendations based on the labour, the capital inputs and the returns of any beekeeping system they advocate.

6.6 Forest beekeeping in north west Zambia

The beekeeping method that prevails in the North-Western Province (NWP) of Zambia is a forest beekeeping system. The most substantial piece of work which describes this system in detail in Zambia is 'Bees and Beekeeping in the NWP of Zambia' (Clauss, 1992). This describes the history of beekeeping in Zambia's NWP and mentions that the use of hives was augmented by honey hunting in some parts of the Province and '*… extension work from the mid-thirties till the early sixties concentrated on the promotion of bark hive making and beeswax production, with very good response*', (Clauss 1992:p4). The report lists the main bee trees, details the flowering calendar, notes the two main honey flows Oct-Dec and March-May and records beekeepers' knowledge about bee forage sources. The role of honey in people's lives, for beer brewing, for food, for medicine and for trade is well documented with a mention that beeswax has minimal local use, beyond trade. The method of hive making is described. Bark is peeled off trees of preferred species and fashioned into cylinders and fixed with hardwood pegs. The hives are left to dry before being hoisted into position in trees. The criteria that beekeepers use when selecting trees for hive making is described. They must be of suitable species with pliable bark, straight, of the right size and with cross-grained inner bark, '*the beekeeper has to test the bark first by cutting a small rectangular flap of about 10 by 8 cm … if the flap can be moved like a small door it will show the characteristic 'twisted grain', and the bark is suitable*' and '*according to beekeepers questioned all over the Province the average percentage of suitable specimens out of a given number of trees is 34%'* (Clauss 1992:p47). Forest beekeeping is dependent on the self-occupation of hives by swarms and beekeepers employ a number of methods to attract bees to their hives, the chief amongst them all is correct size and placing of hives, but many other additional techniques are used. Nevertheless, not all hives will be occupied and this is normal and anticipated. Beekeepers spread their hives over a large area for two main reasons: to compensate local fluctuations in forage and nectar flow and to tap various other forest resources (Clauss 1992:p52).

Clauss describes how beekeepers hang hives, harvest honey, maintain and replace hives. He records that in Mwinilunga the average number of hives per beekeeper is 110 and notes that the number of hives is influenced by marketing prospects. Not all hives are occupied and not all occupied hives are cropped. These ratios are determined by a combination of bee and forest ecology, market access and the availability of other livelihood opportunities. The number of swarms, their movement and their inclination to occupy any given hive are largely ecological factors. Beekeepers place a large number of hives to maximise their chances of catching swarms and the rate of cropping might be determined by the prevailing honey price, ease of selling or whether they have something more productive to do with their time. '*As a subsistence farmer the beekeeper has to uphold a multiple strategy to maintain and earn his and his family's living'* (Clauss 1992:p65). Beekeepers manage their hives using a range of strategies, always balancing as noted above, labour, capital input and returns.

Clauss discusses the use of bark for hive making and notes that forestry and timber economists and consultants from overseas sometimes react 'quite emotionally' to the use of trees to make bark hives. His careful calculation in 1992 of the rate of hive making worked out that 3.1 trees per km3 are used each year (see section 8.4 for up-to-date commentary on this) and he concluded that the impact on the forest was modest and anyway the species used for hive-making are not timber species. So – one could argue – bark harvest is not damaging a higher-value resource. Clauss discusses the relationship between people and forest and notes that forest beekeeping needs to be understood in context of the wider relationship people have with the forest, as shifting cultivators and as users of wide range of forest products for use and trade. He mentions fire as a major cause of forest damage and notes that '*traditional beekeepers are generally worried about late fire between August and October which widely scorch the flush and above all the flower of the most important nectar sources*' and he asks, '*could the beekeeper spearhead communal conservation strategies with regard to fires and careful utilisation of forest resource*?', and he advocates '*early burning which could be done within 1.5-3 months after the last rain, a recommendation by the Forest Department'* (Clauss 1992:pp116-117).

Clauss describes many alternative hive making materials and hive designs, including hives made from mats, calabashes, logs and slats of dead wood. He also details the results of trials with frame hives and top-bar hives. Yet above all, it is the bark hive which has persisted and enabled beekeepers to scale up to meet the growing market demand.

The forest beekeeping system prevalent in Zambia is found across the miombo zone. A detailed description of the practice in Tanzania (Fisher, 1997) noted that in addition to bark, logs are used as hives. The reasons given for placing hives apart from each other is the same as in Zambia i.e. to avoid honey robbing by other bees during harvest and the practice of having more than one hive site is likewise a risk mitigation strategy:

*"you have to have many camps because in order to hang beehives you can't just have one place. If you proceed to put your hives up a group of bees they come and live in the hives and some they stay and some they runaway. Then you put your hives in another place in order to trap the bees.. .bees may miss food in one place so they move, and if you have a camp in another place they move there and then you won't lose.., if your farm does not produce a crop then you need somewhere else as well" (*Fisher 1997:p274)

6.7 Zambia's forests

In addition to providing the resources to underpin forest beekeeping, Zambia's forests provide a wealth of other socio-economic and environmental services. However, they face immense pressure arising from various forms of land use change and anthropogenic activities such as extensive practices of agricultural expansion, increasing demand for fuelwood, overgrazing, late season forest fires and infrastructure development (UN-REDD, 2012). In Zambia, the Integrated Land-Use Assessment Project Phase Two (ILUA II, 2016) was conducted from 2010 to 2016 and was the largest forest inventory ever undertaken in Zambia. Using land cover map data for the years 2000, 2010 and 2014, the assessment concluded that human activities related to land use and land-use change in forest reduced the forest cover from 47.07 million hectares in 2000 to 45.94 million hectares in 2014. The total forest cover lost over this period is estimated to be 1.1 million ha (1,110 km2). The report concluded Zambia's current official deforestation rate to be estimated to be between 79,000 and 150,000 ha per year. The ILUA attributes forest cover change largely to agriculture and settlement expansion. Other land use changes, such as mine development are also mentioned (ILUA-II, 2016).

The proximate causes of forest loss and degradation need to be understood in relation to wider structural and economic factors. Yes, charcoal burning can cause localised forest degradation but the demand for charcoal is driven by other factors, such as the unaffordability of electricity and urbanisation. Some research suggests that Zambia is experiencing higher rate of deforestation than their miombo neighbour, Mozambique, because of differences in forest governance between these two countries. A study on the causes of deforestation in both these countries revealed that Zambia and Mozambique have very different tenure arrangements, with Zambia communities having much lower tenurial security in relation to forests on customary land compared to their counterparts in Mozambique. Forests on customary land fall under a dual tenure arrangement, with responsibilities shared between the state and the local Chief. Customary land forest is accessible to anyone from within the community for home use. Land can be transferred from customary land tenure to leasehold tenure. The conversion of customary land to leasehold title is an expensive process and requires approval from three authorities: the Chief, the District Council, and the Commissioner of Lands. Written consent of the Chief must be obtained by the District Council who then submit a resolution to the Commissioner of Lands who makes the final decision. Customary rights attached to converted land are extinguished once leases are granted. In Zambia forest land is considered 'unused' and therefore at risk of acquisition by private sector developers, regardless of its value for local people. Another significant difference also noted by the research was progress towards devolution of forest governance. In Zambia the 1999 Forest Act was drafted but never enacted, whilst in Mozambique The Forests and Wildlife Act provided communities with incentives towards long term sustainable forest resource usage through secure access and use rights was enacted (Hervey, 2012). Since 2012 changes have occurred in Zambia with the Forest Act 2015 making provision for community forestry.

6.8 The emergence of community forestry in Zambia

As mentioned above the forests where beekeepers hang their hives are not their private property. Forest policy in Zambia does now make provision for local people to gain stronger tenurial security over customary land forests through community forestry, yet this is a recent change.

In common with other African countries, the Zambian forestry sector is rooted in a post-colonial history of top-down command and control. Indigenous forests on customary land have been managed in terms of extraction through concessions and licensing, with local people having no say and no formal rights about the forests they rely on for daily life. The Zambia Forestry Department (ZFD) '*was designed as a policeman and as a protector of natural forests, but not to engage in outreach and collaborative projects*' (Hervey 2012:p122). By the 1990s this approach was deemed out-of-date and ineffectual and a comprehensive review process was conceived under the auspices of the Zambia Forestry Action Programme. This programme included a review of the Forest Policy of 1965 and Forest Act of 1973 and an implementation plan, the Provincial Forestry Action Plan (PFAP I) was executed. These processes led to the publication of a new Zambia Forest Policy in 1998 which included as a key tenet the introduction of participatory approaches to forest management and eventually a concept of Joint Forest Management (JFM). This principle was due to be formalised by the 1999 Forests Act, which provided a general basis for the sharing of forest revenue between the government and local communities. In order to achieve this, the Act mandated the establishment of a Zambia Forestry Commission to take over the responsibilities of the ZFD.

However, the 1999 Forest Act was never implemented. Whilst it is likely that this inertia was probably due to an unwillingness for a department to make itself redundant (Hervey 2012) one of the consequences was that the tentative steps towards empowering communities to have greater control over their own forest resources also faltered.

The second phase of the Provincial Forestry Action Plan (PFAP II), which took place between 2000 and 2006 was intended to build on the success of PFAP I by rolling out Zambia's first examples of JFM in a small number of pilot forest areas. However, in the absence of supporting legal instruments these pilot JFM projects were limited in what they could achieve. Zambia's first attempt at JFM in the early part of the new millennium had a false start and resulted in little more than, '… *JFM plans for six forests in local reserves, one on customary land, 'capacity building' in 45 villages, guidelines for JFM planning and implementation, a 'lessons learned' document and a tentative model for collaborative forest management*.' (Hervey 2012:p131).

A review of JFM in Dambwa Forest Reserve undertaken in 2012 concluded, '*The perception of most members of the community was that there were neither monetary benefits derived from JFM nor any significant improvement in their livelihood following JFM'* although the review did indicate positive outcomes for forest regeneration (Phiri, Chirwa, Watts, & Syampungani, 2012:p1). A review of JFM in Katanino joint forest management area in 2007 reported that despite some positive perceptions, overall the community were disgruntled having been given additional responsibilities with little commensurate benefit; the lack of an adequate legal framework was highlighted as one of the major stumbling blocks (Bwalya, 2007). A subsequent later review of the same Katanino forest JFM pilot also noted lack of clarity about distribution of costs and benefits, lack of communication between the communities and the FD, lack of monitoring and a mismatch between livelihoods activities and JFM activities, ultimately concluding, '*Because the rules of JFM participation do not deliver tangible benefit, and do not allow the communities to manage all aspects of forest use, rules are not followed by the communities'* (Leventon, Kalaba, Dyer, Stringer, & Dougill, 2014:p15).

The 2014 Zambia National Forestry Policy (Ministry of Lands and Natural Resources 2014) does now make provision for communities to acquire stronger rights of forest use and ownership and this has been afforded support by the legal framework enacted in the Forests Act 2015 (specifically sections 29 to 35) and the Regulations on Community Forest Management, 2018. A community forest is defined in the Forests Act, 2015, as a forest controlled, used and managed under an agreement between a community forest management group and the Forestry Department (Ministry of Lands and Natural Resources, 2018). The agreement allows for harvesting and trade in a wide range of timber and non-timber forest products.

The Decentralised Forest and Other Natural Resources Programme (DFNRMP) was a partnership project, launched in 2015, to pilot the implementation of community forestry in accordance with the new Zambian Forestry Policy (DFNRMP, 2018). Project activities informed the development of the Regulations on Community Forest Management, 2018 (referred to above) and created the National Guidelines for Community Forestry in Zambia (Ministry of Lands and Natural Resources 2018)

6.9 Mwinilunga

The main occupation in Mwinilunga District is subsistence-oriented agriculture, based on shifting cultivation of cassava. Semi-commercial farming is practiced to some extent with farmers growing and selling pineapple, maize, potatoes and beans. There is limited potential for other crops due to acid soils. Animal husbandry is not common. The majority of households have no animals apart from a few chickens and goats. Mwinilunga and Ikelenge are constrained by limited infrastructure development having few tarred roads, limited electricity supply, few secondary schools and inadequate health, financial and government extension services. Income generation and formal employment opportunities are few. The area is much forested with miombo woodlands and most of the forest is on customary land. Customary land forest falls under the jurisdiction of the senior chiefs and then village headmen. Customary norms about rights to exclude tend to pertain to the land and not the trees (and other forest produce) and forests appear to be used as an open access resource. So for example, when a member of the community uses land for farming, this land is considered to belong to the farmer – not legally, nor without caveats, but according to local norms. The main threats to the forest are charcoal making, green wood cutting for brick burning, logging, conversion of land to agriculture, industrial mine development and fire. All these factors are highly location specific - for example charcoal making tends to occur at roadside, logging occurs where stands of high value timber (e.g. *Pterocarpus angolensis*) occur. Against these factors beekeepers 'retreat' to more remote forested areas to place their hives.

This chapter is concluded by turning to Pritchett's writing about the relationship between the Lunda and their environment, paraphrased in Box 5.

Box 5. People and the environment.

The Lunda-Ndembu complex of beliefs about the environment extends from a deeply ingrained perception of dwelling in a place of unlimited land, of easily traversed space. The environment is alive with mystery, wonder, and untold surprises.

The Lunda language contains over twenty individual words denoting different kinds of walking, for example, walking briskly, walking giddily, walking mournfully, walking as if carrying a heavy load, walking about restlessly, and so on. The Lunda are, indeed, great walkers. With four to five months of dry season each year, few distances are considered insurmountable.

The productive relationship with the environment centers around the notions of labor as the primary producer of value and the labourer as the primary owner of any value produced. Land, per se, cannot be owned, but anything of value produced on the land belongs solely to the individual producer. As Turner, von Oppen, Papstein, and others have noted, individual ownership has apparently always been the norm on the upper Zambezi.

The focus on individual ownership combined with the perception of endless frontiers produces strong entrepreneurial impulses. The environment is something to be cleverly used, to be mastered. There is little evidence in Lunda proverbs or practice to suggest a view of the environment as finite or exhaustible. The international development community's focus on sustainability through the careful long-term management of discrete sets of activities on circumscribed bits of land does not resonate well with Lunda sensibilities. The view from the plateau is one of endless horizons in all directions.

Extract from Pritchett 2001:pp79-80

The next results chapter presents primary data collected through the field work and answers the first of the research sub-questions about the economic importance of beekeeping for forest beekeepers.

6.10 Conclusion

This chapter has presented the context for this case study research. We learn that beekeepers have harvested honey and beeswax from Zambia's miombo woodlands for generations, with the North-Western Province being the most productive part of the country. In earlier years the export trade was dominated by beeswax, whilst honey consumption and trade was largely domestic. This began to change, with a shift to more interest in long-distance honey trade, in the latter half of the twentieth century. Forest Fruits Ltd. was drawn to set up business in Mwinilunga because of there were a lot of beekeepers, with surplus product. The reliability of the market provided by FF Ltd. has reinforced and consolidated the honey economy in this part of Zambia. The system employed by beekeepers to harvest honey and beeswax is a forest beekeeping system, similar in many respects to systems in other parts of Africa. Low-impact, low-cost, low-risk and extensive. The pro-poor benefits of forest beekeeping have attracted the attention of development programmes which have variously sought to improve the beekeeping and/or the market. It is important to note that the success of forest beekeeping in NWP and the success of FF Ltd. seems to have been achieved despite these programmes, rather than because of them. This scenario makes for the ideal case where the logic of 'conservation by commercialisation' can be tested in reverse. The development planner might aim to achieve conservation by finding a market for an NTFP. In this instance we examine a case where the market is already establised, so making it possible to ask *with what implications for forest maintenance?*

Image 7. *Bark bee hive near Kasochi, Ikelenge, 2016.*

Chapter 7 Contribution of beekeeping to people's livelihoods

If we did not have honey then we must cultivate maize and cassava.
But to be honest - the most important thing we rely on is honey.
Without that we suffer (Beekeepers in Sakunda, 2015)

7.1 Introduction

The main research question is asking: **Given that the market for honey is assured, do beekeepers maintain forests**. Yet, before this can be addressed it is necessary to understand the economic and livelihood benefits of forest beekeeping. This chapter is the second of the four results chapter and presents data to show the scale and the type of the benefits of forest beekeeping for people in north west Zambia, and the implications for people's livelihoods. This provides evidence to answer the first research sub-question: **What is the economic and functional importance of forest beekeeping for forest beekeepers?**

This chapter presents data derived from the Focus Group Discussions[15] and the Questionnaire Survey (QS)[16], with additional data gleaned from Key Informant Interviews[17]. This results in this chapter broadly revolve around three themes. The first is about the economic importance of beekeeping. Data is presented based on the views and responses given by beekeepers during the Focus Group Discussions and this is followed by data about income earned from beekeeping absolutely and relative to other sources, obtained largely from the QS. Within this theme data is presented also about how beekeepers compare with non-beekeepers, according to self-reported metrics about economic wellbeing and the gender dimension is discussed. The gender issue is important because some of the differences between beekeepers and non-beekeepers is accounted for by differences in gender. The

[15] Where data is drawn Focus Group Discussions information is referenced FGD

[16] Where data is drawn from the Questionnaire Survey this is indicated; this data is mainly shown within the tables and figures

[17] Where data is drawn from Key Informant Interviews information is referenced KII, and interviews with individual beekeepers are referenced INT

second theme explored in this chapter concerns the functional importance of beekeeping and this is evidenced by presenting data about how beekeeping income is used within beekeepers' livelihood strategies. This relates to the livelisystem transitions in the FBLF and helps reveal whether beekeepers are 'hanging in' or 'stepping up' or 'stepping out'. The final theme in this chapter concerns evidence of trends in beekeeping adoption. This is important because evidence of increasing or decreasing interest in beekeeping, and the reasons, provide an additional indication about the role of beekeeping in supporting livelihoods and how this is changing.

7.2 Economic importance of forest beekeeping

During all FGDs beekeepers agreed strongly that beekeeping is an important source of income. Money from beekeeping is used for children's education, in farming and as capital for other enterprises, as well as meeting basic needs. Most responses were overwhelmingly positive, "*beekeeping is a business, to educate children, as capital for other ventures, a source of living. Bees are better than maize - bees are more than farming*" (FGDMAK15, Makanu, 2015), and "*We can build houses, buy iron[18] sheets, educate children, buy clothes. It is really helping - we can earn something. We can educate children and it helps keep orphans*" (FGDKAL15, Kalwisha, 2015).

Beekeepers from Sakunda, explained that they also derive income from maize, groundnuts, goats, sheep and cassava, "*But most money comes from honey. We get the animals from honey*". When asked what they might do if they could not keep bees, the respondents from Sakunda said, "*Then we will cultivate maize and cassava. But to be honest - the most important thing - we rely on honey - without that we suffer*" (FGDSAK15, Sakunda, 2015). Further extracts from FGDs are shown in Box 6.

Box 6. Extracts from Focus Group Discussions about the benefits of beekeeping

BKPR: With the money [I got from selling honey] I educated children, fed the family and extended my pineapple farm.
BKPR: 38 buckets last year. Bought iron sheets, educated child (Grade 10), bought motorbike, used money at home, also put money in pineapples.

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[18] Corrugated sheets for house roofs

BKPR: 20 buckets. Bought motorbike, put money in pineapples, kept family.
(FGDSAL15, Saluzhinga, 2015)

BKPRS: Helps to get money. Helps us a lot.
BKPRS: Beekeepers in the village earn a living, educate children. If you are not a beekeeper, you might not manage to educate your children.
(FGDJIM15, Jimbe, 2015)

BKPRS: Source of living, food, money.
(FGDKASC15. Kasochi Central, 2015)

BKPRS: Income. Lot of help from honey. Get a lot of things - source of income. Get money from beekeeping. But there are challenges.
(FGDMUW15, Muweji, 2015)

BKPRS: The benefit - get money, educate kids, money, build good homes
BKPRS: Sell honey, buy cattle, buy chickens and clothes.
(FGDMUZH15, Muzhila, 2015)

Some people gave less effusive answers saying that '*The work is difficult, and the price is low*' (FGDNTA15, Ntambu Satchitolo, 2015) and '*We can't sustain ourselves from one season to the next*' (FGDMAY15, Mayimba, 2015), but such sentiments were rare. An interview with one individual is shown in Box 7.

Box 7. Individual interview with beekeeper in Chibwika

"I was doing maize, beans and farming in general. I had to think about which programme will give me more money. With beekeeping I put in labour and get more profit. Farming I do as well. The advantages of beekeeping is I can pay school fees and help my younger brothers. I get little from my farm. In fact I completed my own education with money from beekeeping. I used to go harvesting in the holidays when I was still in school. I helped my younger brother get his driving license with money from honey also I paid for the dowry for my wife when I got married. I pay for my daughter's clothing – her school uniform – with money from beekeeping. I plan to put more effort into beekeeping and reduce maize farming. The price of maize is very low and fertiliser is coming late. If I look at all the costs of maize farming – it is expensive. Generally maize farming is reducing because there is no profit; beekeeping is increasing".
(INTFRM18, Chibwika, 2018)

On being asked in the QS, '*Why did you start beekeeping and not some other activity*'? 161 beekeepers gave either one or two reasons, numbering 210 answers in total. These, as shown in Table 10, clearly show that the main driver is an economic one. Beekeeping provides an income whilst not being overly time or capital consuming.

Table 10. *Reasons given by beekeepers about why they started beekeeping*

Reason given	**No. of answers (number of respondents =161)**
It brings money, a lot of money, more money than other activities, it is profitable	69
It is easy to do, easier than other activities	49
I see beekeepers who are getting money and so I think of doing it also	38
There is no need to put money in, I don't have money to put in	19
It is a good job	9
Market favourable	7
It is a family activity	4
Farming and beekeeping both bring in money	2
I am dissatisfied with farming alone	2
Lots of trees	2
Only thing I can do / no need to be educated	3
To get money for farm inputs	2
Beekeeping never brings a loss	1
It is an alternative to working for other people	1
I am more skilled in beekeeping than other activities	1
I have no money to buy fertiliser	1
	210

Source: Questionnaire Survey 2016

These results indicate that beekeepers are drawn to beekeeping by the economic benefits they gain. Beekeepers readily explain that their main motivation for beekeeping is income generation and that in comparison to other activities beekeeping has low barriers to participation, for men at least. The gender dimension is discussed later.

Income earned from honey and contribution to household income

The Questionnaire Survey (2016) afforded an opportunity to quantify some of the sentiments expressed in the FGDs (2015). Not all beekeepers sold honey in the year preceding the household questionnaire interview due to sickness or absence, whilst some non-beekeepers did sell honey, because they 'earned' honey through working for beekeepers, which they then sold, or because they purchased it for trade. Table 11. shows average household income across four different categories of respondent and includes a gender breakdown.

Table 11. Income earned from all sources compared to income earned from honey selling for different groups

Respondent	Average hh income all sources in ZK and (USD)	Range (ZK)	Average income from honey, for only those who sold honey	Av % contribution of honey income to total, for only those who sold honey	n of total group	n who sold honey
Beekeepers	6089.40 (USD609)	570-25000	1753.07 (USD175)	31%	164*	155
Former beekeepers	4273.54 (USD427)	320-15204	1623.67 (USD162)	25%	12	3
Non-beekeeper	3098.22 (USD310)	0-23667	780 (USD78)	25%	52	5
Those who sold honey (95% beekeepers)	6310.55 (USD631)	570-25000	1720.84 (USD172)	30%	163	163
Woman respondents, hh sold honey	4985.38 (USD499)	855-9085	1402.99 (USD140)	30%	4	4
Male respondents, hh sold honey	6343.89 (USD634)	570-25000	1728.85 (USD173)	30%	159	159
Those who did not sell both genders	2806.65 (USD281)	0-23667	0		65*	0
Woman respondent, hh did not sell	*2134.95 (USD214)*	*0-8690*	*0*		*22*	*0*
Male respondent, hh did not sell honey	*3150.30 (USD315)*	*200-23667*	*0*		*43**	*0*
All women respondents	2573.48 (USD257)	0-9085	See above for average honey income for each category.		26	4
All men respondents	5664.07 (USD566)	570-25000			202*	159
All respondents	5311.63 (USD531)	0-25000			228*	163

*One male beekeeper who did not sell honey has a well-paid job and was earning an exceptional income. This outlier has been excluded.

These results suggest that out of these categories the group with the highest annual household income on average were those who sold honey. The vast majority of this group, 95%, were beekeepers and honey contributed 30% of their gross annual cash income. The group which reported the lowest household income were women respondents from a household that did not sell honey. The gender dimension is important and discussed later in this chapter. Honey contributes to between 25-30% of all cash income earned across different groups, on average. The range in terms of percentage contribution is from less than 2% to 100%.

Beekeeping income compared to other income sources

Respondents were asked during the QS about all different sources of income for the household and gave an estimate of the amount earned in the twelve months preceding September 2016. The income data shown in Table 12. is gross income.

Table 12. Average income earned from honey and other sources

	Average earned in 12 months prior to Sept 2016, in Zambian Kwacha (gross, excluding input costs) (with USD in brackets and range in Zambian Kwacha)	Frequency of response, out of 229 interviewed
Cattle	4588 (USD 458) [range 300-10,000 ZK]	15
Pineapple	3215 (USD 322) [range 150-15,000 ZK]	33
Maize	1880* (USD 188) [range 100-11,000 ZK]	141
Honey	1721 (USD 172) [range 50-14,000 ZK]	163**
Vegetables	1032 (USD 103) [range 20-5000 ZK]	57
Beans	757 (USD 76) [range 20-4200 ZK]	157
Cassava	523 (USD 52) [range 5-2000 ZK]	56
Onions	458 (USD 46) [range 20-3000 ZK]	20
An additional 23 other sources of income were mentioned, making honey the fourth highest gross income earner out of 31 sources of income.		

Source: Questionnaire Survey in 2016.

*It is reported that the costs incurred in maize production average at about 63% of the gross income earned (Burke, Hichaambwa, Banda, & Jayne, 2011), whilst some respondents interviewed during this study said that sometimes maize yields no profit at all.

**Some of the beekeepers did not sell honey in the previous year because of ill-health or being away from home, whilst some of the non-beekeepers did sell honey because they 'earned' honey by helping beekeepers in the forest.

Cattle was the highest-ranking income source amongst the respondents, but not by many people. Just 40 out of 229 respondents own cattle (17%). Of these 40, 34 were beekeepers (21% of beekeepers), 2 were former beekeepers (17% of former beekeepers) and 4 were non-beekeepers (8% of non-beekeepers). A chi-square test did not indicate a significant relationship between these categories and cattle ownership[19]. Even though cattle was the highest-ranking source of income only some of the cattle-owners earned money from cattle in the last year, just 15. Cattle are an asset, a saving, and not always a regular source of cash. Of the 15 who had earned income from cattle, 12 were beekeepers. During the discussions a number of beekeepers said that they had acquired their cattle using income earned from honey. For example, a beekeeper in Kachikula said that three-quarters of the money he invested in cattle came from beekeeping. In Muzhila, beekeepers said that they do not have bank accounts, but some buy cattle as an investment. Extracts from FGDs about comparing beekeeping with other activities are shown in Box 8.

Box 8. Comparing beekeeping with other activities

BKPRS: Pineapples - you need money to invest and they rot easily. Honey does not rot.
JL: Yes but with pineapples you get money three times in a year - is that not better?
BKPRS: Yes but sometimes the [pineapple] market is flooded. Yet with honey the company provides the transport. We have a lot of pineapples when it is raining and the roads are bad. This makes marketing difficult.
(FGDKAC15, Kachikula, 2015)

Maize can be good - but it can be hard to sell. We cannot fail to sell honey because of the company.
(FGDMUZ15, Muzeya, 2015)

Farming is OK but you don't get much from maize. Animals are good - cows and goats. Beekeeping you get money quickly - the same year. With animals you have to build up

[19] Appendix 4

and wait until they start giving birth - then fatten the young animals. Animals take long. (FGDKAN15, Kanongesha, 2015)

Benefit of beekeeping is income. Other sources of income are maize, groundnuts, goats and sheep, cassava. Most money comes from honey. We get animals from honey. (FGDSAK15, Sakunda, 2015)

Beekeeping is easy to do. We don't pay anything. Maize need money for fertiliser. Bees have no diseases. Animals die sometimes - from disease.
(FGDMUZH15, Muzhila, 2015)

These results emphasise the importance of beekeeping as a source of cash. Some other activities do enable some people to earn more cash, but not necessarily more profit. Furthermore, these other activities such as maize growing and livestock owning require an injection of capital upfront, and in some cases honey selling is the means by which this capital is raised.

All respondents were asked to mention the most important cash earning forest product for the community as a whole (Table 13.), regardless of whether they themselves benefitted.

Table 13. Most important forest product, in terms of cash generation, for the community as a whole and regardless of whether the respondent benefitted personally

Most important forest product, in terms of cash	Frequency of answer					
	Beekeepers n=165	Former beekeepers n=12	Non-beekeepers (male) n=29	Non-beekeepers (female) n=23	Overall n = 229	Number of people who said they earned income from this source n=229
Honey	151	9	21	14	195	163
Mushrooms	5	2	2	0	9	138
Caterpillars	3	0	2	4	9	114
Timber	3	0	0	0	3	20
Firewood	1	0	0	0	1	0

Charcoal	1	0	3	2	6	16
Building poles	1	0	0	0	1	5
Orchids	0	1	1	1	3	49
Grass	0	0	0	1	1	9
Total	165	12	29	23		

Source: Questionnaire Survey 2016.

A number of non-beekeepers explained how they personally benefitted from the injection of cash into the local economy when honey is sold. This ranged from earning income as labourers for beekeepers, selling goods to beekeepers, building houses for beekeepers and being able to borrow money from beekeepers. The results in Table 12. suggest that non-beekeepers are aware of importance of honey as a source of income for the community as a whole. There was a slight gender imbalance in these responses with 61% of female non-beekeepers citing honey as the most important forest product for income compared to 72% of male non-beekeepers. This might be explained by the fact male non-beekeepers may think that they could *in theory* take up beekeeping themselves, whereas women are less likely to see this as a practical option for them. These results indicate that beekeeping is likely to be having an important multiplier effect on the local economy.

Whilst Table 12. reports on the respondents' opinions on the importance of different forest products, Table 14. shows the average incomes earned. These results support the opinions expressed with honey clearly dominant. Timber is a good earner by fewer people, whilst caterpillar and mushroom selling bring in a little cash to many people.

Table 14. Average incomes earned from a range of forest products

Income source	Average income earned in ZK	Number of respondents (n=229) reporting income from this source
Honey	1721	163
Timber	1212	22
Charcoal	483	16
Orchids	204	49
Caterpillars	91	114
Mushrooms	84	138

Source: Questionnaire Survey 2016.

Difference in economic well-being between beekeepers and non-beekeepers

All respondents were asked during the QS questions about their own perception of their economic status, with answers shown in Figures 7-9. Whilst the following results compare beekeepers with non-beekeepers, it must be noted that there is a gender to dimension to these results, as 23 of the 52 non-beekeepers were female.

30% of beekeepers (52) said they were better off than others, whereas less than 10% of former beekeepers (1) and about 20% of non-beekeepers (11) gave this answer.

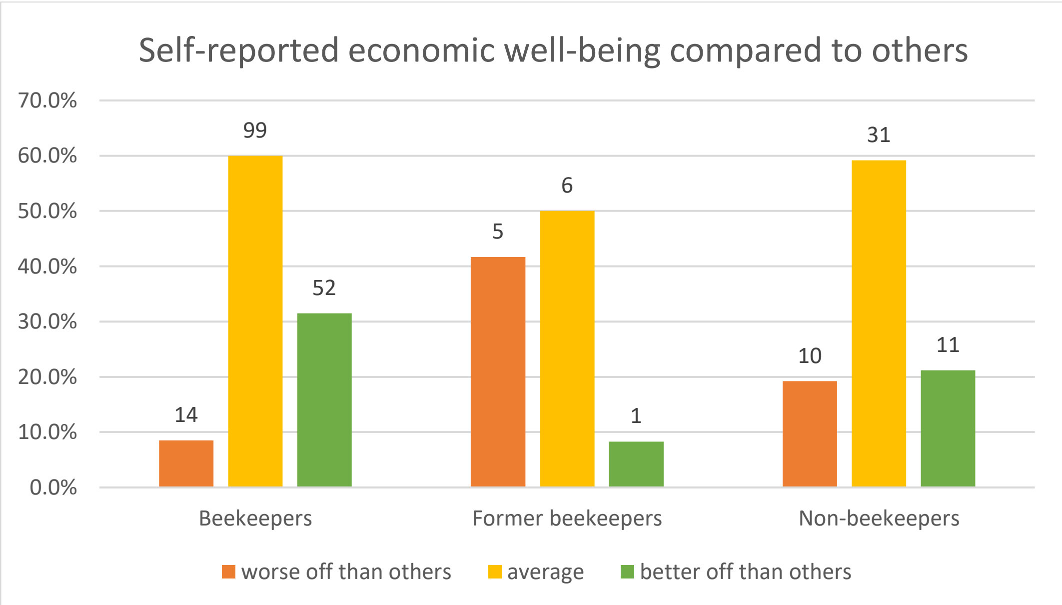

Figure 7. Frequency (%) of responses about relative economic well-being compared to others

Source: Data collected from Questionnaire Survey in 2016. Chi-square test showed a significant relationship between category of respondent and response p= 0.003823[20]

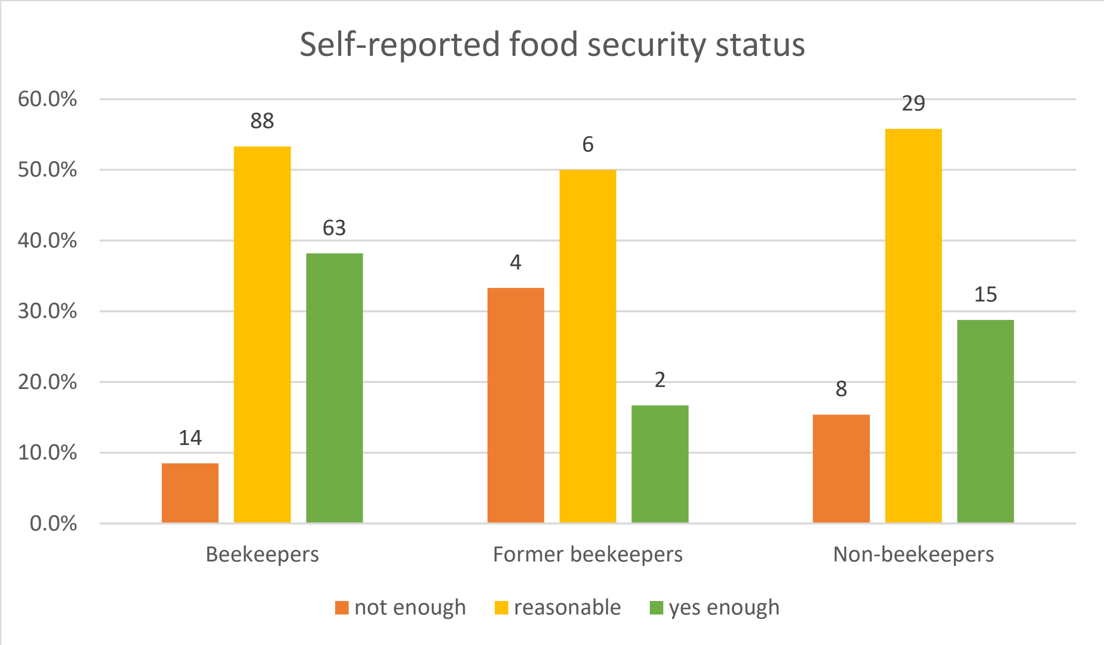

Figure 8. Frequency (%) of responses about perception of own food security status

Source: Data collected from Questionnaire Survey in 2016. Chi-square test did not show a significant relationship between category of respondent and response p=0.053612[21]

Nearly 40% of beekeepers (63) said they had enough food, whereas less than 20% of former beekeepers (2) and just less than 30% of non-beekeepers (15) gave this answer. In answer to the question about economic well-being compared to five years ago, once again the beekeepers gave a higher frequency of positive responses compared to the other two groups.

[20] See Appendix 4

[21] See Appendix 4

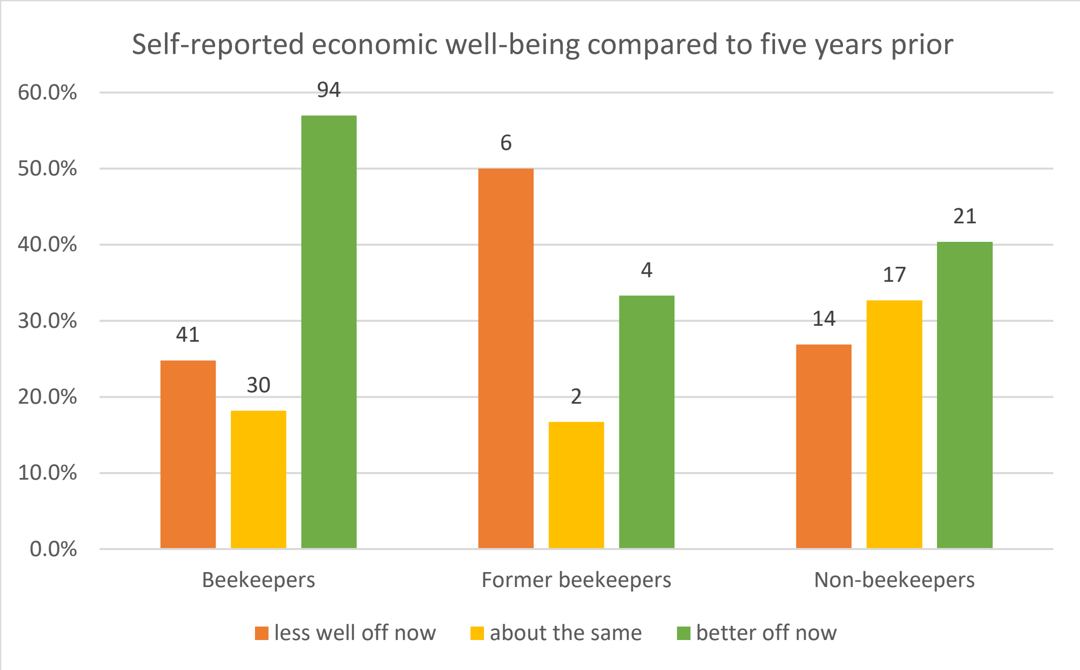

Figure 9. Frequency (%) of responses about perception of economic well-being compared to five years ago i.e. compared to 2011

Source: Data collected from Questionnaire Survey in 2016. Chi-square test did show a significant relationship between category of respondent and response. p=0.047325[22]

These questions about economic well-being were asked to gauge whether differences could be discerned between beekeepers and others. Additional questions were asked about asset ownership and type of dwelling for the same reason. The results showed no significant difference between beekeepers and non-beekeepers for housing materials or asset ownership.

In this study former beekeepers are a small group, just 12 respondents, 5% of all. Almost all indicated that they had stopped beekeeping due to ill-health, injury or old-age. It is not surprising therefore that this group more frequently reported being less well-off across all three metrics. This suggests that beekeeping does not ensure people to save for retirement or build up a 'cushion' against adversity. Again, this is not particularly surprising as old-age is a predictor for poverty in many African nations (Ferreira, 2005).

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[22] See Appendix 4

Wealth and well-being was discussed during informal meetings with beekeepers. On being asked if beekeepers were better off than others, many said, "*it depends*", and "*all activities are important*". There is, however, movement between these groups and the adoption of beekeeping by non-beekeepers is discussed below. The fact that people can move into beekeeping relatively easily (see below) might help explain the lack of a sharp well-being gradient between beekeepers and non-beekeepers. It would not, on reflection, make sense for one group of people in the community to be doing very well and others doing less well, unless there was a barrier preventing the less-well off from copying others, in pursuit of an activity which might be responsible for their better off status.

It was not possible to compare income data from the Questionnaire Survey results with data reported in the 2015 Living Conditions Monitoring Survey Report for Zambia (LCMS) because income data in that report includes consumption of non-purchased goods, the value of which was imputed to cash (Central Statistical Office, 2015: p77). However, it is possible to compare asset ownership as shown in Table 15.

Table 15. *Asset ownership of research respondents compared to national data*

	Beekeepers % ownership	Non-beekeepers % ownership	National averages for rural Zambia (LCMS 2015: p85)
Bicycles	80.8%	57.8%	46%
Motorbikes	17.0%	17.2%	1.4%
Radio	56.4%	37.5%	37.4%
Mobile phone	57.0%	75.0%	46.1%
Satellite dish	1.2%	4.7%	4.4%
TV	9.1%	10.9%	14.2%

Source: Questionnaire Survey in 2016 and Central Statistical Office, 2015.

The asset ownership data suggests that the respondents of the QS do not have fewer assets than the national average except in the case of satellite dish ownership where beekeepers own fewer than the national average and TVs where both beekeepers and non-beekeepers own fewer than the national averages. Mobile phone ownership is highest among the non-beekeeper respondents from the QS and beekeepers owned the most bicycles. This might be because of the importance of having this mode of transport for carrying honey out of the forest. Both groups of QS respondents had more motorbikes than the national average, possibly due to the remoteness of the area and lack of alternative means of transport. Beekeepers do not have more mobile phones than non-beekeepers, which given their greater reported income, might seem unexpected. This result might serve to moderate a conclusion that beekeepers are richer than non-beekeepers. These asset comparison figures do not suggest that the QS respondents are poorer than the national average.

The 2015 LCMS collected data on self-assessed poverty status also. This is a subjective measure of poverty based on the perception of the household. Households were asked to specify their poverty status across three possible categories, non-poor, very poor and moderately poor (Central Statistical Office 2015:p114). These metrics are compared with the question included in the Questionnaire Survey, 'compare your economic wellbeing with others' and shown in Figure 10.

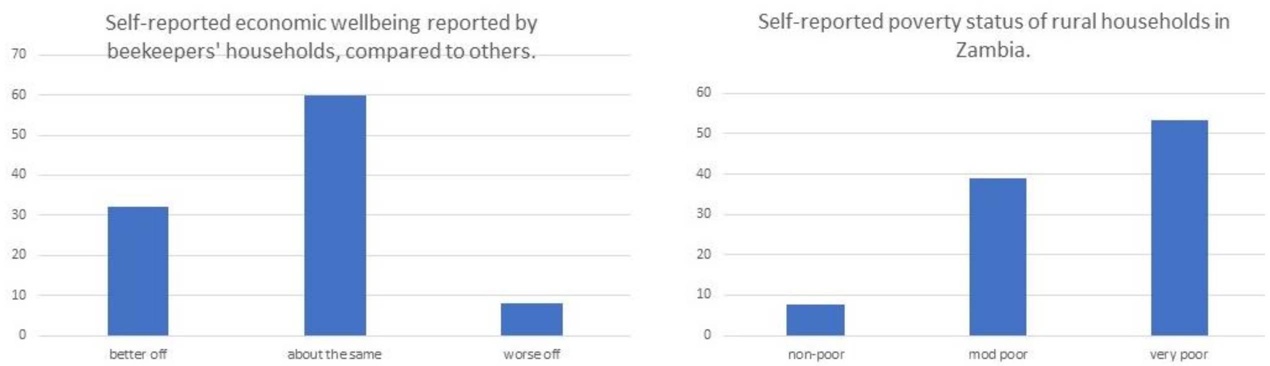

Figure 10. Frequency of beekeepers' responses about self-reported measure of economic wellbeing from the Questionnaire Survey (n=165) compared to national data set reported in the LCMS for rural household (n=1,718,060).

Whilst not wholly comparable it is perhaps interesting that nationally less than 10% of rural respondents consider themselves to be non-poor, whilst over 30% of the beekeeper respondents consider themselves to be better off than others.

Compared to the income data reported in this first part of this chapter these other metrics of well-being do not show a great deal of difference between beekeepers and non-beekeepers. This might be because these other metrics are less sensitive to the gender dimension and more accurately reflect the status of the household as a whole rather than the status of the individual questionnaire respondent. The one result which appeared to be significant was that of self-reported comparison with others, see Figure 7. Here 30% of beekeepers said they were better off compared to others, whereas 20% of non-beekeepers and less than 10% of former beekeepers gave this answer. Comparing well-being metrics of beekeepers in Mwinilunga with national data sets are difficult, due to different methods. Yet it is interesting to note that whilst 53.4% of rural households in Zambia self-categorise themselves as very poor, just less than 10% of beekeepers considered that they were worse off than others.

Forest beekeeping and women

Of the 229 QS respondents 26 (11%) were female. Of these one was the daughter of the household, two were household heads whilst the rest were wives and just three were beekeepers. One of the non-beekeeping women reported that her household had earned money through honey trading, whilst none of the other non-beekeeping women reported income from honey. As shown in Table 10. the average income from honey selling reported by the 4 women respondents (3 beekeepers and one who had bought and sold honey) was 1402ZK, whilst the average across all male honey-selling respondents was 1728ZK.

The most notable difference between male and female respondents, was the total income reported. The women respondents, on average, reported total household income for the 12 months prior to Sept 2016 as 2573ZK, whilst the average from the male respondents was 5664ZK. The question which was asked in the QS was about household income, not individual income. One would not expect to discern a relationship between the gender of the respondent and total household income unless women were under-reporting their household income, which is likely. It is very possible that women respondents reported their own income, the income over which they had control or the income which they knew about. The reason why women tend not to engage in beekeeping is because the activity requires time spent away from home, working and sleeping in the forest. It is likely that the home-duties, childcare and food-growing responsibilities of women contribute in many other ways to their lower incomes, and their inability to engage in forest beekeeping is not the only way in which they are disadvantaged economically.

Women's exclusion from beekeeping is not absolute. During the FGD, informants explained that women do have their own bees but that they do beekeeping "*through men*", "*A woman will get money and give it to a man (husband or relative). She sells the honey as her own and uses the money as she chooses. Some for cultivation (hiring people) and some for fertiliser*" (FGDKAN15, Kanongesha 2015). This same explanation was given in several of the FGDs, most of which were attended by 90% men. Women also participate in the honey economy through brewing beer which can generate useful income. They may access a supply of honey from their husbands or other beekeepers and pay for it using the proceeds from beer sales. Honey beer brewing is another example of how non-beekeepers derive economic benefit from beekeeping activity.

Mickels-Kokwe reported there to be no restrictions on women keeping bees but that they are constrained by the fact that hives need to be located in remote forest areas and, "*It was also considered impossible for them to leave the homestead chores to go and camp in the forest. Male beekeepers suggested that women should be owners of hives and hire men to manage forest hives on their behalf*" (Mickels-Kokwe, 2006:p50). Another study reported beekeeping in Zambia to be a male dominated sector with 34.4% female participation, and that because women must pay men to do some of the beekeeping tasks, production costs are 28% higher for women than for men (SNV, 2008). Jumbe *et. al*. reported that men and women engaged in different forest activities noting that the, '*collection and trade of other commercialized forest products, such as honey and charcoal, is controlled by men, mushrooms, fruits, vegetables and insects are considered activities for women and children'*, (Jumbe, Bwalya, & Husselman, 2008:p8).

It is important not to lose sight of the gender dimension which cuts across all these results and although not explored in detail in this study, the implications of the gender bias should not be overlooked.

These findings demonstrate the absolute importance of beekeeping income. Comparing beekeepers with non-beekeepers, yields a mixed picture, ranging from beekeepers earning more income to self-reported metrics on well-being showing beekeepers as being largely the same as non-beekeepers. Above all these results indicate that beekeepers are attracted to beekeeping because of the useful income they can access and they are not poorer than other groups, providing evidence to dispel any view that people do beekeeping as a last resort.

7.3 How beekeeping income fits within livelihood strategies of beekeepers

The second theme within this chapter concerns not so much what people earn from beekeeping, but what they do with their earnings and the implications of these earnings. This has already been touched on above.

In a number of the meetings participants were asked how they managed their income throughout the year, as money from beekeeping comes just at one time of year. The responses (Box 9.) showed a clear pattern. Income from beekeeping was often invested in crop-farming or businesses, like trading fish, and this way they spent the honey income to obtain money later. Many beekeepers said they spent income from honey on labour for farming, and this prompted a discussion about the difference between beekeepers and non-beekeepers. "*Both live well but the beekeeper is better off - honey is the 'mother' of farming. The labourer will take his money - spend it, and then have nothing. Meanwhile the beekeeper's harvest is growing in the hive. Bees are like a bank. Maize can be good - but it can be hard to sell. We cannot fail to sell honey because of the company*" (FGDKAC15, Kachikula 2015). Others mentioned that livestock are highly valued, but it takes time, sometimes years, to realise a return from livestock. This is unlike bees where the return on investment is realised within a few months.

Box 9. Extracts from interviews about revolving income from honey

JL: How do you make money last all year?
BKPRS: We farm and buy animals and then get the same money back again. We cultivate beans, sweet potatoes, from one season to another - then sell the beans and we keep our money that way.
([FGDMAY15, Mayimba 2015)

JL: How to make money last all year?
Bkpr: We put the money in farming and then get it out again.

(FGDMAV15, Mavunda 2015)

JL: How do you make money last all year?
BKPRS: We do not have bank accounts - some many buy cattle as an investment. Then with what is left plant maize and get money later - when selling the maize.
(FGDKANC15, Kanyama Central 2015)

This topic was also explored through the QS. All respondents were asked what they needed capital for, and in which income-generating activities they invested. Of the 229 respondents, 192 said they raised capital from one venture (not only beekeeping) and invested it in another. Table 16. shows the range of activities invested in, across all respondents.

Table 16. Responses about investment of capital* from all respondents

How capital is used	Beekeepers n=152	Former beekeepers n=9	Non-beekeepers n=46
Buy fertiliser	51	1	10
Buy seeds	50	1	10
Invest in farming in general	19	1	9
Goods to trade	15	0	4
Invest in bean farming	14	3	7
Invest in pineapple farming	9	2	2
Buy livestock	7	1	0
Hire farm labour	5	0	4
Buy beehives	2	0	0
Invest in a shop	1	0	0
Invest in fish farming	1	0	0
Making hoe handles	1	0	0
Honey trading	1	0	1
Invest in potato farming	0	0	1
No investment	10 (7% of those who answered)	1 (11% of those who answered)	12 (26% of those who answered)
Number of answers given	186	10	60

Number of respondents who gave more than one answer	34	1	14
Number of respondents who did not answer / data missing	7	3	6

Source: Questionnaire Survey in 2016.

*Capital in general, not from beekeeping alone

Table 16. clearly shows that farming needs an injection of capital. Respondents were asked how they raised capital. Of the 167 answers provided to this question 45% of the responses included beekeeping and honey selling as a source of capital.

The importance of cash to invest in crop-farming was also reflected in answers to a related question about how money from honey sales is used, as shown in Table 16. This differs from the investment question – which pertains to spending money to earn *more* money as opposed to spending money in general, including to meet household needs.

As shown in Table 17. many different answers were given to the question about how money from honey selling is used, and these include house improvements, livestock purchase and buying crop inputs. The most frequently cited individual answer was, 'paying school fees', and this was mentioned 123 times out of a total of 475 total number of answers (i.e. 26% of all answers). Two answers were given that related to crop farming, 'crop inputs' and 'labour for farming'. Together these two answers were mentioned 136 times out of a total of 475 answers i.e. 29% of all answers related to farming. On the primary area of expenditure 35% of beekeepers said 'school fees'.

Table 17. Areas of expenditure of income earned from selling honey in early 2016

Area of expenditure	Answers about how honey income is spent n=152	Primary area of expenditure of honey income n=152
School fees	123	53 (35% of beekeepers)
Food	87	5
Labour for farming	69	17
Crop inputs	67	16
House improvements	35	12
New house	29	17
Livestock	27	8
Hives	9	0
Other expenditures e.g. bail, hospital	7	3
Invested in trading e.g. fish, honey[23]	7	5
Motorbike	5	1
Invested in carpentry or shop	3	1
Bike	**	1
Solar panels and battery	**	11
Other	7	2
Did not earn any money (e.g. sick)	13	
Total number of answers (152 beekeepers said they sold honey in 2016, out of 165 who identified as beekeepers)	475	152

Source: Questionnaire Survey in 2016.

** These items were not initially mentioned by respondents until they were asked about their primary area of expenditure with respect to honey income

[23] Trading honey, i.e. buying and selling honey, is different from earning money from the primary production of honey through harvest

These results support what was learned through informal discussion i.e. that farming is seen as a more capital-intensive activity, compared to beekeeping which is seen as a cash-generating activity. When asked what they invested in beekeeping, beekeepers from Muzhila said, "*Nothing, just labour*". A beekeeper in Makanu said, "*Beekeeping is about investing energy, not money*" (FGDMAK15, Makanu, 2015).

In conclusion the results from the FGDs and the QS show that beekeeping income is 'revolved' through the year being used and recouped through other productive activities, sometimes being multiplied in the process. It is used to help meet major expenses such as school fees and is sometimes used to build up assets such as livestock.

7.4 Trend in beekeeping and causal factors

The final theme in this chapter concerns trends in beekeeping. The analysis about trends also helps answer the question about whether people leave beekeeping once they have the cash to invest in other activities or whether, conversely, once they start earning from beekeeping they are motivated to do more of it.

In Mickels-Kokwe's report of 2006 reference is made to findings from 2004, where beekeepers in the North-Western Province, '*expressed a need to rapidly increase their number of hives in response to the perceived improved market for honey'* (Mickels-Kokwe 2006:p12)

During the FGDs for this research groups often mentioned that beekeeping was becoming more attractive, "*There are more beekeepers now because the market is better*" (FGDSAM15, Sampasa 2015) and the sentiment expressed by a beekeeper in Kaloza, "*I have been growing maize, but I saw that the beekeepers were doing better than me. They had money, were paying school fees, they had good businesses and building good houses*", was not an unusual one (FGDKAL15, Kaloza, 2015). "*Twenty years ago, we were just selling locally. The market was not good. There are more beekeepers now because the market is better because of Forest Fruits*" (FGDSAM15, Sampasa 2015) and in Sakunda the group participants said, "*In this village most people are farmers - we are just starting to keep bees - we learned from another neighbouring village*". One person in Kasochi, new to beekeeping, was asked his reasoning, "*I have seen the kind of living beekeepers have. They sleep well, they eat well, and they move well*" (FGDKAS15, Kasochi, 2015). Many beekeepers attributed the recent upturn in beekeeping to the reliability of the main buyer, Forest Fruits Ltd. In Jimbe, beekeepers said, "*We will continue beekeeping provided the company still buys. If there is no market, beekeeping would not continue*", (FGDJIM15, Jimbe, 2015) whilst beekeepers in Mayimba said, "*In the past we used to sell to individuals. Now we sell to the company and we can now buy blankets, iron sheets and educate our children. Forest Fruits have brought a big change*" (FGDMAY15, Mayimba, 2015).

Respondents who had been beekeeping for many years were asked what had changed. "*There has been a change – we never used to have a market, nowadays we can sell honey. In the old days we used to suffer. Now everyone can get something, build houses, buy iron sheets, educate children. Now, we have an income it is easy to educate children*" (FGDKAS15, Kasochi, 2015).

The general trend is that more people are joining beekeeping and existing beekeepers are putting up more hives. This trend was corroborated by FF Ltd. (KIIEVA16, Mwinilunga, 2016). The QS put some quantitative data to this trend.

Figure 11. shows the hive numbers across all four sites and at three time-points, at the time of asking (Sept 2016), one year prior (Sept 2015) and five years before the time of asking (2011). The average number of bark hives per beekeeper at the time of the survey was 115[24] and the trend shows increasing numbers. The rate of increase is slightly surprising being particularly steep in the last year and may be due to the fact that these results are based on recall and not counting. They may in part be explained also by the number of new recruits to beekeeping who are building up their stocks.

[24] Two exceptional outliers removed

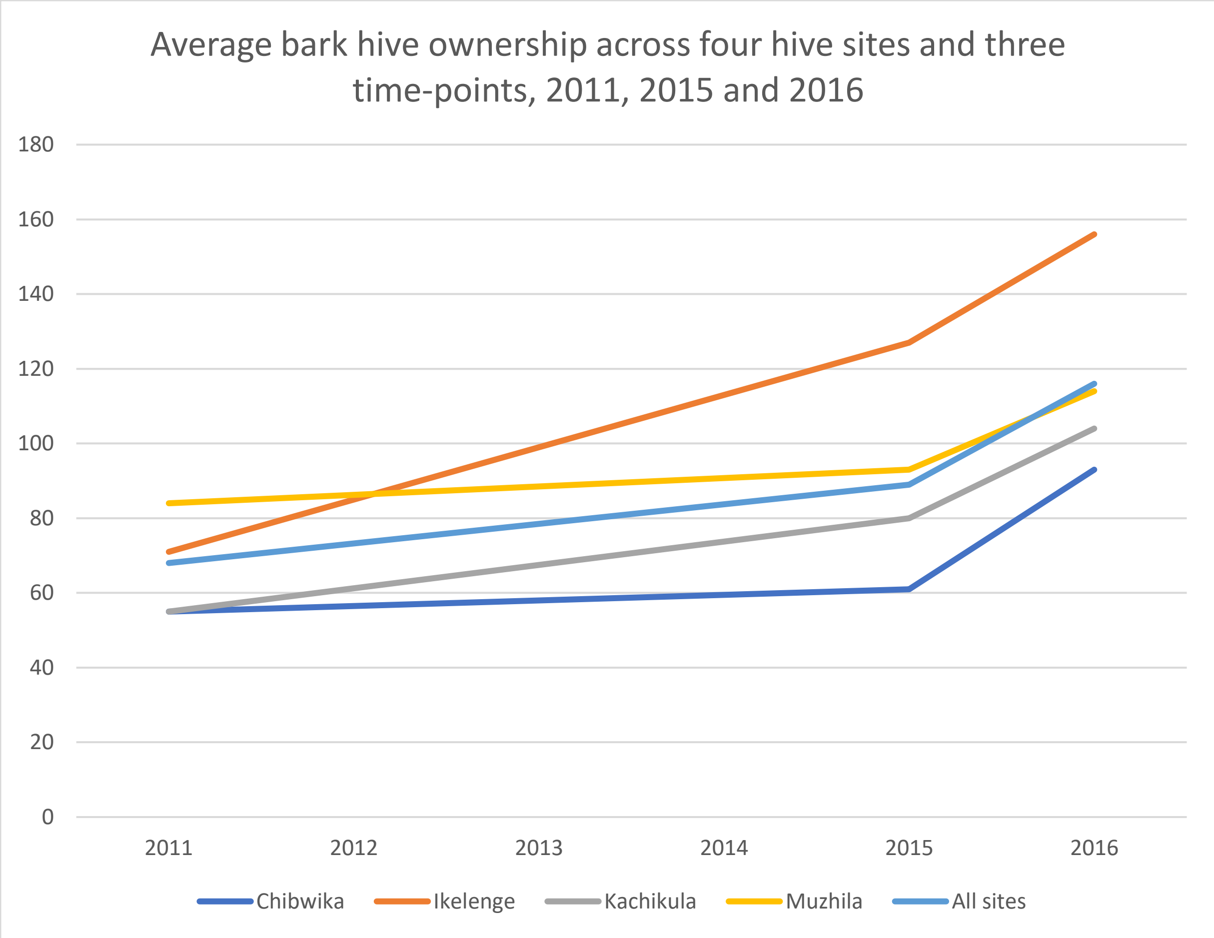

Figure 11. Chart showing average bark hive ownership.

Source: All data was collected by asking beekeepers in the QS in 2016. No counting was done and all historical number were based on recall. No data was collected for 2012, 2013 or 2014.

**Two outliers were removed – two beekeepers in Ikelenge reported hive ownership of 1000 and 1085 respectively. These were more than twice the next highest at 450 therefore removed from the analysis as exceptional.*

A number of the respondents who provided the data for Figure 11. said they had no hives five years ago and they were excluded from the average hive ownership for this year. The number of beekeepers (n) whose data is used to calculate the results in Figure 11, for each year, is shown in Table 18, with the corresponding average number of hives across all beekeepers in each year.

Table 18. Number of beekeeper respondents who said they had hives at different time points, and average hive ownership across sites.

		2011	2015	2016
Chibwika	N = no. of respondent beekeepers who had hives in these years	19	46	48
	Average number of hives	55	61	93
Ikelenge	N	31	38	38
	Av	71	127	156
Kachikula	N	23	39	39
	Av	55	80	104
Muzhila	N	25	37	38
	AV	84	93	114
All sites	N	98	160	163
	AV	68	89	115

**Two outliers removed.*

The rise in average hive numbers per beekeeper does not show the whole picture with regard to changes in beekeeping adoption. Whilst Figure 11. shows changes in average hive ownership – these changes are not uniform. The proportion of beekeepers who reported an increase in hive numbers between 2016 and 2015 was highest in Chibwika, as shown in Table 19. Chibwika beekeepers were also the most recent adopters with 65% of those interviewed reporting that they had started beekeeping in the last five years. This could explain the other findings i.e. lowest numbers of hives and fastest rate of increase. Chibwika is generally known as a maize producing area and according to Forest Fruits Ltd. the company started buying honey from there relatively recently. Falling maize prices, marketing problems associated with maize selling and the increasingly favourable honey market may account for rising beekeeping adoption in Chibwika.

Table 19. Site by site results about hive increasing and adoption rates.

	Proportion of beekeepers who increased hive numbers since the preceding year	Proportion of beekeepers who started beekeeping either last year or between 2-5 years ago.
Chibwika	92%	65%
Ikelenge	80%	23%
Kachikula	80%	44%
Muzhila	66%	42%

Source: Calculated from data collected during Questionnaire Survey, 2016.

The QS revealed data about length of time beekeeping. Beekeepers were asked a multiple choice question, *"When did you start beekeeping"* and their answers are shown in Table 20. The data about beekeepers ages and length of time beekeeping, as presented in Table 20. provides some insight into the rate of beekeeping adoption. 65 respondents had started keeping bees within the last 5 years. Of those that started beekeeping last year, half are over the age of 45. The fact that some new-adopters are older people suggests that the driver for people to take up beekeeping is more than a passive decision of a young person just inheriting an activity from an older relative. It is perhaps a more pro-active decision based on weighing up alternatives and comparing beekeeping with present activities.

Table 20. Age of beekeepers compared to length of time beekeeping

	Frequencies				
Age group	started last year	started 2-5 years ago	started 6-10 years ago	started over 10 years ago	TOTAL
under 24	1	3	1	0	5
25-34	3	22	7	6	38
35-44	3	15	7	13	38
45-54	5	12	12	20	49
55-64	1	7	3	12	23
65-74	0	0	1	5	6
Over 75	1	0	3	2	6
TOTAL	14	59	34	58	165

Source: Questionnaire Survey in 2016.

Beekeepers were asked, during the QS, for their reasons for increasing or decreasing hive numbers, depending on their own personal trend. Of those that had increased hive numbers 65% said their primary reason was because of an 'increase in price', whilst 56% gave a secondary reason of 'better market'. Other less frequently given reasons included 'more profitable than farming', 'copying the example of others' or 'it takes time to accumulate hives'. The most oft-cited reason for decreasing hive numbers concerned old-age, injury or sickness, although other reasons were given by single respondents. Box 10. shows an extract from a discussion about why some men chose to start beekeeping.

Box 10. Group discussion near Chibwika

During the QS a group of men were encountered at a meeting place near Chibwika. Of the five, four had been beekeeping for three years, whilst one had been doing it for one year only. There were farmers and beekeepers. They chose to start beekeeping because they saw others who were selling to FF Ltd and were getting money. They said there is enough land and enough forest to do both activities. In fact beekeeping would allow them to extend their fields because of having the money to do so. After cropping honey and getting the money, they put the cash into farming, school fees and food. (FGDNCH16, Chibwika, 2016)

Beekeepers were also asked about their plans for the future. Results from the FGDs indicated that beekeepers were determined to carry on with their beekeeping and do other activities as well. "*Only if I get too weak [will I stop beekeeping] otherwise I will not. Beekeeping is the source of everything. If need money at another time of year - have animals. Can't do away with beekeeping. We can even eat honey. Animals take long to give offspring. Never do away with beekeeping - it will continue*" (FGDKAN15, Kanongesha Palace, 2015). The QS results showed the same. 158 out of 162 who answered this question (98%) said they will continue with beekeeping, and some explained why. Table 21. shows all answers about future beekeeping plans.

Table 21. Explanations given by beekeepers about their beekeeping plans

Answer and explanation	**Frequency**
I will continue to add more hives	46
I will continue because it is a good way to get money	38
I will continue (no explanation or reason given)	26
I will continue with beekeeping, and develop other activities as well	24
I will continue because it is easy	4
I will put more effort in beekeeping, compared to any other activity	4
I will continue, but I would like to start using modern hives	3
I will continue because I do not need to invest any capital	3
I will continue because it is good work, easy and profitable	2
I will continue because after selling honey I buy fertiliser	2
I will continue because it is the only way to get money for school fees	2
I will continue until my children finish school	2
Not continue - I will focus on farming	2
I will continue, I even think of giving up farming	1
Not continue - no profit in beekeeping	1
Not continue - I plan to open a shop	1
No answer to the question	3
Total (n=165)	165

Source: Questionnaire Survey in 2016.

Overall, these results indicate that beekeeping is on the rise in both terms of numbers and hives per beekeeper. Yet some caution is urged as to the uniqueness of these results. The historical document review work done by Pesa showed that during the colonial period the income beekeepers earned from selling beeswax into international trade routes was incredibly important, suggesting market pull has been operating for decades (Pesa, 2014). Clauss recorded average hive ownership in Mwinilunga to be 110 in 1992 (Clauss, 1992) a not dissimilar figure to present numbers and Mickels-Kokwe reported that beekeepers interviewed in 2004[25] said that in response to market demand, they were going '*flat out to increase the number of hives*' (Mickels-Kokwe 2006: p12). The 'pull' effect of the current good market cannot therefore be considered to be wholly novel. Indeed, Forest Fruits Ltd. started buying honey in Mwinilunga because there was already a lot of honey being produced in the district.

The livelihood options within Mwinilunga and Ikelenge are limited. There is very little formal employment and overall lack of cash does not easily permit people to diversify into trades and specialisms. So, whilst the results suggest that beekeepers are being drawn to beekeeping because the market is making beekeeping more attractive, it is attractive when set against relatively few alternatives.

7.5 Conclusion to the livelihoods section

The results presented in this chapter answer the first research sub-question: **What is the economic and functional importance of forest beekeeping for forest beekeepers?**

Concerning the first theme about economic importance of beekeeping, the results yielded robust evidence that people engage in beekeeping because of its income earning potential. In responses to questions about the benefits of beekeeping, beekeepers provided convincing and expansive answers about how they valued beekeeping for the money they could earn, with relative ease, mentioning that beekeeping allowed people to *get money, educate kids, build good homes, buy cattle, buy chicken, buy clothes*. These narrative answers were backed up by data from the Questionnaire Survey which showed that for households that sold honey, honey selling contributed to 30% of household annual income.

Honey selling compares favourably with other income sources, coming in as the fourth highest gross income earner out of 31 options, after cattle, pineapple and maize. Maize quickly drops down the ranking when profit is considered. Whilst selling livestock earned good income for a few people, livestock are generally used as an asset store, rather than for

[25] Across North-Western Province – not Mwinilunga alone

regular income. It was interesting to note that a number of beekeepers said they purchased their livestock with their honey income.

Whilst beekeepers, as expected, ranked forest honey as the most important forest product, the majority of non-beekeepers also recognised the economic importance of forest honey. The average income earned from honey was about 42% more than timber and more than double the income earned from charcoal selling, and very few people sell these other products. After honey (163 people), mushroom selling is the next most frequently sold forest product (138 people), but the average income is only ZK84. When examining a range of different metrics of economic well-being the forest beekeepers in Mwinilunga and Ikelenge appear to be earning more, are better off or the same as non-beekeepers. None of the results indicated them to be poorer. The fact that there is no very large wealth disparity between beekeepers and non-beekeepers is possibly explained by the fact that most able-bodied men can become beekeepers should they wish to. Non-beekeepers who are struggling to make ends meet do not 'watch' as their neighbours earn whilst they do not. They would join in and level out any emerging wealth disparity between themselves and beekeepers. There is no evidence that beekeepers are poorer than others.

The second theme explored in this chapter concerns the functional importance of beekeeping and in this regard the results provide convincing evidence that income from forest beekeeping serves proactive functions. After selling honey and earning income in a lump sum, beekeepers use this money in a number of different ways. Many invest the income in farming which – depending on the crop and crop prices – achieves a multiplier effect. Some buy livestock as a form of savings or long term investment. The use of honey income to pay for children's school fees was said to be the primary use by the greatest number of respondents. Investing in education is considered one of the most sure routes out of poverty for the child and secures a level of security in old age for the parent. These types of expenditures are not consistent with that earned from 'safety net' type activities, undertaken in times of stress to meet basic needs.

Forest beekeeping appears to be readily adopted by choice because it is 'easy' to do and generates important income. The results from the FGDs and the Questionnaire Survey strongly support the conclusion that beekeeping is seen as a cash-generating activity, whilst farming – whether for cash or for food – is seen as a cash-requiring activity.

The final theme in this chapter concerns evidence of trends in beekeeping adoption. This is important because evidence of increasing or decreasing interest in beekeeping, and the reasons, provide an additional indication about the role of beekeeping in supporting livelihoods and how this is changing. The results indicate that beekeeping is attracting new entrants. Many beekeepers explained that they had recently taken up beekeeping because they saw beekeepers doing so well. Furthermore, many beekeepers are putting more effort in increasing their hive numbers. The reasons people gave for the rising interest in beekeeping were positive pull factors, citing rising prices and a more reliable market or seeing other beekeepers doing better than they. These findings further support the conclusion that forest beekeeping is serving a more pro-active livelihood role than as a safety net. If the safety-net function was the main feature, one might expect people to say they were doing beekeeping because they had no choice or because it was the only way to get money. There was some evidence that low maize prices were causing people to look for alternative and additional sources of income. Yet overall these 'pull effects' are not consistent with a safety net function.

In conclusion we see that beekeeping plays an important functional role in people's livelihoods, being a source of cash, without requiring a cash investment. The cash generated is used to buy farming inputs, pay labourers, to buy food, build houses and pay school fees.

The finding suggest that forest beekeeping is more than a safety-net and there is evidence that forest beekeeping supports people's livelihoods in substantive ways; investment for farming, cash for school fees and improved houses. There is no evidence that forest beekeepers are poorer than other rural people in Zambia – indeed there is some evidence that some are better off.

The local narrative gleaned from the fieldwork suggests that people are drawn to forest beekeeping for positive reasons – the price is better, the market is good, beekeepers were 'doing better than me'. These positive phrases match with the quantitative metrics which show that forest beekeeping does bring in a good amount of money and is accessible to men. There is no evidence that people resort to beekeeping to tide them over a temporary shock or difficulty and they give it up once the difficulty is overcome. It is not a livelihood of last resort.

Putting these findings in the context of the *Livelisystems Framework* helps answer questions about livelihood transitions. They are not 'stepping out'. Even as they develop other activities, they maintain their beekeeping because of the 'free cash' it generates. Old-age and sickness are the triggers for people to 'fall out' of beekeeping, not because of a decline in the resource. Instead the results indicate that forest beekeepers appear to be 'stepping up' in that they are doing more beekeeping, investing more effort.

These results do not immediately elaborate our understanding about beekeepers' incentives for forest maintenance and the main research question, **Given that the market for honey is assured, do beekeepers maintain forests'?** remains unanswered. The findings tell us that beekeepers benefit economically from the forest, in a major way. They have a vested interest in its maintenance. They are not stepping away from the forest and leading lives where they don't need it anymore. They are not using the resource out of a desperation, they are accessing the valuable forest beekeeping assets because they deliver a plentiful supply of 'free' cash.

Image 8. *Initials marking ownership of the bee hive in this tree, Chibwika, 2016.*

Chapter 8 The relationship between beekeepers and the forest

"Only a fool leaves the forest empty handed, poorer than when he entered" (Pritchett, 2001:p51).

8.1 Introduction

The main research question is asking: Given that the market for honey is assured, do beekeepers maintain forests. This chapter is the third of the four results chapter and presents data to show the relationship between forest beekeepers and the forest on which they depend for their honey harvest. This provides evidence to answer the second and third research sub-questions: How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation? and Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping?

This chapter presents data derived from the Focus Group Discussions[26] and the Questionnaire Survey (QS)[27]. Results from the extended hive site[28] visits are also presented in this chapter.

The results in this chapter broadly revolve around five themes.

The first theme concerns the perceptions, views and values of beekeepers in Mwinilunga with regard to the forest, with a focus on perceived threats and values. It was important to explore these views because beekeepers' concerns about the future of the forest may underpin their decisions and their actions in relation to the forest use and management. The second theme explores the decisions and actions beekeepers take in relation to the forest, with specific reference to the activity of forest beekeeping. The third theme considers the

[26] Where data is drawn Focus Group Discussions information is referenced FGD

[27] Where data is drawn from the Questionnaire Survey this is indicated, this data is mainly shown within the tables and figures

[28] See Box 12 for 'what is a hive site'

amount of forest used by forest beekeepers. This is important because it quantifies the scale of the actions of beekeepers and puts their actions in perspective. The fourth theme considers the sustainability of bark hive use. This is necessary because the result of beekeepers' actions in relation to the forest is the sum of all actions, use, protection and management. These four themes help answer the research sub-question: **How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation?** The final theme in this chapter explores whether beekeepers self-organise to manage the common resource and in doing so contributes to answering the third research sub-question: **Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping?**

Drawing from the *Forest Beekeeping Livelisystems Framework* reference is made how people adapt to and negotiate their natural environment. The Livelisystem Framework enables consideration of a whole range of processes – harvesting, exploiting, nurturing, managing, mitigating, adapting. It is these processes which are explored in this chapter.

8.2 What beekeepers think and say about forests

During the Focus Group Discussions (FGDs) in 2015 beekeepers were asked about their thinking, their perceptions and their actions in relation to the forest. Starter questions ranged from, "*what are the threats to beekeeping*?", "*who owns the forest*?" to "*are you concerned about loss of forest – as seen in other parts of Zambia*?". Questions about the forest were included in the Questionnaire Survey (QS) in 2016 and additional informal interviews were held in 2018 where more challenging questions were asked such as, "*Some people say that forest beekeepers destroy forest – is this true*?".

Threats to the forest

Threats to the forest and loss of forest were discussed during the FGDs. Starter questions were as neutral as possible, but once themes emerged during one discussion these were often deliberately raised again in subsequent meetings. Probing questions were used to elicit more specific responses, such as, "*Do you worry about people cutting trees in places where you hang* *your hives*?" and "*Is fire a problem*?". These questions were usually phrased in the context of forests for beekeeping, rather than all forests in general.

The threats mentioned by beekeepers were loss of access to forest through land sales, deforestation and/ or tree cutting in general, tree use for hive making, charcoal making and fire.

Beekeepers mentioned their concerns about land sales in four of the twenty FGD. "*The government and the Chief sell the land to big farmers and to the mines. The Government wants money through selling the land. We have no powers*", (FGDMAY15, Mayimba, 2015) and "*We worry about the Chief giving land to big farmers"*, (FGDKAC15, Kachikula, 2015).

Charcoal burning was not considered a serious threat to beekeeping because in most instances beekeepers said that charcoal is made near the roadside, whilst beehives are hung far away in the forest interior. This lack of apparent conflict between beekeeping and charcoal burning is in contrast to other parts of Zambia. One key informant mentioned that where charcoal burning and beekeeping is done side by side, such as in Kapiri Moshi, charcoal making brings in more money and beekeeping suffers from the consequent forest degradation (KIIBIK18, Lusaka, 2018). In Mwinilunga charcoal burning is done near to the town and large piles of charcoal were seen in Mayimba. Beekeepers in Mayimba gave conflicted responses to this situation, saying that they allow their relatives to come to the village to make charcoal, whilst also admitting that seeing bee-useful trees being cut for charcoal '*is painful to see. But what can we do. Everyone needs to make a living*'. (INTMAY14, Mayimba, 2014).

On the more general question of tree loss, tree cutting and deforestation the responses were also mixed as these responses show.

*"Yes, we worry about people cutting flowering trees. We talk about it when we meet - but we do not solve it. The problem is always there - for example people cut trees to get caterpillars", (*FGDMUZH15, Muzhila, 2015).

"No it [deforestation] cannot happen here - we see the importance of honey and we cannot allow that. We cannot allow anyone to cut trees carelessly. There are rules. There are restrictions." (FGDMUW15, Muweji, 2015).

During the discussion at Kasochi Central the group were asked if they feared deforestation, as seen in other parts of Zambia. To which some people replied, yes and others no. "*No - because tree cutting happens by the road where people are farming - they need access to the roads. Tree cutting cannot go far into the bush", (*FGDKASC15, Kasochi Central, 2015).

On fire beekeepers clearly stated that late season fires were a threat, but one that they could handle.

"*Fire destroys flowers. Early burning is the solution and the Forestry Department used to get people to do that in June and July. We beekeepers do that now, we burn here and there, where the hives are. In June*", (FGDMUZH15, Muzhila, 2015).

***Box 11**.* Extract from one interview near Kachikula

JL: Is fire a problem for beekeepers?
JM: No, we do early burning in June to avoid fire destroying the hives and the flowers later on.
JL: Are there threats to beekeeping?
JM: We fear the Chief selling land to miners or big farmers.
JL: What can you do about that?
JM: I don't know.
(FGDKAL15, Kaloza, 2015)

The question of hive-making as a forest threat was raised. This is discussed in a later section in this chapter.

Questions about forest threats were asked during the Questionnaire Survey. A multiple-choice question about forest cover change and an open-answer question about causes of forest cover change was posed to all respondents (Table 22), whilst beekeepers were asked an additional question about forests and beekeeping (Table 23).

Table 22. Questionnaire responses about views on forest cover change

Answers to the question, *"Has forest cover in your area changed in the past five years"*?	Number of responses	Reasons for change	Number of responses (some people gave more than 1 response)
More forest now	68 [30%]	Early burning	37
		No careless tree cutting / trees are conserved	23
		Trees grow fast / tree re-grow	15
		Not so many people	5
		Other answer	4
		No answer	2
Less forest now	106 [46%]	Many people farming	49
		Chief sold some land	38
		Many beekeepers	19
		Trees cut for caterpillar harvest	7
		Charcoal making	1
			200 reasons given for changes by 174 people were said they perceived a change.
About the same	55 [24%]		
Number of people who responded	229		

Source: Questionnaire Survey 2016.

These results indicate that just under half of the respondents considered that the area of forest was reducing.

Table 23. Beekeepers' view's about forests and beekeeping given in response to a multiple-choice question (n=165)

Questions	Options					
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Percentage who agreed or strongly agreed to this statement
Even if more people wanted to hang hives and keep bees, there is enough forest	73	43	3	20	26	70%
The place where we hang most of our hives is remote - people do not go there to cut trees	79	53	3	25	5	80%
Deforestation is a problem in some of the places where I hang hives	84	17	3	44	16	61%
In future there will be not enough forest for beekeeping	45	28	3	61	27	53%
There is a problem of private landowners - they buy the forest so we cannot hang hives	46	18	0	68	33	38%

Source: Questionnaire Survey 2016

These answers are a little too broad and generic to be very illuminating. On the face of it some appear contradictory, for example, 61% of respondents strongly agreed that deforestation is a problem in some of their hive sites, whilst the other responses indicated different views. There are a number of ways to explain these contradictions. Question 1, for example, about 'enough forest' could be interpreted to mean that there is enough forest now, whilst Question 4 is about the future availability of forest. The contradiction in the answers to Questions 2 and 3 might be explained by specifics. Yes, deforestation is a problem in *some* places but *most* of the hive sites are free from interference. Whilst these ambiguous results have perhaps emanated from imperfect questions, they speak also to the fact that beekeepers lack access to perfect information. They cannot answer question 4 for example without knowing how many beekeepers there are likely to be in the future or whether forest use changes outside of their knowledge, might occur.

Value and importance of forests

In a scoring question both beekeepers and non-beekeepers were asked to agree or disagree to statements about the value of forest (Figure 12). Four of the statements comprised a onedimensional view e.g. '*the forest brings us wealth*'. The fifth posed a trade-off between forest and farmland, and the sixth compared forest with employment. There, was very little difference in what beekeepers said and what non-beekeepers said, a finding which suggests, not surprisingly, that the forests are useful for much more than beekeeping.

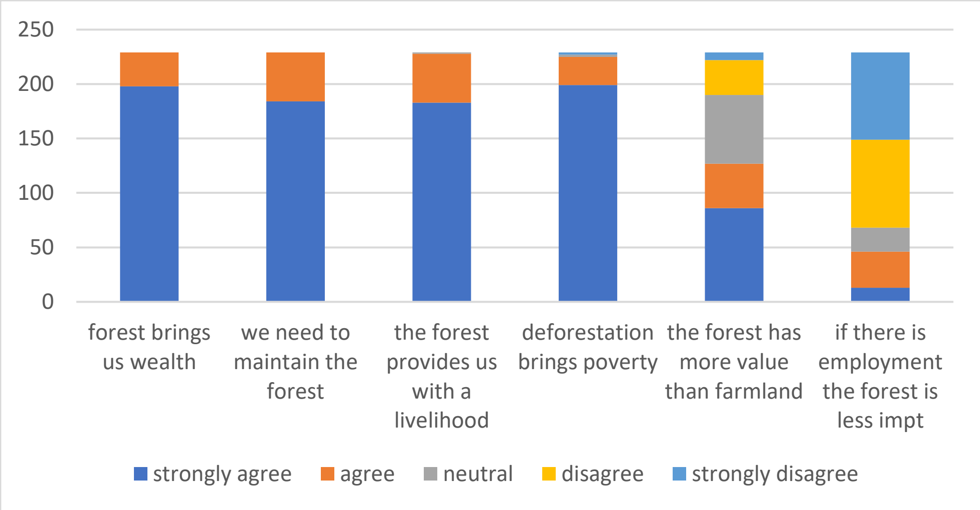

Figure 12. Responses to a question about the value and importance of forest n=229. *Source: Questionnaire Survey 2016.*

Statements 1-4, the one-sided questions are largely 'strongly agrees'. Answers to the trade-off questions were more mixed. These results are both revealing and yet not surprising. People everywhere find it relatively easy to say environmental issues are important but find it harder to elevate environmental issues above other concerns which affect their well-being. For example, in the last statement (which is reversed so a strongly disagree answer is a forest-favouring answer) 49 out of 229 people[29] (21%) agreed or strongly agreed that the forest is less important when there is employment.

During FGDs beekeepers were asked another question about perception of value. They were asked what they thought of when they saw a flowering tree. They said, "*I see money*" and "*I see flowers and money. I am thinking money*", (FGDKAC15, Kachikula, 2015; FGDMAK15, Makanu, 2015).

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[29] All respondents

During the FGDs beekeepers exhibited different emotional responses to problems discussed. Land sales to outsiders was an issue which they raised without prompting and appeared to make them angry. The threat of fire for hives, flowers and trees was easily discussed, but usually only when prompted. Their answers showed that fire was a problem that they could handle themselves, it was within their capability and they knew what to do. The general loss of trees for crop farming was met with resignation. The process of clearing trees for crops was something done by themselves and their neighbours as an essential part of life. It was not seen as a problem as such – to think such a thing would be like saying eating was a problem. Everyone is entitled to a livelihood and growing food is a necessity. Land sales to outsiders seemed to elicit a stronger response. This is not surprising. When land sales occur they happen at a large scale all at once, rather than a gradual change. Importantly the beneficiaries are from outside the immediate community and beekeepers feel the sales bring minimal local benefit. Land sales rarely bring many jobs and as the land is not theirs to sell, they do not earn anything from the sales.

Overall, these results indicate that the respondents currently value forest very highly, yet people held a range of different views whether they perceived forests to be under threat. The mixed responses can be partly explained by the complexity of the topic. Not all forest is the same. Forest in some places e.g. near town, is more at risk than forest far away from the roadside and threats vary also. The future is uncertain making it hard for people to estimate with any confidence whether forest resources will become limiting and finally there is a difference between forest cover and access to forest.

8.3 Decisions about resource use made by forest beekeepers

This section reports on data which shows how forest beekeepers protect, manage or maintain forest resources. It begins with findings about the extent to which beekeepers can exclude other forest users from the forest, their hives sites in particular. This is important because excluding other users from a resource is often a pre-requisite for forest management. This sections begins with an explanation in Box 12, of what is a hive site.

Box 12. What is a hive site?

A hive site is the area of forest where beekeepers place their hives. Hive sites are very large and one site, used by one beekeeper may exceed 100 ha. The dozens of hives in each hive site are placed far apart in trees. Hive sites may be located up to a day's walk away from the roadside, away from residential areas and farms. Beekeepers tend to locate hives in more than one hive site to take advantage of natural variations in vegetation, topography and flowering patterns. Beekeepers establish their own hive sites separate from others, although they may be adjacent. All beekeepers interviewed in this study (QS) had at least one hive site, 146 claimed to have two and 82 said they had 3 making a total of 393 sites used by all 165 beekeepers. Of these 163 were 'inherited' and 222 were identified by the current user. To a casual observer a hive site is indistinguishable from the forest 'at large' and the wide spacing between the hives and their location in trees means even the hives themselves are often 'invisible'.

Forest ownership and rights to use, exclude or protect

The right to exclude other people from using a resource is a key tenet of common-property resource regimes and goes to the heart of the 'tragedy of the commons' versus 'community management' debate. In their important work on Community Management of Natural Resources in Africa, Roe, Nelson & Sandbrook (2009:p8) draw attention to this point, '*It is also important, if communities are to invest in resource governance, that they are able to make decisions about how the resource is used, enforce rules governing use, and exclude outsiders from using their resources*'.

During the FGDs, respondents gave examples of customary land forest which had been previously used for beekeeping being sold by their chief to private landowners. Beekeepers complained about this but there was nothing they could do about it. Indeed, this trend of chiefs becoming more acquisitive, instead of prioritising the needs of their people is of widespread concern in Zambia (Lusaka Times, 2018; Chitonge, Mfune, Kafwamba, & Kajoba, 2017). This demonstrates that beekeepers do not have full rights to protect the forests where they keep their bees. 39% of beekeepers gave this as a concern in the Questionnaire Survey. In 2015 beekeepers in Kachikula complained about the sale of a large tract of land to a private farmer, and beekeepers in Mavunda complained about another land sale. One beekeeper raised this as a question, asking, "*Can it be possible to find a donor to help us buy a piece of land* *for the bees? Yes, we can ask the Chief - but he will need money, and so will the District and we want a title deed. As a group. Then we would not allow anything there but beekeeping"* (FGDKAC15, Kachikula, 2015).

In 2018, beekeepers in Chibwika expressed concern about expansion of mining into their beekeeping area. They had no idea what would happen and appeared to have no response. They were not optimistic that mining would bring jobs because they knew that they did not have the skills for mining-related jobs, but they feared for the impact on their beekeeping.

During the FGDs (2015) beekeepers were asked if there was any conflict between beekeeping and farming. Beekeepers said that they do not try and discourage anyone from clearing forest to grow crops, pointing out that growing food is essential for people's livelihoods. Indeed, beekeepers are also farmers, growing maize, cassava and beans. Some responses indicated that the reliable market for honey and the rising honey price is enticing some people to put more effort into beekeeping, and less effort into farming. This is discussed further in chapter 9.

To elicit more understanding about rights to exclude, beekeepers were asked about forest ownership in general and about their hive sites in particular.

"You cannot claim any forest for yourself - the Chief will challenge you. The forest is for everyone. Beekeepers are cooperative - they recognise if someone put their bees there first, and it is possible to recognise the owner of the hive by looking at the hive" (FGDKAC15, Kachikula, 2015).

Box 13. Extracts from four Focus Group Discussion about tenurial security of hive sites BKPRS: We don't change the hanging places - we replace a rotten hive with a new one on the same branch. JL: The places you were using 10 years ago - are you still using now? BKPRS: Yes. They are 'our' places but we do not own them. JL: Can someone do something else there? BKPRS: Yes. For example Fisher opened a farm at Lwakela and beekeepers lost their bee places. (FGDMAV15, Mavunda, 2015) JL: Do you keep the same places for hanging hives or use different places from time to time?

BKPRS: Each person might have different places but they stick to them when they have them. I know my place. I have used the same place 10-20 years, and I replace hives if old. We have our own places.
BKPR: People are not allowed to cut trees there (in my hive place) - it can never happen. Anyway, the people who make planks are selective they choose only some trees. If there are good plank trees in my area they will come and ask permission and if we agree - then they proceed, if not, they do not.
JL: So how does the newcomer get a place?
BKPR: The old man [experienced beekeeper] will take newcomers and advise which places they can use - they say 'you have this place'.
JL: Who owns the forest?
BKPRS: The Chief. The Chief allows us to put beehives in the forest. We don't pay anything.
(FGDKASC15, Kasochi Central, 2015)

JL: You are quite new to beekeeping (to MK) - did you get advice about where to put your hives?
MK: Yes, I was trained by another beekeeper. That is my place now. If the tree dies - I will move to the next tree.
JL: Do you have your place?
BKPR: Yes.
BKPR: No not really - we do not own the places.
(*People discussed this point).*
BKPR: We mark the trees with our marks - so this is my tree.
JL: How do you protect the places where you hang hives.
BKPRS: We do early burning - to protect the flowers from late fires. Yes everyone does early burning.
(FGDSAL15, Saluzhinga, 2015)

JL: Do you use the same place for your hives - year in year out?
BKPRS: Yes (they laugh).
JL: Is it your place?
BKPRS: Yes. No one can interfere there. My children will take it over.
JL: Can other people cut trees there?
BKPRS: No people are fearful and respectful.
(FGDMUW15, Muweji, 2015)

Questions about hive sites were included in the QS but the bravado that beekeepers exhibited during the FGD about their claims to hive sites were not quite so evident in the QS (Figure 13). Many said that they felt that the site was theirs, but explained that it was really a matter of discussing, reasoning and negotiating with another forest users, rather than being able to insist on their rights – they knew they had none.

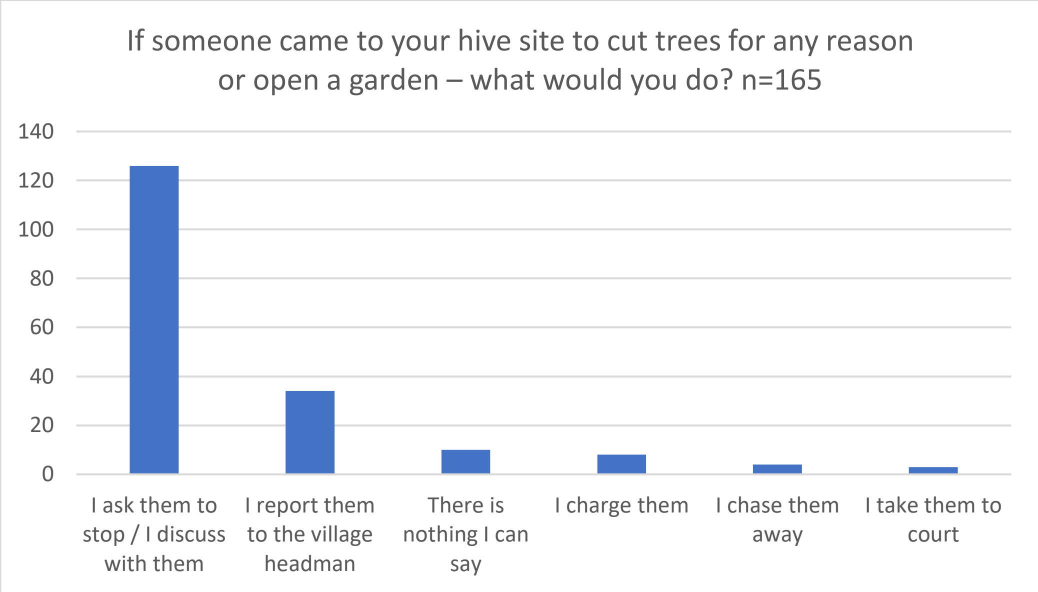

Figure 13. Questionnaire answers to a question about excluding other users from hive sites. *Source: Questionnaire Survey 2016*

Fire mitigation

Clauss noted that Zambian beekeepers were worried about the impact of late fires between August and October because these fires scorch the trees and damage many of the flowers of key nectar species (Clauss, 1992). This view was reinforced by a representative from the Provincial Forestry Office in Solwezi in 2014 who said that all beekeepers know the impact of fire and favour early burning as a mitigation measure (KIIPFO14, Solwezi, 2014).

Beekeepers mentioned during the FGDs, that they protected their hive sites from fire, usually in response to a deliberate question, for example, "*Is fire a problem for beekeepers*?" or "*How do you protect the places where you hang hives*?" or when asking specifically about how beekeepers ensure there will be enough trees for hives in future, "*How do you protect small trees from fire*?". Beekeepers were very ready to explain and their responses were illuminating as the interview extracts below show in Box 14.

Box 14. Extracts from Focus Group Discussions about beekeepers' views and actions in relation to fire

JL: Is fire a problem for beekeeping?
BKPRS: What kind of fire?
BKPRS: Early burning is good, late is bad. Early burning protects the hives and also deters the *chibudi* (honey badger) - they are put off. Yes, we do early burning.
(FGDKAN15, Kanongesha, 2015)

JL: Is bush fire a problem?
BKPRS: Yes, it destroys flowers. Early burning is the solution and the Forestry Department used to get people to do that in June and July. We beekeepers do that now, we burn here and there, where are hives are. In June.
JL: You also need trees to make hives - is there a shortage?
BKPRS: Yes, with more beekeepers. But we select trees, we do not use all. Also, small trees are protected when we do early burning.
(FGDMUZH15, Muzhila, 2015)

JL: How do you protect the places where you hang hives e.g. from fire?
BKPRS: We do early burning - to protect the flowers from late fires. Yes everyone does early burning.
JL: You need big trees to make hives - how do you protect the small trees?
BKPRS: We protect by not cutting carelessly and through early burning.
BKPRS: We do not allow careless cutting - so we can get hives in future. That is also why we do early burning.
(FGDSAL15, Saluzhinga, 2015)

JL: How do you protect these places where the beehives are?
BKPRS: We do early burning to protect the hives.
JL: When you make hives - the trees die - can there be a shortage of trees for hive-making?
BKPRS: That is why we do early burning - to give hives in the future.
(FGDKAL15, Kalwisha, 2015)

Beekeepers in 16 out of 20 FGDs said they sometimes or always practised early burning. In the remaining 4 discussions fire was not discussed. No group said they did not do it. As can be seen from the interview extracts beekeepers know why they are doing it, "*what kind of fire*?" was an illuminating comment from one beekeeper. They clearly know that early burning prevents more destructive late season fires. Beekeepers mentioned that they sought to prevent these late season fires to protect the flowers, their hives (and the bees and honey therein) and small trees.

Beekeepers were asked about fire management in the Questionnaire Survey:

(i) Beekeepers were asked if they protected their hive sites from fire, and if so how (Table 24).

Table 24. Beekeepers' response to protecting hive sites from fire n=165

Question	Answer	Beekeepers response n=165	If yes explain in detail
Do you protect your hive site from fire?	Yes	146 (88%)	145 people said they did this through setting fire in and around their hives sites in May and June when the grass was slightly wet, but dry enough to burn. 2 people said they would try and extinguish a fire if it was threatening to burn a hive site. 2 people said they slashed the tall grass in and around their hive sites.
	No	15	
	No data	4	

Source: Questionnaire Survey 2016

(ii) Beekeepers were asked how they balanced hive-making with ensuring sufficient future trees for hive making, and fire management was one of the multiple-choice answers. 89% of beekeepers said they carry out early burning as a protective measure to balance tree use with replenishment. This data is shown in Figure 14 (later) combined with other results.

Subsequent FGDs held in 2016 and 2018 supported the same findings. In a meeting with a small group of beekeepers in Katemwa, Chibwika, in August 2016 the issue of fire and burning was discussed. "*Early burning is done, everyone does it, it is traditional. We do it thinking of the future, thinking of the flowers and thinking of the beehives. Beekeepers take care of the trees. Non-beekeepers can burn at any time*" (FGDKAT16, Katemwa, 2016).

A discussion was held with a group of seven beekeepers near Chief Chibwika in June 2018. The beekeepers said that they prevent trees from being damaged by late fires. "*We set the early fires in the place where we hang our hives. If we did not do this, late fires would come and kill the flowers*", (FGDSIM18, Chibwika, 2018). During this discussion the implications of rising numbers of beekeepers was raised. It was put to the group that as more beekeepers engage in beekeeping then more and more of the forest gets used for hive hanging, "*So as there are more beekeepers – then it will get to the point when one person's hive site comes up against another person's hive site. And if each beekeeper sets early fires then we could say that more beekeepers, means more of the forest is subject to early burning*?". The beekeepers readily concurred with this view. "*Yes that is exactly what is happening*" (FGDSIM18, Chibwika, 2018). On who causes late fires they said that people who are not in beekeeping have a number of reasons for causing late-season fires, particularly people hunting for small animals.

During the extended hive site visit in Ikelenge the principal beekeeper explained that whilst the fires seen in June appeared to scorch the trees and burn the leaves the fires were 'harmless', unlike fires in October which kill small trees (EXHIKE18, Ikelenge, 2018). Other data collected during the extended hive site visits about early burning practices is reported later in this chapter.

These answers show that:

- Early burning is commonly and widely practised – beekeepers in 16 out of the 20 of the FGDs said they practise early burning and 89% of beekeepers interviewed during the QS said they carry out early burning to protect their hive sites from fire
- Beekeepers can explain clearly that the purpose of early burning is to prevent damaging late season fires

Forest management actions

In her summary about perceived positive and negative linkages between forest beekeeping Mickels-Kokwe, (2006) noted that beekeeping potentially encouraged the '*community to look after forest*' and for beekeepers to engage in '*sustainable woodland management practices*'. The previous section shows results in relation to one practice – early burning. This section presents results concerning other practices and decisions. Beekeepers and non-beekeepers were asked about actions they took to maintain or protect trees and forests. This question was posed in different ways. Everyone was asked about actions they took as individuals (Figure 14) and everyone was asked about the community as a whole (Figure 15) and additional questions were posed to beekeepers only, including the question about protecting hive sites from fire previously reported in Table 23.

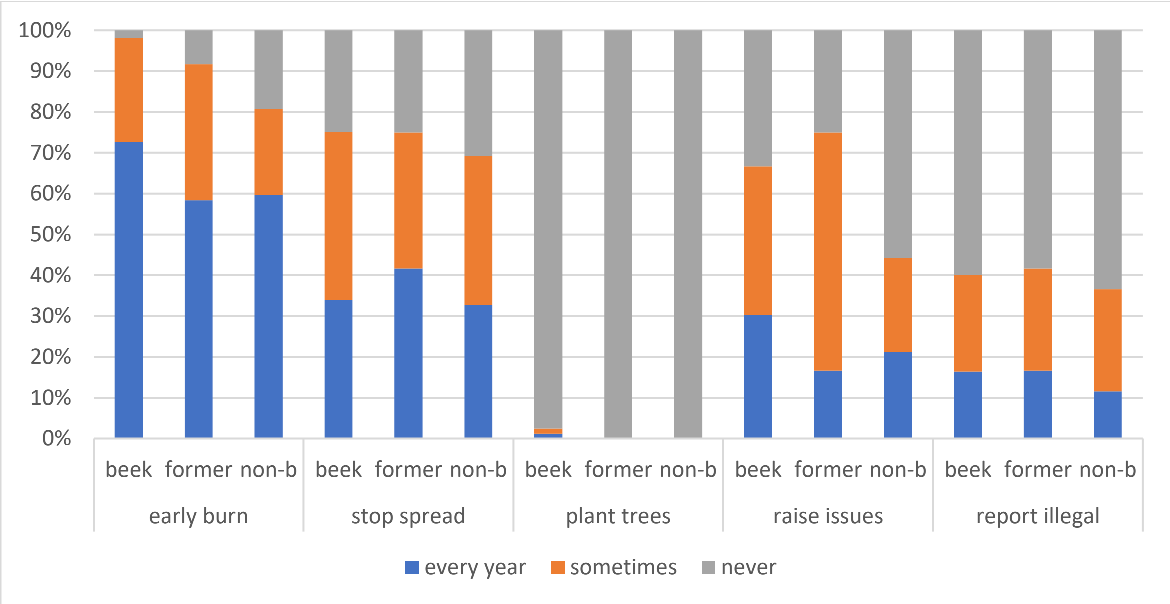

Figure 14. Percentage of people who take different individual actions to support forest maintenance n=229. Source: Questionnaire Survey 2016.[30]

[30] Beek=beekeeper. Former=former beekeeper. Non-b=non-beekeeper. Early burn = the respondent practices early burning. Stop spread=respondent tries to stop the spread of a fire. Plant trees=respondent plants trees. Raise issues=respondent raises issues about deforestation and forest management at village meetings. Report illegal=respondent reports an illegal forest activity to the Forestry Department. See Appendix 2 for QS form.

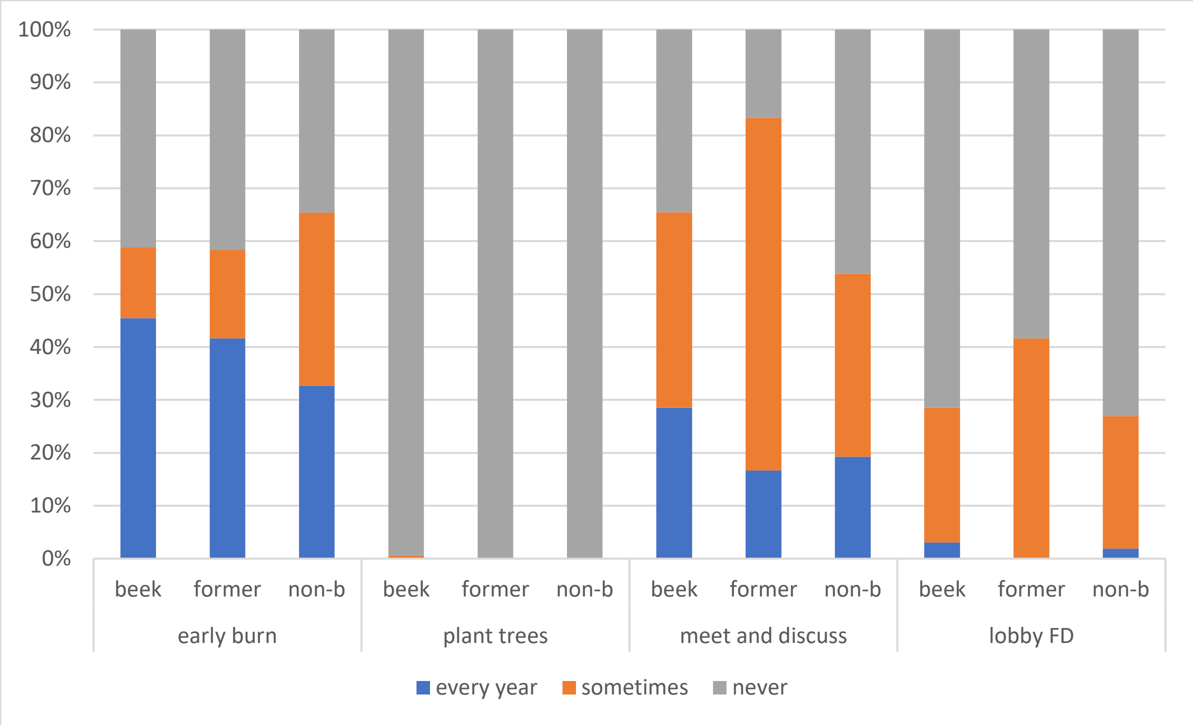

Figure 15. Percentage of responses about action taken at the community level to support forest maintenance n=229. Source: Questionnaire Survey 2016.[31]

As Figures 14 and 15 show the actions which were reportedly taken most often by both individuals and at community level are actions to mitigate forest fire. Concerning early burning, 73% of beekeepers said they carried out early burning every year, whilst just 2% of beekeepers said they never did this. For non-beekeepers the results were 60% every year and 19% never. These questions asked about forests in general and did not specify hive sites. The next action with the highest frequency was 'meet and discuss'. In full the statement in this multiple-choice question was 'Community members meet and discuss forest conservation issues'. Tree planting was very infrequently mentioned as an action taken to support forests.

[31] Beek=beekeeper. Former=former beekeeper. Non-b=non-beekeeper. Early burn=respondent said the community work together to practice early burning in some portion of the forest. Plant trees=respondent said that the community work together to plant trees. Meet and discuss=the respondent said that the community meet and discuss issue about forest conservation. Lobby FD=respondent said the community lobby the FD about forestry matters.

One question to beekeepers only was framed in relation to the specific issue of tree use for hive making (Figure 16) and another in relation to hive site protection from fire (already reported in Table 23).

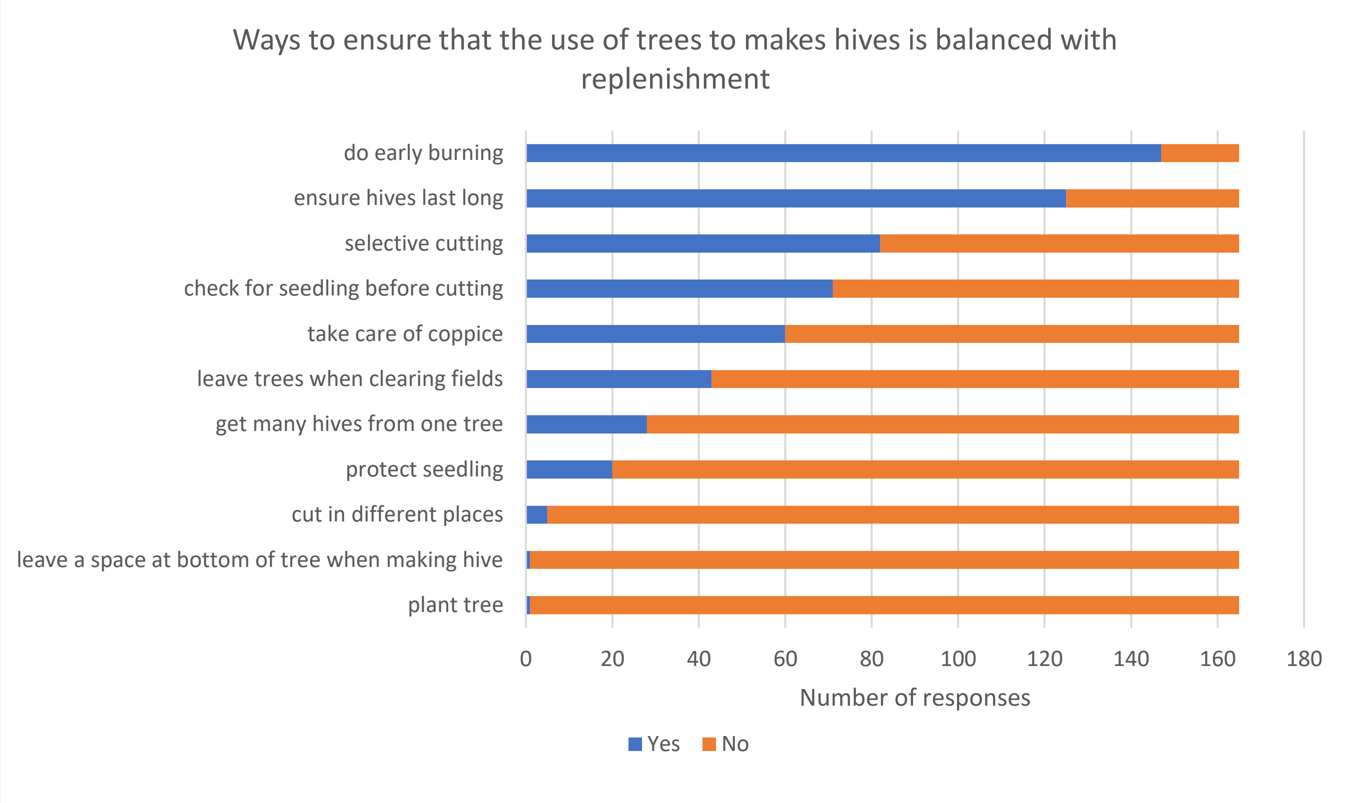

Figure 16. Responses given by beekeepers (n=165) in answer to the question, *How do you balance making hives with ensuring there will be sufficient trees in future?'*

The practice of early burning was the action taken by the largest number of beekeepers to balance tree use with replenishment and this has been previously discussed. The second most oft-cited method employed is '*ensure hives last a long time*'.

Given that '*ensure hives last a long time'* was given as the second-most frequently mentioned answer to a question about balancing tree use with future supplies this answer is worth interrogating. There are two main ways to '*ensure hives last a long time*' and that is (i) choosing more durable species for making hives (ii) ensuring occupancy by bees, as empty hives rot more quickly than occupied hives. Beekeepers in Village Headman Sampasa (FGDSAM15, Sampasa, 2015) said a hive will last 2-3 years with bees, whilst those in Mavunda (FGDMAV15, Mavunda, 2015) said 4-5 years with bees and 1-2 years without bees.

Beekeepers in Muzhila (FGDMUZH15, Muzhila, 2015) said a hive can last 10-15 year with bees or 1-2 years with no bees. On further enquiry one beekeeper defended this claim by saying he is using beehives his brother left in 2007 and that durability depends on tree species used. Beekeepers at Kasochi Central (FGDKASC15, Kasochi, 2015) said the same, 10-15 years with bees and 1-2 without bees. This data corresponds with that reported by Clauss that the average lifespan of bark hives ranges from 2 to 10 years depending on species (Clauss 1992:p48).

Whilst species choice influences the durability of hives and so influences the rate of tree use to make hives, it is on reflection unlikely that beekeepers choose specific species *in order* to reduce tree use. Based on the conversations held with beekeepers during the extended hive site visits beekeepers selected trees for hives based on what is suitable – according to the parameters of size, straightness and bark quality - and available.

Beekeepers employ a number of techniques to ensure their hives are occupied, explaining, *"We check them. If they are not occupied we move them. We chase squirrels away. If bees have not come we put wax and propolis in the hive to attract bees. We go once a month to check them"* (FGDKANC15, Kanyama Central, 2015). Clauss also reported on the actions beekeepers take to increase occupancy which included different ways of baiting the hives, careful hive site selection and the repair, cleaning and, if deemed necessary, the relocation of unoccupied hives (Clauss 1992). However, again, on reflection whilst hive occupancy can extend the life of a hive and reduce tree use, the main motivating factor for achieving good hive occupancy is most likely the simple fact that more bees means more honey. As with many forest beekeeping practices, one action has more than one consequence. Actions are part of whole system with many embedded parts with coincidental outcomes.

The third most oft-cited action taken to balance tree use with replenishment was 'selective cutting'. Beekeepers wait until a tree is big enough to use for hive-making. This is discussed in more depth later in the chapter.

Questions about forest management yielded a range of different responses. Fire mitigation was the answer which was given by the greatest number of people, including non-beekeepers. The difference in answers between beekeepers and non-beekeepers is not great (Figures 15 and 16) and indicates that forest is important for everyone and beekeepers are not alone in the actions they take. It must be noted however that the questions which were posed to both beekeepers and non-beekeepers were about forest in general and not hive sites in particular. The questions posed to beekeepers only were more specific, with one question specifically about protecting hives sites from fire and one question specifically about balancing tree use with tree protection.

8.3 Area of forest used by forest beekeepers and impacted by their actions

Field work was undertaken in 2018 to investigate in more detail how beekeepers used and protected their hive sites. Two extended hive site visits were undertaken, accompanied by beekeepers, in June 2018. Both sites were about 15km from a road. The locations of the hive sites are shown in Figure 17.

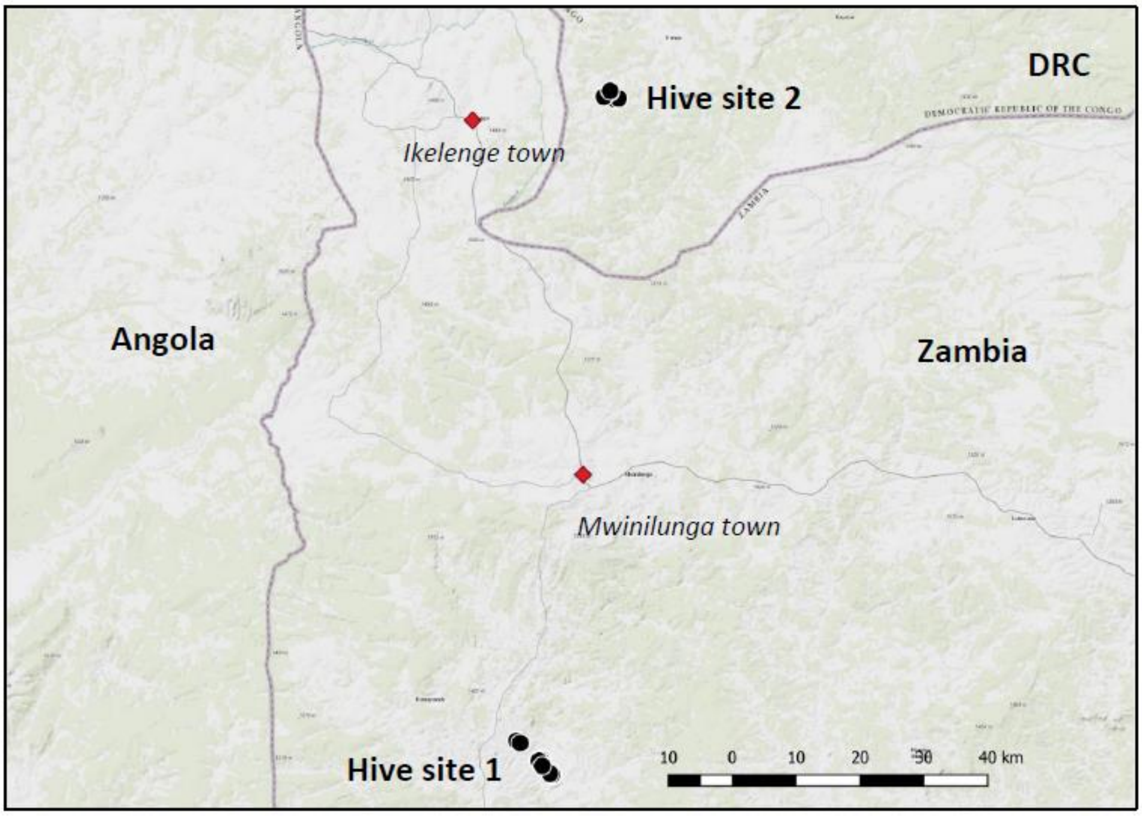

Figure 17. Map showing location of two hive sites visited, in relation to main towns and the Zambian border.*Map created using QGIS 3.4 using ESRI Topo base map*

The questionnaire respondents said that most sites are between 2-3 hours walk from the roadside and most beekeepers have at least two hive sites because, "*If we fail to get honey from one site we can be sure to get from another*", (FGDMUZH15, Muzhila, 2015). The aims of the hive site visits were to understand how beekeepers protect these sites from damaging fires and to estimate the area of the hive sites with a view to estimating the extent of the forest used by beekeepers.

The visits took place at the beginning of the dry season, relatively cold, no rain. The first site visit was led by the principal beekeeper (NP) and his friend and helper (BN). The second site visit was led by the principal beekeeper (DGS) and his friend and helper (KJ) who was also one of the enumerators who helped with the Questionnaire Survey in 2016. NP the principal beekeeper from the first site visit chose to join the second site visit as a visitor.

These extended hive site visits involved camping in the forest for four and three nights respectively. During each day the beekeepers worked in the forest. They hung hives that had been made some weeks earlier, made new hives and burned the grass. In June the grass is still green in parts, elsewhere dry and flammable. On the way to the first hive site the principal beekeeper (NP) ignited some dry grass some distance prior to reaching the main hive site. On being questioned he answered that it was important to protect the forest everywhere because the bees travel long distances and he may need other forest places in future. During the subsequent three days of work he walked throughout the hive site hanging hives he had made in March and making new hives. He also set fires whilst walking from one side of the hive site to the other. He set fires where there was a clear build-up of dry grass, sufficient for the burn to spread. He explained that at this time of year the fire does not burn hot and does not damage trees. The main purpose is to avoid late season fires which would be extremely hot and (i) scorch flowers in bloom (ii) disturb bees, harming them or causing them to abscond, (iii) kill small trees, needed for future hive making and for nectar. In the second hive site the beekeepers were complaining that the grass was still too wet and the burns they set did not spread far. The beekeepers did not create firebreaks and they did not try to burn everything. They burned patches, largely determined by where they happen to be working and where there is enough dry material to ignite. The result was a mosaic of burnt and unburnt areas. It is not necessary for fire to reach every part of a hive site for that area of forest to be protected as the burned areas act is firebreaks protecting the unburned areas from spreading fires that occur later in the year.

It was important to gauge the extent, in forest area, impacted by this June burning. The Questionnaire Survey revealed average hive ownership is 115[32], and FF Ltd. buy honey from 3000 beekeepers in Mwinilunga and Ikelenge, which works out to be 3000 x 115 hives = 345,000 hives. Beehives are spread very thinly. A hive site is not a collection of closely located hives as might be found in commercial apiary. It is a large forest area with widely spaced hives in trees. There are three reasons for the sparse distribution. Beekeepers do not wish to carry beehives, once made, very far. Therefore, the location of the hive is partly determined by the natural distribution of suitable trees (size, species, shape, quality of bark). Beekeepers site the hives where they make the hives. Beekeepers need to find trees with 'good branches' in which to hang the hives. The branches must allow a hive to be wedged safely without any danger of falling and enable the beekeeper to stand safely in the tree during harvest. Such trees are scattered. "*Sometimes I walk a long way with a hive on my shoulder looking for a tree with good branches. It is tiring*", (EXHCHI18, Chibwika, 2018). Finally, beekeepers place a good distance between hives because whilst harvesting a hive, bees from a neighbouring hive are likely to smell the honey and come to rob from the hive being harvested. Beekeepers avoid this stress by putting distance between hives. With a rough estimate of total hive numbers, it should be possible to work out total area of woodland subject to early burning provided the ratio of area to hive numbers in a typical hive site is known. Figures 18 and 19 and Table 25 provide data about the hive sites.

[32] Two outliers of more than 1000 hives per beekeepers were excluded from this average

Table 25. Recorded metrics from two hives sites

	Number of fires ignited	Furthest distance between a fire ignition and its closest hive	Spread of each fire	Estimated area of hive site, using two methods*.	Number of hives seen within the hive site (newly hung, already sited and drying before siting)
Chibwika	19	A fire was set 4498m before the main hive site.	Unknown	135ha 300ha	30
Ikelenge	13	382m.	Unknown	163ha 195ha	29

*See chapter 5 on methodology for the two methods for estimating hive site area and repeated here in Box 15.

Box 15. Method used for estimating the size of hive sites

The areas of both hive sites were estimated by creating a polygon in QGIS by using the most exterior GPS points where fires were set, as external vertices (method a). In each case a second area estimate was made by using, as the vertices, the most exterior fire ignitions and the most exterior hives i.e. more points (method b). Method a gave lower estimates of hive site sizes. The size of the polygon was assumed to be the size of the hive site even though the hives were sparsely and non-uniformly distributed within the most external points. All points were collected in the course of following the beekeepers as they worked.

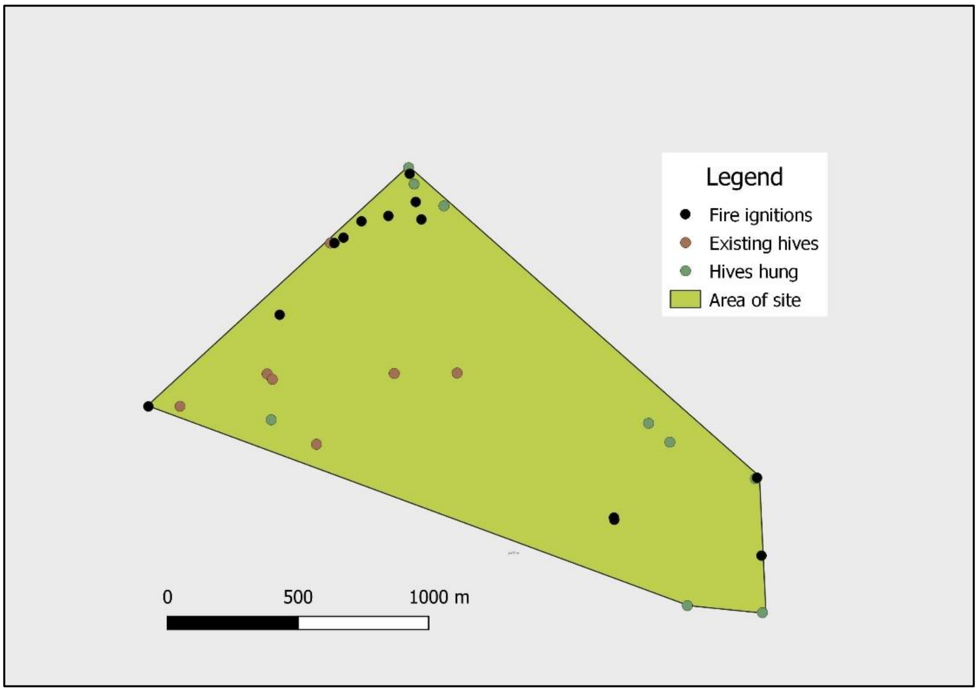

Figure 18. Map of the hive site in Ikelenge showing fire ignition points, existing and new hives

Map created by author using QGIS 3.4 using data collected during fieldwork using app GPS Waypoints

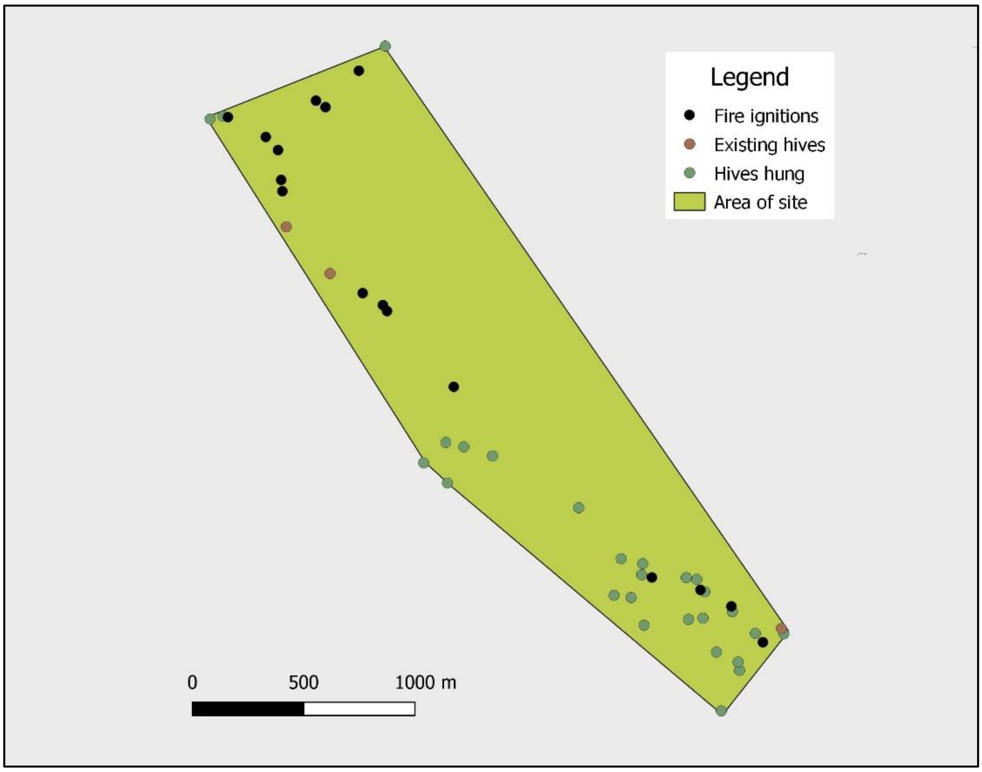

Figure 19. Map of the hive site in Chibwika showing fire ignition points, existing and new hives

Map created by author using QGIS 3.4 using data collected during fieldwork using app GPS Waypoints

As explained in chapter 5 and Box 15 two estimates were worked out to gauge the size of a hive site. Table 26 shows how the recorded metrics from the two hive sites can be used to work out a ratio of hive numbers to hectares. If we assume that a hive – or more accurately a collection of hives – causes some level of fire management over an area of forest, these ratios can be used to work out how much forest is managed in total. This relies on knowing the total number hives. If the 2016 hive ownership data is used (115 hives per beekeeper on average) this would be 115 x 3000 = 345,000 hives. If the 2015 hive ownership data is used (89 hives per beekeeper on average) this would be 89 x 3000 = 267,000 hives.

Table 26. *Estimates of extent of forest impacted by fire mitigating actions worked out using different assumptions.*

	Size of hive site	Number of hives	Ratio of ha to hives	Hectares of forest which could be said to be 'hive site'	
				If 345,000 hives	If 267,000 hives
Size of the hive site in Chibwika using method (a)	135 ha	30	4.5:1	1,552,500 ha	1,201,500 ha
Size of the hive site in Chibwika using method (b)	300 ha	30	10:1	3,450,000 ha	2,670,000 ha
Size of the hive site in Ikelenge using method (a)	163 ha	29	5.6:1	1,932,000 ha	1,495,200 ha
Size of the hive site in Ikelenge using method (b)	195 ha	29	6.7:1	2,311,500 ha	1,788,900 ha

Source: Calculated by author

The calculations applied to the results shown in Table 25 have resulted in eight different estimates of total area of forest used for forest beekeeping. These range from the smallest estimate of 1,201,500 ha to the largest 3,450,000 ha. The whole area of Mwinilunga and Ikelenge combined is 2,111,600 ha (City Population, 2018) which puts both these estimates in context. The larger of the estimates suggests more forest is used for forest beekeeping than is available, whilst the smallest estimate suggests that 57% of the total land area [not just 57% of the forest] is used for forest beekeeping. Even this lower estimate is a staggeringly large area.

There are possible causes of error here. It is possible that the average hive ownership recorded in the Questionnaire Survey is an overestimate. One beekeeper mentioned that some people exaggerate the number of hives owned. Figure 11 in chapter 7 shows a sharp increase in hive numbers between 2015 and 2016, a trend not wholly explained. Another way of ground-truthing these estimates is to triangulate the research results with honey supply data from Forest Fruits. These honey supply metrics are shown in Box 16.

Box 16. A look at the honey supply metrics

The 2015 harvest was purchased by Forest Fruits Ltd. starting in late 2015 and extending into early 2016 and they reported a total purchase of nearly 1000 tonnes, from about 3000 beekeepers. In 2016 beekeepers provided information that they had, on average, 115 hives each at the time of asking –however they also reported that in the previous year, in 2015, when the 1000 tonne purchase was made, the average was 89 hives each (see Table 17, chapter 7).
Through discussions in 2015 beekeepers said they normally crop honey from about 53% of all hives because some may not be occupied with bees, whilst the bee colony in others is too small to make cropping worthwhile.
Using the FF Ltd purchase figures, these figures imply that each beekeeper sells, on average, 333kg of honey to Forest Fruits Ltd. (333kg x 3000 beekeeper = 999 tonnes). If, in the 2015 season beekeepers cropped 53% of 89 hives each this would suggest they harvested 333kg from 47 hives i.e. 7kg per colony. This is slightly less than the yield figure of 8kg per hive that has been worked out by Forest Fruits Ltd. over the years. The discrepancy might be explained by the fact that not all honey is sold. Honey is eaten at home and honey-beer making is popular and widespread in the area. Furthermore, some honey is sold to other buyers in addition to FF Ltd. The metrics are however very plausible and suggest that using an average of 89 hives per beekeeper is not an overestimate.

The honey supply estimate appears to be realistic if compared to the honey purchased made by Forest Fruits Ltd. and are based on the 2015 figures of average hive ownership of 89, not

115. This suggests that using the average hive ownership figure of 89 is realistic. That 57% of the total land area of the two districts might be being used for forest beekeeping is still a staggering result. That this area of forest may be being protected by fire mitigation measures by forest beekeepers more often maligned as forest destroyers than forest protectors is extraordinary.

Other information supports the evidence that a very large area of forest is used for forest beekeeping. In the Questionnaire Survey 28% of beekeepers feared there would not be enough forest to cater for more hives in future, possibly suggesting a lack of 'spare' forest in some places. Perhaps more crucially, Zambian beekeepers are not confining their hive hanging to Zambia, instead readily utilising forests across the borders in Angola and DRC. Indeed, on plotting the location of the second hive site on the ESRI World Topo basemap, it became clear that it was actually located 7 km across the border into DRC. See Figure 17. Interestingly the tendency of forest beekeepers to disregard national borders is nothing new, as reported elsewhere, '*The green border in North Mwinilunga is crossed by nearly every beekeeper in order to suspend most of the hives in the largely untouched Zairean forests*' (Clauss 1992:p52).

Notwithstanding the uncertainties in these metrics this data does plot individual hive locations in actual forest hives sites for the first time, as far as we are aware. The exact area of forest being used for forest beekeeping in Mwinilunga and Ikelenge is not known – but it is certainly a vast area.

8.4 Does forest beekeeping cause forest loss?

In examining the relationship between the beekeepers and the forest it is necessary to consider the issue most often mentioned as the negative relationship between forests and forest beekeeping. It is an issue which many external observers find unpalatable i.e. that in making bark hives, trees are killed. Indeed, the perception that beekeepers damage the forest through bark-hive making is possibly more widely mentioned, than the view that beekeepers maintain forests, for example, Kommerskollegium, 2009, ITC, 2015, Nature's Nectar, 2020. Interestingly, representatives from the Forestry Department met during this research did not share this view; "*bark hive beekeeping does not cause deforestation because beekeepers are selective*"

(KIIDFO14, Solwezi, 2014) and "*the harm caused by bark hive making is blown out of proportion – beekeepers make maximum use of trees*" (KIIKEN16, Mwinilunga, 2016).

This research is concerned with the net effect of beekeepers' actions and the use of forest trees is necessarily a contributing factor towards the overall outcome.

The impact of bark-hive making on forests was considered by Clauss in 1992 who made an estimation based on the whole of North-Western Province. He estimated the total number of beekeepers and their rate of hive-making and compared this to the total forest available in the whole of the North Western Province i.e. 70% of 125,800 km2. His results suggested that 3.1 trees were used per km^2, whilst he estimated the number of suitable specimens at 224 trees per km^2. See Box 17 for a reflection on Clauss's estimations compared with the hive to hectare ratio discussed above.

Box 17. Comparison of Clauss's estimates of tree use against hive density evidenced by this research

Clauss worked out that 3.1 trees were used per km2, each year, which works out at 1 tree per 32 ha. If we assume – as evidenced by the work of the beekeepers visited during this research, hives are sited more or less where the hives are made there should be a good correlation between number of hives sited per ha and trees used per ha. Clauss estimated that 1 tree was used per 32 ha – which would mean (if each tree made 1.7 hives) that 1.7 hives could be found in 32 ha or 1 hive found in 18 ha.

The ratio worked out from this research suggests 1 hive per 4.5 to 10ha (see Table 25) – somewhat more densely located than Clauss's estimate of 1 hive per 18ha. However, if we recall that Clauss's estimate refer to trees used (based on hives made) each year and not an accumulated figures, and that hives last for between 3-10 years, it is possible to see that the hive densities revealed in this study are commensurate with Clauss's estimates.

IFAD (1999 reported in Mickels-Kokwe 2006) estimated that Clauss's estimations allowed for a regrowth period of 72 years and concluded that '*the overall number of trees remain in a range that implies relatively low levels of damage, which are likely to be within the limits of replacement*' (Mickels-Kokwe 2006:p26)

Mickels-Kokwe used the same metrics, and then using assumptions for increase, extrapolated up to 2006. Her assumptions included an increase in number of beekeepers, an increase in number of hives made per beekeeper and a decrease in forest area. As a consequence of her extrapolations she concluded that in the intervening years (from the IFAD calculation in 1999 to her re-assessment in 2006) the rate of tree use per km^2 had risen from 3.1 to 4.9. She also concluded that for this rate of use to be sustainable, given that only 224 trees per km^2 are suitable for bark the regrowth period would need to be 45 years, whereas other data (Stromgaard, 1985) suggested that trees of bark-making dimensions are 50 years old. She concluded that '*the outcome of the updated calculations is disturbing*' and '*this level of out-take is beyond the gross regeneration level of the resource*' (Mickels-Kokwe 2006:p15). Mickels-Kokwe nevertheless warns against jumping to conclusions that bark-hive beekeeping causes deforestation and explains that the selective nature of the harvest minimises the overall impact of the activity. She does suggest four possible concerns:

1. Trees suitable for hive-making may become scarce as a result of unsustainable use, obliging beekeepers to use smaller trees

2. The constant off-take of suitable trees may erode the genetic base

3. Removal of trees for hive-making may reduce nectar availability, because some of these trees also produce nectar

4. Her fourth point is largely a combination of points 1 and 2 i.e. that pressure on specific trees may change the woodland composition

(Mickels-Kokwe 2006:p16)

No attempt is made here to repeat this extrapolation exercise based new updated assumptions. Instead this question is addressed from a different perspective, using results collected through this study.

During the camping trips a spontaneous decision was taken to measure trees used to make hives. Twenty-five trees and their hives were measured directly or measured by calculation[33].

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[33] In some instances the hives were measured and the width of the tree was calculated based on a multiplier

The methodology was somewhat rudimentary because this was not planned. The average diameter over bark of trees used to make hives was worked out to be 34.85 (SD=5.07) cm and the average hive diameter was 30.24 (SD=0.97) cm.

Clauss (1992) reports that in Mwinilunga hives are typically 20-25cm in diameter (Clauss 1992:p48), whilst **Simplified beekeeping with bark hives** (Forestry Department, n.d.) mentions that hives should be 120cm long and 30cm diameter.

These results suggest that hives made in 2018 are no smaller than in previous years and suggest that Mickel-Kokwe's first warning that beekeepers will be constrained by lack of hive material and will be forced to user smaller trees appears not to be the case – or at least not in these two locations. During interviews beekeepers were asked about this issue. They explained that if they face difficulty in finding trees suitable for bark hive making they do not use smaller trees because that would be a waste of effort. Smaller hives may not be able to attract or accommodate a bee colony and may result in lower honey yields or total failure. Their strategy is to move further afield and look in another place. In Mwinilunga and Ikelenge beekeepers are not constrained provided they are willing to walk for long distances.

When seeking trees to make hives beekeepers are highly selective, choosing trees of the right species, the right shape (straight) and the right width. Then before removing bark they cut and peel a small patch of bark to test its pliability. If it cracks they leave the tree. It is these particular requirements – also explained in detail in Clauss's work – that led to the estimation of 224 suitable trees per km^2. Yet forest ecologists agree that miombo woodland is resilient and able to withstand moderate harvesting pressure without its regeneration potential being harmed. One study in Tanzania looked at miombo woodland experiencing varying levels of utilisation and reported that the general trend was falling tree species richness, diversity and abundance with increasing disturbance yet '*… in areas of moderate utilisation these values were retained, and species richness and abundance initially increased with disturbance*', (Jew et al 2016:p149). The study agreed with other ecologists that management strategies can accommodate low to moderate levels of utilisation whilst maintaining tree species richness, diversity and abundance (Jew *et al*., 2016).

According to FAO, deforestation is *the conversion of forest to another land use or the long-term reduction of tree canopy cover below the 10% threshold* (FAO, 2007). The highly selective nature of tree use for bark hive making does not bring about a change in land use nor lead to a reduction of tree canopy cover below 10%. Any claim therefore that beekeepers can potentially cause deforestation is wholly false. If, however an area of forest has been heavily used by beekeepers for hive-making for some years or if the forest has been cut over for another purpose it might happen that beekeepers cannot find sufficient material to make hives. They could face a local scarcity of the specific trees that meet their exacting requirements, resulting in beekeepers being constrained from expanding production because of lack of hive material, a point raised by Mickels-Kokwe (2006). In such an instance it would be the beekeeper who suffers and not the forest, which would be able to recover from the harvesting pressure, given time, as attested by forest ecologists who agree that '*miombo woodland actually regenerates fairly easily and prolifically, provided that regeneration is not inhibited by late dry season fires or by cultivation*' (Dewees *et al*., 2011:p7).

The second point, that the constant removal of suitable trees could erode the genetic base is also unlikely. Information about age of seed-bearing is hard to find. One report notes that '*Julbernardia globiflora* reproduces while still a small sapling[34]' and '*Brachystegia* only reproduces when the plant emerges in the canopy' (Campbell, 1996:p61). Notwithstanding the relative slowness of *Brachystegia* to produce seed, these smaller trees are not used to make bark. Trees of dbh 34 cm are likely to be between 40-60 years old (Stromgaard 1985) and have had several years of seed bearing by the time of harvest. On *Brachystegia spiciformis* it is noted that '*The ground under the trees is frequently saturated with seedlings*' (Bingham, 2010). The tree species used for hive-making are not uncommon and not endangered. *Brachystegia spiciformis* for example is reported to be the most widespread of the *Brachystegia* species (Bingham 2010) and the Zambia ILUA reports that *Brachystegia spiciformis* and *Julbernardia paniculata* to be the two most abundant species in Zambia (ILUA II, 2016:pvii). These happen to be two of the

[34] JP starts flowering already when 10-15 years old – page 118 of Clauss 1992

most preferred tree species for hive-making. Bark hive making has been occurring at scale for decades in Zambia and these two tree species are still abundant, suggesting that fear that they are failing to regenerate because seed-bearing trees have been removed is unfounded.

The third point is about nectar availability. One could make the same argument as above i.e. the exacting requirements of beekeepers is such that even heavy bark-hive making pressure has relatively low overall impact on density of trees. The total honey harvest has been increasing year on year, with no signs of nectar shortage (KIIDAN15, Lusaka, 2015). Work done by Chidumayo indicates that miombo responds well to low-level harvesting pressure, reporting, '*Where these [biomass] losses were relatively small in relation to the standing biomass, no obvious impact was observed in standing biomass stocks. Indeed, a decrease in tree population appeared to reduce competition and enhanced the growth of the surviving trees and in many cases the standing biomass either remained the same or actually increased*' (Chidumayo, 2013:p158). The impact of light canopy removal on seedling recruitment is also noted by other forest scientists. '*The high level of recruitment of saplings from the seedling pool that have hitherto been stunted suggests that further development of seedlings with well-established roots is suppressed by the woodland canopy. Lees (1962) also observed that old but stunted seedlings of many miombo woodland trees are heliophytic and require high light intensities to develop and grow*' (Campbell 1996:p67). The implication of this capacity to sustain regrowth is that miombo woodland can sustain heavy cutting pressures (Campbell 1996).

The hive sites which were visited in 2018 were 15 km away from the roadside and the landscape which was traversed to reach them comprised permanent crop land, temporary crop land and young secondary forest. This young secondary forest was re-growing after the cessation of cassava farming. These young forests produce nectar many years before any stems are large enough to yield bark suitable for hive-making. Walking through these young melliferous forests, as was done on the way to the remote hive sites, throws a stark spotlight on the issue of bark-hive making. These young forests were essentially unusable for beekeeping, not because of a lack of nectar but because of a lack of trees large enough to make bark hives. The reliance on bark for hive-making is not a problem for the forest – which has many far more serious pressures to deal with and can recover from the far more impactful pressures of cutting for cassava growing (McNicol, Ryan, & Williams, 2015) and charcoal making (Kalaba, Quinn, Dougill, & Vinya, 2013; Syampungani, Tigabu, Matakala, Handavu, & Oden, 2017). It is a potential problem for beekeepers. Beekeepers can really only do bark-hive beekeeping where there enough suitable trees and should they ever be in short supply it will be the beekeepers who notice first. Their requirements are so exact and demanding that a forest without suitable trees would probably look no different to any other observer. Yet, 14 years on from Mickel-Kokwe's 'concerns' these forests are yielding ever greater quantities of honey, whilst the practices have not changed. Her more pragmatic warning against 'jumping to conclusions' seems valid.

Given the likelihood that forest beekeepers are most likely to notice a shortage of suitable trees for making bark hives before any outsider researcher using hard-to-measure data can accurately calculate when this might occur - it seems prudent to now turn to the voices (see Box 18.) of the beekeepers.

Box 18. Extracts from interviews

VH Sampasa
"If someone cannot find enough trees… so moves to another place to find trees for hive-making. Then after 2-3 years he can go back to the place he left because the smaller trees will have grown bigger".
(FGDSAM15, VH Sampasa 2015)

"Yes, trees dry out when we make the hives but we do it selectively. We leave the small trees to grow. We do not do it anyhow. It is true that in the old days there were many fewer beekeepers - that is why we are selective when choosing trees for hives. Yes, we move from place to place. Then we go back to the place we used earlier after 3-5 years. The smaller trees will be big enough. If you see the places where our ancestors kept bees and made hives - the trees are all big now".
(FGDKAN15, Kanongesha Palace, 2015)

Beekeepers: We don't change the hanging places - we replace a rotten hive with a new one on the same branch."
JL: The places you were using 10 years ago - are you still using now?
BKPRS: Yes.
(FGDMAV15, Mavunda, 2015)

“We use the same places. Same as our forefathers. If they rot we take down and put up new ones” and “Yes I am using the place my father used”.
(FGAKANC15, Kanyama Central, 2015)

JL: Making hives from bark - does it create a shortage?
BKPRS: We do it selectively. If we see a small tree that is suitable for hive-making we protect it until it is big enough.
(FGDKASC15, Kasochi Central, 2015)

JL: Making hives kills trees - how can you ensure there will be trees in future.
BKPRS: If we make hives here - we then leave the place until the trees grow again.
(FGDJIM15, Jimbe, 2015).

This section uses secondary data documented in earlier seminal works on Zambian forest beekeeping and new data collected in the course of this study. In asking ‘does forest beekeeping damage forest’ no attempt was made in this study to try and count trees and compare the rate of use with rate of replenishment. Instead a macro-level perspective was considered by asking whether there is any evidence that beekeepers are using smaller trees, for lack of ideal sized trees, and whether there is any evidence that bark-hive making was causing a reduction in nectar availability. In both instances the answer is no – in this case study area. The apparent lightness of impact of bark hive making on forest condition can be attributed to a number of different factors:

1. Beekeepers are very exacting in their requirements in terms of tree species, size, form and bark quality meaning the large majority of trees in the forest do not meet their needs and are left untouched

2. Miombo woodlands are very resilient to light level harvesting, and suffer no lasting damage and regeneration is aided where early burning is practised

3. The species most suitable for bark-hive making happen to be very common species

4. Finally – and this is interesting – beekeepers appear ready to walk extremely long distances and cover a lot of ground to find just a few trees per km^2 to meet their needs.

There is no evidence that bark-hive making damages forests. There is however, evidence that localised shortages of trees which have the exact criteria needed can become a limiting factor for beekeepers. It is likely that some nectar goes unharvested by beekeepers (although presumably it is available to many other insects) because they cannot always find trees to make bark hives in every melliferous location.

8.5 Participatory forest management

The forests where beekeepers hang their hives are not their private property. The new (2014) Zambia National Forestry Policy does make provision for communities to acquire stronger rights of forest use and ownership and this has been afforded support by the legal framework enacted in the Forests Act 2015 (KIIPFO18, Solwezi, 2018). Representatives from the Forestry Department explained that the provision for Community Forestry gave local people rights to customary land forest 'like a title' (KIIKEN16, Mwinilunga, 2016) and that the process involved selection of an area and approval by the chief and Forestry Department (KIIPFO18, Solwezi, 2018).

Implementation of community forestry was supported by the Decentralised Forest and Other Natural Resources Programme (DFNRMP), which started in 2014. The project, a collaboration between the Government of the Republic of Zambia and the Ministry for Foreign Affairs of Finland, delivered three components: (i) Institutional Development for Natural Resource Sector Devolution; (ii) Sustainable Forest and other Natural Resources Management; and (iii) Rural Entrepreneurship and Alternative Livelihoods. The project set out to succeed where JFM failed – and this included developing a Statutory Instrument for Community Forestry Management – providing the legal framework to turn '*de facto open access forests into community controlled forests*' (DFNRMP 2016:px). One of the pilot community forests was in the area of Chief Kanyama in Mwinilunga.

During one of the FGDs held in Kachikula in 2015 one of the beekeepers said that he wished that it would be possible for beekeepers to gain a title to the forests where they hang hives. He lamented the impossibility of normal people gaining leasehold title due to the high costs involved (FGDKAC15, Kachikula, 2015). This was prompted because a large area of forest used by forest beekeepers had recently been sold to an outside private farmer, much to the dismay of the beekeepers who lost access to this bee forest. At that time the beekeepers had no knowledge about community forestry.

During another FGD, beekeepers said they talked about the problem of tree-cutting by other people but could not see any solution other than obtaining a title deed for the forests where they hang hives, *"… but that would be impossible, because it is a large area"* (FGDMUZH15, Muzhila, 2015).

The roll out of the new form of CFM could potentially be one solution. Community Forests created under the auspices of the Forests Act 2015 will afford local communities strong legal rights to customary land forest for the first time, subject to certain conditions within a forest management plan signed by the Forestry Department. The Chief Technical Adviser (CTA) to this project said that when introducing this project to communities in the six pilot districts the benefit of secure rights was rated very highly by community members (KIIAA16, Lusaka, 2016).

Community forestry was raised in a discussion with a group of beekeepers in Kasochi Central in 2016. They said it would be difficult to achieve as a community because there were too many people wanting to use the forest for different purposes e.g. burning charcoal, beekeeping and caterpillar harvesting. When they were asked what they thought of the idea of having a beekeeper-only Community Forest they replied positively, *"yes we can do that, yes that would help us"* (FGDKAS16, Kasochi, 2016).

Community forestry was discussed also with a group in Kachikula in 2016. The group were told about the pilot project taking place in Kapundu (not far away) and were asked for their views. They said they welcomed the idea because it would stop the Chief from selling land. This group of beekeepers had experienced a recent loss of forest for beekeeping because of land sales and so this was of interest to them (FGDKAC15, Kachikula, 2015). When asked about how they would manage such an area they said they would make rules, and some regulations would be put in place. The ensuing discussion touched on the other users of forests, for example caterpillar collectors and pit-sawyers. They agreed that beekeepers benefit more from the forest compared to other people and consequently they would be willing to sit together to decide about the right area for a Community Forest. As the CTA for the DFNRMP had previously explained the option for communities to apply for Community Forests was now law and so they were entitled to request for the process. They did not need to be 'in a project' and this information was communicated to the group. They asked a number of questions, "*Why Kapundu*?" and "*Do people have to pay*?" (FGDKAC16, Kachikula, August 2016).

A group of beekeepers in Muzhila near the Kapundu Community Forest were interviewed also. The community forest of 200 ha was established in February 2016 as a result of a joint agreement between government and local people. The forest was subject to a community management plan which gave the community more secure rights over their customary land forest, as allowed for by the Forest Act 2015. As they had first-hand knowledge of the concept of the CF their views were particularly interesting. They expressed interest and support for CF but said also that the site that had been identified was too small to cover all their beekeeping areas. They perceived the CF as 'confining' them. They need to have many hives sites in different places to take advantage of the varying floral resources and the idea of one smallish concentrated forest did not meet their needs. They were also concerned lest they might be constrained from making bark hives within the CF as the management rules may not allow it or that they might be asked to pay a nominal fee for hanging their hives there in future, but they were not overly worried. The beekeepers didn't recognise any immediate benefits of the community forests for themselves but said that they thought it might help their children and grandchildren in the future since forest clearing for farming would not be permitted in the community forest, and so the forest would be maintained in the long term.

During the extended hive site visits in 2018 the same topic was discussed with the beekeepers in the two sites. In both sites the beekeepers expressed muted enthusiasm for the idea. However, they very rightly pointed out some legitimate concerns. Beekeepers see their hives sites as theirs, yet a CF forest would be for everyone. The size of the forest they needed for beekeeping was very large and even extended into forests outside the jurisdiction of their own Chiefdoms. How would that work? On rules they were more forthcoming saying that they would willingly protect such a forest if they were given the rights and the responsibilities to do so.

In conclusion this study learned that Community Forestry has been introduced relatively recently in Zambia and the beekeepers interviewed during the course of this study had little knowledge of what CF could offer them and had mixed views. Their opinions ranged from enthusiasm, to interest, to uncertainty. Apart from the pilot Community Forests initiated under the auspices of the DFNRMP there was no apparent evidence of local people adopting community management regimes similar to PFM arrangements.

8.6 Conclusion

Looking at the *Forest Beekeeping Livelisystem* through an SES lens helps to show that the bees, the trees and the beekeepers as components in an interconnected whole, which is connected to and impacted by the wider external context. The results presented in this chapter illuminate some of the processes within the system which are instigated by people as they adapt to, use and negotiate their natural environment. The results do not indicate that beekeepers have a 'grand plan' about how to maintain a functioning forest system. They are however making many decisions which cumulatively, almost accidentally, result in a maintained forest.

The results presented in this chapter provide evidence to answer the research sub-question: *How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation?*

The results clearly show that beekeeper's actions towards the forest, such as where they hang their hives, are governed by a determination to achieve benefit in practical and feasible ways. They have an intimate knowledge of how to use the available natural resources to secure a good income from forest beekeeping. Although bees are wild, hives and any honey stored in the hives, are owned. Hives, in effect, achieve 'privatisation' of a wild resource. Beekeepers are concerned about any obstacle that might reduce their honey harvest, and this includes forest loss and degradation. Yet responses to threats vary.

Fire is a frequent occurrence and one that they are used to. Importantly they know how to reduce the worst impacts of fire and it is within their means to do so. Fires harm the resources on which they depend for forest beekeeping and they take actions to mitigate this damage. This concern was also noted by Clauss, "… *beekeepers are generally worried about late fires between August and October which widely scorch the flush and above all the flowers of the most important nectar sources*", (Clauss 1992). It is within their power to reduce harm from fires by engaging in early season burning, a known fire mitigation method much promoted as standard forestry practice (Campbell 1996, Chidumayo, 1997). Fire control is not an action which is incompatible with other livelihoods; indeed other people also benefit from fewer late fires, e.g. collectors of mushrooms and edible orchids. A reason why fire management is undertaken might be because it is relatively easy to do. During both extended hive site visits fire setting was done in-between the much more arduous tasks of making and hanging hives. The time-lag between taking the action (setting the match) and seeing the result (protected flowers) is just a few months. When interviewing beekeepers, it was not easy to separate out their different reasons for discouraging hot, late fires. It is likely that their primary concern is protecting bees, hives and flowers, and the 'line of sight' between action and benefit is therefore short-term, just a few months. As hives are owned, the benefit is gained by the person who carries out the action. The other beneficial consequences of protecting future hive-making trees and future nectar-bearing trees is not felt for some years and given that these are not owned resources, may accrue to another person. It does not matter! Forest beekeeping, as currently practiced works best when late season fires are prevented and this delivers both short-term, private benefits and long-term, public benefits. One of the most outstanding findings learned was the vast extent of forest which is potentially impacted positively by the early-burning fire mitigation actions taken by the beekeepers.

There are other threats to the forest. Clearing forest for crops may interfere with the pursuit of forest beekeeping, but this is not seen as something that beekeepers will readily challenge. Everyone needs to eat! They have no rights and little inclination to push back against members of their own community pursuing their normal way of life. In cases where land is sold to an outsider this is viewed differently and beekeepers who had lost hive sites in this way, were unhappy. It is likelihood that this unhappiness is exacerbated when the area of forest lost is large and happens to be prime hive-hanging forest, which was reported to have occurred in some cases. This is something they wished to be able to change, but could see no solution. "*We fear the Chief selling land to miners or big farmers*" (FGDKAL15, Kaloza 2015). It is likely that the reason beekeepers take actions to control fires but do not take actions to combat other causes of forest loss is because it is feasible for them do so, whereas it is outside of their power to exclude other users from the forest, be they fellow villagers clearing forest for cultivation or mine developers.

The other research sub-question addressed in this chapter is: ***Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping?*** The results indicate that beekeepers have not developed a self-organised common property resource regime with members, rules, sanctions. The way they interact with other local forest users is much more nuanced and depends on them using the more remote parts of the forest and discussing and negotiating with other users on a case by case basis. Whilst the new instruments in support of Community Forest may empower beekeepers by affording them strong rights to exclude outsiders and prevent land sales, at present the forest areas included in the introductory phase were too small to accommodate forest beekeeping on the scale that it is currently practiced. Furthermore a CF must accommodate multiple interest groups and beekeepers admitted that not everyone can necessarily agree about how to use the forest.

Beekeepers are resource users and planners. They hang a hive today and they will harvest honey at the end of the year. They burn today because the effects will be felt later in the season. They value natural resources and are not wasteful. Walking back from the extended hive site visit in Chibwika the principal beekeeper was surprised to see a tree that had been debarked for no apparent reason. Debarking for productive use he could understand, but debarking for no reason was wasteful. Likewise, the same beekeeper was shocked to see the swathe of forest that had been cut to make way for electricity lines in Chibwika in June 2018. The trees were not being used – there were just too many. A representative from the DFO's office confirmed that tract cut for the lines was 48km long and 20m wide (KIIDFO18, Mwinilunga, 2018) and he explained how the electricity company was charged for the timber species felled, but not the bark-yielding species. Yet forest beekeepers are not forest conservers according to the principles of sustainable forest management. They do not count trees (!) and work out their rate of use compared with the natural regeneration rate. They do not know how many years it takes for a seedling to grow to bark-hive size. In fact, very little is known about the growth rate of miombo species (Grundy, 2006) so they share their ignorance with many trained forest ecologists. They do not know the total demand for bark hives at present or in the near future. Their unwillingness to waste natural resources is however balanced against their unwillingness to waste another valuable resource – their own labour. Beekeepers will make more than one hive from a tree if easy to do, indeed taking two or three from one tree saves the effort of looking for another tree. But if the tree needs to be felled to reach the upper bark this is too much trouble. During the extended hive site visits beekeepers were often seen to take more than one piece of bark from a tree by erecting a ladder to reach the upper part. Felling a tree is hard work and more importantly if it falls completely flat on the ground the bark cannot actually be removed. On being asked why they do not always take more than one from each tree on at least one occasion the answer was "*there are plenty of trees*". They are weighing up their time and labour with the resource. At present their labour is a constraining factor in the forest beekeeping system, more than the forest resources.

Beekeepers do not conserve natural resources in a scientific managed way. They do not measure rate of use with rate of replenishment and deliberately keep their use patterns within an 'allowable' margin. Beekeepers in Chibwika admitted "*We did not protect our wildlife – it is all finished*". Yet to gain from forest beekeeping it is necessary to protect hives sites and in doing so the forest is protected also. Their precise and exacting requirements for bark hive making places a self-constraining limit on offtake. The attributes and the processes of *Forest Beekeeping Livelisystem* interact in a way that maintains system order, provided the system is protected from external shocks such as a change of land use. Against such pressures forest beekeepers have few defences.

Image 9. *Pathias Ngolofwana harvesting honey, Chibwika, 2016.*

Chapter 9 Trade as a driver and other wider influences on the forest beekeeping system

It was directly from the environment that the Lunda extracted the commodities that linked them in networks of exchange with neighbours, adjacent people, and ultimately both the Atlantic and Indian Ocean trade blocs (Oppen 1993 in Pritchett, 2001:p50*)*

The previous chapters explored the income benefits of beekeeping and the actions, thinking and decisions beekeepers make about the forest resource. The relationship between people and the forest appears to embody an SES where there is a close coupling of humans and nature, with reciprocal effects and emergent properties. This system – the forest beekeeping system – is impacted by external forces and drivers which influence the whole in different ways. It is these wider and external forces, which are discussed in this chapter. This chapter explores the impact of land and forest tenure on the beekeeping system thereby adds some further insights in answer to Research question 3, already discussed in chapter 8, about beekeepers as actors in a common-property resource regime. The impact of trade as an external driver of the system is also explored so answering Research question 4: How does trade drive or impact on the dynamics of the system.

9.1 Land and tenure

Whilst beekeepers clearly have a close affinity to and a feeling of ownership of the forest they use, it is nevertheless an inescapable fact that the legal tenurial arrangements do not formally support their claims. The forest is not theirs. They, and the forest beekeeping system of which they are part, are subject to external institutions including the prevailing land tenure regime.

Under the Land Act of 1995, all land in Zambia is vested in the President on behalf of the people and the Act designates land as either customary or statutory (Government of Zambia, 1995, Daka, 2019). Traditional chiefs have the right to grant permission to occupy and use all land in customary areas, impose restrictions on its use for activities such as cultivation or the grazing of animals, and resolve disputes. The Act makes provision for customary land to be converted to privately owned leasehold land. In this instance a private buyer must first seek permission from the local chief, whilst the title is granted by the Ministry of Lands. Members of the local community are able to secure *de facto* use and occupancy rights to land that they farm or use for a settlement but using a forest for a productive activity is not normally considered in the same way, and forest land is often deemed to be not in use. The lack of formal property rights in customary areas has resulted in a number of perverse outcomes for Zambia's forests. For example, research by Unruh *et. al*. (2005 in Hervey, 2012) shows how migrants moving to new areas will tend to clear more land than is necessary for fear that the local leadership may subsequently take back any uncultivated land. Forest beekeeping challenges this prevailing norm up to a point.

The results from discussions and interviews with beekeepers about their claims to the forest have been reported in part in chapter 8 [see section 8.3]. Beekeepers tell that the forest is not theirs, belonging variably to God, to everyone, to the Chief or to the Government, whilst at the same time staking some sort of exclusive or respected claims to their hives sites. They admit that they have no say should the chief wish to sell land to private buyers. "*The chief and the Government will not listen to us. The Government wants money through selling the land - we have no powers. The government needs money - we do not give money to the Government- we have no powers*", (FGDMA16, Mayimba, 2016).

If a fellow villager wishes to open a farm in places where hives are located, beekeepers respond in different ways. Answers to this question ranged from 'nothing I can do', to 'I will not allow it', with perhaps the usual response being something in between 'I will talk to the person and we will agree'. The fact that fellow community members are willing to recognise beekeepers' claims to hive sites probably stems from the Lunda cultural view that labour is a validator of ownership and hence the labour invested in making and hanging hives must be respected.

The lack of clarity about ownership rights does not stem only from the external institution of government laws. There is also a cultural ambiguity. On the one hand things put there by God, such as the forest, belong to everyone. This is set against the '*uncontested rule that* *anything of value that comes into being as the result of an individual's labour belongs solely to that individual: labour in fact gives a thing its value and confers ownership*' (Pritchett 2001:p73). A hive site comprising a forest made by God and hives made by people – indeed makes for an ambiguity, but one that society has come to embrace and accept up to a point. In repeated questions about rights to own, protect or exclude beekeepers' responses oscillated between confidence and unease, highlighting the way people respond to these overlapping forms of property ownership.

The implications of the land tenure regime is further complicated by the fact that beekeepers are operating in vast landscapes where boundaries are not always meaningful. Beekeepers do not confine themselves to their own chiefdom only, nor their own country. The extended hive site visit in Ikelenge (EXHIKE18, Ikelenge, 2018) revealed some further insights into this issue. The beekeepers explained that when they ventured into DRC to locate hives the local chief there would charge them a fee for 'using' the forest for beekeeping. The fee was based on the amount earned not the area of forest used, but the figure ZK100 was mentioned. Cassava growers also paid ZK60 to open a cassava field in DRC. The beekeepers implied that they were very happy with this arrangement because the fee secured their forest patch, free from interference and as it was not their home place their friends and neighbours could not open gardens there. They felt more secure. The accompanying beekeeper from Chibwika area expressed surprise at this arrangement explaining that in his area beekeepers who ventured into Angola for beekeeping did not have to pay. However, there seemed to be a consensus that paying a fee to use and secure a forest patch was not unwelcome and the idea of having such a system within their own chiefdom was discussed favourably.

9.2 Trade as driver or disrupter

One of the most apparent external influences on the forest beekeeping system is the distant demand for organic forest honey, mediated through the buying actions of Forest Fruits. The way in which this trade impacts on the system is now explored.

The 'conservation by commercialisation' thesis emphasises the importance of - well - 'commercialisation'. The NGOs and development planners that advocate this thesis tend to have perhaps grander ideas about what commercialisation entails than the dictionary definition which states '*managing something for financial gain*' (OED, 2012). Development projects which promote commercialisation sometimes denigrate local, informal trade as a lesser form of trade. For example, one report (ITC, 2015) distinguished between formal buyers and informal buyers labelling the latter as 'opportunists' (ITC, 2015:p87) and consultancy reports frequently describe honey value chains in developing countries as informal, unofficial and disorganised (Simukoko, 2008; Tadesse & Phillips, 2007). The juxtaposition of traditional beekeeping with commercial trade has already been discussed in chapter 2. Taking an SES approach as applied to a forest beekeeping system calls for understanding on the impact of trade on the decisions of the primary actors, regardless of the nature of trade. Nevertheless, this case study was chosen because Mwinilunga is a case where the market for trade in honey and wax is well established and well organised. At present a reliable and large volume market is provided by FF Ltd. It is however the way beekeepers feel about and perceive this trade that is important and how it influences their decisions and actions

The historical work (Pesa, 2014) showed that beekeeping has been highly valued for a long time, as an activity yielding products for trade and trade is a strong external factor driving the forest beekeeping system. In recent times FF Ltd. has provided a consistent, well-organised and large market for bee products. Beekeepers explained their perception of this.

Box 19. Extracts from Focus Group Discussions about beekeepers' views of changes in honey trade opportunities

BKPR: 20 years ago we were just selling locally. The market was not good. There are more beekeepers now because the market is better because of Forest Fruits. (FGDSAM15, VH Sampasa, 2015)

BKPRS: Beekeeping is important because of income. Cultivation is also important, each has their season.
JL: Why are the number of beekeepers increasing?
BKPRS: Because [it is a] better source of income.
BKPRS: In the old days we did not see the importance of hives, we just used to cultivate, now we see the importance of the income from beekeeping.
BKPRS: There are more beekeepers now because the market is better - and there are more

people, the young ones are coming up.
(FGDNYI15, Nyidi, 2015)

JL: Yona - what has changed since the old days?
NY: We never used to have enough money, now we have enough. Buyers were not there before. Now the price has gone up.
(FGDKAN15, Kanongesha, 2015)

BKPRS: In the old days people used to make honey - for eating, not like now, for money. There is some cash from honey now.
BKPRS: We expect a bumper harvest. We hope the company will buy everything. We only believe in that company. We also sell to individuals from time to time.
BKPR: Young people are interested.
BKPR: In this village most people are farmers - we are just starting to keep bees - we learned from [-] another neighbouring village.
(FGDSAK15, Sakunda, 2015)

BKPR: No because back then the market was poor. We now have a reliable market. We used to sell locally only - perhaps 2 buckets. Now we can educate our children, buy goats, buy iron sheets. Now there is a change.
BKPR: In the past we used to sell to individuals. Now we sell to the company Dan Ball - we can now buy blankets, iron sheets and educate our children.
BKPR: FF - they have brought a big change. They tell how to keep the forest - in the future we will have something good.
BKPR: We used to sleep in thatched houses - now we have iron sheets. This what FF has brought us.
(FGDMAY15, Mayimba, 2015)

JL: What has changed in last 10 years?
BKPR: Now we have a satellite dish, grow maize and beans, motorbikes, iron sheets, further education for children. 10 years ago there was a poor market and the price was low. Never used to have buckets so hard to sell.
(FGDKANC15, Kanyama Central, 2015)

The honey price obviously makes a difference to the profitability (return on labour invested) of beekeeping and the level of confidence people have in a buyer will determine their willingness to forward plan. A buyer, such as FF Ltd. that is willing and able to buy in large volumes encourages beekeepers to scale up their activities, confident that they will be able to sell even large honey harvests without running the risk of a local surplus depressing prices. It helps tip the balance in favour of beekeeping. The beekeepers acknowledge that the market is more reliable at present and this is a factor which is driving increased beekeeping adoption, and it is important to consider how this change might impact on the forest. If there are more beekeepers or more beekeeping, then any and all of the forest beekeeping management actions discussed in chapter 8 will occur on a bigger scale. In particular more forest will be used for hive sites, bringing more forest under an early burning management regime.

Whilst there is evidence that trade is driving beekeeping adoption and by extension the forest management actions previously mentioned, it was not possible to discern any new dynamics, new processes or new entities in the forest beekeeping system as a result of better trade. The findings from the research do not provide evidence that the improving market is *changing* the relationship of beekeepers with the forest. The results could be interpreted to say the trade is reinforcing and strengthening the existing forest beekeeping system, but not changing it. No beekeeper explicitly said that, '*because of improvements in the honey market we now do such and such to maintain the forest resource*'. They did say that they were doing more beekeeping as previously indicated in chapter 7. In this regard better trade is not disruptive, it appears not to be bringing about spontaneous or novel new ways of working or new ways of relating to the forest.

There is little evidence of stronger honey trade in Mwinilunga causing beekeepers to form new institutions, elect leaders, or create novel rules and sanctions. They are not building new regimes for managing their common resource. Where these types of processes are being encouraged and supported by external actors – notably the DNRMP - there appears to be no cognisance from beekeepers or project staff of the possible utility of creating a synergy between the trade potential offered by FF Ltd. and community forestry. The DNRMP project approached FF Ltd. asking them to provide training in beekeeping (KIEEVANS2018, Mwinilunga, 2018) but this rather seemed to miss the point. The Chief Technical Officer of the DNRMP did propose what some of these synergies might look like – for example he proposed that it might it be possible for levies on honey trade implemented by the District Council to be directly invested in supporting the CFA and so, creating a novel positive feedback mechanism between trade and forest maintenance. Unfortunately, the programme ended before these proposals could be developed (KIIAA2018, Lusaka, 2018).

Trade is an essential external factor which drives the social-ecological system. As the trade grows stronger, more people are adopting beekeeping or increasing the scale of their beekeeping. The SES can therefore be said to be reaching across new scales (more forest) – but it is hard to detect any substantive changes in the essential working of the SES or positive disruptions. This can possibly be accounted for by the fact that trade itself is not a new phenomenon and by the fact that the forest beekeeping system is robust. The existing entities and processes are able to respond to new external factors, without substantial change.

Whilst it might not be possible to detect outstanding positive disruptions caused by increased commercialisation, it is also important to consider possible negative disruptions.

One negative disruption to forest systems which can sometimes be caused by increased commercialisation is over-harvesting of the resource. The overexploitation of *Prunus africana* bark in Cameroon which followed an increase in demand has been well documented (Bodeker, Van'T Klooster, & Weisbord, 2014; Stewart, 2003). The discussion on bark-hive making in the previous section addresses this type of concern. With more beekeeping more trees will be used. Evidence and argument already covered in chapter 8 suggests that if tree-use was occurring at an unsustainable rate, the yield of honey harvest should begin to level off or fall. This is not occurring. Another negative disruption caused by commercialisation, reported in the NTFP literature, is elite capture. A boom in demand for rattan in Indonesia led to the rattan trade association being taken over by a member of the political-economic elite (Dove, 1993). There is no evidence of this occurring in the forest beekeeping system, nor is it clear how it could occur. No beekeeper reported being excluded from the resources they need for forest beekeeping because these sites had been commandeered by more powerful groups. There was no evidence of beekeepers being forced into debt obligations to more powerful people, dependant on their future earnings. With the significant caveats that it is hard for women or the infirm to fully participate in forest beekeeping, it is an otherwise inclusive activity. It is hard to envisage an entry point for powerful elite to capture disproportionate benefits from forest beekeeping. This is probably due to the nature of the activity itself.

According to beekeepers the good market for honey is one of the main reasons why more people are taking up beekeeping and existing beekeepers are expanding. This is bringing in more income to beekeepers and to others. Beekeepers engage helpers to help them carry honey and casual labourer to help them in their fields, whilst they are busy harvesting honey. The other impact of a boost in honey trade is that this changes the attractiveness of beekeeping, relative to other activities.

9.3 Changing emphasis in the livelihood portfolio

Chapter 7 provided results about the importance of forest beekeeping as an income source and compared beekeeping with other activities. Here we look again at the relationship between beekeeping and other activities, this time considering how the attractiveness of forest beekeeping, compared to other income sources, must be driven in part by the ease with which honey can be sold. At the outset of this research Dan Ball, the Director of FF Ltd. implied that it was wrong to overstate the commitment of beekeepers to honey production, explaining that people do what they do to survive and will make choices about their livelihood activities based on the prevailing opportunities (KIEDAN14, Lusaka, 2014).

People in Mwinilunga are always making choices about their activities, within the constraints of their situation. If a person does well from one activity, they may choose to do more of it than another. If beekeeping is more profitable and more accessible than farming a person may put more effort into beekeeping and less effort into farming. Chapter 7 looked briefly at how beekeeping compares with other activities. This comparison is considered in more depth here. One of the attributes of forest honey as clearly stated in chapter 7 is the ease with which it is converted into cash, an attribute that is much influenced by the prevailing trade environment. This has an impact on the economics of beekeeping, compared to other activities.

Box 20. Comparing beekeeping with other activities

BKPRS: Pineapples - you need money to invest and they rot easily. Honey does not rot.
JL: Yes, but with pineapples you get money 3x in a year - is that not better?
BKPRS: Yes but sometimes the market is flooded. Yet with honey the company provides the transport. We have a lot of pineapples when it is raining and the roads are bad. This

makes marketing difficult.
(FGDMUZ15, Muzeya, 2015)

Maize can be good - but it can be hard to sell. We cannot fail to sell honey because of the company.
(FGDKAC15, Kachikula, 2015)

Farming is OK but you don't get much from maize. Animals are good - cows and goats. Beekeeping you get money quickly - the same year. With animals you have to build up and wait until they start giving birth - then fatten the young animals. Animals take long.
(FGDKAN15, Kanongesha, 2015)

BKPRS: Benefit of beekeeping is income. Other sources of income are maize, groundnuts, goats and sheep, cassava. Most money comes from honey. We get animals from honey.
(FGDSAK15, Sakunda, 2015)

JL: Why beekeeping and not other activities?
BKPRS: Easy to do. Don't pay anything. Maize need money for fertiliser. Bees have no diseases. Animals die sometimes - from disease.
(FGDMUZH15, Muzhila, 2015)

As these results show there are some very substantive benefits to beekeeping compared to other activities, yet these benefits depend heavily on the ease with which honey is sold.

The economics of beekeeping, compared to other activities

Although beekeepers were ready to mention the importance of honey, generally there was an appreciation that all livelihood activities are important. Each has its benefit. Yet it was striking how many beekeepers pointed out that beekeeping enabled the generation of cash, with the investment of labour and time only, and this cash allowed them to develop other income generating activities. On being asked if they would give up beekeeping once these other income-generating activities (e.g. livestock, farming) were established, they said no, not unless they were too old. With regard to their children, answers tended to be different. Many expressed hope that their children would be educated and gain employment.

During the FGDs in 2015 information was collected about the effort involved in beekeeping. Many beekeepers said that the only investment needed for beekeeping was labour, "*we spend no money – energy and time only* ", although when pressed further some said they needed food for camping trips in the forest and sometimes paid people to help them carry honey – although this payment was usually in a share of the honey. Importantly – and this is a point raised by Wainwright in his paper comparing beekeeping technologies (Wainwright, 1989) sharing a proportion of a harvest in exchange for collecting that harvest is a very different type of investment than putting in upfront costs when the outcome is not known – and indeed problems may arise before the harvest is secured. This pertains to risk. There is absolutely no risk involved in sharing a proportion of a harvest in the gathering in of that harvest. Not being able to gather in one's own harvest alone due to its size is a good problem to have! Beekeepers' expressed views about the labour versus cash investment in forest beekeeping is shown in Box 21.

Box 21. Beekeepers views about the type of investments needed for beekeeping

JL: Is beekeeping profitable?
JM: It is a profitable business because it just needs time - no money.
(FGDKAL15, Kaloza, 2015)

BKPRS: We use our own labour. When going to the bush for cropping [honey] we also need food, salt, soap, boots.
(FGDNTA15, Ntambu Satchitolo, 2015)

BKPRS: Nothing. Just labour. Also supplies when in the bush e.g. relish, soap and salt.
(FGDKAL15, Kalwisha, 2015

This ability to generate cash through the investment of labour as opposed to scarce financial resources is one of the main advantages of beekeeping. Yet labour is also a precious resource and when comparing beekeeping with other activities, beekeepers are considering the return on their labour. Beekeepers also provided information about the time it takes for the various beekeeping activities and it was possible to use this information to compute the financial return on a day's labour invested in beekeeping as follows:

Table 27. Basic data about time taken for beekeeping activities

Unit	Number	Source
Average hive ownership	89 (2015)*	QS in 2016
Average cropping ratio	53%	FGDs in 2015
Average hives cropped in a year	47	Calculated. 53% of 89.
Number of hives that can be made and hung in a day and time needed to make and hang one hive	6.7 in a day 0.15 days per hive	In fact beekeepers do not make and hang in the same day. This was an aggregate calculated figure based on information collected during FGD in 2015
Time spent checking on hives	27 in a day 0.037 days per hive x 3 times = 0.11 days to check each hive	Hugely variable. Based on an average of the answers provided in the FGD it is estimated that 27 hives can be checked in a day and a beekeeper will check them three times in the season before harvest.
Time spent cropping hives	3 in a day 0.33 days per hive	An average of the answers collected during the FGDs.
Number of hives made each year	30 hives	If hives last three years, to maintain 89 hives without increasing it would be necessary to make 89/3 each year = 30 hives

**The 2015 hive numbers are used for this calculation because the amount of honey harvested in this season was known, and this allowed for triangulation – see Box 16 in chapter 8.*

Table 28. Model of beekeeping cost benefit analysis[35] of a typical 89-hive beekeeper, using figures from Table 27.

Time taken for activities	**Working**	**Days' work**
Total time to make and hang 30 hives	0.15 days x 30 hives	4.5
Total time to check all 89 hives	0.11 days x 89 hives	9.79
Total time to crop 47 hives i.e. 53%	0.33 days x 47 hives	15.51
Total days' work (excluding carrying)	Sum of above activities	29.80
Average bucket sales per year (data from QS about honey sold in the previous harvest season)	9.5	
Carrying 2 buckets per day using a bike - days carrying	9.5 / 2	4.75
Total days' work (all activities, including carrying)	29.80 + 4.75	34.55
Average income per year from honey selling in ZK (see Table 10 in chapter 7)	1721	
Income per day's work in ZK		49.81 ZK (USD5)

Source: Calculated by author

How does USD5 a day for a day's work beekeeping compare with other activities? This question was asked when the opportunity arose but piece work is usually costed by piece, not by day. One informant said casual farm labouring is costed at ZK100 to 150 per lima and this might take 10 days of work, working out at USD1 per day. Another said ZK200 per lima for 2 weeks work, working out at about 1.5USD per day. As beekeepers explained – it is hard to compare like for like with other activities. Farming provides food and regardless of the effort involved, food is a necessity. Beekeeping income comes once a year and will not last all year so beekeepers will invest in other activities to get the money back later. The following data provides some evidence about how honey income can be multiplied when invested elsewhere.

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[35] In 2016 Zambia Kwacha 10 = USD 1

Box 22. Investing in pineapple farming

Source 1 Information provided by informants in 2016 (KIIALEX16, Ikelenge, 2016)
500 ZK to dig 1 lima (0.25ha) (establishment year) 150 ZK to plant 1 lima (establishment year)
100 ZK to weed and mulch 1 lima for the year (every year for 7 years)
No need to buy the suckers for planting
Can harvest 1000 pineapples per lima and sell 3 for ZK 10 i.e. 3.33 each
Annual earning = 3333 ZK or USD 333 per year for six years.
A gross calculation, considering no discounting or inflation suggests that an investment of 500 + 150 + 700 = 1350 would yield an income of ZK 20,000.

Source 2 Information provided by informants in 2018 (EXHIKE18, Ikelenge, 2018)
300 ZK digging and planting (establishment year)
500 ZK to buy suckers (establishment year)
400 ZK weeding each year (for 7 years)
Can harvest 1000 pineapples per lima and sell some at 3 for ZK10 and some at 4 for ZK10 depending on the time of year yielding an annual income of ZK2910 for six years.
A gross calculation, considering no discounting or inflation suggests that an investment of 300 + 500 + 2800 = 3600 would yield an income of ZK17,460

Notes:
If the initial money invested was sourced from honey selling (see FGDMUW15, Muweji, 2015) this would suggest honey income can be multiplied between 5 to 15 times when invested in pineapples
A farmer with enough cash to establish a pineapple farm will make an annual profit about between 2510 to 3230 ZK per lima, making pineapple farming more rewarding than beekeeping
Beekeepers said that pineapple farming yielded more income than beekeeping but sometimes the market was a problem and the pineapples would rot.
They also said that pineapples only grew in particular areas and that most suitable land was now used up and so no longer easy to expand

Box 23. Investing in maize farming

Source 1 Information provided by informants in 2018 (INTFRM18, Chibwika, 2018)
3 lima[36] yields 45 bags of maize
390 ZK to pay for digging 3 lima
150 ZK to spray agrochemicals on 3 lima

[36] One lima = 0.25 hectares

630 ZK for fertilizer for 3 lima
200 ZK for seed for 3 lima
Total cost for 3 lima 1370 ZK
Last year (2017) maize sold for 50ZK per bag. The informant did not know the price the FRA would pay this year (2018)
Profit will be 2250-1370 = ZK880 if sell all at last years' prices.
If keep half for food
Profit is 1125-1370 = ZK -245.
If honey income is used for maize farming and all maize is sold, then the honey income can be multiplied by 1.64. If half is sold and half is used for food, then one could say that honey income is being used to subsidise food production.

Source 2 Information provided by informants in 2018 (FGDSIM18, Chibwika, 2018)
50 ZK per lima land preparation
150 ZK per lima for digging
80 ZK for weedkiller
50 ZK for fertiliser application (labour)
60 ZK for harvesting labour
460 ZK for seeds and fertiliser
Harvest 20-25 bags per lima. Sometimes it is less – 10, 16 or 18.
If selling price is 50 ZK per bag = 20 bags x 50 =1000 per lima
Total costs per lima = 850 ZK, profit is 150 ZK

Notes:
This information was derived in 2018 when the maize price was falling, probably due to the national export ban for maize which was in place at that time
Beekeepers were saying that maize production was going down and some were thinking of stopping maize production as a cash crop
Maize is also grown for food, not all is sold. The costs of production suggest that when grown for food, if honey income is used, beekeeping is subsidising food production
Regardless of price it is interesting to juxtapose the uncertainty posed by Food Reserve Agency – prices not known and falling and slow to pay compared to FF Ltd. Beekeepers of course wish for a higher price for their honey, but the price that FF Ltd pays is known, if it changes it goes up not down, and they are reliable and steadfast payers, on occasion paying cash even before honey is collected.

Balance between beekeeping and farming

The market into which beekeepers are selling their honey is an external driver over which they have little control, but one that has a huge impact on the attractiveness of beekeeping, not only absolutely, but relative to other activities. The current favourable market conditions mean honey sells for a fair price, the transaction costs associated with selling are relatively low and beekeepers have confidence that if they harvest more, they can sell more – with no risk of surplus. FF Ltd. pay cash in a timely manner. This is in stark contrast to the marketability of maize. Beekeepers in Chibwika complained that they were obliged to sell their maize to the FRA but prices were too low, "*and we wait too long to sell - we suffer with maize*" (FGDSIM18, Chibwika, 2018). The inefficiency of FRA is widely reported and delays in buying lead some farmers to sell to middlemen for even lower prices, (Nkonde, 2018).

These factors, will, in some instances tip the balance in favour of beekeeping. There are emergent outcomes from decisions taken about the overall livelihood portfolio which have impacts on the forest and these decisions are influenced by the reliability of honey trade and the price of honey on the one hand, and the marketability and price of other cash crops on the other hand. For example, the maize price set by the FRA is an external factor that can influence how forest beekeeping is rated in relation to maize farming. It is useful to briefly explore some of the possible consequences, on the forest, of shifts in overall livelihood portfolio:

(i) A person who puts more effort into beekeeping and less effort into agriculture, e.g. maize farming, may clear less forest for cropping

(ii) A person who earns more from beekeeping may have the resources they need, e.g. access to paid labour, to expand their crop land and hence clear more forest.

Market access, transaction costs, prices, price stability and market reliability are a number of the trade related external factors which might tip the balance between farming and beekeeping. If, as beekeepers in Chibwika were saying in 2018, the price of honey is rising, and the price of maize is falling, and the company that buys honey pays promptly and the company that buys maize delays – then a shift to beekeeping, away from maize farming may occur (FGDSIM, Chibwika, 2018).

It was not possible to measure the land cleared by different groups of people with view to detecting any relationship between income earned from beekeeping and area of land cleared. However, one way of testing this 'activity balance' was achieved by asking '*what would happen* *if you could not keep bees anymore*?'. People always answered by saying they would then be obliged to focus on more farming. For further insights into this issue see Box 24.

Box 24. What beekeepers said about the balance between beekeeping and farming

JL: What might happen if something happened to the bees e.g. got diseased? (or similar)
BKPRS: Then we will cultivate maize and cassava.
(FGDSAK15, Sakunda, 2015)

NEW BKPR: I was seeing my colleagues getting a lot [from honey] and decided to join. I was cultivating maize before - now I do both.
(FGDKAL15, Kalwisha, 2015)

BKPRS: If Forest Fruits stopped buying honey we would go back to maize.
BKPRS: Maize production is going down. Beekeeping is growing.
(FGDSIM18, Chibwika, 2018)

BKPR: After cropping [honey] I will extend my field because of having money.
(FGDNCH16, Chibwika, 2016)

Beekeeping does give beekeepers the money they need to invest in farming and comes at the right time, at the start of the farming season, when cash is needed for inputs. This is supported by the evidence in chapter 7 and reported by other authors. A finding also noted by Jumbe, '*This provides farmers with cash at the start of the planting season to pay for agricultural inputs*' (Jumbe, Bwalya & Husselman, 2008:p6). Yet beekeeping is labour-demanding and agriculture is labour-demanding and cash-demanding. There is not a pool of landless, poor willing to work for beekeepers for sufficiently low pay to enable beekeepers to transfer their honey earnings to others, through paid labour, on a *large scale* and still make a good enough profit at the end to make it worthwhile.

It is important to note that any forest that is maintained because people have opted to reduce activities which drive its demise is not really being *managed* in the purposeful way that a forester may envisage. The forest extent and condition is an emergent property of the cumulative effect of the actions and processes which make up the coupled human and natural system in which people are living. Considering the way in which different livelihood activities impact on forests goes to the heart of the 'alternative livelihoods' strategy for forest conservation, where an outside agency e.g. an NGO, helps people develop 'alternative livelihoods' to reduce people's reliance on forest activities. It is interesting to note that in this instance – should it be so – that it is a *forest*-based activity that is taking people into the forest that (might) be reducing pressure on the forest.

9.4 Policy and paradigms

Forest beekeeping has been practised in Zambia for generations and is widespread. The forest beekeeping system is a complex, multi-faceted SES comprising assets, knowledge, entities and processes. It is robust. Of the tradable goods mentioned in the historical reviews only honey and wax has persisted.

During the field work in 2018 it came to light that Chief Chibwika had expressed some views about Forest Fruits Ltd. implying that the company was not contributing to development in the area. This view appeared to be in contradiction to the value that beekeepers placed on the company. Indeed in the Chibwika Chiefdom Development Plan 2015-2019 (Chibwika Royal Establishment, 2015) the stakeholder analysis scores Forest Fruits Ltd. as LIHP which is explained as Low Interest / High Power which mean 'the stakeholders may have low interest in the chiefdom or have a low stake in chiefdom activities but are nonetheless powerful' (Chibwika Royal Establishment 2015:p28). A meeting was arranged with Chief Chibwika where some of the emerging results from the research were presented. Chief Chibwika acknowledged the importance of forest beekeeping, honey selling and the role played by Forest Fruits but seemed to expect more. In the same meeting it was learned that some mining companies are considering investing in projects to offset some of the environmental damage caused by mining and one such project mentioned was a Game Management Area. This exchange provided some insight into what might be considered 'development'. In Zambia, chiefs have jurisdiction over land and this brings power and money. A mine development and land sales generate money for a chiefdom and mines are the archetypal development. Against this a company that drives the rewards of forest beekeeping activities may not been seen in the same light. A chief also achieves some kudos, admiration and respect if they 'bring development'. So for example a chief who influences a local NGO to build a clinic or provide an ambulance will be admired. Forest beekeeping brings no kudos, no money to the chief and no influence. The transaction is direct between beekeeper and honey buyer and as an economic activity is under-appreciated. It is possible that prevailing paradigms about development have created an external context for the forest beekeeping system which does not afford it sufficient value. This has implications. For example, this may exacerbate the prevailing notion in Zambia that forest land is 'unused' and 'undeveloped'. These ideas, external to the *Forest Beekeeping Livelisystem* do pose an existential threat.

9.5 Conclusion

The *Forest Beekeeping Livelisystems Framework* is situated in a context partly determined by external factors. The prevailing tenure arrangement is a mix of local, national and international constraints and opportunities and within this forest beekeepers negotiate to achieve their ends. They are able to have some influence at the local level and are able to navigate their way to achieve their objective of accessing the natural resources they need to harvest honey, but they appear to have very little influence on more powerful agents, such as their local chiefs, the national government, mining companies and private investors. The forest beekeeping system is nevertheless compatible with the prevailing tenurial arrangements and does not cause conflict or disharmony. In answer to Research question 3, there is little evidence that forest beekeepers are developing an organised common-property management regime. They are however creating locally-appropriate approaches to engage with local tenure structures in which they find themselves, yet these approaches do have some limitations. For example, beekeepers have succeeded in gaining some acknowledgement from members of their own community that their hives and their hive sites should not be disturbed by others and have negotiated access to forest areas outside their own chiefdoms.

Honey trade is a very strong external driver, influencing the scale of forest beekeeping. The international demand for beeswax in the eighteenth and nineteenth centuries meant this commodity was included in the highly profitable trade caravans between the Lunda state and Angolan coast, and "*By means of food, beeswax or ivory production for trade caravans, the inhabitants of Mwinilunga found an outlet for productive activities, thereby firmly linking themselves* *to international markets and circuits of trade*" (Pesa, 2014:p36). The current international demand for organic forest honey and beeswax is having a similarly profound impact on the local economy in Mwinilunga. In comparison to other forest products honey sales yield[37] more than twice as much income as timber and 20 times as much as mushrooms (chapter 7). It compares well when set against farming, earning more profit – in a purely financial sense – than maize, beans or cassava growing. Beekeeping is profitable because it requires so little financial investment and time invested is well rewarded at USD5 a day. It is slightly less lucrative than pineapple farming but pineapple farming is by no means accessible to everyone and is more risky, as poor roads mean pineapples are sometimes left to rot in the rainy season. Maize remains important but falling prices, late payment and non-collection meant that some people were choosing, at the time of the study, to reduce the amount of land they put to maize farming. The economics of beekeeping and its attractiveness is heavily influenced by the current honey price and the ease at which beekeepers can sell and convert a natural resource to cash. This is tipping the balance in favour of beekeeping, but there is very little evidence that the favourable market environment is changing the fundamentals of the system. Forest beekeeping is becoming more attractive and more people are doing more of it. This is not changing the way beekeepers interact with the natural resources, but those interactions which are fundamental to the system are increasing in scale. If it were not for the international trade accessed by Forest Fruits the current high level of honey harvest would result in a local honey surplus, lower prices and reduced enthusiasm to engage in beekeeping at scale. In this regard trade is a driver of the forest beekeeping system and is causing it to occur on a larger scale. Forest Fruits Ltd. report increasing supply, year on year[38]. This is bringing very large areas of forest into this particular coupled human and natural system.

The *Forest Beekeeping Livelisystem* is delivering important economic benefits to thousands of people and is being carried out without causing conflict or disharmony with other forests users, and yet it is surprisingly invisible to development planners, politicians and chiefs. That

[37] Per individual earner

[38] Weather patterns cause fluctuations, but the general trend is increasing supply

Forest Fruits Ltd. the main agent serving to enable to conversion of 1000 tonnes of raw honey into 1 million USD and deliver this cash direct to individuals should be rated as having Low Interest / High Power by one local development plan suggests that the value of forest beekeeping is not fully appreciated.

Image 10. *Burn set in June 2018 to protect the hive site from dry season fires.*

Chapter 10 Beekeepers are forest-keepers

Through the process of perceiving and interpreting the world around them, beekeepers organise diverse local elements in order to generate meaningful and significant environments in which to make a livelihood (Fisher, 1997:p257)

10.1 Introduction

The idea for this study can be traced back to woodland management strategies being tested in Malawi in the 1990s. At that time two closely related strategies for the conservation of indigenous woodlands were being introduced, in Malawi, as well as in other parts of the world. The first, community or participatory forestry, concerned policies to empower local people with enhanced rights and responsibilities over woodlands which previously had been controlled by government in a 'top-down' way. The second concerned seeking opportunities to add value to non-timber forest products with view to off-setting some of the direct or opportunity costs associated with forest management, an approach sometimes called, 'conservation by commercialisation' (Evans, 1993 in Sutcliffe, Wood and Meaton, 212:p472). Adding value to NTFPs garnered popularity because the harvesting of NTFPs is generally considered to be less destructive than harvesting timber (Neumann & Hirsch, 2000), or – more likely – because it was recognised that harvesting timber sustainably, called for levels of information, management, inventory and oversight which only professional foresters, rather than local people, could aspire to. You just can't get it that wrong with mushrooms! Since the 1990s very significant bodies of work and experience about these two strategies have been generated by forestry departments, development agencies and researchers. Collectively we have learned that participatory forestry works best when there is clarity about who is in the group, about benefit sharing and about roles and responsibilities. In addition, the government must be willing to give away some control and back this up with legislation. Collectively we learned that 'conservation by commercialisation' works best when the NTFP is special enough to be high value and abundant enough to meet market demand. The NTFP must be accessible to quite a lot of people who must each be able to earn a rewarding income, whilst avoiding the exploitative actions of more powerful players. The literature is replete with examples of lessons learned, concerning both what to do and what not to do, and the recommended best practice guidelines are much more extensive than mentioned here. The two strategies are linked. The ideal link between these two concepts is that NTFP harvesters are so invested in their trade that they willingly self-organise to protect the forest and engage in participatory forest management. This happy ideal is very often the goal of development projects, struggling with the dual problems of helping people, without harming the environment – or the converse, the goal of conservation projects, struggling with the dual problems of conserving biodiversity, without denying people a livelihood.

The NTFP commercialisation story is a small part of a much bigger concern. The need to reduce negative trade-offs between human development and ecosystem integrity is a global problem. The Millenium Ecosystem Assessment (2005) draws stark attention to the fact that substantial net-gains in human wellbeing secured in recent decades have been achieved at a cost to the environment. Ecosystem services have been degraded to such an extent that future benefits are likely to be diminished, with the poorest people suffering most. The MEA considers a number of options to '*conserve or enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services*' (Millenium Ecosystem Assessment, 2005: p18). The WWF Living Planet report calls for policies to exploit synergies and avoid trade-offs amongst the many targets of the sustainable development agenda (WWF, 2018).

As alluded to above, using NTFPs to secure a happy synergy between poverty alleviation and forest maintenance has led to some disappointments (Sills *et al*., 2011). Yet an analysis of one NTFP – forest honey - shows that this activity does not appear to exhibit many of the known failure factors in the field of NTFP commercialisation – and therefore offers substantial promise in this regard (Lowore *et al.,* 2018). Forest honey trade was noted by Campbell as offering promise in his somewhat sober commentary on poverty in the miombo forest zone (Campbell, 2007). Importantly substantial trade in forest honey derived from Africa's forests is actually happening and is not a hypothetical ambition or goal. This situation affords an excellent opportunity to test the link between NTFP commercialisation and livelihood and forest outcomes. This research specifically concerns forest honey i.e. honey harvested from wooded as opposed to agricultural landscapes. The location for this research was chosen as Mwinilunga in north west Zambia for the simple reason that it is here where the largest and longest-established honey buying company in Africa is based and all their supplies are harvested from forests. This context affords the best opportunity to explore whether commercial trade in forest honey really can incentivise forest users to maintain their forest. The original research question was simple, 'Do beekeepers conserve forest?'. But on reflection the question turned out to be not so much simple, as simplistic. Forest users' perceptions of forest are connected to a web of other considerations and livelihood opportunities and is influenced by forest ecology, by governance institutions, external trade and competing land uses. A forest is not a silo, a bounded space, a static entity. The question, 'do beekeepers conserve forest?' quickly loses validity when considered from the perspective of the beekeepers. Forest beekeeping is a complex system of connected ecological and human components. A systems thinking approach underpins the conceptual framework of Millenium Ecosystem Assessment which, '*posits that people are integral parts of ecosystems and that a dynamic interaction exists between them and other parts of ecosystems*' (MEA 2005:p1). A systems thinking approach asks not 'how do we conserve nature' but how do we manage economic development in a way that does not undermine the natural systems on which people rely. Consequently, this research used a modified Social-Ecological Systems framework to explore the connections between forest beekeepers and their environment.

This research was guided by one overall research question: **Given that the market for honey is assured, do beekeepers maintain forests'?** and four research sub-questions. These are discussed below.

The first of these asks **What is the economic and functional importance of forest beekeeping for forest beekeepers?**

10.2 The economic and functional importance of forest beekeeping for forest beekeepers

There is a significant wealth of literature about the importance of environmental income, especially for poor people. Yet, this importance does not automatically translate into actions to conserve. Many scholars point to the 'safety-net' role of environmental or forest income (Shackleton & Shackleton, 2004; Wunder, 2001). A 'safety-net' is vital – if you are falling - yet it is hard to invest effort in maintaining your 'safety-net'; you may be too poor to do so and anyway any spare labour or money is better invested in preventing the fall in the first place. In asking about beekeeping income it was necessary to understand whether beekeeping was serving a safety-net role, or not. If it was, then this might raise doubts about whether this would be sufficient motivation for forest maintenance. For NTFP income to be important enough to act as an incentive to conserve, it must be 'worth it'. The *Forest Beekeeping Livelisystems Framework*, a modified version of the *Livelisystems Framework* developed by Dorward (2012, 2014), is used as a basis to analyse how forest beekeeping supports livelihoods in Mwinilunga.

An analysis of asset attribute and function (Table 29.) within the *Forest Beekeeping Livelisystems Framework* (see section 4.5 in chapter 4) helps to demonstrate how the attributes of the asset base underpin the functional importance of forest beekeeping and contribute to proactive livelihood roles.

Table 29. Attributes and functions of natural assets underpinning forest beekeeping

Attributes	**Question (from Dorward, et al., 2005)**	**Forest beekeeping**
Complementarity	Does the use of this asset preclude the use of other assets/ livelihood activities?	Forest beekeeping is compatible with other forest uses and occurs in remote forest areas where there is no clash with other livelihood activities. It is possible to be a beekeeper and a farmer at the same time.
Convertibility	How easy is it to convert this asset into cash?	Very easy as reported by beekeepers who say that income is the main driver for their interest in beekeeping. This is made possible by the steadfast presence of Forest Fruits Ltd. as reported by forest beekeepers.
Use costs	The cost of accessing and utilising a resource	There is a low cost to utilising the natural assets for beekeeping. It is this low cost which makes beekeepers report beekeeping as 'easy to do'.
Productivity	'Normal' productivity; sensitivity to and resilience under different conditions.	Honey harvests do vary from year to year, but the bee population is resilient. Beekeepers are able to increase harvests in response to growing demand as evidenced by increasing adoption.
Rules of access	Rights and responsibilities for access	There are limited barriers to accessing the natural assets, the forest, – again evidenced by beekeepers' responses about beekeeping being 'easy to do'. Women find it harder to use the forest, due to social norms and domestic-responsibilities, but this is not a rights-based limitation.
Security	Risks to asset, future availability of resource.	This cannot be guaranteed under customary land tenure. Forest may be converted to other land uses. Yet the persistence of forest beekeeping is notable.

Risk	Risks to users. Can this asset be used without risk of harm?	Beekeepers do get stung! This is not considered a serious harm to health.
Social value	Does the use of this asset contribute to identity, group belonging, heritage?	This was not explored.
Substitutability	Can the services provided by this asset be substituted by another?	Clearly beekeeping needs bees! Forage can in theory be provided by other sources e.g. agricultural crops, but not in this part of Zambia.
Functions		
Consumption	Honey can be consumed or used to make beer. This is not the main use. Beeswax is not consumed locally.	
Exchange	Honey and beeswax are exchanged readily for cash. This is the main function of honey in Mwinilunga.	
Savings	Income earned from honey selling can contribute to savings, for example, through the purchase of livestock.	
Transformative	Income from honey can lead to a multiplier effect through its use to support crop farming, through the purchase of seeds, fertiliser or paying for labour.	
Protective	Beekeepers use honey income to pay for children's school fees. This is a long term investment, in the expectation that children may be able to support them in their old age.	
Social/cultural	This was not explored.	

This asset and attribute function analysis of the natural assets underpinning forest beekeeping suggests some of the reasons why beekeeping can make a substantive contribution to livelihoods. The assets are abundant, free to access and readily converted into cash. Honey meets multiple functions including consumption, protection, savings and exchange. The primary forest assets of bark, bees and nectar are needed to produce honey and are valued for their production functions. In terms of attributes, forest honey also scores highly. The current market opportunity provided by FF Ltd. means honey is easily converted to cash, with relatively low transaction costs. Use costs are essentially labour and time, and not financial and together with the absence of restriction to forest, there is no barrier to able-bodied men engaging in this income-generating activity. Women can access beekeeping through men, by paying them to make and hang hives and to harvest honey. The use costs are higher for women and they benefit less. In normal times there is an abundance of honey. Forest beekeeping has other attributes. Unlike most forest resources the making and hanging of hives turns an open access asset (bees and honey) into an owned resource, and this increases certainty and reduces risk. This is important when set against many wild resources which can be unpredictable.

An analysis of the livelisystem transitions (Dorward 2014) contributes further to our understanding of the role of beekeeping in supporting livelihoods. Forest beekeepers appear to be 'stepping up'. This is evidenced by more people joining beekeeping and existing beekeepers acquiring greater number of hives to increase their harvests. Beekeepers are not 'stepping out' – even as they develop other activities, they maintain their beekeeping because of the 'free cash' it generates. They are not falling out or staying the same. They are putting more effort into beekeeping. It can be argued that of the four livelisystem transitions the 'stepping up' strategy is most likely to engender an investment in forest maintenance. Those who are 'falling out' are perhaps giving up on the activity and see no future in it. Those who are 'stepping out' also see no future in it, but for different reasons, they have moved on to another activity outside of the forest system. Those who are 'hanging in' probably most closely align with using forest resources for a 'safety-net' function. They are in an adverse situation and are likely to be too poor to invest in maintaining the system. Old-age and sickness are the triggers for people to 'fall out' of beekeeping, not because of a decline in the resource.

One of the most illuminating findings from the research was the importance beekeepers placed on the ability of forest beekeeping to generate cash without requiring money up-front. Forest beekeeping can be likened to harvesting money from the bush, particularly because the current market means honey is predictably and quickly sold. Historical research shows that harvesting cash from the forest is nothing new, '*in the past, the environment was also the source of local currencies which is in turn the provider of units of exchange*' (Pritchett, 2001:p50).

The value of this attribute cannot be over-estimated. Pritchett goes on the explain that the long-distance caravan trade system of the eighteenth and nineteenth centuries '*promoted increasing commoditization and monetization in Central Africa*' (Pritchett 2001:p62). Natural resources were used as convertible currency and this included (amongst others) honey, but more usefully wax (Pesa, 2014, Pritchett 2001). The colonial era interrupted these opportunities introducing less easily acquired European currencies and new, onerous uses for cash – notably paying taxes - with the outcome that '*Mwinilunga was forcibly integrated into a new monetary union, in a most disadvantageous position*' (Pritchett 2001:p62). So Mwinilunga entered an era with an areawide shortage of cash, limiting the extent to which local artisans can practice their craft, limiting the ability of local buyers to purchase crops and obliging each person to be self-sufficient for want of cash to pay another.

In a 100 year turn-about of events, one could argue that honey is once again serving a purpose as a currency – albeit mediated through its exchange for cash with FF Ltd. Cash is needed to invest in other cash crops, and can be multiplied, potentially between five to fifteen times in the case of pineapple farming. Cash is needed to buy seeds and fertiliser for growing maize. When the maize price is fair, maize farming can double the cash invested, when it is low this might mean honey income is being used to subsidise food production. Cash is needed for school fees and related costs, a major expense for Lunda people who place great importance on educating their children (Pritchett 2001). This research showed expenditure on school costs was the primary use of cash earned from honey selling.

Forest beekeeping in Mwinilunga appears to be unusual in that its features and function differ from other NTFPs. This is hinted at in a conclusion to Jumbe's work on forest income in Zambia. Whilst he alludes to the fact that, '*The dry forests do not appear to function as a means to poverty elimination, by themselves, but are crucial to poverty mitigation*', he then goes on to single out beekeeping, '*…with perhaps honey being the exception*' (Jumbe, Bwalya, & Husselman, 2008:p23). In an article about poverty alleviation in the miombo zone (Campbell & Angelsen, 2007:p28) admit that miombo woodlands cannot easily offer a pathway out of poverty for millions of people but that one possible strategy is the enhancement of forest-based markets and honey is highlighted in this regard, with the authors noting that the value of beekeeping is such as to make '*habitat destruction more costly*'.

The results presented in chapter 7 (Table 13) show that the majority of non-beekeepers recognise forest beekeeping to be the most important forest product and it compares favourably against farming, being more profitable than maize (chapter 9, Table 28), and less risky. When examining a range of different metrics of economic well-being the results indicate that many forest beekeepers in Mwinilunga and Ikelenge are either slightly better or the same as others – but not all. Beekeepers are not a homogeneous group as evidenced, for example, by hive ownership. Whilst the average hive ownership was worked out at 89 (Box 16) this hides a large range, from 8 to 480! Some people are choosing to specialise in beekeeping, more than others.

Many beekeepers explained that they had recently taken up beekeeping because they saw beekeepers doing so well. As a consequence, beekeeping appears to be attracting more people to the activity and many beekeepers are putting more effort in an increasing their hive numbers. The reasons people gave tended to be positive pull factors, citing rising prices and a more reliable market or seeing other beekeepers doing better than they. The circumstances which draw people to beekeeping do not fit the safety net language of desperation and an action in response to a shock. Forest beekeeping requires forward planning; hives must be sited six months before harvest. This is further evidence that it is a carefully chosen livelihood option. There was some evidence that low maize prices were causing people to look for alternative and additional sources of income. Yet overall these 'pull effects' are not consistent with a safety net function.

In answer to the research sub-question we can conclude that the evidence suggests that unlike many NTFP activities beekeeping is more than a safety-net. It is not a fall-back activity undertaken only in times of stress. There is a lot of evidence to demonstrate the value of beekeeping income – both absolutely, relatively and functionally. The language that beekeepers use when telling why they have opted to engage in beekeeping indicates that they are being attracted for positive reasons and not out of desperation, 'I see beekeepers doing better than me', 'Beekeepers live well, move well and sleep well' and 'Nowadays we can sell honey'. A return on labour invested works out at about US 5 per day. In a society where one's own labour is more limiting than land, this is significant.

These results do not immediately elaborate our understanding about beekeepers' incentives for forest maintenance and do not answer the main research question. **Given that the market for honey is assured, do beekeepers maintain forests'?** However, the clear indication that beekeeping income has a significant pro-active function in people's lives and is more than a safety-net, raises expectations that beekeepers are invested in maintaining the forest. It is to this question that we now turn.

10.3 How forest beekeepers in north-west Zambia interact with the forest on which their bees rely

The answer to the first research sub-question has validated the research goal. The evidence supports the view that forest beekeepers have a vested interested in maintaining the forest. The second research question considers whether and how this interest is manifested. Forest beekeeping is important – undoubtedly – but we do not know what the costs of management are – or indeed whether there are other barriers, constraints or bottlenecks to management which are not to do with cost. To address these complexities the second research question was posed as **How do forest beekeepers in north-west Zambia interact with the forest on which their bees rely in terms of causing or preventing forest loss or degradation?**

'*The relationship between people and the environment in Mwinilunga is immediate, direct and complex'* (Pritchett 2001:p49). Pritchett mentions how, without intermediary processes or institutions people in Mwinilunga can access a wide variety of household products, foods, medicine and construction materials needed for everyday life. The wealth of tradeable good used to be wider than it is today and used to include rubber, ivory and animal skins, alongside honey and wax (Pesa, 2014).

The results from this research provided evidence of the value people place on the forest. As shown in section 8.2 86% of respondents strongly agreed that the forest brings wealth, 80% strongly agreed that the forest must be maintained and 86% strongly agreed that deforestation brings poverty. There was little difference in what beekeepers said compared to non-beekeepers, highlighting the diversity of benefits of the forest beyond forest beekeeping. Yet, opinions do not necessarily translate into action. People may think employment is a good thing, but they don't have jobs. People may think deforestation brings poverty, but this opinion alone does not avoid deforestation.

People are aware of threats to the productive capacity of forest in relation to forest beekeeping, and these include fire, farming and land sales.

Fire was not considered an insurmountable problem as such because beekeepers know how to manage it. 90% of beekeepers said they protected their hive sites from damaging late season fires because the hot and intense fires of October and November can damage the nectar-giving tree flowers and burn hives at the height of the honey flow. They achieved this by burning early and removing the accumulation of flammable grass around their hive sites. Beekeepers also explain that early burning protects small trees, which are not harmed by the cool early burn, but killed by late burns. Hive sites are extensive – the two that were measured were approximately 135 ha and 163 ha respectively. If the results from these two hive sites can be extrapolated to all 3000 beekeepers this suggests a staggering 1,201,500 ha (lowest estimate) of forest which is subject to some sort of fire mitigation measure. This is an extraordinary result and even if this estimate is double the true figure, this is still a vast area. This provides strong evidence that forest beekeepers are carrying out, for free, and of their own volition, an established forest management practice, advocated by professional foresters as one of the most important measures that can be taken to manage miombo woodland.

The results from this research indicate that beekeepers carry out these early burns because they know the harm caused by late season fires, they know how to minimise the incidence and extent of late burning and the action needed is within their capability. It is easy to do. They have the information and the means. The cost of implementing this action is low. Furthermore, the effects are immediate and the returns, a good honey crop, are achieved within a few months. Crucially, the benefits of the actions accrue to themselves – the honey is theirs. This is achieved because – and this is important – bees are housed in hives and hives are owned. This is quite unlike almost all other resources within this open-access forest. They have privatised a little bit of it. By making hives they have invested labour and earned ownership of a wild, natural, previously unowned resource – the bees and the honey they make. This is consistent with Lunda culture where people have '*an inalienable right to the fruits of ones' own labour*' (Pritchett 2001:p106).

Together these actions and benefits present a favourable cost-benefit ratio. The cost is low, the benefit is high. Yet this is not an example of users self-organising to manage a common-property resource – or at least not in the 'conventional' sense. There is no leadership, no boundaries and no sanctions. These are individual actions being practised in bits of the forest which beekeepers are using, individually. The aggregate of these individual actions is hugely significant.

Preventing late season fires through early burning protects their owned assets, the hives and flowers; and they know they will obtain the benefit from the flowers because their owned bees will collect the nectar. This action also protects seedlings of all forest tree species – not just those they may wish to protect because they might use them for hive-making in the future. In this way the *Forest Beekeeping Livelisystem* has indirect benefits and helps multiple non-target species. This is important. To give a contrasting example from Southern Africa, the *marula* tree is much valued for its fruits and *marula* is an example of a commercialised NTFP (Wynberg *et al.*, 2003). The main way *marula* harvesters manage this resource is through not cutting the *marula* tree! The *marula* fruit trade protects *marula* trees alone.

It is possible that were it not for their interest in hives and flowers, beekeepers may not carry out early burning specifically to protect tree seedlings. It is possible, but we don't know. Protecting future trees which might be useful for bark-hive making requires long term planning. It does not matter. This is where taking a systems thinking approach is so important. A complex SES comprises multiple interactions, with non-linear relationships and emergent properties (Levin, 1998) and seedlings protected by an early burning practice implemented for one reason, having a secondary effect, is an example of an SES unplanned outcome.

In some senses it is important to distinguish between forest in general and hive sites in particular. A general question about 'is the forest under threat?' is hard for a forest beekeeper to answer. Which bit of forest are you talking about? A specific question about hive-sites can elicit a more specific answer. Yet in other respects it makes no sense to make a distinction between hive-sites and forest. Hive sites are forest. They are forests with beehives hanging in trees. So, in protecting hive-sites, beekeepers are protecting forest. They cannot help it. They are one and the same.

In making this claim it is important to examine the question of the impact of bark hive making on the forest. This activity is often said to cause forest degradation and in an analysis of perceived negative linkages between beekeeping and forests in Zambia '*the aggregate effect of bark-hive making*' was mentioned (Mickels-Kokwe, 2006:p20). In discussing this, the workings of previous authors (Clauss, 1992; Mickels-Kokwe, 2006) have not been repeated using new or extrapolated data. Readers can instead refer to the overview analysis in Mickels-Kokwe's book. Instead macro-level or systems-level evidence is presented to argue that bark hive making does not degrade forest:

- The specific criteria of species, size, bark quality and bole straightness are so exacting that the impact on the forest condition is minimal, as just a few trees per ha meet these requirements (Clauss, 1992). Forest ecologists record that miombo woodland is very able to withstand relatively moderate cutting, and in some cases removal of biomass, aids growth of remaining stand (Chidumayo, 2013).
- If the actions of beekeepers caused a shortage of bark hive making materials the first people to notice (before any forest inventory specialist) would be beekeepers, as it would impact directly on their honey harvest potential. Beekeepers do say there are some forests which have insufficient bark, but the reason for a shortage is usually something else and not bark exploitation e.g. secondary forest re-growing after cassava cultivation and not because other beekeepers have degraded the forest. There appears to be no downturn in honey harvest across the study area as a whole.

- If the rate of use was so intense that all hive making trees were used, the beekeepers would suffer, but the impact on the forest would still be negligible because the number of trees suitable for bark-hive making in each hectare of forest is so few.
- The species beekeepers use are the most common miombo species in Zambia (ILUA II, 2016). Even after decades of bark-hive making *Brachystegia spiciformis* and *Julbernardia paniculata* are still the most abundant species in Zambia, the concern that removal of mature trees of these species would damage the regeneration potential has not been borne out.

The notion that beekeepers would resort to using smaller trees, once the bigger were removed is rejected for two reasons (1) small hives would not be attractive as nest sites for bees and are not worth the bother for beekeepers (2) The hives measured in this research were the same roughly the same size (or a little bigger) as the sizes recorded in the past (Forestry Department, n.d.).

Using bark to make hives needs to be understood as part of the whole beekeeping system. Hive making and hive hanging encourages beekeepers to mitigate late season fires. The use of bark and the fire mitigation measures are part of the same system, the gain of one offsets the loss of the other and the system cannot be dismantled to individual component parts.

Compared to other forest-removing activities farming, mining, road-making, electrification projects, charcoal making – bark-hive making has negligible impact.

The greatest threats to forest in Zambia is complete removal of trees for farming, mining and settlement. Bark hive beekeeping does not contribute to these land cover changes. Reliance on bark hives does pose some challenges for beekeepers. They are quick to make and cost nothing and they work. These are the plus points. On the negative side there are some forests, namely re-growth forests and fallow forests, especially those that grow back after cassava farming, that have nectar but no bark-making materials. In these cases it would help beekeepers if they had an alternative. Such a change might increase honey yields, but would make no difference to forest condition[39].

It is a very narrow traditional foresters' view of forests to think that felling trees to make timber is 'more worthy' than stripping bark off a tree. Yet these miombo woodlands have very few timber species and are full of bark yielding trees (Dewees et al., 2011). A forest beekeeper might visit a timber yard and lament the bark being stripped off trees and shredded as waste! This is an example of a clash of perspective, between technically trained foresters[40] and local forest users.

SES thinking must be applied to bark-hive making. Bark-hive making does not cause forest degradation, yet not because forest beekeepers have planned it to be this way. They have little information about the total number of trees, the aggregate usage, the future demands and nor do they know how many years it takes for trees to reach hive-making size[41]. The ability of the forest to withstand the pressure imposed by bark harvesting is an outcome of the inherent resilience of miombo woodland, the coincidence that the most abundant species are those with strong, pliable bark and the natural variability of trees which means that only a percentage (34% according to Clauss 1992) meet the beekeepers' precise criteria, and the dispersed way hives are located across large areas. The SES is robust only up to a certain point and that begins to change when forest is removed or becomes inaccessible for different reasons.

Clearing forest for cropping is the main cause of land cover change in Zambia (ILUA II, 2016) and is a potential threat to forests for honey harvest in Mwinilunga also. 53% of respondents said they feared that an increase in population might impinge on beekeeping. Beekeepers accept farming as a normal part of every livelihood; it is essential to life. People have to eat.

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[39] Unless of course the alternative was to use sawn planks, in which case a change to box hives might increase demand for timber

[40] Although two members of the PFO office one in Solwezi and one in Mwinilunga admitted that they thought concerns about bark hive causing forest degradation as 'exaggerated'.

[41] Nor in fact do forest ecologists know, the growth rates of miombo species have not been well studied

Beekeepers are also farmers and also clear forest for crops. On whether farming posed a threat to forests or to forest beekeeping – responses were mixed. Usually forest beekeeping is done 'beyond the farms' – too far away. On farming forest beekeepers could see no real point of intervention to bring about change. No one opened a farm for any other reason than to survive and no one has a right to deny a fellow person a livelihood. Discouraging people from opening gardens in hive sites can be achieved through negotiation, discussion, understanding. There are some unwritten rules – infinitely more nuanced and localised than the Community Forest approach (see later).

Land sales are more threatening and engender a stronger response from beekeepers. Land sales are unpredictable, sudden and large-scale and are a 'shock'. Furthermore, the benefits may accrue to non-locals. It would be naïve to suggest that beekeepers would reject a mine development if they thought they would get a good job. Their fear is that they lose, not just the forest, but their livelihood as well. The fact that forest beekeepers do not have any control over this is not unusual. Access rights of poor people to the forest tend to be open or informal, difficult to protect against external interests (Wunder, 2001:p2)

In describing people who hang hives in the forest we refer to them as beekeepers – or *imbabi* in Lunda - but they are not 'keeping bees' in the same way that European or American beekeepers practice their craft. Zambian beekeepers do very little honey bee colony management. They do not – for example – rear queen bees, cull drone brood, make artificial splits, control swarming, make up nucs, re-arrange the combs, feed or medicate the bees. They do, these results suggest, invest effort in nurturing, managing and manipulating[42] the primary productive assets – bees, nectar and bark – so that the natural process of bees making honey can work to their advantage. Zambian beekeepers don't manage the bees. Zambian beekeepers nurture and husband the resources which enable the bees to work and then let nature take its course, and they focus their effort in those parts of the forest where hives are located. The primary natural resource which underpins honey production in Zambia's forest

[42] Bark is manipulated so that it becomes suitable as a nest site for bees

is – well – the forest. Hive-sites are forest. In this way it could be said that people who hang hives in forests in Zambia are not beekeepers, they are hive-site keepers or forest-keepers. In answering the question about how forest beekeepers in north-west Zambia interact with the forest on which their bees rely it can be concluded that they, as individuals, value the forest for its wealth, they use forest resources wisely and not wastefully, they act to protect their hive sites from fire and have minimal negative impact.

10.4 Beekeepers as actors in a common-property resource regime

The third research sub-question asks: Is there any evidence that beekeepers are actors in a common-property resource regime, managed for beekeeping? In some respects this is related to the previous question as this concerns an important dimension to how beekeepers do, or do not, relate to the forest. Given that forest beekeepers are using a resource which they do not own, it is important to understand their claims to the resource and how they relate to other people who may threaten the forest. It is important to understand if beekeepers exclude other users or adhere to socially accepted rules about forest use.

The answer to the second research question above explains about how beekeepers interact with the forest. The results suggest strongly that cumulative effect on beekeepers' decisions and use patterns, on balance, support forest maintenance. Yet these actions do little to protect the forest from a change of land use, driven by non-local external forces and an increasing demand for agricultural land. It is useful therefore to interrogate the findings to look for evidence of a common-property resource regime, as such a regime could, in theory, protect the resource from such threats.

Ostrom's guiding principles for CPRs largely underpin contemporary approaches to participatory forest management and are based around having a defined group of users, a defined forest boundary, rules, sanctions and external legitimacy. At present these features are absent from the *Forest Beekeeping Livelisystem*. Forest beekeepers are not a fixed group of people and they have no organisation. The forest they use for beekeeping is vast and whilst there is some understanding of chiefdom and national boundaries, these borders are freely traversed. Rules and sanctions are barely declared and those that do apply, apply at a very intimate level and could be more accurately described as social norms or respect for fellow beekeepers. Hive sites once occupied are respected. Most importantly forest beekeepers have limited rights to no rights to exclude others from the forest. Interestingly whilst Ostrom's principles for common-property regimes are often advocated as the solutions to averting a 'tragedy of the commons', it is worth noting that Mwinilunga's forests are not suffering a 'tragedy of the commons'. Their vulnerability, as far as beekeepers are concerned, is a result of the national land and forest governance system. Land sales to private farmers, as mines, or as game management areas is not a result of a 'tragedy of the commons'. Yet there is no evidence that the growing demand for honey is providing 'an incentive for organising and strengthening communal action' (McElwee 1994 in Neumann & Hirsch, 2000).

Ostrom's work on a General Framework for Analyzing Sustainability of SES (Ostrom, 2009) identified that size of the resource system was an important variable which underpinned self-organisation, '*for land related resource systems, such as forests, very large territories are unlikely to be self-organized given the high costs of defining boundaries, monitoring use patterns and gaining ecological knowledge'* (Ostrom, 2009:p420). These results support this conclusion yet raise additional questions. Conventional management regimes are not in place, but resource claims and resource use are nevertheless taking place within a social space, governed by negotiations, decisions and norms.

Beekeepers did express a wish that they could find a response to the external threats. This proved a difficult line of enquiry because beekeepers have little concept of what this response might be, what it might cost – in money, transaction costs, effort, organisation etc. Or what might happen if they didn't. As Ostrom said '*perceived benefits and costs are difficult and costly to obtain, making it hard to test theories based on users' expected net benefits'*, (Ostrom, 2009:p420).

The Community Forestry pilot project in Kapundu, Mwinilunga does provide an example for forest beekeepers to consider. Beekeepers who were part of this project applauded the forest protection that the Community forestry area (CFA) achieved but noted that the community forest area was too small to cater for their hive sites. Beekeepers elsewhere had differing views about the CFA approach noting that the CFA must be managed to serve a range of different interests and commented that 'different people have different ideas'. The undoubted strength of the CFA approach is its legitimacy, backed by national law.

Beekeepers in Ikelenge gave an accidental glimpse into their thinking. They were happy to pay the DRC Chief for access to forest (approximately ZK100 for a hive site) in exchange for use – yes – but interestingly not only did they get use of his forest in exchange they got exclusive use, they got protected use. This finding indicates that beekeepers might be willing to pay something to have these rights. In that case the cost v benefit was worth it. This is different from creating a CPR regime. Creating a novel tenurial framework, in a community group, of differing interests, when they have no experience of that – is difficult. Finding a way to 'buy into' the existing tenurial framework, by paying for exclusive access, appears more doable. As mentioned above, this suggestion is merely a glimpse into a novel approach.

Beekeepers also lack information, and information is a requirement for the emergence of common-property resource regimes. They do not know how many people there will be in future, or if a mine will open in Chibwika. There is no point in working out an annual allowable use rate for bark-hive making (even if that were possible) when a mine might come and clear the forest. At the moment the pressures on the forest in Mwinilunga are not great. People think there is plenty of forest, and there is. Should a shock event occur such as a mine opening they not only do beekeepers have no control over this, but they cannot know for sure what the consequences would be. The spontaneous emergence of a CPR regime, is unlikely in such a situation of not-knowing.

Whilst the forest is not owned, beehives are. This creates an interesting dynamic. The fact that beehives are personally owned brings the wild resources – bees, and their honey – into private ownership. This is hugely important as it is the certainty of being able to harvest honey from the hives in a hive-site which creates the favourable cost-benefit ratio in respect of hive-site protection. This situation accords with that reported in Tanzania where forest beekeepers stake claims to beehive sites (called camps), trees and beehives and these informal rights are recognised by the society in which they live, '*Alone amongst forest products the beehive (as an object, its contents and its siting) is the private property of the beekeeper. By siting a hive in a* *tree, he or she gains personal use-rights over the tree for as many years as a beehive continues to be placed in it'* (Fisher, 1997:p265).

The answer to the question, **Are beekeepers actors in a common-property resource regime?,** is no, at least not in the conventional sense. There is evidence that beekeepers have negotiated security over their hive sites with other members of the same community, but this does not afford security against outside interests. There is also some evidence that beekeepers might be interested in investing in some elements of such a regime, but the absence of information and leadership, and the vastness of the forest makes it hard to see how this might occur, or whether it would be cost-effective.

10.5 The impact of trade on the dynamics of the *Forest Beekeeping Livelisystem*

The fourth research question considers the impact of trade and other exogenous factors asking: **How does trade drive or impact on any of the dynamics revealed in answering questions 1-3?**

Good and reliable trade is undoubtedly an external driver to the SES as a whole. It is external to the core elements of the SES; the people and the natural assets. Trade drives the system. It enables beekeepers to convert natural wealth into cash, essential for so many aspects of their lives. Trade keeps people doing beekeeping and attracting more people to beekeeping. This has two 'line of sight' connections to forest outcomes.

The first concerns the proportion of the forest that is being used to hang hives. All hive sites are forest, but not all forest is a hive site. As more hives are hung, more of the forest becomes hive-site forest protected by fire mitigation measures. The results indicate that between 2011 and 2016 the number of hives in the forest increased by 70% (Table 17, chapter 7), meaning, if the hive to forest ratio stayed the same, 70% more forest being used for beekeeping. This is probably an overestimate but the trend is likely. As trade is driving this increase, trade is responsible for increasing the area of forest being protected by beekeepers' fire mitigation measures.

The second is easy to explain, but hard to quantify. As the price of honey goes up and the price of maize goes down (these are not connected!), this changes the comparative rate of return on labour invested in these two activities. One is a forest re-enforcing activity, the other a forest-removing activity. If, in the aggregate, people do more of one and less of the other, this can potentially change the area of forest cleared for farming. This concerns broadening the SES beyond a forest beekeeping system only to a holistic, land, landscape and livelihood SES that includes a much broader range of natural assets. This argument is particularly relevant to maize farming because cassava farming is mainly undertaken to provide food and food demand is relatively inelastic and maize farming has a more permanent impact on forest removal, compared to cassava farming. If people can afford to do both and the maize price improves, they will. This research shows also that honey income is invested in maize growing so there is an offset in the other direction too. Yet labour availability is an issue. Mwinilunga is a place where labour is more scarce than land and '*human labour remained the chief productive resource, constituting the fundamental continuity in patterns of consumption in the area of Mwinilunga'* (Pesa 2014:p201). The notion that a rise in beekeeping might cause a coincidental significant rapid expansion in agriculture is unlikely. Rendered more unlikely by the prevailing low price for maize and the poor performance of the FRA.

Trade in bee products is not new, the historical literature shows the importance of beeswax trade in the 18th and 19th centuries. In recent times the constancy and logistical support provided by FF ltd. is exerting and strengthening influence on the pre-existing FBL. Trade is underpinning the existing practices and strengthening trends. There is little evidence of new forces or new dynamics within the FBL. Better trade is not, it seems, causing any spontaneous self-organization amongst beekeepers to create new rules or new institutions or new demands. This is in contrast to examples of NTFP commercialisation elsewhere. Neumann and Hirsch analysed the impact of NTFP commercialisation on tenure arrangements and noted that commercialisation can sometimes strengthen local tenure (Neumann & Hirsch, 2000:p22). McElwee (1994 in Neumann and Hirsch 2000) noted that commercialisation of NTFPs may benefit common property resource regimes because it provides an incentive for organising and strengthening communal action. This appears not to be occurring in Mwinilunga.

Returning to Neumann and Hirsch (2000:p22) we read that commercialisation can sometimes exacerbate attacks on local land rights from outside interests. McElwee (1994 in Neumann and Hirsch 2000) reported that commercialisation of NTFPs may also lead to increased disputes, privatisation, the usurpation of women's marketing and money control roles by men, and overharvesting. There is no evidence of honey trade commercialisation having this effect.

In conclusion; trade drives the SES and more and better trade makes it stronger. There is little evidence that more and better trade is changing the fundamentals of the SES.

10.6 Beekeepers maintain forests

Forest beekeepers are using their natural resources to meet their needs and have crafted ways of doing so which appear to be sustainable – in a way that works. They are not driven by a desire 'to conserve the environment' – they are driven by a need to use their resources wisely, using knowledge and experience and not wastefully.

Forest beekeeping is a system that works. It comprises interconnected entities that interact and feedback. Trade supports, binds and strengthens but does not disrupt. The reason why it works is not because of rules or a plan. The asset attribute and function analysis shows that the system works because of inherent features. Fire damages flowers and protecting flowers protects trees at the same time. It is the most abundant tree species that yield useful bark, and not the rarest. The end product, honey, is a desirable high-value commodity and is non-perishable, so making trade more achievable. The simple act of turning a piece of bark into a cylinder works really well as a nest site for bees and in doing so beekeepers turn a common-property resource into a private one. As a consequence beekeepers are motivated to control the fire that would otherwise damage the flowers, and future trees. Hence, we begin to see the system as a whole. This system has not emerged as a matter of chance, it has emerged driven by the forces of evolution. i.e. survival of the fittest. If any one of those factors just mentioned were not true, the system as a whole may never have persisted.

The Forest Beekeeping Livelisystem is not infallibly strong. It has almost no defences against removal of forest – whether these be access to forest (e.g. a Game Management Area) or change of land use (e.g. opening of mine). Against these forces which are external and powerful the FBL has very few defences. As Wunder (2001) points out '*external change factors can possibly set off self-perpetrating processes of forest degradation*' and disrupt scenarios where '*welfare-poor indigenous peoples have conserved their forests for centuries'* (Wunder 2001:p1819). The FBL has withstood many changes, but remains vulnerable to changes in land use.

There are glimpses of evidence that the 1 million USD injection of cash into the local economy each year is multiplied through the economy, through farming, through trading and lending. There are glimpses of evidence of non-beekeepers being able to access a share of these benefits through labouring, through building houses for beekeepers and selling goods to beekeepers. Quantifying these glimpses would require another PhD! For some, beekeeping offers a pathway of out poverty, but not for all. Some groups benefit more than others, with women benefitting less than men. The poverty of elderly, former-beekeepers, suggests that accumulating surplus and savings remains a challenge. Investing in children's education and hoping these children will have jobs, outside of Mwinilunga is probably a surer way to secure a comfort in old age.

Campbell (2007) presents a case that people living in the miombo zone are poor and have limited options. He also mentions some few opportunities – and honey trade is one. Honey trade is an outstanding example of a marketable NTFP with excellent forest maintaining credentials.

Forest beekeeping is an example of a coupled human and natural system that clearly has strong positive synergies. The negative impact of forest beekeeping on forests is minimal and the positive is substantial. The sum gain is a maintained forest. This result is not the planned outcome of a scientifically reasoned forest management plan. It is instead the emergent outcome from the accumulated actions of beekeepers skilfully practising their craft in the forest.

Image 11. *Bark hive under construction.*

Chapter 11. Conclusion

In answer to the main research question; **Given that the market for honey is assured, do beekeepers maintain forests'?** this research strongly supports the contention that in NW Zambia the answer is yes. Yet the way in which they do this is not in the manner that advocates of the 'conservation by commercialisation' concept usually conceive. The idea that commercialisation of NTFPs can drive forest conservation is a highly compelling one and has been much promoted since the 1980s, yet not always with success. Disappointments have been analysed to reveal, variously, that commercialisation can cause over-harvesting, that natural products are hard to commercialise and that incomes earned are relatively low. Many forest products serve safety-net functions for the poorest people, but this does not mean they make forest management actions 'worth it'. Forest honey trade seems to be an exception; honey harvest does not degrade the resource, honey and beeswax are relatively easy to sell and the incomes earned by beekeepers are not inconsiderable. Yet despite these apparent advantages the positive linkages between forest beekeeping and forest management had been insufficiently studied. This thesis makes a significant contribution to filling this gap.

Conservation proved to be a problematic construct for this research. Conservation programmes are too often driven by outsiders for reasons that do not always match with the daily realities of local people's lives and what people usually mean by the term conservation could not easily be applied to this context. Situating this research within the conceptual framework of social-ecological systems thinking was deemed much more useful. In this regard the research explored the entities, the assets, the processes and the outcomes of a *Forest Beekeeping Livelisystem.*

The research has provided evidence that beekeeping income is incredibly important in the research area of NW Zambia. Honey income serves multiple functions including production, consumption, savings and investment. The evident economic importance of forest beekeeping validates, but does not answer, the main research question. It also counters one of the strong findings from previous NTFP research, namely that NTFPs are very often valued for their safety net functions, as opposed to more productive functions. Using

Dorward's schema of livelihood transitions we learn that beekeepers appear to be using beekeeping as a 'stepping-up' strategy, a more pro-active livelihood function than 'hanging-in'; helping to dispel the idea that beekeepers use honey selling as a safety-net.

In exploring the relationship between beekeepers and the forest it is evident that beekeepers do not manage the forest in the way a conventional forest management plan might work. i.e. there is no inventory, there is no boundary, there is no 'allowable harvest', and no regulations in the conventional sense. Beekeepers do not have a clearly articulated plan for the future, balancing use with harvest. There is also no common-property resource regime in place, with the features which have been shown to support successful CPRs. The missing components are again – no boundary to the resource, no group of users with members, leaders, rules and sanctions, no rights to exclude other users and no formal ownership. Yet despite Ostrom's principles for CPR management being absent (Ostrom, 1991), the forest does not suffer from over-exploitation and is maintained.

Instead the findings show evidence of a robust social-ecological system, where people '*must be seen as a part of, not apart from, nature*', (Berkes & Folke, 1998). The research reveals the entities and components of a forest beekeeping system – a complex, knowledge rich system where the ecological elements and the human elements are intricately connected. The system is robust, sustainable, successful, productive and works with minimal external costs. It is self-sustaining and self-financing.

The forest beekeeping system is in and of itself a forest utilising and forest maintaining system. Forest beekeepers are resource users and the resources on which they rely are bees, trees and flowers. Their production units are hive sites which are places in the forest where hives are located. These hive sites are indistinguishable from other parts of the indigenous woodland in form and function. Hive sites are forests which deliver the full complement of forest ecosystems services. Hive sites are the beekeepers' productive units and they maintain them in order to obtain the harvest they seek, and in doing so they maintain the forest.

In the miombo forest zone fire is one of the most recognised causes of forest degradation and forest beekeepers manage fire. They do this to protect their own private assets – their hives, and also the flowers (communal assets) which produce nectar at the time of year when the most damaging fires burn. Beekeepers explain that the forest mitigation measures they employ also protect small trees, the trees they will need in future for nectar and hive-making. If it were not for the short-term benefits of protecting hives and flowers, they may not take these actions for the long-term gain of future mature trees. It is not possible to say. Yet these are inseparable components of the *Forest Beekeeping Livelisystem*. The area of forest maintained as hive-site in total by all beekeepers supplying Forest Fruits Ltd. is immense, possibly in the region of 1,500,000ha. They protect these sites from the ravages of late-season fires because they know how to do it, they are able to do it and it works. Importantly, the benefits in the form of a honey harvest accrue to the actors in a matter of months.

Conventional forest management plans balance the rate of use with the rate of replenishment. In the *Forest Beekeeping Livelisystem* this is occurring by evolution, not by design. The extraction of nectar from the system presents no risk to the integrity of the forest. The use of bark to make hives is often held up as negative consequence of forest beekeeping, yet there is no evidence to support this concern. Using bark to make hives does not cause forest loss or forest degradation. Not because beekeepers count trees, measure growth rates and restrain their bark-hive making to within sustainable limits. Instead the precise criteria needed to make a hive creates a self-constraining limit on the system, which is supported by the fact that the species suitable for hive-making are the most abundant. The natural capacity coupled with the beekeepers' requirements creates a balance. Beekeepers harvest mature trees in a manner not dissimilar to the way production forests allow timber harvests, but with less-valuable species. As Dorward, (2014) says, one feature of robust SES is that they evolve according to laws similar to those that guide natural selection. If bark-hive making eroded the system, the system would not have survived. Taking the approach of 'survival of the fittest', the ivory trade did not survive, forest beekeeping did survive. Forest beekeeping, as a natural resource harvesting system is 'fitter'.

Beekeepers have unwritten rules of engagement amongst themselves with regard to use of what is essentially an open-access resource. They have unwritten, culturally agreed, rules with others within their community. These rules only go so far when it comes to other land uses. Other land users are their main threat against which they have very little in the way of defence. Neither the law, nor locally-negotiated relations, protect beekeepers against external forces.

Access to a reliable market for honey is the essential driver of the system. From a forest maintenance perspective more trade means more beekeepers, and more effort per beekeeper, which in turn means more forest is used for hive sites. This means more forest is impacted by beekeepers' use, custodianship and – importantly – their fire mitigation measures. There is no evidence yet that more trade is generating new, positively disruptive elements to the system – for example, there is no united call from forest beekeepers for help to secure rights to the forest, nor evidence that local authorities are seeking to invest in forest maintenance to secure honey trade. The other way that trade positively drives the system is that good honey trade improves the attractiveness of forest beekeeping in relation to other livelihood activities. When the maize is hard to sell for a low price, and honey is easy to sell for a high price, this tilts people's livelihood portfolios away from maize towards beekeeping. The consequence of this, not fully quantified in this study, is less effort invested in removing forest for maize and more effort invested in keeping forest for bees. This 'tilting' is not unlike the alternative livelihoods approach advocated by some conservation projects which endeavour to purposefully 'tilt' people's livelihoods away from forest-harming activities e.g. charcoal making. Interestingly, unlike many alternative livelihood initiatives, for this 'tilting' to work in this instance, people are drawn into the forest not taken out.

Community Forestry now has a supporting legal framework in Zambia and one of the pilot Community Forests falls within an area used by forest beekeepers. Forest beekeepers are beginning to understand what this might mean. However, analysis by them and through this research shows that creating a CFA to safeguard beekeepers' forests would be difficult. The area is vast and forest beekeepers are not a united group – even at village level. This is however, an area that deserves greater attention and study.

From a research perspective this study partly, but not wholly, fills a gap in understanding about the social-ecological system of forest beekeeping. It provides a glimpse into a rich and complex avenue of research. There is considerable scope for further research. In terms of livelihoods it would be interesting to delve deeper into the impact of honey income on the rural economy. The research provided clues as to the multiplier effect of beekeeping income for beekeepers and for non-beekeepers, but fell short of quantifying this. This would be interesting to explore further. The gender dimension also warrants a closer look, both in regard to understanding more about women's engagement in the forest beekeeping system and in understanding whether beekeeper's wives contribute to decisions about how honey income is used. The study did not interrogate deeply why and how some people specialise in beekeeping more than others, and with what consequences for their household. Questions remain about whether beekeeping can impact or is impacting on wider dimensions of poverty, beyond income. People in this part of Zambia are poor. There is a lack of infrastructure, limited opportunity for saving and borrowing and poor health services. People have little to fall back on. It would be interesting to consider how beekeeping might contribute – or is contributing – to more transformational changes in the area. In terms of forest outcomes it would be useful to find ways to quantify more reliably the extent of forest used as hive-sites and hence subject to the fire mitigation measures described. One way to do this would be to analyse satellite imagery to compare the condition of forests with hives and those without.

Forest beekeeping is under-appreciated and under-valued. On many levels. It is thought of as old-fashioned and rudimentary. Too often forest beekeepers are accused of degrading forests, when the evidence points to the opposite. Forest beekeeping is not new and has not been 'brought' by a development project. It is not classed as 'development'. This is perhaps another reason why it is overlooked. Yet in a millennium where the need to manage the negative trade-offs between human development and environmental wellbeing has never been more urgent, forest beekeeping is an outstanding example of a system that promotes good synergy between ecosystem service provision and other needs of society.

A jar of honey sourced from NW Zambia has contained within it many values beyond the simple product. The purchase of Zambian honey is the principal driver of a robust, complex social-ecological system that delivers positive outcomes for people and for forests. At present these values are insufficiently captured and rewarded. This raises questions about the marketing of Zambian honey. It is important that buyers of Zambia honey know that their purchasing power is strengthening this forest-maintaining system. This gives them the chance to demand more and pay more, so ensuring the persistence of forest beekeeping and its benefits for people and forest.

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Appendix 1. List of people met, and interviews

Codes are used for citation purposes

CODE	Place of interview or discussion	Year	Further details about the person / people interviewed
INTEMC14	Mayimba	14	One to one interview with beekeeper, Emmanual Chibumbu.
INTLAM14	Mayimba	14	One to one interview with beekeeper, Larson Machai
INTMAY14	Mayimba	14	Interview with two beekeepers in Mayimba
KIIBOB14	Solwezi	14	Interview with Bob Malichi, former manager of North West Bee Products
KIICHI14	Mwinilunga	14	Interview with Patrun Chikolwizu, operations manager[43] of the Mwinilunga facility of Forest Fruits Ltd.
KIICHK14	Kanongesha Palace	14	Meeting with Chief Kanongesha
KIIDAN14	Lusaka	14	Two meetings with Dan Ball of FF Ltd.
KIIDAV14	Lusaka	14	Meeting with Dr. Davison Gumbo, CIFOR Zambia
KIIPFO14	Lusaka	14	Meeting with a representative from NWP Provincial Forestry Office
KIIZHC14	Lusaka	14	Meeting with MacDonald of Zambia Honey Council

[43] At that time Chiko was operations manager

FGDJIM15	Jimbe	15	Focus Group Discussion with beekeepers in Jimbe
FGDKAC15	Kachikula	15	FGD with beekeepers in Kachikula
FGDKAL15	Kaloza	15	FGD with beekeepers in Kaloza
FGDKALW15	Kalwisha	15	FGD with beekeepers in Kalwisha
FGDKAN15	Kanongesha Palace	15	FGD with beekeepers
FGDKANC15	Kanyama Central	15	FGD with beekeepers
FGDKAS15	Kaseloki	15	FGD with beekeepers
FGDKASC15	Kasochi Central	15	FGD with beekeepers
FGDMAK15	Makanu	15	FGD with beekeepers
FGDMAV15	Mavunda	15	FGD with beekeepers
FGDMAY15	Mayimba	15	FGD with beekeepers
FGDMUW15	Muweji	15	FGD with beekeepers
FGDMUZH15	Muzhila	15	FGD with beekeepers
FGDMUZ15	Muzeya	15	FGD with beekeepers
FGDNTA15	Ntambu Sachitolo	15	FGD with beekeepers
FGDNYI15	Nyidi	15	FGD with beekeepers
FGDSAK15	Sakunda	15	FGD with beekeepers
FGDSAL15	Saluzhinga	15	FGD with beekeepers
FGDSAM15	Sampasa	15	FGD with beekeepers
FGDUNK15	Unknown	15	FGD with beekeepers
KIIDAN15	Lusaka	15	Meeting with Dan Ball of FF Ltd.

KIIMIK15	Lusaka	15	Meeting with Misael Kokwe
FGDKAC16	Kachikula	16	Group discussion with beekeepers - reflecting back some of the Questionnaire Survey results.
FGDKAT16	Katemwa	16	Group discussion with beekeepers - reflecting back some of the Questionnaire Survey results.
FGDMUZH16	Muzhila	16	Group discussion with beekeepers - reflecting back some of the Questionnaire Survey results.
FGDNCH16	Near Chibwika	16	Group discussion with 5 beekeepers, when implementing questionnaire
FGDSIM16	Chibwika	16	Discussion with Mr. Makina's group of beekeepers.
FGDKASC16	Kasoche Central	16	Group discussion with beekeepers.
INTLUE16	Kasoche Central	16	Further discussion with one of the questionnaire respondents in Chibwika, Luwi Egan.
INTPEM16	Mayimba	16	One on one interview with beekeeper Peter Machai
INTSIM16	Chibwika	16	One on one interview with Simon Makina
INTQSR16	Near Chibwika	16	Further discussion with one of the questionnaire respondents in Chibwika.
KIIALA16	Lusaka	16	Met with Alistair Anton, Chief Technical Officer of the Decentralised Forest and other Natural Resources Management Programme – Introduction Project

KIIALEX16	Ikelenge	16	Information about pineapple farming collected by Alex Mbewe
KIIDAV16	Lusaka	16	Meeting with Dr. Davison Gumbo, CIFOR, Zambia
KIIEVA16	Mwinilunga	16	Meeting with Evans Sikombwe, operations manager of FF Ltd's Mwinilunga facility
KIIKEN16	Mwinilunga	16	Officer working on DFNRMP project in Mwinilunga, Kennedy
KIILUK16	Mwinilunga	16	Interview with Luke Musona, one of the enumerators hired for the Questionnaire Survey and a beekeeper
FORMUZH16	Muzhila	16	Day long forest walk with beekeepers near Muzhila.
EXHCHI18	Chibwika	18	Extended hive visit 4 nights with beekeepers Pathias Ngolofwana and Brian.
EXHIKE18	Ikelenge	18	Extended hive visit 3 nights with beekeepers Dimas Sakalechi and Jocken Kasochi.
FGDSIM18	Chibwika	18	Group discussion with 7 beekeepers of Makina's group
INTFRM18	Chibwika	18	One on one interview with beekeeper Francis Mukoma
INTHES18	Chibwika	18	One on one interview with beekeeper Henry Samalesu
INTKAE18	Chibwika	18	One on one interview with beekeeper Kasoke Edwin
KIIALA18	Lusaka	18	Meeting with Chief Technical Officer of the DFNRMP project, Alistair Anton

KIIBIK18	Lusaka	18	Meeting with Bill Kalaluka of Zambia Honey Council
KIICHCH18	Chibwika	18	Meeting with Chief Chibwika
KIIDAV18	Lusaka	18	Meeting with Dr. Davison Gumbo, CIFOR, Zambia
KIIDFO18	Mwinilunga	18	Meeting with a representative of the District Forestry Office in Mwinilunga, Lennox Samakonga
KIIEVA18	Mwinilunga	18	Meeting with Evans Sikombwe, operations manager of FF Ltd's Mwinilunga facility
KIIFRZ18	Kitwe	18	Meeting with Mrs. M. Kunda representative of Zambia Forestry Department, Research
KIIPFO18	Solwezi	18	Meeting with the Provincial Forestry Officer in Solwezi, Mr. M. Phiri
KIIDFO18	Mwinilunga	18	Meeting with a representative from the District Forestry Office. The DFO was absent. Met with Lennox Samakonga.
KIIAA18	Lusaka	18	Meeting with Alistair Anton, Chief Technical Officer of the Decentralised Forest and other Natural Resources Management Programme – Introduction Project

Appendix 2. Narrative from all Focus Group Discussions held in 2015

13 August 2015
Kaloza
Justin Mankishi, 30 years old

Beekeeping for 5 years, has 150 hives. He checked them recently - they are well filled.

JL: Why beekeeping?

JM: It was hard to make a living - so I chose beekeeping 5 years ago.

He got attracted by father - who taught him. He also farms maize, beans, cassava, onions, and makes and sells brooms. Maize needs rain. He can get a lot of money from honey in comparison. Next year he plans to increase hives to 300 and farm 1.5 ha of maize. He can manage 300 hives by himself. At first there was a problem of selling honey but there are many buyers now.

JL: You predict a good harvest. Do you fear you will be left with unsold honey?

That had occurred to him - he hopes all will be bought. Other people are still joining beekeeping. He sells to Dan Ball - he is given receipts first and then the money comes after. FF weigh and then pay.

JL: What do you use the money for?

JM: Put in an account (was this an intention or actual?). I use to pay labourers to do farming. Just now I am selling maize and tomatoes.

JL: Is beekeeping profitable?

JM: It is a profitable business because it just needs time - no money.

Breakdown

1 day - cut 30 pieces of bark

3 days make 30 hives.2 days to hang 30 hives

Check - are there bees - 1 day for 40 hives

Check - are there still bees - 1 day for 40 hives

Check - are the hives full - 1 day for 40 hives

Cropping

1 big full hive - 0.5 or 1 bucket. 3 small hives - 1 bucket

150 hives - he has checked 115 - of these 105 have bees and 10 are empty.

If the hives are full he will crop, if they are half full he will leave until the next year then crop. More than 50% are full (he predicts). 1 bucket sells for K200 liquid, K170-150 comb. FF pay K6 comb, k7 liquid per kg.

JL: How do you decide where to put your hives?

JM: 1st I look for the right kind of tree - it must have branches where I can sit or stand to do the harvesting without falling. I am free to put the hives anywhere. If people want to open gardens where my bees are they can do that - but they will not tamper with the actual tree and my hives.

JL: Is fire a problem for beekeepers?

JM: No we do early burning (in June) to avoid fire destroying the hives and the flowers later on.

JL: Are there threats to beekeeping?

JM: We fear the Chief selling land to miners or big farmers.

JL: What can you do about that?

JM had no answer.

JL: Do women participate?

JM: Yes because my wife makes cassava flour - and the bees collect it.

JM said he gives his wife money for farming.

JL: When you see a bee tree in flower what do you think of?

JM: Money

JL: How much money from one tree?

JM: No answer (laughed).

13 August 2015
Kachikula
3 beekeepers

Peter Sakufola, CB, 35 years in beekeeping, 250 hives

Semechi Changala, 2 years in beekeeping, 49 hives

Venas Kawumba, 11 years in beekeeping, 80 hives

Peter said that now he has cattle but three-quarters of the money he invested in building up his cattle came from honey. Cattle are now his no. 1 - but he will never stop beekeeping. That is who he is.
Cows 1,Bees 2, Maize 3, Beans 4, Cassava 5
Four children in secondary school - paid for with honey. Children have different ideas - they may not be beekeepers.

JL: Semechi - you are new to beekeeping - why now?
SC: To get money. Bees are like a bank full of money. I learned from Peter.
JL: what are your plans?
SC: I plan to expand to 500 hives.
JL: What will you do with the money?
SC: Two of my sisters died and I must take care of the orphans, along with my own children. I need the money for this. I also make cooking sticks, buy cooking sticks from other people and take them to Lusaka and sell.
JL: As the honey money comes all at once - how do you make it last all year?
BKPR: Grow maize and beans, put in the bank (did they mean like a bank or actually in the bank?), then harvest the maize and beans
Peter is planning to open a bank account this year. Semechi also would like to invest his money as a shareholder in a business.
JL: What about the youngsters - will they be beekeepers?
SC: 3 already are - 1 of 16 years has 8 hives, 1 of 20 years has 5 hives, 1 of 20 has 4 occupied hives. *Venas has 80 hives and is planning for more. He plans to use the honey money to invest in farming.* JL: You say you engage labourers to farm for you. Why are these people not beekeeping also?
BKPRS: They are not interested.
JL: Who is better off - those who work as labourers or beekeepers?
BKPRS: Both live well but the beekeeper is better off - honey is the mother of farming. The labourer will take his money - spend it, and then have nothing. Meanwhile the beekeeper's harvest is growing in the hive. Bees are like a bank. Maize can be good - but it can be hard to sell. We cannot fail to sell honey because of the company.

Peter wants to buy a car.

JL: How profitable is beekeeping?

Peter: I do everything myself - I do not pay other people, perhaps they will kill the bees. I do everything myself.

Peter mentioned about having to spend time checking for rats in the hives and burning (something) to attract bees.

Peter's economics - see the excel spreadsheet.

There seems to be a limit to what one person can do before hiring people to help - in Peter's case he needs help transporting the honey out of the forest (especially in a good harvest)

Semechi. He does spend money - he has an arrangement with other beekeepers who help him - he buys things for them in Lusaka when he goes to sell cooking spoons, and then they do a deal on labour to help with beekeeping. He always makes a profit.

Forests

Different forests yield differently. You cannot claim any forest for yourself - the Chief will challenge you. The forest is for everyone. Beekeepers are cooperative - they recognise if someone put their bees there first, and it is possible to recognise the owner of the hive by looking at the hive.

JL: Peter you said people must not kill a single bee - but what about cutting trees?

Peter said the same thing - they must not do it. But then he said that the hives are far away and people do not cut trees there.

JL: Do you worry about tree cutting?

BKPRS: We worry about the Chief giving land to big farmers.

BKPRS: We do early burning in June.

JL: When I look at a tree - I see just a tree. What do you see?

BKPR: I see flowers and money, I am thinking money

JL. How much is one tree worth?

BKPRS: One tree is not enough. It takes many trees to make honey, and flowers come at different times so it is a bit complicated - you need all the trees. (i.e. that is a silly question).

Beekeepers said that if you do early burning bees can feed from fallen flowers (really?)

Any questions?

Peter - I need help to get honey out of forest - was asking for a bike from FF. Ernest Kasempe (spelling?) explained that he can buy a bike in exchange for honey - but honey first.

Semechi asked - can it be possible to find a donor to help us buy a piece of land for the bees - yes we can ask the Chief - but he will need money, and so will the District and we want a title deed. As a group. Then we would not allow anything there but beekeeping. (interesting question)

13 August 2015
Makanu
5 beekeepers

Mjunga James, 32 years old, 20 hives

Finwell Chimwinsa - 95 hives

Mrs Grace Soin has 5 of her own (3 with bees) and her husband has 100.

Maggie Mjunga has 4 hives.

Laxon Katenga

JL: What is the benefit of beekeeping?

BKPRS: Business, to educate children, as capital for other ventures, source of living. Bees are better than maize - bees are more than farming.

JL: James - why start beekeeping now?

JM: I have been growing maize but I saw that the beekeepers were doing better than me. They had money, were paying school fees, they had good businesses and building good houses.

Maggie: Years back we also had bees but it was not bringing in a profit - the mkt has changed and now people live well.

Finwell : With this year's money - I plan buy a plot, build a good house, set up a shop. I plan to increase to 145 hives.

Grace: I would like more beehives so I can educate my children. I will make the money last all year by cultivating - if you invest money in cultivating then you get the money back later.

JL: How profitable is honey?

James: Profit is more than enough. As a learner I spent 1 week to make 20 hives. The whole enterprise is about investing in energy.

Laxon Katenga has 215 hives. It takes 3 days to make 20 hives, 2 days to hang them. Go and check 5 times a year - need to melt wax into them from time to time.

Harvesting - 2 months to harvest 215 hives. 5 or 6 in one day.

Buckets are provided (no need to buy), veils (cost little) - gloves - we are asking from the company.

Laxon has been keeping bees about 20 years. In the past it was hard to sell - it was a real challenge.

Beekeeping is popular with young people. They want good houses - and this means getting enough money from honey.

Laxon can manage 215 hives alone.

1 person can manage 500 hives alone - perhaps getting help with transportation by hiring someone with a bike - this costs little.

JL: How do you decide where to put the hives?

BKPRS: First look for trees with a good branching structure - so it is possible to harvest safely.

BKPRS: We have been taught to put the hives away from the village (2-3km) to avoid contamination with things like fertiliser. Also to protect small children from stings.

JL: Who does the forest belong to?

At first they said FD - because in the past the FD was in charge of beekeeping. Not anymore. The Chief owns the forest. People do not need permission - they can put hives anywhere.

JL: All over Zambia trees are being cut - will that happen here?

Some said no, Maggie said ‘it is scaring us’.

Another pointed out that they protect the trees through early burning.

Other said the laws of Zambia will protect the trees. People need permission to make charcoal. There is no conflict with charcoal making because the hives are far from the road.

JL: When I look at a tree - I see just a tree. What do you see?

Beekeepers said they see money. But they do not count flowers or trees or yield per ha - they just count colonies - and the placing of hives is determined by having a good branched tree.

Any questions:

They asked about a storage shed for when there is a lot of honey at the place. Ernest said they should do that themselves - it is better. If FF build - they will build one big one somewhere and they will all will have to take the honey there - less convenient.

The women had been part of a beekeeping training / project and were asking about ants. I suspect they were less interested in hearing about solutions - I think they were really interested in another bee hive project.

14 August 2015
VH Sampasa, Kanongesha
4 beekeepers

Stenily Chi'tambala, 69 hives, bkpg 12 years

Hennery Mayibolu, 40 hives, bkpg 3 years

Allex Samuwika, 90 hives, 5 years

Sampasa came later (speaks English)

JL: Hennery - you started recently - why?

HM: One way of getting money, income. Also cultivate cassava. Bkpg is much better, cultivation takes long. There is a restriction about making hives so not to destroy the trees. We are allowed to make 15 new ones each year. This is a new thing - introduced recently. The FD pressurised (?) the Chief to introduce this rule. It is better we use plank hives.

JL: But planks also come from trees - so does that really save trees?

HM: Yes but only some types of trees. And the hives last longer.

JL: Stenily - since you started beekeeping - what has changed?

SC: The income is better and there are now restrictions over trees.

JL: Alex - what else do you do - in addition to beekeeping?

AS: Maize, cassava and beans - for food and income. Beekeeping is better for income.

JL: How many people are beekeepers - what proportion - all, few, half?

BKPRS: Most of the men, about 50% (?)

JL: If not a beekeeper - what?

BKPRS: Cultivation only, and some people are charcoal burners.

JL: Who is better off?

BKPRS. Beekeepers

They said there will be a bumper harvest this year. I asked what they will do with the money.

SC: Increase my garden (hire labourers), build house and buy iron sheets.

HM: Go back to school and increase my education.

AS: Increase my fields, buy iron sheets. Build house and educate my children.

JL: You say you will increase your fields. Does this mean you will begin to do more farming and less beekeeping?

SC: No we will stay with beekeeping.

JL: And your children?

BKPRS: If they succeed in school they will be educated and get jobs. Otherwise they will be beekeepers.

JL: How profitable is beekeeping - what do you put in?

BKPRS: Spend no money. Energy and time only. Veils cost K 14.

SC: Transportation of honey to collection place (from 69 hives) costs about K 300.

See excel spreadsheet.

Hennery made his yield estimate in July - that was sufficient to know that:

Of 40 hives, 35 occupied, 21 will be cropped and 14 will be left until next year.

FOREST

BKPRS: The forest belongs to the Chief, we do not need permission to put hives, he knows that we do, we sometimes give honey to the Chief.
BKPRS: Charcoal burners cut trees - but we do not fight. There is tension between the FD and the charcoal burners.

Fire? Late fire is a problem for beekeepers, early burning is better. At first they said they do not do early burning - then they said they did. Said that they do not burn in the near places because that could damage their fields, but they do so in the far places.

BKPRS: No one checks how many hives we make.
JL: How long do beehives last?
BKPRS: When bees have entered the hives last 2-3 years. Otherwise they rot quickly.

Peter Sampasa, 20 years bkpg, 210 hives.

He keeps hives in four areas. He keeps moving the places because when hives are no longer strong - needs to make more - and so moves to another place to find trees for hive-making. Then after 2-3 years he can go back to the place he left because the smaller trees will have grown bigger. (at first I understood that he moved the places where he was hanging hives - but I think he meant he moved to different places to look for trees to make hives)
PS: The Chief restricts the forest we can cut for cultivation. 1-2 lima is OK but recently I was asked to attend the Chief because it had been reported that I had cut 3 lima - which I had not.
PS: 20 years ago we were just selling locally. The market was not good. There are more beekeepers now because the market is better because of FF.

14 August
Village Nyidi, Kanongesha
4 beekeepers

Andrew Kambwenji, 50 hives, 12 years.

Chioma Harrison, 130 hives, 7 years

Ford Sakalezhi, 120 hives, 6 years

Ernest Chioma 81 hives, 4 years

BKPRS: Beekeeping is important because of income. Cultivation is also important, each has their season.

JL: Why are the number of beekeepers increasing?

BKPRS: Because better source of income.

BKPRS: In the old days we did not see the importance of hives, we just used to cultivate, now we see the importance of the income from beekeeping.

BKPRS: There are more beekeepers now because the market is better - and there are more people, the young ones are coming up.

BKPRS: We sell in Oct to Jan to Dan Ball, and on 'on the black market'. This year will be a bumper harvest. We are depending on FF to buy everything.

JL: What will you do with the money?

BKPRS: Iron sheets, cultivate, buy bicycles, motorbike, school fees

FS: bike, iron sheets, educate my children (has 11 children)

Ernest Chioma. Started beekeeping when 13 years old. He has a small house (not married), will buy iron sheets and will cultivate.

[when people say cultivate they mean hire people to cultivate, some of these people might be beekeepers, some are not]

Overall many people keep bees, but some on a small scale only.

PROFIT

See excel spreadsheet

If need help carrying honey they will pay people with honey. So if 10 buckets are carried, 2 will be given to the person carrying.
CH said that he has 130 hives, he knows 30 are empty, he will not check again until harvest time - so of the 100 with bees not sure if all will be full. Last year there was not enough. He cropped 15 only.

FOREST

BKPRS: When deciding where to put hives, we choose the right tree - best branches. The place in the forest does not belong to us, belongs to the Chief. The hives can be far apart. The Chief has his representative (VH) who supervises what we do in the forest. When cutting we should stay in 'our area' (i.e. that associated with our VH). No restriction on making hives. But there is a restriction on cutting for farming (perhaps connected with the finger millet?) - do not let people cut more than 2 lima. (lima = 50m x 50m)
Early burning is better. Yes, we go to where the hives are and do early burning. Do in May when the grass is still fresh.

JL: Across Zambia there is much deforestation - can that happen here?
BKPRS: No because the Chief restricts because he wants to preserve forest for the rain. People make charcoal on a small-scale. They need permission to do that. The 'eye of the chief' is always there.

14 August 2015 Near Kanongesha Palace 5 beekeepers

Nikomba Yona, 100 hives (now), 30 years + bkpg

Seraphin Mloza, 200 hives, 30 years + bkpg

Moses Mwinda ,10 years bkpg, 250 hives

Mutebo Sakaimbu Mukonzo, 15 years bkpg, 330 hives

Sakaimbu Charles, since 1998, 380 hives

BKPRS: Benefit of beekeeping is for income to educate children, buy clothes, buy animals, build houses, farm. Farming is OK but you don't get much from maize. Animals are good -

cows and goats. Beekeeping you get money quickly - the same year. With animals you have to build up and wait until they start giving birth - then fatten the young animals. Animals take long.

JL: What do you do if you need money for an emergency?

BKPRS: We keep the money from beekeeping and invest in farming and animals - then you can access money through the year.

JL: Who is better off - people with bees or without?

BKPRS: It depends. Others see beekeeping as very hard work. Some are better off, some are not. Young people are interested in beekeeping -but not all.

JL: Yona - what has changed since the old days?

NY: We never used to have enough money, now we have enough. Buyers were not there before. Now the price has gone up.

BKPRS: Not all hives are full and we add new hives each year. Some hives are occupied in April, some in August - if in August we must leave them until the next year.

Sakaimbu Charles: 380 hives, 50 are empty, 80 are half full - I will crop from the remainder.

JL: Charles - what will you do with the money?

SC: I will build a house, and a house in town to rent, buy animals.

JL: Once you have enough animals and enough houses - will you stop beekeeping?

SC: Only if I get too weak - otherwise I will not. “Beekeeping is the source of everything”.

BKPRS: If need money at another time of year - have animals. Can’t do away with beekeeping. We can even eat honey. Animals take long to give offspring. In Jan we hang hives. Never do away with beekeeping - it will continue.

JL: Moses - what will you spend money on?

MM: Build a house, educate children, buy cattle - when I am old these animals will help me.

JL: Do women keep bees?

BKPRS: Yes - they have their own. They do it through men. A woman will get money and give it to a man (husband or relative). She sells the honey as her own and uses the money as she chooses. Some for cultivation (hiring people) and some for fertiliser.

PROFIT

We do everything ourselves. See excel spreadsheet.

FOREST

JL: Who does the forest belong to?

BKPRS: To God. The Chief. We are not required to ask permission to place hives. When cropping we pay the Chief in honey. Yes trees dry out when we make the hives but we do it selectively. We leave the small trees to grow. We do not do it anyhow. It is true that in the old days there were many fewer beekeepers - that is why we are selective when choosing trees for hives. Yes we move from place to place. Then we go back to the place we used earlier after 3-5 years[44]. The smaller trees will be big enough. If you see the places where are ancestors kept bees and made hives - the trees are all big now.

JL: Is fire a problem for beekeeping?

BKPRs: What kind of fire?

BKPRS: Early burning is good, late is bad. Early burning protects the hives and also deters the chibudi (honey badger) - they are put off. Yes we do the early burning.

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14 August 2015
Sakunda
Group of beekeepers

BKPRS: Benefit of beekeeping is income. Other sources of income are maize, groundnuts, goats and sheep, cassava. Most money comes from honey. We get animals from honey.

JL: What might happen if something happened to the bees e.g. got diseased? (or similar)

[44] Again I think they meant they move about when seeking trees to make hives and not that they move their hanging places

BKPRS: Then we will cultivate maize and cassava. But to be honest - the most important thing - we rely on honey - without that we suffer.

The group members - we found them making bricks - and there were many. They stopped to talk to us. I did not take down each name. Those I asked had been keeping bees for 2,3,5 years - including one older man who has been doing it for 2 years (only). In the past he used to farm only. He is planning to use his income for farming and to build a house.

BKPRS: In the old days people used to make honey - for eating, not like now, for money. There is some cash from honey now. Wax is used for soap, lotions and candles - we did not know that before.

BKPRS: We expect a bumper harvest. We hope the company will buy everything. We only believe in that company. We also sell to individuals from time to time.

JL: How profitable is beekeeping?

BKPRS: We buy veils. Company provides buckets. We do not put in money.

BKPR: Out of 150 hives I expect to harvest from 80 hives.

BKPR: I have 76 hives, 38 are occupied and one that was occupied has been taken by a honey badger.

BKPR: Young people are interested.

BKPR: In this village most people are farmers - we are just starting to keep bees - we learned from [-] another neighbouring village.

BKPR: We do not need permission to hang hives. Open area. Public area.

Some said there are enough trees, some say not. Some say the deforestation cannot come here. There was a discussion about permanent hives - instead of temporary - that will save trees. Some fear the loss of trees 'but we can't help it, that is what we live on'.

I asked about early burning and they said they do that.

They asked 'what can be done about the loss of trees'?

17 August 2015
Mayimba
Large group (more than 10 - part of the training programme)

JL: Why did you start beekeeping? (to a newcomer to beekeeping)

Bkpr: Because there are riches in it.

JL: What were you doing before?

Bkpr: Just farming.

JL: Which is better?

Bkpr: Both are important. Beekeeping provides a source of income to cultivate.

JL. You said you have been keeping bees for 20 years. Are you a rich man?

Bkpr: No because back then the market was poor. We now have a reliable market. We used to sell locally only - perhaps 2 buckets. Now we can educate our children, buy goats, buy iron sheets. Now there is a change.

Bkpr: In the past we used to sell to individuals. Now we sell to the company Dan Ball - we can now buy blankets, iron sheets and educate our children.

Bkpr: FF - they have brought a big change. They tell how to keep the forest - in the future we will have something good.

Bkpr: We used to sleep in thatched houses - now we have iron sheets. This what FF has brought us.

Bkpr:. You asked if we have become rich - that is difficult because we are not paid in bulk - but bit by bit.

JL: What yield do you expect this year?

Bkprs: 50-60 buckets, 50 buckets, 40 buckets. This will be a bumper harvest.

JL: What will you do with the money?

Bkpr: Educate children, buy animals - then if I stop beekeeping I can use the same money again.

Bkpr (the one who said paid bit by bit): 50 buckets. To buy iron sheets and educate children.

Bkpr: We would like the company to grow and give a higher price.

Bkpr: I will buy a plot and build a house.

Bkpr: I will harvest 50 buckets, buy a plot, build a house and buy cattle.

JL: Will your children be beekeepers?

Bkpr: We are suffering with the work, we want our children to do better.

Bkpr: We see people finishing trees, it will not be possible to keep bees in future.

Bkpr: If FF can come up with a solution to hive-making from bark - that would be better e.g. hives made of planks.

Bkpr: We are many - we are uneducated that is why we do this work.

Bkpr: I bought 2 animals from honey money, they have reproduced to become 4.

JL: How do you make money last all year?

Bkprs:

- We suffer and that is why we ask the company for loans.
- We can't sustain from one season to the next
- We are not educated - we cannot have a bank account

Then people started saying differently … "we farm and buy animals and then get the same money back again. We cultivate beans, sweet potatoes, from one season to another - then sell the beans and we keep our money that way". *Others said the same thing.*

JL: Do you worry about forest loss?

Bkprs: Yes. The government and the chief sell the land to big farmers (Fisher) and to the mines. We use the bark from trees and there are many beekeepers.

JL: Do you discuss solutions amongst yourselves?

Bkprs: Yes we do talk about it but we do not know the solution.

Bkprs: The chief and the govt. will not listen to us. Govt. wants money through selling the land - we have no powers - the government needs money - we do not give money to the govt. - we have no powers.

Then someone asked … can you suggest a solution?

I explained about bee reserves in Tanzania but that the beekeepers pay something. They said could not work here because beekeepers keep their bees in different places - and they gave other reasons why it could not work. Something about abiding by the law? I said I did not mean that it would work here but I was just giving an example.

17 August 2015
Mavunda
3 beekeepers

Rimod Katoka (also a plank sawyer) 7 years, 200 hives, 102 with bees

Mistera Ifumbu 20 years, 200 hives, 150 with bees, will harvest about 50% of those.

Ephraim Chikwama - 150 hives

Maurice Kusaloka - 100 hives (20 occupied last time looked)

Expect to harvest 40-50 buckets each.

JL: What is the benefit of beekeeping?

Bkprs: Income and use for farming

JL: Rimod - before beekeeping what did you do?

RK: I cut trees and made planks. I still do that. When I was in the bush I saw beekeepers and wished to copy them. After cropping I can educate my children, buy clothes and solve my problems.

JL: Which is better bkpg v farming?

Bkpr: Better to be a beekeeper, earn a lot.

JL: What planning to do with the money:

- Educate children
- Buy clothes
- Buy animals
- Buy iron sheets
- Build house

JL: How to make money last all year?

Bkpr: Used to earn a little in the past - now we have a bulk income so we could open bank account (I think I asked about bank account).

Bkpr: We put the money in farming and then get it out again.

Bkpr: There are just a few beekeepers here.

JL: Who is better off - bkpr or farmer?

Bkpr: It depends.

JL: Are young people interested?

Bkpr: Yes some are.

JL: Is fire a problem?

Bkprs: Yes it can damage flowers and hives.

They said they avoid the situation by early burning. They fear deforestation - it is difficult. If the trees become few they will just do farming.

JL: Do you talk about it - the problem of losing trees?

Bkprs: Yes we do. But it is too difficult to advise people who are cutting trees.

JL: But Rimod - you also cut trees to make planks?

RK: Yes.

I think he said he was selective and did not cut bee trees.

PROFIT

Make 10-15 in one day. Hanging is easy. Can take long to check the hives. Can crop 4 in one day.

They explained they choose forked trees to place beehives. They also said they had their places for hanging hives, "We have our places, we have a map".

Bkprs: We don't change the hanging places - we replace a rotten hive with a new one on the same branch.

JL: The places you were using 10 years ago - are you still using now?

Bkprs: Yes. They are 'our' places but we do not own them.

JL: Can someone do something else there?

Yes. For example Fisher opened a farm at Lwakela and beekeepers lost their bee places.

A hive can last 4-5 years with bees in and 1-2 without.

18 August 2015
Kanyama Central
6-7 beekeepers

CB John Samuheha - sold 10 buckets last year

Anton Inkuba - 100 hives, sold 7 buckets last year

Mkosa Charles - sold 5 buckets last year

Sameji Lowson (3 years beekeeping) - sold 5 last year

Maheka Phillip sold 15 last year

JL: What is the benefit of beekeeping

SL: Profit-making, source of income, educate children

Bkpr: Source of income.

JL: Lowson - why now? Why not before?

SL: I used to cultivate maize, now I joined beekeeping. It has really helped me.

JL: What has changed for you?

SL: I crop honey and I educate my children.

AI (anticipates 25 bcukets): I will educate my children, buy clothes, buy animals and cultivate.

JL: How do you make money last all year?

Bkprs: We do not have bank accounts - some many buy cattle as an investment. Then with what is left plant maize and get money later - when selling the maize.

JL: Mkosa - how long a beekeeper

MC: 10-12 years

JL: What has changed in last 10 years?

MC: Have satellite dish, grow maize and beans, motorbikes, iron sheets, further education for children. 10 years ago there was a poor market and the price was low. Never used to have buckets so hard to sell.

JL: What about maize - don’t you get money from that? (they laughed)

Bkprs: We do all things, animals, maize and beans.

JL: Which is better?

Bkprs: We need all.

JL: How profitable is beekeeping?

Bkprs: In beekeeping the trees are from God and the flowers and the bees are from God. We work just to crop the honey.

JL: What money do you put in?

Bkprs: With us just labour.

JL: Do young people join in?

JS: I don't see any following. They fear bees. We are pushing them to be better than us. Let them be educated. We do tell them about the advantages of beekeeping but they want to be educated and they are not interested. [note that John said this - he speaks English therefore probably education oriented]

They said that there are 72 in the group. In the village as a whole, less than half are beekeepers. There is one woman - she does it with her husband. One how many beehives can be made in a day - they said 5,8,8,8

Bkprs: We check them - if not occupied we move them. We chase squirrels. If not occupied we put wax and propolis. To check we go once a month. Near the houses we cultivate maize and cassava and we are advised to put the hives far away (for organic cert.) The hard part is cropping - because they are far and the bees sting. We carry on shoulder, head and by bike.

John - 200, 2 empty, 48 new, 150 to crop. Two months work to crop 150. 1 day, 3 hives, 2 buckets.

Bkprs: We use the same places. Same as our forefathers. If rot we take down and put up new ones.

Anton: Yes I am using the place my father used. If people interfere I chase them. People don't cut trees there - the places are too far away.

They asked about using plank hives instead of bark. I asked would they put them in the same places *and they said yes. They had been parts of a project with Keepers Zambia and had been given some top-bar hives - which they showed me.*

18 August 2015
Kaseloki
Kaseloki Graham - the CB on his own

49 members in the group and 13 newcomers (new to the group). He started beekeeping in 1999 and was part of NWBP. Uses income to educate children.

Since that time get good money from Dan Ball. They have been taught to differentiate on quality - grade as they sort.

Feed family, cultivate, education, buy animals for the future.

Group - last year 270 buckets, individual 14 buckets, this year forecast is 40 buckets (for himself).

Some children have gone on to higher education level - as a result of income from honey.

18 August 2015
Mujila
About 7 beekeepers - plus others from the Kapundu area

Venas Musona CB - 12 years

Muhona Makina - 50 years

Anton Levun - 5 years

Kosta Paul - 9 years

Gilbert Musona - just starting this is year 1

Ted Machikini - 13 years

Chianga Elad is the CB of Kapundu area.

Bkprs: The benefit - get money, educate kids, money, build good homes

Bkprs: Sell honey, buy cattle, buy chickens and clothes

Bkprs: When I become sick I will sell an animal

JL: What has changed since you started? (asked Ted Machikini - 13 years in bkpg)

TM: Change in price. Build houses, educate children, mkt before was not good, mkt there now.

Bkprs: In the old days when we cropped we did not differentiate, now we are trained, even when cropping we use less smoke. When storing we don't mix with chemicals. Old days there was little money in it.

JL: What has changed?

Bkprs: The price is K6. Able to pay school fees.

JL: Why price gone up?

Bkprs: Honey has found a market in other countries

Bkprs: Honey is good, we get money straight away.

JL: Are more people joining?

Bkprs: Yes many more.

60% to 80% people are beekeepers.

JL: Why bkpg and not other activities?

Bkprs: Easy to do. Don't pay anything. Maize need money for fertiliser. Bees have no diseases. Animals die sometimes - from disease.

JL: How make money last to next year [they laugh]

Bkprs: We buy some few items and sell them and this sustains. Buy animals like goats, cattle, chickens. Paying for school fees is an investment too - when our children have jobs they will help us.

Bkprs: Children will prefer to get jobs 'be managers', they will get employment.

Muhona - 200 hives, 20 buckets this year, 10 last year

Bkpr; 25 this year, 5 last year (100 hives)

Bkps: 15 this year, 8 last year (95 hives)

They all know how much others produce and how many hives they have.

Bkpr: The bees are in different places but we keep the same places - over 10 years use the same place. I hang a hive - then it is my place. I will replace the old hives. Never happens that someone can put there hives there too. It is like you have bought the place.

Bkpr: We put them in different places because there is more or less flowering in different places and in order to get max benefit we have different places - to be safe.

JL: Are you afraid of people cutting flowering trees?

Bkprs: Yes - we worry.

JL: Do you talk about it?

Bkprs: Yes we talk about it when we meet - but we do not solve it.The problem is always there - for example people cut trees to get caterpillars.

I tried to ask if they would be willing to spend money to protect trees. They said that would mean getting a title deed and that would be impossible for such a large area.

JL: Is bush fire a problem?

Bkprs: Yes, it destroys flowers. Early burning is the solution and the FD used to get people to do that in June and July. We beekeepers do that now, we burn here and there, where are hives are. In June.

JL: You also need trees to make hives - is there a shortage?

Bkps: Yes with more beekeepers. But we select trees, we do not use all. Also small trees are protected when we do early burning.

If occupied a hive can last 10 year (if empty 1-2). Even 15 years. I said other beekeepers had said less time. One person defended by saying he is using beehives his brother left in 2007. It also depends on the tree species.

JL: What do you invest in beekeeping?

Bkprs: Nothing just labour. Veil K15.

One said he bought hives. Used to be K10, now K20. If starting out this is a good way to start. If one is sick during hive-making time better to buy from others.

Bkpr: Can make 10-15 in one day. Always we leave some trees for the following year.

Bkpr: We check monthly for damage, if occupied, if full or not.

Cropping - 1 day, 4 hives, 2 buckets or this year perhaps 1 hive to 1 bucket.

Bkpr: If far, we go and sleep. We suffer with transport. You can walk for 20km with a bucket on shoulder.

JL: In future will you leave beekeeping and do another business?

Bkpr: Not to leave, never. We can add activities, but not leave.

JL: Do you fear the company can fail to buy all?

Bkprs: No we do not fear that. They will buy all.

Bkprs: Deforestation is caused by caterpillar cutting, mines, charcoal and farming. But the forest is God's creation - it cannot be finished.

I tried to mention the bee reserve idea - they liked the idea. "The FD used to do that. In fact the places the FD used to use for beekeeping are still there".

19 August 2015
Muweji (Ikelenge)
Group

JL: What is the benefit of beekeeping?

BKPRS: Income. Lot of help from honey. Get a lot of things - source of income. Get money from beekeeping. But there are challenges. The price is too low.

JL: Some people have been keeping bees 30 yrs +. What has changed?

BKPRS: No difference. There is a market problem. We suffer for nothing.

They said they now sell to Dan Ball and before that to the Germany company and to NWBP. They said nothing had changed since that time. Someone said that the Germans used to give loans. DB gives no loans. One said, "We are suffering".

JL: (One person - new to beekeeping). Why did you opt for bkpg?

BKPR: It is a source of income.

JL: What other things can you do?

BKPR: Lots of things - different types of farming.

JL: How compare?

BKPR: Bkpg is better - bkpg is seasonal.

JL: How many buckets did you sell last year?

Beekeepers contributed their answers 25,20,18,15,9,7,5,37,30,28,25,14,28 - buckets.

JL: And this year?

BKPRS: Bumper harvest. We have started cropping. But there is a delay in buckets.

JL: You said beekeeping was seasonal, and that was a good thing - why is that good?

BKPR: Because it is not a full time job - not the whole year. We can still do other things as well.

JL: How do you make the money last all year?

BKPRS: We buy animals, educate children - as we put the money in animals we have invested it and get the money back slowly.

I asked the three women beekeepers the same question.

JL: How do you plan to use the money that you will earn this year?

Woman Bkpr: Children's education. Buy soap in bulk and then sell bit by bit. Also iron sheets.

Woman Bkprs: Farm pineapples, lima of maize, house maintenance and for the children.

Bkpr - Iron sheets, goats, educate children

Bkpr - I have been sick and have not enough hives. I do not anticipate a good yield. The little I will get I will work on my house and educate children.

Bkpr - I have a lot of children - I will use the money to take care of them. But bucket distribution is a problem.

JL: How profitable is honey?

Bkprs: We invest labour to carry the honey. I do not have a bike - so I hire a bike. We also invest the food we need to go and crop.

Bkprs: We invest labour. Beekeeping is a very difficult job. Need working suits, need veils and smokers and gloves.

JL: How many hives to make in a day?

Bkprs: 10,10,12

Bkprs: After hanging - we check from time to time to see if occupied. If damaged we replace. If rats inside we chase them. We check monthly.

JL: How do you protect hives from fire?

Bkprs: The way to protect from fire is to hang them high up. At times we do early burning. All people do it in the same month - everyone does.

Bkprs: We also hang where the grasses are not big - to avoid the problem as well.

JL: What about the trees that flower - do you have to care for them?

Bkprs: Yes with the same early burning.

JL: Do you use the same place for your hives - year in year out?

Bkprs: Yes (they laugh).

JL: Is it your place?

Bkprs: Yes. No one can interfere there. My children will take it over.

JL: Can other people cut trees there?

Bkprs: No people are fearful and respectful.

JL: But whilst this protects trees - what about making hives themselves - that also kills trees?

Bkprs: Yes that is true but we cannot afford plank hives - they are too expensive. But there are enough trees.

JL: What about your children?

Bkprs: Yes they will keep bees there too in the same places we use for hanging - it is their inheritance.

Young people also keep bees.

JL: How many hives can you crop in a day.

Bkprs: We have no protection - so it is difficult.

Bkprs: 3 a day, 2 or 1.

JL: How many hives to fill a bucket?

Bkprs: Between 3 and 1.

Bkpr: Out of 85 hives, 55 have bees, 30-40 will be cropped.

Bkpr: 110 hives, - 40 have bees, 25 will be cropped

Four groups represented here. In each group there are some women - 4,10,5 and 6.

JL: In other parts of Zambia there is a lot of deforestation - can that happen here?

Bkprs: No it cannot - we see the importance of honey and we cannot allow that. We cannot allow anyone to cut trees carelessly. There are rules. There are restrictions.

I asked who makes these restrictions. The answer was not clear - something to do with having a card, must sell honey with a card. They pay something. Fee for the ID. Company pays the FD. Can't sell honey 'anyhow'.

19 August 2015
Four groups: Kasochi Central, Kamukanda, Mungwayanga, Kasalimuna.
About 9 beekeepers

One person was quite vocal English speaker.

JL: What benefit of beekeeping?

Bkprs: Source of living, food, money.

Bkpr: I am not educated - beekeeping means I can get something. In beekeeping - it is a free thing, given as a gift from God.

JL: How long have you been keeping bees?

Bkprs: 30-40 years, 30, 10, 15 years.

JL: If have been beekeeping a long time - what has changed?

Bkprs: There has been a change - never used to have a market, nowadays we can sell honey.

JL: What was it like before

Bkprs: There was no market.

JL: What difference does it make to people's lives.

Bkprs: Old days used to suffer. Now each and everyone can get something, build houses, buy iron sheets, educate children.

Bkpr:Now we have an income it is easy to educate children.

Bkpr: We started with the German company. Now DB.

JL: Which better?

Bkpr: We sell whole comb to DB - before we used to sell liquid honey. The price is better nowadays. JL: How many hives do you have?

Bkpr: 200 (75 buckets last year)

Others said 300, 450, 370, 205 hives. On being asked how many buckets can they sell this year they said it depends on the rate of supply of buckets. With no restrictions a 450 hive beekeeper can sell 150 buckets. "If all are occupied we fail to crop them all". *They were complaining of buckets - they come late.*

Bkpr: (Young man) I predicts 17 buckets.

JL: What will you spend money on?

Bkpr: Clothing and iron sheets.

JL: (to newcomer) Why have you chosen beekeeping.

Bkpr: I have seen the kind of living beekeepers have. They sleep well, they eat well and the move well.

JL: What were you doing before?

Bkpr: I was a worked on Fisher farm, but now I am retired.

Bkpr - 18 buckets (last year) - I am educating my child at college. I predict 40 buckets this year. I am educating other children too.

JL: How do you make money last all year?

Bkpr: Use money in farming, maize cultivation, pineapples.

Bkpr: One person (English speaker) buy fish in solwezi and sell - this way generate money.

Bkpr: Cultivate maize.

JL: What percentage beekeepers (e.g. out of 10)

Bkprs: More than 50% are beekeepers. Other people grow pineapples and others maize.

JL: Which is better?

Bkprs: Pineapples are better because get something throughout the year. Pineapples are hard work. 3 harvest seasons. Bkpg lump sum.

JL: Which is better - income spread out or lump sum?

There were two different opinions. Some said little by little because if all comes at once one can fail to plan and misuse the money. Another said - lump sum is good because you can invest - especially if you are a good planner.

FOREST

Hives are in the bush.

JL: Do you keep the same places for hanging hives or us different places from time to time?

Bkprs: Each person might have different places but they stick to them when they have them. I know my place. I have used the same place 10-20 years, replace hives if old. We have our own places.

Bkpr: People are not allowed to cut trees there (in my hive place) - it can never happen. Anyway the people who make planks are selective they choose only some trees. If there are good plank trees in my area they will come and ask permission and if we agree - then they proceed, if not, they do not. JL: So how does the newcomer get a place?

Bkpr: The old man (big man) will take newcomers and advise which places they can use - they say 'you have this place'.

JL: Who owns the forest?

Bkprs: The chief. The chief allows us to put beehives in the forest. We don't pay anything.

JL: Does fire threaten your hives?

Bkprs: Yes we protect the trees through early burning in April and May when the grass is not fully dry.

JL: Does it help?

Bkprs: It helps - yes. No one tells us to do it.

JL: Making hives from bark - does it create a shortage?

Bkprs: We do it selectively. If we see a small tree that is suitable for hive-making we protect it until it is big enough.

JL: Is beekeeping profitable? Do you put money in?

Bkprs: No nothing.

Bkprs: We might have to walk to 30km - the whole day - it costs is in food.

JL: How many beehives can you make in 1 day?

Bkprs: 3-4.

JL: How long last - 10-15 years, if occupied. 1-3 if empty. They get damaged.

JL: How many crop in one day?

Bkprs: 3 to 4 in a day. Often less. Sometimes 1. Some bees are stubborn.

Bkprs: Transportation. We carry on heads, one bucket at a time - or with a bike. But there are no roads - even with a bike we have to carry until the place where the bike can pass.

Bkprs: To get one bucket - you might need 1,2 or 4 hives. During cropping we make a place and bring all the buckets to one place. Then begin to transport back. We usually camp - then we carry. We often work in pairs.

JL: How can one person manage 450 hives?

Bkprs: It is a full time job - I am always in the bush. It takes long to crop them. 450, 400 have bees but I do not know how many I will crop yet. I have all my bees in more or less one place - but it is a big area.

JL: In other parts of Zambia there is deforestation. Can it happen here?

Bkprs: Yes.

Bkprs: No - because tree cutting happens by the road where people are farming (they need access to the roads). Tree cutting cannot go far into the bush.

JL: Will there always be honey?

Bkprs: Yes always.

JL: How many children do you have?

Bkpr: 8 - I am still training them in beekeeping.

Bkprs: 11 - 5 are elsewhere, 6 young, one is coming-up as a beekeeper.

August 20
Place?
Large group

JL: What is the benefit of beekeeping?

BKPRS: To earn our living, educate children, source of food, source of living, honey helps, we get food

JL: How long have you been beekeeping?

Women beekeeper: 2 years

JL: What were you doing before that?

She said she was doing business. She said that honey was really helping her now.

Older BKPR (more than 15 years keeping bees): In years past we never used to have a market. The company is buying now. There was no market before.

BKPR: (15 years in bkpg). Slight change in price now. Bit increased.

BKPR: (5 years) (was asked why did he join beekeeping): The market is open. Easy to do the work. No need to invest anything. As long as you are committed you can do it.

BKPR: (sold 20 buckets last year): Used money to educate my children, I bought clothes for myself, bought iron sheets and used money to help the family.

BKPR: (sold 5 buckets last year): Bought iron sheets and clothes.

JL: How is the yield this year?

BKPRS: It will be a good yield

JL: What yield do you expect (to one beekeeper)

BKPR: 10 buckets.

JL: What will you use the money for?

BKPR: I will educate my children and use money for cultivation.

JL: How do you make the money last all year?

BKPR: There are so many kinds of business one can do. If we keep the money at home it will get destroyed.

BKPR: I don’t take the money to the bank (it is not enough). I go to Western Province to get fish and to sell here. I buy fish and sell. I buy salt and sell.

Another BKPR: I buy fresh fish and sell

Another BKPR: Cultivation, education, blankets

[one CB had motorbike and could speak quite good English]

BKPR: To make money last some people buy fertiliser - grow maize - then sell maize.

JL: Once you have these other activities up and running - do you then leave beekeeping?

- No we concentrate on beekeeping
- As villagers we cannot just stick to one thing (you cannot live well)
- Honey has a season - so you can do other things at other times

JL: How many people (%) are beekeepers - on average? As is out of 10 households?

BKPRS: About 50%. If not a beekeeper, other people concentrate on farming - such as cassava, pineapples, maize, vegetables, groundnuts and rice.

JL: What do you invest in beekeeping? What do you put in?

BKPRS: Much time making hives, much labour and the food we take in the bush when harvesting. Women: We give money to men to do the beekeeping for us. K20 to buy a hive and K10 to hang a hive. Same person will make, hang and crop. Pay K280 to crop 5 buckets. You can earn a lot from honey. Compared to the other things. *[the ladies were well dressed]*

About the forest

BKPRS: If hives rot they are replaced. But otherwise we keep the same places. No one can interfere with another person's place. We do pay anything.

JL: How do you protect your places?

BKPRS: We do early burning. We do not allow people to cut there. We protect hive trees through early burning too. Get hives from big trees - to allow the small ones to grow.

August 20
Jimbe
About 12 beekeepers (from 4 groups)

JL: What is the benefit of beekeeping?

BKPRS: Helps to get money. Helps us a lot.

BKPR: It is a hard job and it does not give enough to sustain us.

BKPRS: Beekeepers in the village earn a living, educate children. If you are not a beekeeper, you might not manage to educate your children.

JL: How long have you been beekeeping?

BKPR: 40 years.

JL: What was it like 40 years ago?

BKPR: Old days no market. Used to crop honey for home consumption and to make beer.

All the members at the meeting had kept bees more than 11 years. I asked about newcomers.

BKPRS: Young people do join - the price is bad - but they are attracted. This year will be a good year.

1. predicts 30 buckets (25 last year)
2. predicts 35 buckets (19 last year)
3. 40 - from 400 hives [others said he was a commercial farmer - old man]
4. 25 buckets (15 last year)

JL: What do you spend money on?

BKPR: School, iron sheets, house

BKPR: School, iron sheets, house (if not enough for all iron sheets will add next year)

BKPR: 20 buckets last year, this year fertiliser and kids education

JL: How make money last all year?

BKPR: It is very difficult. It comes at one season. Might have some debts which need to be paid back. V. difficult seasonal budget.

BKPR: Beekeeping is difficult - intend to crop - but buckets are few and one can't crop.

One person (amongst about 11) grew maize. I asked why others do not grow maize.

BKPRS: Lack of capital. Honey does not need capital.

JL: I saw maize being sold - who is farming maize?

BKPR: Other people. Beekeeping is better because you do not need to put in money.

JL: But if you did/could invest in maize would it return?

BKPR: No the soils are poor. 1 lima gives 5-7 bags.

JL: If you see a house with iron sheets - is it likely to belong to a beekeeper?

BKPR: Yes. [remember that FF helps with transport of iron sheets]

PROFIT in beekeeping

BKPR: We do not put in any money. Food for cropping camps. Sometimes hire transport. If crop a lot sometimes hire people with bikes.

JL: How many hives can be made in a day?

BKPR: Between 5 and 12 in one day. It depends on the forest and easy availability of trees.

The older man said 8,9 or 10 in one day.

BKPR: After hanging we check - about once a month.

JL: How do you protect your hives?

BKPR: Honey badgers and snakes - they are hard to get rid of. Fire - we do not fear. We hang the hives high up. If the forest burns at this time it is bad. If we do early burning that protects the trees and we all do that.

BKPR: Can harvest 1 or 2 buckets a day - that might come from 1-2 hives.

1. 250 hives, 95 with bees, 75 to crop
2. 120 hives, 90 with bees, 80 to crop
3. 45 hives, 22 with bees, 10 to crop

[I asked the beekeeper with 400 hives if he put all in one place - I think he thought I meant literally in one place - so he said no]

JL: Do you hang your hives in the same place for some time - for example for 10 years or more?

BKPR: Yes - even longer. We will replace the hive if rotten. We only shift the place if there is no yield.

BKPR: When you have a place - it is yours - no one can come there.

JL: Can people cut trees there?

BKPR: Well yes in the general vicinity, but not at that spot.

[I am not sure what a 'place' is - one tree or perhaps a hectare of several trees with hives]

BKPRS: The Chief owns the forest. There is no need to ask permission. He knows.

JL: What about FD?

BKPRS: In the old days we used to get cards from the FD. Not now. The FD has some restricted places (FRs).

JL: Making hives kills trees - how can you ensure there will be trees in future.

BKPRS: If we make hives here - we then leave the place until the trees grow again.

BKPRS: In fact small trees are not that threatened by fire because we put hives in places where there is no tall grass

JL: Can deforestation happen here?

BKPRS: No. We place our hives far away - deforestation happens near the village.

BKPRS: We will continue beekeeping provided the company still buys. If no market, bkpg would not continue. Then we would have to farm instead.

CB - Katanga Adrian from Katanga gp

CB - Briton Kanasa from Kanyanda gp

CB - Kayinda Isaac - Mbuya gp

CB - Kilio Charles - Jimbe central

21 August 2015
Saluzhinga [Kayuka, Lukandu, Kajimana, Nswanaihamba]
Large group, school room

Lewis Masoga - keeping bees 21 years

Kaliama Justin - keeping bees 18 years

JL: What has changed?

BKPRS: FF has trained us on a lot of things. We used to crop anyhow - but now we grade the honey in types. There are changes in the work of beekeeping. Now we crop our honey properly and the company appreciates it.

There are difficult challenges still.

JL: Where did you sell honey in the past - 20 years ago?

Luwika Dzadi said Germans used to buy, and now FF buys.

BKPR: Our live is changing - beekeepers can rejoice.

BKPRS: We crop seasonally. During cropping season. We know how to keep bees so they can sustain our future. We check our hives. We hang more hives every year to increase the number.

JL: How has living changed?

BKPRS: Price and market used not to be there. We can buy iron sheets now. With the price as it is now - we can educate our children.

BKPRS: In addition we are far from town - for us to buy iron sheets, is difficult - we need help. There is a change - we used to sleep in thatched houses - not now.

The company helps us with transport so we can buy iron sheets.

David Tshinga (16 years bkpr). I would like to add on. Very happy and agree with what my friend said. People suffered in the past. Germany used to buy BUT it was not as it is like now (now better). Not even one used to build a house with iron sheets.

Newcomer (8 years) - JL asked - why choose beekeeping and not another activity?.

BKPRD: Lack of employment - beekeepers are living well. *Another agreed.*

Kakwena Enidi: There are so many companies buying honey - now women we are allowed too. Women BKPR: We buy hives and we even make our own. We have attended training in hive-making. JL: Do you do the work yourselves? (to the women)

Women BKPR: We work with men. We use money to educate our children.

JL: How many buckets did you sell last year?

BKPR: 35.

JL: What did you do with the money?

BKPR: With the money I educated children, feed family and extend pineapple farm.

BKPR: 38 buckets last year. Bought iron sheets, educate child (Grade 10), bought motorbike, used money at home, also put money in pineapples.

BKPR: 20 buckets. Bought motorbike, put money in pineapples, keep family.

JL: If you see someone with a motorbike - are they likely to be a beekeeper?

BKPRS: Yes.

JL: How sustain yourself the rest of the year (because money comes at one time)?

BKPRS: Just as others are explaining - by extending farms, then we get money rest of the year. We do different businesses. To keep money and avoid abusing it - go to town and get fish, sell to others. This way we recycle money.

BKPR: I sold 27 buckets, used money to make more hives so have enough. Educate children - want future to bring change.

JL: Out of 10 households - how many might be beekeepers - what proportion?

BKPRS: 70% hh might be beekeepers.

BKPRS: People think they have to do what others are doing - if they are being successful they will copy them. Cannot remain behind.

JL: What other kind of farming / activities do people do?

BKPRS: Maize, pineapples, beans, making chairs, baskets.

I asked about the forest

BKPRS: This is how we do it. We keep the same place - and just replace the hives. We don't want to destroy all the trees.

BKPR: Where we hang = home for bees. We shift the place if the tree dies or falls.

Martin Kastora (4yrs beekeeper): We go in the bush - check our hives regularly.

When cropping we make a hole to get the honey out, don't crop everything - leave something behind.

JL: You are quite new to beekeeping (to MK) - did you get advice about where to put your hives?

MK: Yes I was trained by another beekeeper. That is my place now. If the tree dies - I will move to the next tree.

JL: Do you have your place?

BKPR: Yes.

Another said - not really - "we do not own the places". People discussed this point.

BKPR: We mark the trees with our marks - so this is my tree.

JL: How do you protect the places where you hang hives e.g. from fire?

BKPRS: We do early burning - to protect the flowers from late fires.

Yes everyone does early burning.

JL: You need big trees to make hives - how do you protect the small trees?

BKPRS: We protect by not cutting carelessly and through early burning.

BKPRS: We do not allow careless cutting - so we can get hives in future. That is also why we do early burning.

BKPR: I have 85 hives - they are spread out. Yes get different yields in different places. Sometimes I shift the place if the place is not good. Sometimes bees are not productive.

21 August 2015
Muzeya
Large group, church

JL: How long beekeeping?

BKPRS: 12,25 and 30 years.

JL: What was it like 30 years ago?

BKPRS: Old days used to crop but never used to earn much, now earn more and educate our children. Old days used to sell to individuals - now a company.

Another said not a great change - just the same.

I asked if there are people new to beekeeping. One person said he started in 2011 - so I asked why.

BKPR: There is money in honey. It is a seasonal thing - during season, sell get something, then invest in maize, sell and get something again.

BKPR: Now have market. Honey is not difficult to sell. Maize is difficult to sell.

BKPR: Honey goes from here to UK and RSA. Maize has a local market only. There is demand for our honey. Maize needs fertiliser. We add a lot and don't get much.

BKPRS: In this place nearly everyone is a beekeeper.

I asked how many buckets they sold in the previous year and what they spent the money on.

BKPR: 45 hives, 17 buckets - money used for children, to buy a bike and home consumption

BKPR: 150 hives, 45 buckets (not enough flowers) - money invested in child in college, home consumption.

JL: How do you make money last all year?

BKPR: It does not last [Royson said they don't have to say that thinking they will get something]

BKPR: Some of us manage to reach the other season. Buy salt, sell salt - keep money going like that. BKPR: We use money for fertiliser, cultivate maize and this sustains us.

BKPR: Use some money in building houses, buy iron sheets.

BKPR: If sell 15 buckets, I will not spend all the money at once. Last year I used for school fees and bought a goat e.g. an investment.

BKPR: Yes some people grow pineapples. Beekeeping much better than pineapples.

JL: Why?

BKPRS: Pineapples - you need money to invest and they rot easily. Honey does not rot.

JL: Yes but with pineapples you get money 3x in a year - is that not better?

BKPRS: Yes but sometimes the market is flooded. Yet with honey the company provides the transport. We have a lot of pineapples when it is raining and the roads are bad. This makes marketing difficult.

I asked about the forest

BKPRS: Yes we keep in same place. If the hives rot we replace them.

JL: Does the place belong to you?

BKPRS: The forest does not, but that place does. I have used the same place for 30 years. No one can interfere -unless at a distance.

JL: How do you protect that place?

BKPR: I protect it through not cutting and through early burning.

BKPR: I check the hives every time - for insects and rats.

BKPR: Early burning - everyone does it. Before the grass is too dry.

JL: How does a newcomer find a place?

BKPR: We go with the leaders - in the system - they train us.

Leaders said - "yes we advise newcomers".

JL: Can there be too many newcomers? (I meant from a resource point of view but I don't think the meaning was clear)

BKPR: No, we are enough leaders to train the newcomers.

JL: Is tree cutting a problem?

BKPRS: We do not allow people to cut trees where our hives are.

BKPRS: Anyway they are 30km away - so people tend not to go that far to cut trees for whatever purpose.

JL: How can you be sure there will be enough new trees to make hives?

BKPRS: Just like we said before - through early burning. This allows small trees to grow up.

BKPRS: There are rules set by the elders in the system. You cannot take bark from small trees, you must let them grow bigger.

JL (to the woman beekeeper): As a woman you are alone. Why have you joined beekeeping.

Woman beekeeper: I have children. I am looking at beekeepers being able to educate their children and buy iron sheets and I want to do the same. I bought 5-10 hives, they hang for me, they crop for me. Not only that I also make out of planks. I have been doing this for 3 years. Bark hives (7), plank hives (3). It is helping me. I have fertiliser enough to farm 2 lima. Also I intend to farm 0.5 lima of pineapple.

JL: Will your children be beekeepers?

BKPRS: If they are educated they will get jobs, if not they will be beekeepers.

JL: Can deforestation happen here?

BKPRS: No we have been trained by Keepers Zambia not to cut trees.

24 August 2015
Ntambu Satchitolo
7 beekeepers, then more came

Benson Sokola, Kalelema gp

Winston Mandefu, Kangomba gp

Fons Mtambo (lady) - wife of the CB Jaquet Mtambo (not there) - Kalelema gp

Gilbert Mpenji, Sakayanda gp

Patrick Kumesa, Ntambu Central

Robson Sokola, Kalelema gp

Chiuka John, Ntambu Central

JL: Has beekeeping be practiced for a long time?

BPKR: 20 years or more

JL: What has changed?

BKPR: No change. Work is very difficult. We are getting a little.

BKPR: Work is difficult. But there has been a slight change on the market side. We are able to sell. But the price is little.

JL: Where did you sell in the past?

BKPR: At times the Germany company. Also we used to crop and take to town and sell to beer brewers.

JL: Are there newcomers to beekeeping?

2 beekeepers said they started five years ago.

JL: Why did you start beekeeping?

BKPR: I saw that with beekeeping I could earn. With maize there is sometimes nowhere to sell it until it rots.

The other newcomer said the same thing. None of the group said they grew maize now. On being asked some beekeepers said they had 50, 160 and 289 bee hives.

BKPR with 160 hives said that last year the flowering was not enough and he sold 7 buckets.

JL: Do you expect to sell all to the company (FF Ltd) this year?

BKPR: There is plenty of honey, don't know if we will sell all to DB.

They said they had been selling to DB since 2002.

JL: How many buckets do you forecast for this year? What will you spend your money on?

Benson: I predict 30 buckets. I will use some money to educate my children, I will buy goats, cattle and some money for home use.

Winston: I expect to spend money on building my house, iron sheets, educating children and buying animals.

BKPR: I have the same idea. I want to push the children to school.

BKPR: I will educate my children and buy animals - these I will leave to my children in case I die.

JL: How do you make honey income last all year?

BKPR: People have different ideas. Some put money into business e.g. a bar - then the money will last to the next season.

The beekeeper explained that the source of capital for his bar was honey. But at times he also takes money from the bar as capital to buy honey from other beekeepers - and he sells that too.

JL: What about others?

Benson: If you keep money in the pocket it gets used carelessly - I buy animals to sustain my living.

Fons: I have animals - they came from honey - and now the animals are rearing themselves. I also have a small shop. I do not grow maize - but some cassava.

JL: Out of 10 households or families - how many are beekeepers - 5, 8, 9?

BKPRS: Nearly everyone is a beekeeper.

JL: In all activities you have to put something in to get benefit - what do you invest in beekeeping?

BKPRS: We use our own labour. When going to the bush for cropping we also need food, salt, soap, boots.

JL: How many hives can you make in a day?

BKPRS: 8 or 10 or 15.

JL: You check hives from time to time during the year - how often?

BKPRS: We spend about 4 days in a month. Hives are in different places - so this month we go that side, then next month to the other place.

Others in the group started laughing because the one who answered is always checking his hives - very often. He said it was like a full-time job. In future his young brother will join him.

JL: Why do you have different places for your hives?

BKPR: If I put in one place - it is the way bees behave. Perhaps I will get honey from this side, but sometimes from the other place. To be sure, to be safe, to get something. That is why I put in different places. At times there are flowers but no bees.

BKPR with 200 hives said 200 hives, 162 with bees, 70 will be cropped this year (estimate)

BKPR with 419 hives - 289 with bees, 250 will be cropped this year yielding 100 buckets (estimate)

JL: How many hives can you crop in one day?

BKPR: Highest is 4, usually 2 or 3.

They do the cropping in the camps and hire people to help.

They said they have been using the same places for their bees for 20 years or more. They each have their own places and if others come there "If I find I will fight". No - people do not come and cut trees where there are hives, because the hives are very far away. People cut trees nearby houses not far in the bush.

JL: Do bush fires damage hives?

BKPRS: Always there are fires - we do early burning and this prevents fire to damage the hives.

JL: How does a newcomer find a place to put there hives?

BKPR: There are senior beekeepers - a newcomer will go with someone who will show him.

The one newcomer said he was shown where to put his hives by another beekeeper. There are enough places for everyone.

JL to Fons (the lady): Do you also get involved?

Fons: Yes I help my husband - I help to carry the honey.

It is normal for wives to help their husbands if they don't have anyone else to help them.

A newcomer joined the group - also new to beekeeping. He said he had been keeping bees for 3 years. He used to farm but he decided to start beekeeping because farming never used to give cash. Since keeping bees it has made a difference. He has cash. He still farms but just to eat - not to sell.

JL: Deforestation is seen in other parts of Zambia - can it happen here?

BKPRS: The chief sets rules - people should not cut trees carelessly.

They explained that hives are far - 30km away - and people cannot go there to cut trees.

JL: What about making hives - can that cause a shortage of trees?

BKPRS: No because we use large trees for hive-making and we leave the small trees to grow larger. You don't make hives from small trees.

JL: But small trees can be harmed by fire? [leading question]

BKPRS: We do early burning - and so fire does not destroy the small trees.

JL: I want to go back to my first question - you said not much has changed over the last 20 years?

BKPRS: There has been a slight change with the DB company. DB will buy all our honey - even if we have 100 buckets - they will buy. But the price is too low. In the past we used to sell beeswax and honey separately to the Germany company - even wax has its own value. [implied that they get more value if sell separately]

We concluded. Appreciation given. I invited questions - but said could not answer for FF Ltd and was not a donor. They asked if beekeepers used smoke in England when harvesting honey.

25 August 2015
Kalwisha
More than 10 beekeepers

JL: Has beekeeping be practiced for a long time?

BPKR: 20 years or more

JL: What has changed?

BKPR: There has been a slight change in the last 5 years. In old days used to crop and sell to beer brewers. Now that DB here - selling is easier.

JL: What is the benefit?

BKPRS: We can build houses, buy iron sheets, educate children, buy clothes. It is really helping - we can earn something. We can educate children and it helps keep orphans.

JL: Are there newcomers to beekeeping?

BKPRS: Many, there are many who are 1-2 years in the system.

BKPR: I have been a beekeeper for 20 years plus and have educated my child to a high level.

BKPR: I have orphans to keep, honey helps me.

JL: To the newcomers - why did you decide to start bkpg?

NEW BKPR: I used to cultivate (cassava) - but never used to earn anything.

NEW BKPR: I was seeing my colleagues getting a lot and decided to join. I was cultivating maize before - now I do both.

JL: How many hives do you have (asked one person)

BKPR: 680. Last year I harvested 110 buckets, other hives I never cropped.

JL: What did you spend the money on?

BKPR (680 hives): I am not educated. I am now educating my brothers, my sisters and my children.

JL: And this year?

BKPR (680 hives): I plan to buy a car.

BKPR (600 hives): I sold 150 buckets last year - sold half to FF ltd and half to Mpongwe.

JL: What did you spend the money on?

BKPR (600 hives): Iron sheets. Educating my brother. I am not educated. Clothes. I predict 300 buckets this year. If the company can buy all the honey - I will buy a hammer mill or vehicle.

JL: Has life changed in the five years you have been keeping bees? (to a 5 year newcomer).

BKPR: I built my house from honey (he pointed to his house) - educate my relatives and have bought 5 animals.

JL: Out of 10 households or families - how many are beekeepers?

BKPRS: Only a few are not. Most are beekeepers.

JL: How do you make the money last all year?

They said that none had bank accounts but that this year they intend to open bank accounts. They intend to save in the bank. Some will use to cultivate beans. Another said he will buy goats, cattle - this way investing the money that will sustain live during the year. Others mentioned education again and taking money to the bank.

JL: In all activities you have to put something in to get benefit - what do you invest in beekeeping?

BKPRS: Nothing. Just labour. Also supplies when in the bush e.g. relish, soap and salt.

JL: Can one person manage more than 600 hives? (to the beekeeper with 680).

He explained that he hired people to helping with cropping and transportation. These are also beekeeper but those with a few hives. In fact some of the hired helpers are not beekeepers.

JL: How many hives can you make in a day?

BKPRS: 8 or 10 (or 15 - but others did not agree to 15)

JL: You check hives from time to time during the year - how often?

BKPRS: We check monthly.

I asked two beekeepers about their hives to cropping ratios. One said 80 hives, 40 with bees, not sure how many will crop. Another said 150 hives, 135 with bees and will crop 135.

JL: How many hives can you crop in one day?

BKPR: We have no working suits. If bees are stubborn this means only 1 hive in a day. Otherwise 3-6 in a day.

The beekeeper explained that he writes his initials on all his hives and so he can send other people to crop for him. He explained that these 'other people' are those who are just starting out in beekeeping and have not yet built up a large number of hives of their own yet.

JL: Do you keep the same places for your hives for a long time?

BKPRS: Yes

JL: Are these places your places?

BKPRS: Yes

JL: How do newcomers find a place to start?

BKPRS: There are instructors - they will go with the newcomers and show where to put their hives.

JL: How do you protect these places where the beehives are?

BKPRS: We do early burning to protect the hives.

JL: What about protection from tree-cutting?

BKPRS: There is no risk of that. The beehives are very far and the trees are never destroyed there.

JL: When you make hives - the trees die - can there be a shortage of trees for hive-making?

BKPRS: That is why we do early burning - to give hives in the future.

JL: You talk of educating children - will they be beekeepers?

BKPRS: Those that succeed in education will get jobs. Other who fail will become beekeepers.

JL: Deforestation is seen in other parts of Zambia - can it happen here?

BKPRS: The places for hives are different from the places for cultivation. So no it cannot happen here.

JL: How many buckets can you get from a hive.

BKPRS: Sometimes 1 hive = 1 bucket. Sometimes 1 hive gives 2. Often it is less.

The beekeepers asked for help with protective clothing - saying they are willing to buy. They said that without proper clothing - it slows down the process of cropping. They asked "what happens to all this honey"? Why is the price low? I said the goodness of export is that this means the honey reaches big markets (many people, good demand) but that the costs of transportation is high. Despite denials they said they thought maybe I would become a honey buyer in future. I said I was more interested in telling people in UK (for instance) to choose honey from Zambia - as opposed to honey from other countries.

They demonstrated how to harvest honey with one nearby hive.

Appendix 3. The household questionnaire form

RESEARCH STUDY ABOUT LIVELIHOODS, FORESTS AND BEEKEEPING IN MWINILUNGA AND IKELENGE

University of Huddersfield and CIFOR-Zambia

Hello, my name is ________________________________. I am collecting data for a study about beekeeping and forests. The purpose of the research is to understand the importance of beekeeping as an economic activity, and we also want to compare beekeeping with other activities. We are involving both beekeepers and non-beekeepers in the research. We are interested to understand how people conserve the forests in this area.

The research is part of a study undertaken by Janet Lowore of University of Huddersfield UK and supervised by CIFOR Zambia. (CIFOR = Centre for International Forestry Research)

Consent

We would like you to ask you some questions. Your participation is voluntary. You don't have to answer any question if you do not want to. The information you provide will help us to better understand the situation and will be used to inform decision-makers – and will also be communicated to people who buy honey in Europe. People who buy Zambian honey in Europe sometimes ask about where the honey comes from and ask about the beekeepers who harvest it. Information collected will not be used for any other purpose.

We would greatly appreciate your help in participating in this study, would you be willing to participate?

☐ Yes, proceed

☐ No, good bye. Thank you for your cooperation!!!

Date	
Time of interview	
ID	

RESPONDENT

Name of respondent		Relationship to household head	
Village Headman		Age in years	
Chief's area		No. of people in household	
District		Gender (M or F) of respondent	

<u>SECTION A: INCOME, LIVELIHOODS AND WELLBEING</u>

QU 1.0 Please indicate the type of house you have?

1.1 What are the walls of your house made of?	Tick
1 Mud and wood	
2 Unburnt bricks	
3 Burnt bricks	
4 Other	
1.2 What is roof of your house made of?	Tick
1 Thatch	

2 Iron sheets	
3 Other	

QU 2.0 How many large household items are owned by the household?

	Number owned by the household
1 Radio	
2 Motorcycle	
3 Bicycle	
4 Mobile phone	
5 TV	
6 Solar panel	
7 Satellite dish	
8 Car or truck	
9	
10	

QU 3.0 How many livestock do you own?

	Number owned (adults)
1 Cattle	
2 Goats	
3 Pigs	
4 Sheep	
5 Chickens	
6 Ducks	

7 Other	

QU 4.0 Cultivation

4i	Can you estimate the total area of land you have in cultivation this year (all crops)		*lima*
4ii	Did the household clear any land for cultivation during the past 5 years? *IF NO GO TO QU* 4iv *IF YES continue below*	Yes	
		No	
4iii	How much land was cleared?		*lima*
4iv	Did the household abandon any crop fields in the last 5 years? *IF YES continue below, IF NO GOT TO QU. 5*	Yes	
		No	
4v	What area of crop fields were abandoned?		*lima*

QU 5.0 Perception of economic wellbeing

		TICK
5.1 Has the household's food production and income over the past 12 months been sufficient to cover what you consider to be the needs of the household?	1. No	
	2. Reasonable (just about sufficient)	
	3. Yes, enough	
	1. Worse off	
	2. Average	

5.2 Compared with other households in the village (or community), how different is your household?	3. Better off	
5.3 How well-off is your household today compared with the situation 5 years ago?	1. Less well-off	
	2. About the same	
If 1 or 3, go to 5.4. If 2, skip to next question	3. Better-off now	
5.4 Cause of change, if any change		

QU 6.0 How much income has the household earned in the last 12 months? ***[concerns income only, not home consumption]***

	A	B	C	D
Source of income	Tick if income earned	Income in kwacha **<u>if known</u>**	% contribution to all hh income (approx.)	Does figure in B take into account costs of inputs? YES or NO
Maize				
Cassava				
Pineapple				
Tomatoes or other vegetables				
Beans				
Other crop				
Other crop				
Cattle				
Goats				
Pigs				
Sheep				
Chickens				
Other livestock				
Honey sales				
Charcoal sales				

Firewood sales				
Timber sales				
Fish sales (from fishing)				
Caterpillar sales				
Fruit sales				
Mushroom sales				
Hunting and selling game meat				
Remittances				
Carpentry workshop				
Piece work / casual work				
Brewing beer				
Making, selling crafts e.g. chairs, baskets				
Rent of house				
Employment				
From a business e.g. shop, bar				
Trading e.g. fish trading				
Other specify				
Other specify				

QU 7.0 Some activities require investment e.g. to buy seeds, inputs, goods for trading. Where do you get this capital from? What do you invest in?

SECTION B: BEEKEEPING AND HONEY SELLING

QU 8.0 Are you a beekeeper?

No (1) ☐ *If no go to 8.1, then Section C*

I used to be, but not anymore (2) ☐ *If used to, go to 8.2, then Section C*

Yes (3) ☐ *If yes, go to 8.3 and continue*

QU 8.1 *If no (1)* – Why not?

Do you benefit from honey indirectly e.g. piece work carrying honey or do you have a shop and notice that many of your best customers are beekeepers? Explain.

THEN GO TO SECTION C on page 12

QU 8.2 *If used to, but not anymore (2)* - Why did you stop beekeeping?

THEN GO TO SECTION C on page 12

QU 8.3 *If yes* - When did you start beekeeping?

Last year ☐ 2-5 years ago ☐ 6-10 years ago ☐ more than 10 years ago ☐

Why did you start beekeeping and not some other activity?

QU 9.0 How many hives……?

	…do you have today (in total, even those with no bees)	… and how many are occupied (today)	…did you have this time last year (in total, even	…did you have 5 years ago (in total, even those with no bees)

			those with no bees)	[indicate 0 if was not keeping bees then]
Bark hives				
Top-bar hives				

Observe the response to this question and choose the correct box for the next question.

If the number of hives is increasing, ask Why more? (*tick as many as apply, then rank 1 and 2*)

☐ The price is better, so I choose to do more beekeeping

☐ It is easier to sell honey, so I choose to do more beekeeping

☐ I see other beekeepers earning money, so I think of doing more

☐ Farming is not so profitable

☐ I have gained in experience and skills

☐ It takes time to accumulate hives – I am gradually building up

☐ Other

☐ Other

If the number of hives is decreasing, ask Why fewer? (*tick as many as apply, then rank 1 and 2*)

☐ The price is lower, so I choose to do less beekeeping

☐ It is not so easy to sell honey, so I choose to do less beekeeping

☐ I see other beekeepers work hard and earn less – so what is the point

☐ Farming is more profitable

☐ There is less forage for the bees because of deforestation

☐ There are too many beekeepers

☐ Private landowners are leasing more land – so we cannot hang hives

☐ It is hard to find enough trees to make more hives

☐ The good places for hive-hanging are few

☐ I am getting old

☐ I have been sick or injured

☐ Other

If there is no change – ask, "Why do you not increase number of hives to get more money?"

QU 10.0 Honey sales

How many buckets of honey did you sell last year (total)?	Total income from all honey sales last year?	How many buckets did you sell to Forest Fruits – last year?	Predicted sales this year [in buckets of honey] – regardless of whom to sell to?

QU 11.0 How did you spend income earned from honey selling last year? (*even if a contribution) (put a 1 where most money was spent)*

	Tick those where money was spent
1. School fees	
2. New house	
3. House improvements e.g. iron sheets on roof	
4. Crop inputs	
5. Livestock	
6. Motorbike	
7. Food	
8. Making / buying additional hives	
9. Labour for farming (clearing land, weeding)	
10. Other (specify)	

QU 12.0 What do you plan to spend money on when you sell this year's harvest? (*even if a contribution) (put a 1 where most money will be spent)*

	Tick those where expenditure is planned
1. School fees	
2. New house	

3. House improvements e.g. iron sheets on roof	
4. Crop inputs	
5. Livestock	
6. Motorbike	
7. Food	
8. Making / buying additional hives	
9. Labour for farming (clearing land, weeding)	
10. Other (specify)	

QU 13.0 What are your plans for the future in relation to beekeeping – to continue or develop other economic activities?

QU 14.0 Where do you place most of your hives in the forest

Name of the place	Distance in km from homestead	Distance in walking in time	Did you inherit the place from another person or start a new site? *Circle one only*
			Inherit New

			Inherit New
			Inherit New

QU 15.0 Who advised you about where to locate your hives?

QU 16.0 Who is allowed to locate hives in that place?

QU 17.0 If someone came to your hive site to cut trees for any reason or open a garden – what would you do?

QU 18.0 Have you ever left or lost hive site for any reason?

☐ **YES** ☐ **NO**

If yes – what was the reason?

QU 19.0 How many new hives did you make or buy?

	Number of new hives made	Number of new hives purchased or made to order for money
This year		
Last year		

QU 20.0 Making bark hives usually causes trees to die - how do you balance making hives with ensuring there will be sufficient trees for making more bark hives in future?

Action	Tick if action taken
If I find seedlings or saplings of suitable species I protect them (e.g. from cattle, by not cutting, clearing around them)	
Before choosing a tree for hive-making I check there are seedlings nearby to replace it	
I do early burning to protect small trees from fire	
When clearing land for farming I leave trees I need for hives	
I take care of coppice regrowth	

When cutting trees e.g. building poles, I am selective and leave trees for hive-making	
I plant trees	
I do not take any actions	
I take care of my hives – so they last a long time. This means I do not need to replace them regularly.	
Other (specify)	
Other (specify)	

QU 21.0 Do you protect your hive site from fire?

☐ **YES** ☐ **NO**

If yes explain how in detail.

QU 22.0 Do you agree or disagree with the following statements about forests and beekeeping? Say how strongly you agree or disagree.

	strongly agree	agree	neutral	disagree	strongly disagree
Even if more people wanted to hang hives and keep bees, there is enough forest					
The place where we hang most of our hives is remote – people do not go there to cut trees					
Deforestation is a problem in some of the places where I hang beehives					
In the future there will not be enough forest for beekeeping					
There is a problem of private landowners – they buy the forest so we cannot hang hives					

Insert any notes or comments about question 22

QU 23.0 Do you think your child/children will hang hives in the forest?

YES ☐ **NO** ☐ **SOME, NOT ALL** ☐ **I DON'T KNOW** ☐

If yes, why? If no, why not?

QU 24.0 How many households in the village are involved with beekeeping?

<u>SECTION C. About the forest</u>

QU 25.0 **What is the most important forest product for your household?** ***[in terms of income not home use] Rank 1,2 and 3***

Firewood	Charcoal	Honey	Building poles	Mushrooms	Caterpillars	Timber	Other (specify)	Other (specify)

QU 26.0 **What do you think is the most important forest product for the local economy and community as a whole?** ***[in terms of income not home use] Rank 1,2 and 3***

Firewood	Charcoal	Honey	Building poles	Mushrooms	Caterpillars	Timber	Other (specify)	Other (specify)

QU 27.0 Has forest cover in your area changed in the past five years?

Change	Tick one	
More forest		*If more – go to qu 28 and skip 29*
Less forest		*If less – go to qu 29 and skip 28*
About the same		*If same – skip 28 and 29*

QU 28.0 If more what is the cause?

QU 29.0 If less what is the cause?

QU 30.0 Do you agree or disagree with the following statements about forests? Say how strongly you agree or disagree.

	strongly agree	agree	neutral	disagree	strongly disagree
The forest brings us wealth					

The forest has more value than farmland					
We need to maintain the forest					
If there is employment the forest is less important					
The forest provides us with a livelihood					
Deforestation brings poverty					

QU 31.0 Do you take any actions to maintain or protect trees and the forests? Select a response for each statement.

	Every year – or more	Not every year – but	Never
I practice early burning			
I take care to stop fires spreading into			
I plant trees			
I raise the issue about forest protection at village meetings			
I report illegal activities to the VH or FD			
Other			

QU 32.0 What about at community level? Select a response for each statement.

	Every year – or more	Not every year – but	Never
As a community we work together to carry out early burning in some parts of			
As a community we plant trees			
Community members meet and discuss forest conservation issues			
We have lobbied the Forestry Department to help us protect our forest			
Other			

QU 33.0 As a community, are there rules and guidelines about stopping forest fires?

☐ **YES** ☐ **NO**

QU 34.0 Is there conflict or differing ideas between beekeepers and people who want to use trees or forest land for other purposes? If yes, explain. How can differences be solved?

OTHER REMARKS

Please thank the respondent for their time. Ask if they wish to make a comment to be mentioned to the research team – if so record here.

Appendix 4. Selected results from the household questionnaire

4.1 Association between cattle ownership and category of respondent

cattle * are you a beekeeper Crosstabulation

Count

		are you a beekeeper			
		yes	I used to be not anymore	no	Total
cattle	0	131	10	48	189
	1	8	0	3	11
	2	12	0	1	13
	3	3	1	0	4
	4	3	1	0	4
	5	3	0	0	3
	12	2	0	0	2
	16	1	0	0	1
	20	1	0	0	1
	60	1	0	0	1
Total		165	12	52	229

A chi-square test was undertaken to test if there was any association between cattle ownership (yes/no) and category of respondent (beekeeper/former-beekeeper/non-beekeeper). The null hypothesis was that there was no association. The alternative hypothesis was that there is an association.

Observed values (see output above)

	Beekeeper	Former	Non-beekeeper	Totals
Cattle	34	2	4	40
No cattle	131	10	48	189
Totals	165	12	52	229

Expected values (calculated)

	Beekeeper	Former	Non-beekeeper	Totals
Cattle	28.82	2.10	9.08	40
No cattle	136.18	9.90	42.92	189

Totals	165	12	52	229

P value =CHISQ.TEST(observed, expected) = 0.101292921284014, calculated using Excel

The P-value (0.101) is greater than the significance level (0.05), indicating that there is no association between cattle ownership (y/n) and category of respondent (beekeeper/former-beek/non-beek).

4.2 Association between self-reported economic well-being compared to others and category of respondent

compared to others * are you a beekeeper Crosstabulation

Count

		are you a beekeeper			Total
		yes	I used to be not anymore	no	
compared to others	worse off	14	5	10	29
	average	99	6	31	136
	better off	52	1	11	64
Total		165	12	52	229

```
CROSSTABS
  /TABLES=sufficientfoodproduction BY areyouabeekeeper
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

A chi-square test was undertaken to test if there was any association between self-reported economic well-being compared to others (worse off/average/better off) and category of respondent (beekeeper/former-beekeeper/non-beekeeper). The null hypothesis was that there was no association. The alternative hypothesis was that there is an association.

Observed values (see output above)

	Beekeeper	Former	Non-beekeeper	Totals

Worse off	14	5	10	29
Average	99	6	31	136
Better off	52	1	11	64
Totals	165	12	52	229

Expected values (calculated)

	Beekeeper	Former	Non-beekeeper	Totals
Worse off	20.90	1.52	6.59	29
Average	97.99	7.13	30.88	136
Better off	46.11	3.35	14.53	64
Totals	165	12	52	229

P value =CHISQ.TEST(observed, expected) = 0.003823, calculated using Excel

The P-value (0.0038) is lower than the significance level (0.05), indicating that there is an association between self-reported economic well-being compared to others and category of respondent (beekeeper/former-beek/non-beek). Since fewer beekeepers said they thought they were less well-off compared to the expected value (14 v 20.9) and more non-beekeepers said this (10 v 6.59) the association suggests that more beekeepers consider they are well-off, compared to non-beekeepers.

4.3 Association between self-reported food security status and category of respondent.

sufficient food production * are you a beekeeper Crosstabulation

Count

		are you a beekeeper			
		yes	I used to be not anymore	no	Total
sufficient food production	not enough	14	4	8	26
	reasonable	88	6	29	123
	yes enough	63	2	15	80
Total		165	12	52	229

```
CROSSTABS
  /TABLES=comparedtofiveyearsago BY areyouabeekeeper
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

A chi-square test was undertaken to test if there was any association between self-reported food security (not enough/reasonable/yes enough) and category of respondent (beekeeper/former-beekeeper/non-beekeeper). The null hypothesis was that there was no association. The alternative hypothesis was that there is an association.

Observed values (see output above)

	Beekeeper	Former	Non-beekeeper	Totals
Not enough	14	4	8	26
Reasonable	88	6	29	123
Yes enough	63	2	15	80
Totals	165	12	52	229

Expected values (calculated)

	Beekeeper	Former	Non-beekeeper	Totals
Not enough	18.73	1.36	5.90	26
Reasonable	88.62	6.45	27.93	123

Yes enough	57.64	4.19	18.17	80
Totals	165	12	52	229

P value =CHISQ.TEST(observed, expected) = 0.053612, calculated using Excel

The P-value (0.053) is greater than the significance level (0.05), indicating that there is no association between food security status and category of respondent (beekeeper/former-beek/non-beek).

4.4 Association between self-reported feeling of economic well-being compared to 5 years prior and category of respondent.

compared to five years ago * are you a beekeeper Crosstabulation

Count

		are you a beekeeper			
		yes	I used to be not anymore	no	Total
compared to five years ago	less well off	41	6	14	61
	about the same	30	2	17	49
	better off now	94	4	21	119
Total		165	12	52	229

A chi-square test was undertaken to test if there was any association between self-reported feeling of economic well-being compared to 5 years prior (less well off/about the same/better off now) and category of respondent (beekeeper/former-beekeeper/non-beekeeper). The null hypothesis was that there was no association. The alternative hypothesis was that there is an association.

Observed values (see output above)

	Beekeeper	Former	Non-beekeeper	Totals
Less well off	41	6	14	61

About the same	30	2	17	49
Better off now	94	4	21	119
Totals	165	12	52	229

Expected values (calculated)

	Beekeeper	Former	Non-beekeeper	Totals
Less well off	43.95	3.20	13.85	61
About the same	35.31	2.57	11.13	49
Better off now	85.74	6.24	27.02	119
Totals	165	12	52	229

P value =CHISQ.TEST(observed, expected) = 0.047325, calculated using Excel

The P-value (0.047) is less than the significance level (0.05), this indicates that there is an association. Since more beekeepers said they thought they were better off now than five years prior (94 v 85.74) and fewer non-beekeepers said this (21 v 27) the association suggests that more beekeepers consider they are better-off now, compared to non-beekeepers.

Appendix 5. Data used to inform the cost benefit analysis of forest beekeeping

	Beekeepers responses (19 beekeepers)																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Totals	n=	Average	
no. of hives owned	150	250		40	130	380	150	200	200		85	110	450	250	120	45	200	419	150	3329	17	195.8	
no. of hives with colonies	135			35	100	330	145	150	198		55	40	400	95	90	22	162	289	135	2381	16	148.8	
no. of hives which beekeepers predicted to crop in coming season	81	230		21		250	80	75	150		35	25		75	80	10	70	250	135	1567	15	104.5	
crop to hive ratio (calculated)	54%	92%		53%		66%	53%	38%	75%		41%	23%		30%	67%	22%	35%	60%	90%			53%	Used in Table 26
no. of hives which can be made and hung in one day (worked out by asking time taken for each activity and adding - bkprs do not make and hang in the same day)	5	6	6.6	9.6	5	8	6	9	6	6	6		4	8			8		8	101.2	15	6.7	Used in Table 26
no. of hives which can be checked in one day (this might be done 3-4 times a year)	40	10		23	22	16	25										50			186	7	26.6	Used in Table 26
no. of hives which can be cropped on one day	3	3	5	2		6		4	3	2	2		2	2			2		3	39	13	3	Used in Table 26

Other relevant answers																							
cropping goes beyond half																							
It takes a month to check 250 hives																							
It takes 3 days to check all my hives (69)																							
It takes a week to check 130 hives																							
It takes 1-2 weeks to check 200 hives																							
It takes a week to check 150 hives																							
With a bike I can carry 2 buckets at once																							
With no bike it is possible to carry one bucket																							
2 months work to crop 150																							
cropping is a full time job if you have 450 hives																							
2 months work to crop 215																							

Source: FGDs 2015

Appendix 6. Ethics approval

Staff research ethical review form (Version 2020)

THE UNIVERSITY OF HUDDERSFIELD
Business School Research Ethics Committee

RESEARCH ETHICAL REVIEWER PROFORMA

- Please complete and return via email to alex.thompson@hud.ac.uk.

DETAILS OF THE APPLICATION

Title of the project	Forest beekeeping in Zambia: Analysing the nexus of sustainable forest management and commercial honey trade.
Name of the main investigator (or PGR)	Janet Wendy Lowore
Name of other investigators (if applicable)	n/a
Supervisors names (if applicable)	Adrian Wood Julia Meaton
Date sent to the reviewer	07/01/21
Target review deadline	**21/01/21**

RECOMMENDATION

APPROVE	☑
APPROVE WITH FOLLOWING RECOMMENDATIONS: **Details:**	☐
APPROVE SUBJECT TO FOLLOWING CONDITIONS TO BE MET: **Details:**	☐
FURTHER DOCUMENTATION REQUIRED. **Details:**	☐
REJECT **Details of the reasons:**	☐

Any other advice/feedback you would like to provide to the applicant regarding the project (not obligatory). This may include any additional recommendations if you are imposing conditions.

Details:

No advice or feedback required.

Date: 21st January 2021