



Understanding the Livelihood Implications of Reliable Honey Trade in the Miombo Woodlands in Zambia

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In some of Africa's forests a natural endowment of floral resources and honey bee populations, have given rise to significant beekeeping activity. One such area is Mwinilunga, in the North-Western Province of Zambia. The scale of this economic activity is influenced by the strength of beekeepers' links to market. In recent decades, the demand for organic-certified bee products has created export potential and a private honey buying company started buying honey from Mwinilunga in 1996. By 2004 Forest Fruits Ltd had obtained organic certification and by 2016 the company was buying close to 1,000 tons of honey a year, from 3,000 registered beekeeper-suppliers. The importance of this growing honey trade for the local population has been recognized, but not explored in depth. A field study was carried out in 2, 3-week periods in 2015 and 2016. The work involved Focus Group Discussions with beekeepers and a questionnaire survey conducted with 165 beekeepers, and 64 non-beekeepers in four sites. The purpose was 2-fold: to understand the livelihood implications of income from honey and to explore how the honey economy influences the relationship between beekeepers and forest. This paper reports on the results of the first question—livelihood implications. The results show that the reliability of the market and rising honey prices have increased the attractiveness of forest beekeeping. It was found that income earned is invested in education, in farming and as capital for other enterprises. Honey is often considered “the mother” of other activities because no financial capital is required to generate this income. The low productivity of miombo woodland and soils do not offer a clear pathway out of poverty for the many millions of poor people who live in the miombo zone. This study demonstrates that where honey and beeswax trade is developed and dependable, forest beekeeping is becoming more attractive as an economic activity. Beekeepers are able to use the natural resources available, bees and tree nectar, to finance their varied and pressing livelihood needs in multiple ways.

Keywords: miombo, honey, trade, livelihoods, forest

INTRODUCTION

Forests are among the richest ecosystems. Tropical, temperate and boreal forests cover nearly 30% of the Earth's land area, and yet they are home to more than 80% of all terrestrial species of animals, plants and insects (WWF, 2018). Forests are incredibly important for people. It is estimated that 100 million people depend directly and indirectly on Africa's seasonally-dry deciduous miombo

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woodlands (Syampungani et al., 2009). Yet forests are under pressure. Most of the forest converted to other land uses between 1990 and 2015 was in the tropical domain (FAO, 2015). Overall the world is losing forests, with tropical countries and low-income countries losing forests fastest (FAO, 2015). Solutions to slow the rate of forest loss include certification schemes that reward sustainable management (Rametsteiner and Markku, 2003; Cashore et al., 2006; Kalonga et al., 2016), REDD+ schemes that provide monetary rewards for avoided forest loss (Bond et al., 2010), statutory protection (Bennett, 2015) and community forest management (Nelson et al., 2009).

One strategy that gained traction in the 1990s focussed on the development of non-timber forest products (NTFPs) as a means of making the forest pay its way and become a competitive land use for forest-fringe households (Counsell and Rice, 1992). The idea is that if forests have value for local communities, they will be more inclined to maintain them. NTFP harvesting is described as “the practice of extracting economically valuable, non-timber forest products leaving the forests structurally and functionally intact” (Nepstad and Schwartzman, 1992). Evans (1993) called this the “conservation by commercialization” hypothesis.

There is now considerable understanding about both the promise and the limitations of NTFPs as drivers for sustainable natural resource management (Sills et al., 2011 in Shackleton et al., 2011). There are a large number of examples of NTFPs contributing significantly to people’s livelihoods, especially for poor people (Ros-Tonen and Wiersum, 2003; Vedeld et al., 2007). Yet instances of a demonstrable link between cause (economic benefit) and effect (positive conservation outcome) still remain relatively rare. Why? An analysis of cases of NTFP commercialization in 2005 revealed that in many instances, the outcome of commercialization was not a reduction in poverty (Belcher et al., 2005). Thin markets and perishable, inferior produce keep prices low. Belcher and Schrekenberg (2007) note that some NTFP activities act as poverty traps, where decreasing prices lead to increased harvesting to maintain income. It is possible that NTFPs that are inferior and substitutable, are “not worth managing” (Sills et al., 2011 in Shackleton et al., 2011). They may play a safety net function, but that may not be a strong enough incentive to give rise to resource management actions.

Interest in NTFP commercialization is sometimes discussed as a viable “win–win” for sustainable development (Sunderland and Ndoye, 2004; Elliot and Sumba, 2011; Howe et al., 2014; Ingram, 2014), yet this seemingly harmless phrase hides an incontrovertible truth. The two “wins” may represent equal objectives for development programmes but for local forest users these two “wins” are unlikely to be equal. Achieving a secure livelihood almost certainly takes precedent, and deliberate forest maintenance, when and if achieved, is done so as a means to an end. It therefore seems logical to posit, as others have done (Ros-Tonen and Wiersum, 2003; Shackleton and Shackleton, 2004), that it is only possible to fully understand linkages between NTFP commercialization and forest conservation when we understand the contribution of NTFPs to livelihoods.

Forests and Livelihoods

At the heart of the “conservation by commercialization” 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 and Nicholson, 2009). But this phrase “receive economic benefits” says nothing about the scale or function of the benefit. The phrase from Sills et al. (2011), is more illuminating in this regard; the NTFP (and by extension, in some cases, the forest) must be “worth managing” (Sills et al., 2011, p. 35). Ostrom (2009) also explains that effort is more likely to be invested in managing natural resources “when expected benefits ... exceed the perceived costs” (Ostrom, 2009, p. 420) further underlying the necessity of understanding the scale of the benefits.

In seeking to understand whether the forest is “worth managing” from a poor person’s perspective it is important to look beyond monetary gain only and appreciate that, in addition to income, a livelihood “encompasses income, both cash and in-kind, social institutions, gender relations and property rights ...” (Ellis, 1998, p. 4). The Sustainable Livelihoods Approach framework recognized the importance of natural capital in supporting rural livelihoods (Ashley and Carney, 1999) and the value of environmental income for poor people is increasingly appreciated (Vedeld et al., 2007; Angelsen et al., 2014; Gumbo et al., 2018). 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, p. 38). In particular, environmental income may permit gap filling in times of predictable income shortages and act as a safety net after shocks (Angelsen and Wunder, 2003; Shackleton and Shackleton, 2004). Work done on livelihood diversification throws further light on the function of livelihood activities and identifies that some people seek to diversify their livelihoods out of desperation, to reduce risk, for income smoothing and to accumulate assets (Ellis, 1998; Loison, 2015) and a mixed livelihood portfolio results from dynamic livelihood adaptation to various constraints and opportunities faced by smallholders (Ellis, 2000). 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.

Sunderlin et al. (2003) recognized 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 specializing in relation to a forest-based activity. In helping to understand whether forest management is “worth it” this distinction is important because a person who

steps away from needing forests is probably less inclined to invest in forest management.

Dorward et al. (2009), further help to elucidate the livelihood aspirations of poor people, though not specifically in relation to forest-based livelihoods. The authors describe three broad types of strategy pursued by poor people: “Hanging In”; “Stepping Up”; and “Stepping Out,” explained as follows:

- “Hanging In” activities are engaged in to maintain subsistence livelihood levels.
- “Stepping Up” where investments are made in current activities, in order to improve livelihoods.
- “Stepping Out” where existing activities are engaged in to accumulate assets to subsequently provide a base or “launch pad” for moving into different activities (Dorward et al., 2009).

If this schema were applied to forest beekeepers a “Stepping Up” strategy would involve doing more beekeeping to improve livelihoods, a “Stepping Out” strategy would involve doing something else.

Honey and Forest Beekeeping

This paper concerns one particular NTFP—honey—specifically honey harvested from natural woodlands in Africa. Honey is chosen for three main reasons: (1) In some areas honey trade is well established and is not a hypothetical ambition or goal (Wainwright, 2002; Mickels-Kokwe, 2006; Abebe, 2013; Bekele and Tesfaye, 2013). This situation affords an excellent opportunity to test the link between NTFP commercialization and livelihood and forest outcomes, (2) There has been a lack of attention to date analyzing honey (and beeswax) trade, and the implications for livelihoods and forests, (3) A theoretical analysis of forest beekeeping and honey trade shows that this activity does not appear to exhibit many of the known failure factors in the field of NTFP commercialization—and therefore offers substantial promise in this regard (Lowore et al., 2018).

Forest beekeeping is widespread in Africa and provides important income. The extent of the activity has been documented for parts of Ethiopia (Hartmann, 2004; Endalamaw, 2005), Tanzania (Fisher, 1997; Bradbear, 2009), Zambia (Clauss, 1992) and Cameroon (Ingram and Njikeu, 2011). Its importance is not new. Arnold Landor, the nineteenth 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 color (Landor 1907 in Yoshimasa, 2014: p. 198).

Document research done by Iva Pesa in 2014 draws attention to the importance of apiculture for income generation in Zambia in the nineteenth 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, p. 92).

The importance of forest beekeeping persists. 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, p. 15). In some parts of south-west Ethiopia, forest honey is the primary source of cash for households (Hartmann, 2004; Endalamaw, 2005). Work done by van Beijnen et al. (2004) in Bench-Maji, Kefa, and Sheka in Ethiopia shows that the sale of forest honey contributes from between 12 and 27% to people’s total livelihood portfolio 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, p. 7). 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 and Mugongo, 1991) and research done by Mwakatobe and Machumu (2010) 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 and Machumu, 2010, p. 6). For people living near Niassa National Reserve in Mozambique honey is a major source of income and nutrition (Ribeiro et al., 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.

RESEARCH QUESTIONS

This paper explores how forest beekeeping contributes to people’s livelihoods in north-west Zambia. The purpose of this investigation is to pave the way for asking subsequent questions about whether beekeeping actually incentivises actions and investments related to forest conservation. To help frame the research, reference is made to Dorward’s schema (Dorward et al., 2009). I pose the argument that the forest is “worth managing” when people are engaged in “Stepping Up” activities which rely on forests. Those who are “Hanging In” are 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. I 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. In this paper I

consider the economic incentive for investing in forests by asking the following specific questions:

- Is forest beekeeping economically important? How important is it?
- How well-off are beekeepers, absolutely, and compared to non-beekeepers?
- How does beekeeping income compare with other sources of income?
- What are the factors which encourage people to adopt beekeeping—are people drawn for positive reasons (better than alternatives)? or driven by negative reasons (no other options)?
- Is beekeeping becoming more important? How do we know?
- How does beekeeping income fit within the livelihood strategies of beekeepers, with particular reference to the schema devised by Dorward et al. (2009).

The paper starts with a section on methods which includes a brief description of beekeeping practice and honey trade in the study area. The results follow the questions outlined above, before the discussion explores the functional importance of forest beekeeping in the livelihood strategies of beekeepers. Particular focus is placed on the economic importance of beekeeping and how this source of income is used and valued.

METHODS

Detailed here is a brief description of the study area, followed by an outline of research methods employed.

Beekeeping Practice and Honey Trade in the Study Area

This research was undertaken in the districts of Mwinilunga and Ikelenge in the North-Western Province of Zambia. See **Figure 1**. In this part of Zambia, forest beekeepers make simple cylinder hives made from bark, derived mainly from *Brachystegia spiciformis* and *Julbernardia paniculata* (Claus, 1992). The hives are placed in trees and dispersed in distant well-forested sites where they subsequently become occupied by wild honey bees of the species *Apis mellifera*. The bees forage on tree nectar and pollen and beekeepers collect forest honey from October to December. The bees are wild, but once they occupy a hive, the hive's owner claims the honey stored within. The activity requires skill, labor and access to forest, but no financial outlay. Beekeepers hang a large number of hives, usually in more than one location in the forest. Given the unpredictability of the natural system, and the inability of beekeepers to control variables such as flowering and movement of bees, this approach increases their chances of securing good honey harvests at a favorable rate of return on effort invested.

A private honey buying company, Forest Fruits Ltd. started buying honey from Mwinilunga in 1996. By 2004 Forest Fruits Ltd. had obtained organic certification and by 2016 the company was buying close to 1,000 tons of honey a year, from 3,000 registered beekeeper-suppliers. The

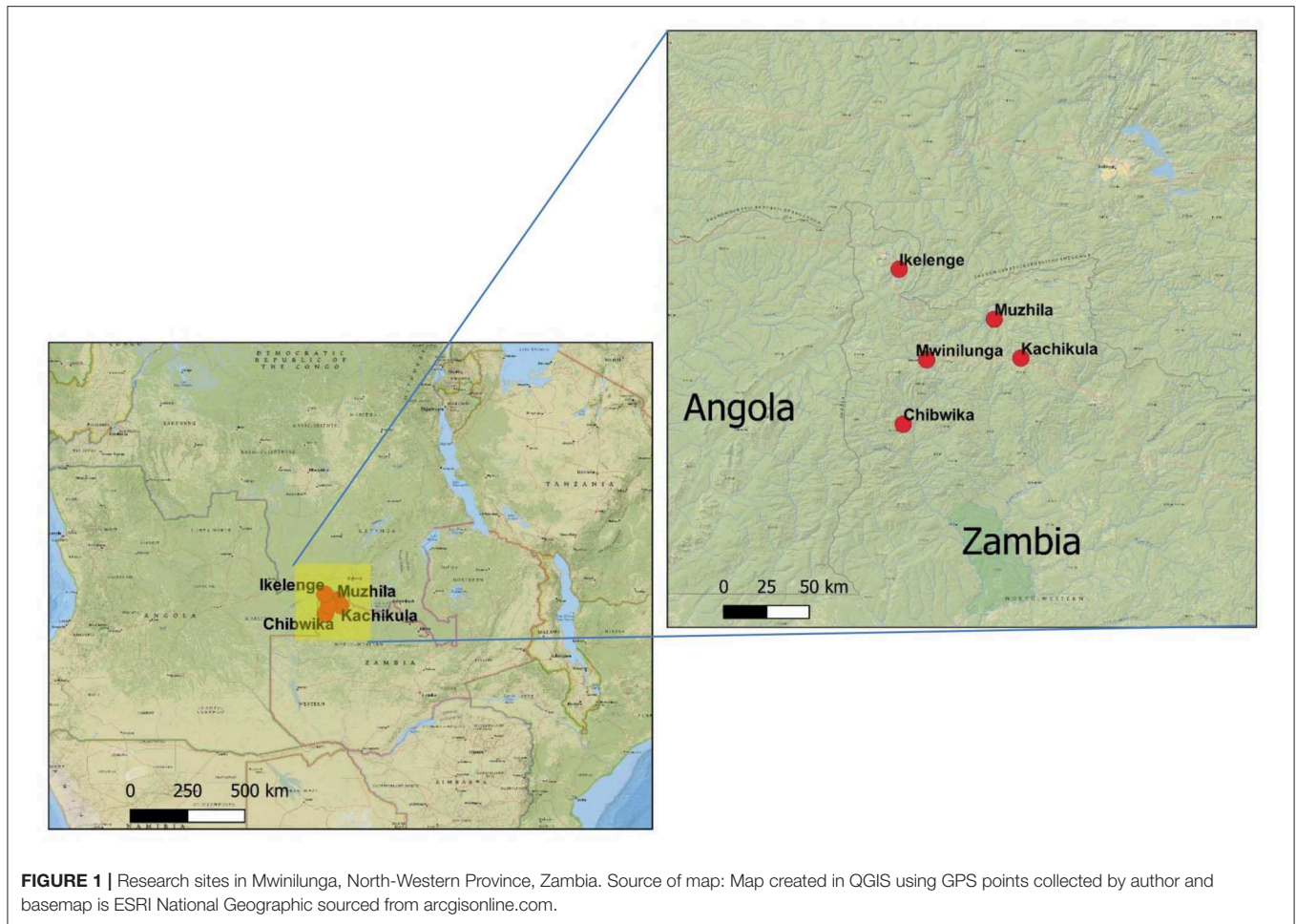
company has invested in beekeeper training, coordination and logistics and serves as a reliable and steadfast buyer. They are able and willing to buy all honey harvested by their registered suppliers provided the honey meets the required quality parameters.

Research Methods

The study used both qualitative and quantitative research methods. In 2015 Focus Group Discussions were held in the districts of Mwinilunga and Ikelenge with 20 groups of beekeepers, of between 3 and 15 participants, during the month of August 2015. The Focus Group Discussions were informal and conversational in style, guided by a checklist which covered benefits of beekeeping, livelihood implications of honey selling, attitude and practices toward forest conservation and beekeeping economics. Some of the most useful starter questions were, “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?” The discussions were moderated by the principal researcher, assisted by a local translator. 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 sessions. The main purpose of the Focus Group Discussions 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. During the discussions, notes were recorded in a notebook, and these were later transcribed. The information was analyzed by highlighting key phrases and statements put forward by respondents and summarized. The results of these interviews were used to help frame the questions which were included in the questionnaire survey which was conducted in 2016.

A questionnaire survey was conducted in September–October 2016 with 229 respondents in four locations, three in Mwinilunga district and one in Ikelenge district. The four sites were Chibwika, Kachikula, Muzhila, and near Kasochi in Ikelenge. All four locations were visited in 2015 and were chosen for the questionnaire survey because of their contrasting characteristics. See **Table 1** for overview of research locations. Enumerators, with appropriate educational qualifications, were hired from within the target communities, two women and four men. The purpose was 2-fold: to understand the livelihood implications of income from honey and 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 analyzed using frequencies and descriptive statistics. Of the 229 respondents, 165 were practicing beekeeping, 12 had previously kept bees but were not doing so at present (also known as former-beekeepers) and 52 were non-beekeepers. Enumerators were asked to deliberately select as many beekeepers as they could because they were the main focus of the research.

Beekeepers were asked about their relationship with the forest, however for this paper the data was interrogated specifically in relation to income and livelihoods.



Respondents were asked about income earned in the 12 months previous to the interviews i.e., September and October 2016. Respondents answered based on recall. The use of local enumerators was intended to increase accuracy. They were able to prompt respondents if they overlooked a source of income and check answers if they appeared unusually high or low. One declared weakness in the income data collection method was that the question concerned household income yet only one member of the household provided the answer. Ninety percentage of respondents were male household heads. It is possible they may have had poor recall about income earned by other members of the household. This was not checked through triangulation.

The information gathered in 2015 and 2016 was similar in that the importance of beekeeping as a valuable and significant source of income was clear, a fact recognized even by those who were not beekeepers themselves. The discussions held in 2015 provided richer and more passionate responses from beekeepers, compared to the more muted replies to the questionnaires, largely because the format of the questionnaire interviews did not allow greatly for to and fro discussion, probing enquiry or free-form answers. The work done in 2016 enabled some of the information collected in 2015 to be quantified and helped place beekeeping in relation to other components of the respondent's diverse livelihood portfolios.

RESULTS

Results of the Focus Group Discussions

All beekeepers said that beekeeping is an important source of income. Some of the groups said that almost everyone in their village kept bees, whereas in other places, just a few. Money from beekeeping is used for education, in farming and as capital for other enterprises, as well as meeting basic needs. Some people mentioned, that “the work is difficult, and the price is low” (two beekeepers, Ntambu Satchitolo) and “We can't sustain ourselves from one season to the next” (beekeepers, Mayimba), but the more frequent sentiment was 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” (beekeepers, Makanu), and “We can build houses, buy iron¹ sheets, educate children, buy clothes. It is really helping—we can earn something. We can educate children and it helps keep orphans” (beekeepers, Kalwisha).

Groups often mentioned that beekeeping was becoming more attractive, “There are more beekeepers now because the market is better” (beekeepers, Sampasa) and the sentiment expressed by a beekeeper in Kaloza, “I have been growing maize, but I saw

¹Corrugated sheets for house roofs

TABLE 1 | Overview of research locations visited in 2015 and 2016.

	2015	2016
Method	Focus group discussions	Household questionnaire survey
Respondents	All respondents were beekeepers registered as suppliers to Forest Fruits Ltd. 19 groups of beekeepers.	229 respondents comprising 165 practicing beekeepers, 12 former-beekeepers, and 52 non-beekeepers
Gender	Approximately 95% were men	203 men and 26 women
Locations	20 meetings in 20 separate locations spread throughout the Districts of Mwinilunga and Ikelenge. Each meeting was held at or near a location of a Forest Fruits' beekeepers' group.	<ol style="list-style-type: none"> 1. Chibwika—near the palace of Chief Chibwika 2. Ikelenge—near Kasochi 3. Kachikula 4. Muzhila
How locations were selected	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.	<p>The four locations are a sub-set of the places visited in 2015 and were selected based on contrasting characteristics.</p> <ol style="list-style-type: none"> 1. Chibwika – maize growing area 2. Ikelenge – pineapple growing area 3. Kachikula – near the main highway 4. Muzhila – none of the above

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. “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” (beekeepers, Sampasa) 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 neighboring 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.” 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,” 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.”

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.” 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 labor 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.

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 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. Several beekeepers said they spent income from honey on labor 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 laborer 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” (beekeepers, Kachikula). Others mentioned that livestock are highly valued, but it takes time, sometimes years, to realize a return from livestock. This is unlike bees where the return on investment is realized within a few months.

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” (beekeepers, Kasochi).

Results of the Questionnaire Survey

The questionnaire survey was conducted in four sites; Chibwika, Ikelenge, Kachikula, and Muzhila. A total of 229 respondents were interviewed, of these 165 were beekeepers, 52 were non-beekeepers and 12 respondents used to be beekeepers, but were no longer. **Table 2** provides a summary of the main demographics.

Income Earned From Honey and Other Activities

Respondents were asked about sources of income for the household were asked for an estimate of the amount earned in the last 12 months. The income data shown in **Table 3** is gross income.

TABLE 2 | Respondents and demographics, disaggregated by site.

Site	Beekeepers	Former beekeepers	Non- beekeepers	M	F	Mean no. in household	Mean age (years)
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.

TABLE 3 | 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 (165 beekeepers)
Cattle	4,588 (USD 458) [range 300–10,000 ZK]	15
Pineapple	3,215 (USD 322) [range 150–15,000 ZK]	33
Maize	1,880* (USD 188) [range 100–11,000 ZK]	141
Honey	1,721 (USD 172) [range 50–14,000 ZK]	163**
Vegetables	1,032 (USD 103) [range 20–5,000 ZK]	57
Beans	757 (USD 76) [range 20–4,200 ZK]	157
Cassava	523 (USD 52) [range 5–2,000 ZK]	56
Onions	458 (USD 46) [range 20–3,000 ZK]	20

Source: Data collected from questionnaire survey in 2016.

*It is reported (Burke et al., 2011) that about 55% of the income from maize growing in Zambia is profit.

**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.

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

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 laborers for beekeepers, selling goods to beekeepers, building houses for beekeepers and being able to borrow money from beekeepers. The results in **Table 4** 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.

Of the 229 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. The average income from honey selling reported by the 4 women respondents (3 beekeepers and one who had bought and sold honey) was 1402ZK (USD 140), whilst the average across all male honey-selling respondents was 1728ZK (USD 173).

The most notable difference between men and women, was the total income reported. The women respondents, on average,

reported total household income for the 12 months prior to Sept 2016 as 2573ZK (USD 257), whilst the average from the male respondents was 5664ZK (USD 566). The question which was asked was about household income, not individual income. However, it seems likely that women were under-reporting their household income—and possibly reporting 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 to their lower incomes, and these are also reasons why they do not engage in forest beekeeping.

Difference in Economic Well-Being Between Beekeepers and Non-beekeepers

Cattle is a wealth indicator, but cattle ownership is generally low. 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). Even though cattle was the highest-ranking source of income among all (**Table 3**) 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

TABLE 4 | 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 <i>n</i> = 165	Former beekeepers <i>n</i> = 12	Non-beekeepers (male) <i>n</i> = 29	Non-beekeepers (female) <i>n</i> = 23
Firewood	1	0	0	0
Charcoal	1	0	3	2
Honey	151	9	21	14
Building poles	1	0	0	0
Mushrooms	5	2	2	0
Caterpillars	3	0	2	4
Timber	3	0	0	0
Orchids	0	1	1	1
Grass	0	0	0	1
Total	165	12	29	23

Source: Data collected from questionnaire survey in 2016.

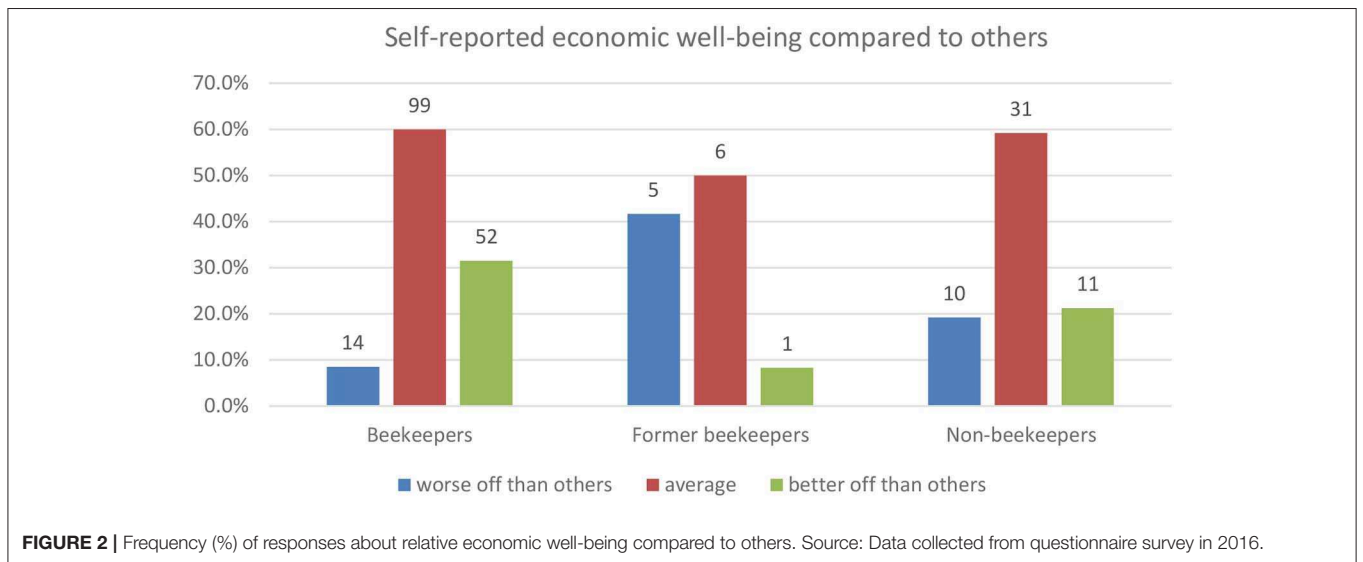


FIGURE 2 | Frequency (%) of responses about relative economic well-being compared to others. Source: Data collected from questionnaire survey in 2016.

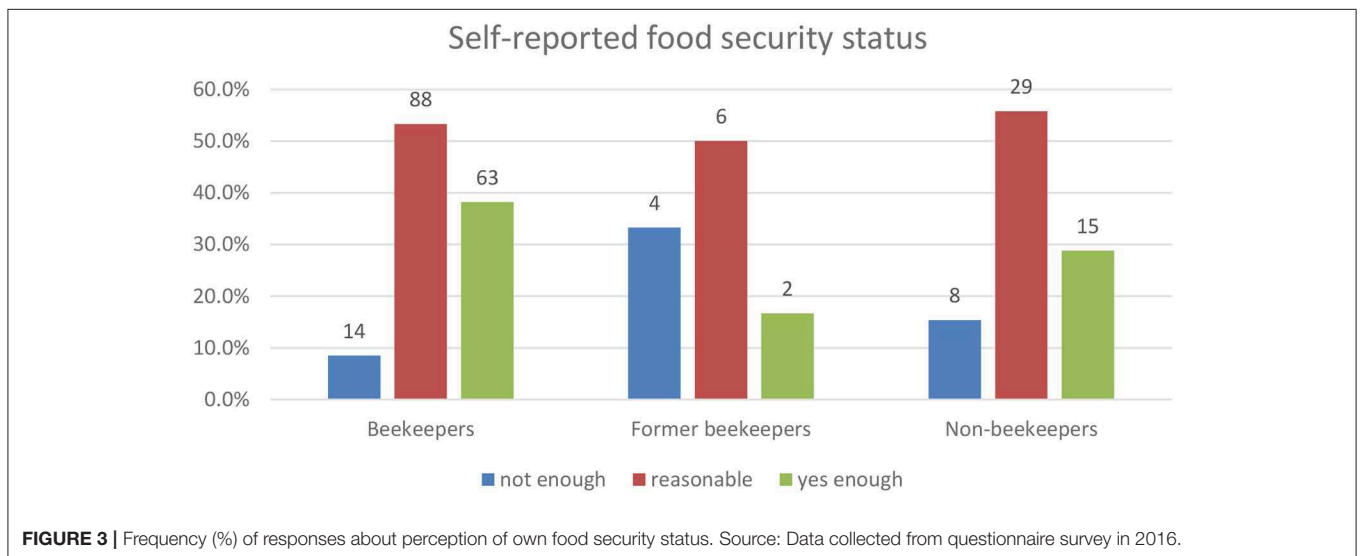
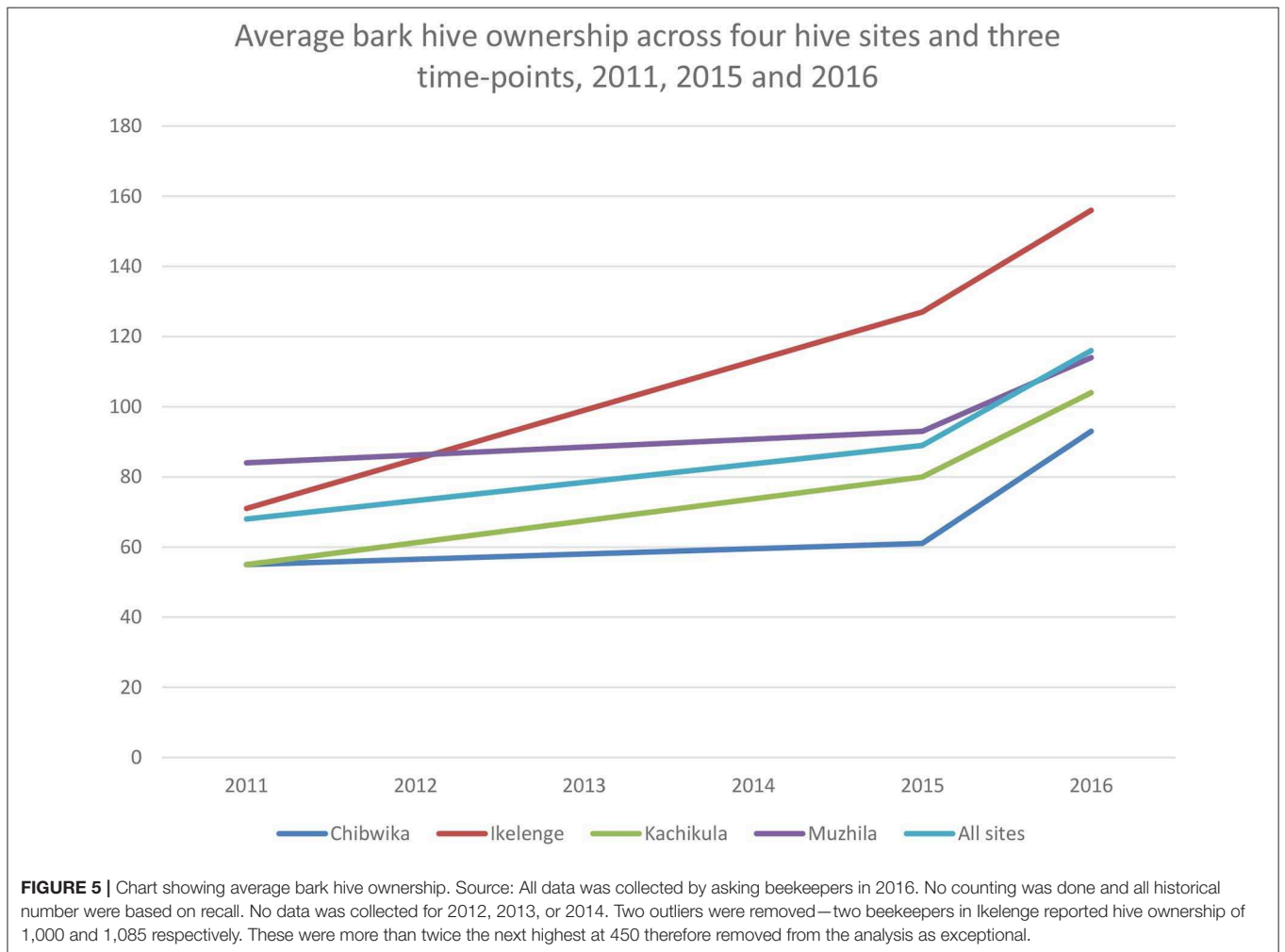
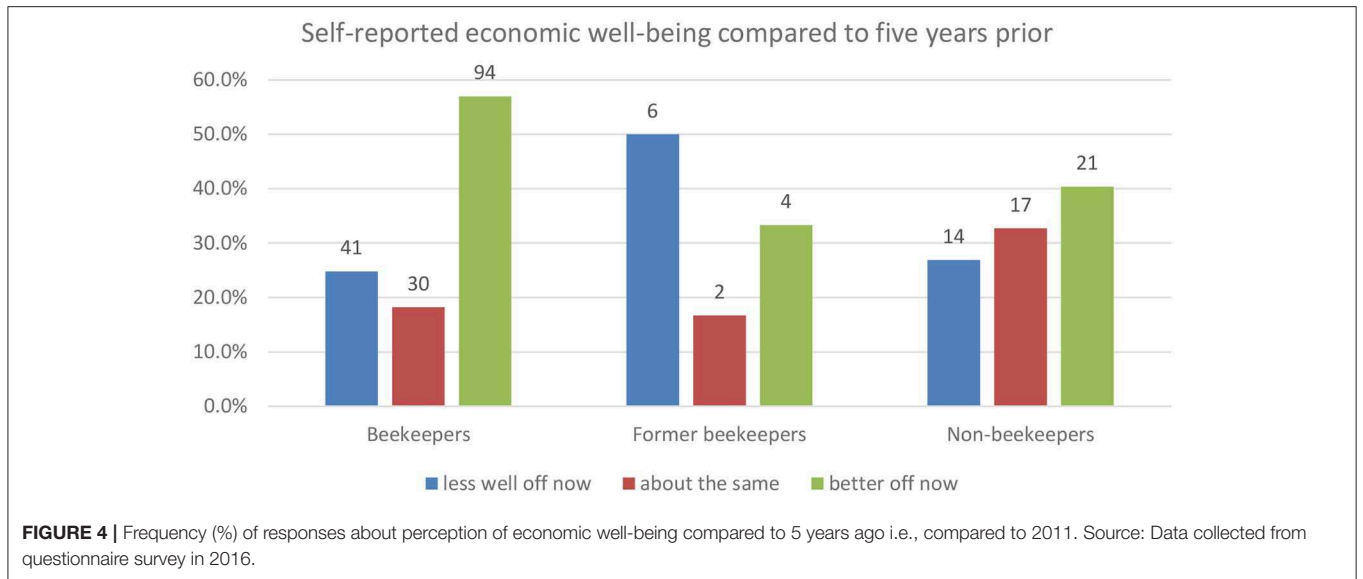


FIGURE 3 | Frequency (%) of responses about perception of own food security status. Source: Data collected from questionnaire survey in 2016.



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.

All respondents were asked questions about their own perception of their economic status, with answers shown in **Figures 2–4**. Whilst the following results compare beekeepers with non-beekeepers, it must be noted that there is a gender dimension to these results, as 23 of the 26 female respondents were non-beekeepers.

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

Nearly 40% of beekeepers (63) said they had enough food, whereas <20% of former beekeepers (2) and just <30% of non-beekeepers (15) gave this answer. In answer to the question about economic well-being compared to 5 years ago, once again the beekeepers gave a higher frequency of positive responses compared to the other two groups.

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 allow 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 (Dhembba, 2012). 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.” As the next section shows there is movement between these groups and as honey selling becomes more reliable, more people choose to become beekeepers. During discussions beekeepers were asked a hypothetical question, “What might happen if something happened to the bees e.g., got diseased?” They replied, “Then we will cultivate maize and cassava.”

Beekeeping Trend

The general trend is that beekeepers are keeping more bees. **Figure 5** shows the hive numbers across all four sites and at three time-points, at the time of asking (Sept 2016), 1 year prior (Sept 2015) and 5 years before the time of asking (2011). The average number of hives per beekeeper at the time of the survey in 2016 was 116² and the trend shows increasing numbers. The rate of increase is slightly surprising being particularly steep in the last year. These results are based on beekeepers responses, and not counting. They may in part be explained by the number of new recruits to beekeeping who are building up their stocks. Yet, of the 100 beekeepers who had been keeping bees for 5 years or more, 85 had increased the number of hives in the last 5 years, 1 no change and 14 now had fewer.

Not all respondents had hives in all years. Those without hives in any particular year were excluded from the average hive ownership count, as shown in **Table 5**.

TABLE 5 | Average hive ownership and no. of beekeepers who had hives at each time-points.

		2016	2015	2011
Chibwika	<i>n</i>	48	46	19
	mean	93	61	55
Ikelenge	<i>n</i>	38	38	31
	mean	156	127	71
Kachikula	<i>n</i>	39	39	23
	mean	104	80	55
Muzhila	<i>n</i>	38	37	25
	mean	114	93	84
All sites	<i>n</i>	163*	160*	98*
	mean	116	89	68

*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 5** shows changes in average hive ownership—these changes are not uniform. The proportion of beekeepers who reported an increase of hive numbers between 2016 and 2015 was highest in Chibwika, as shown in **Table 6**. Chibwika beekeepers were also the most recent adopters with 65% of those interviewed reporting that they had started beekeeping in the last 5 years.

The questionnaire survey 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 7**. This data provides some insight into the rate of beekeeping adoption. Sixty five 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.

Beekeepers were asked 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.

Beekeepers were also asked about their plans for the future. One hundred and fifty eight out of 162 who answered this question (98%) said they will continue with beekeeping, and some explained why. **Table 8** shows all answers about future beekeeping plans. **Box 1** gives an overview of honey yield metrics and triangulated data provides a realistic picture of the 2015/2016 honey harvest.

Importance of Honey Income Within the Wider Livelihood Context

All respondents were asked how they raised capital, and in which income-generating activities they invested. Of the 229

²Two outliers with exceptionally high (more than 1,000) hive numbers were excluded in calculating the mean.

TABLE 6 | 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 and 5 years ago
Chibwika	92%	65%
Ikelenge	80%	23%
Kachikula	80%	44%
Muzhila	66%	42%

TABLE 7 | Age of beekeepers compared to length of time beekeeping.

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: Data collected from questionnaire survey in 2016.

TABLE 8 | 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, I have only just started	1
I will continue because it is good work, easy and profitable	2
I will continue because after selling honey I buy fertilizer	2
I will continue because it is easy	4
I will continue, but I would like to start using modern hives	3
I will continue, I even think of giving up farming	1
I will continue because I do not need to invest any capital	3
I will continue because it is the only way to get money for school fees	2
I will put more effort in beekeeping, compared to any other activity	4
I will continue with beekeeping, and develop other activities as well	24
I will continue until my children finish school	2
I will continue (no explanation or reason given)	26
Not continue—no profit in beekeeping	1
Not continue—I will focus on farming	2
Not continue—I plan to open a shop	1
No answer to the question	3
Total ($n = 165$)	165

Source: Data collected from questionnaire survey in 2016.

respondents, 192 said they raised capital from one venture and invested in another. **Table 9** shows the range of activities invested in, across all respondents.

Table 9 clearly shows that farming needs injection 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 10**.

As shown in **Table 10**, 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 answer was, “paying school fees,” and 29% of beekeepers gave this as their primary area of expenditure and “paying school fees” accounted for 25% of all answers. Twenty nine percentage of all answers were related to crop-farming.

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 labor.” A beekeeper in Makanu said, “Beekeeping is about investing energy, not money.”

DISCUSSION

The main research question is asking about the functional importance of beekeeping in people’s livelihoods and this is considered by discussing the importance of the earned income, trends with regard to engagement in beekeeping and finally, how it fits with people’s livelihood strategies.

The Importance of Beekeeping Income

Beekeeping is an important source of income. After cattle, pineapples and maize, it is the fourth-highest gross income earner amongst the respondents interviewed, although not every respondent engages in the higher-earning activities. Compared

BOX 1 | A look at the honey yield metrics.

The 2015 harvest was purchased by Forest Fruits Ltd. starting late 2015 and extending into early 2016 and they reported a total purchase of nearly 1,000 tons, from about 3,000 beekeepers (Dan Ball, personal communication). In 2016 beekeepers provided information that they had, on average, 116 hives each at the time of asking—however they also reported that in the previous year, in 2015, when the 1,000 ton purchase was made, the average was 89 hives each (see **Table 5**).

Through the Focus Group 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. ($333\text{ kg} \times 3,000 \text{ beekeeper} = 999 \text{ tons}$). If, in the 2015 season beekeepers cropped 53% of 89 hives each this would suggest they harvested 333 kg from 47 hives i.e., 7 kg 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 (Evans Sikombwe, personal communication). 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.

with maize, beekeeping is more profitable, once the costs of inputs are considered. Many beekeepers mentioned the high cost of inputs when growing maize, and further mentioned that honey income was required to sustain this activity. Beekeepers clearly stated that they needed cash to invest in farming, and honey sales provided this cash. Livestock too are sometimes acquired with honey income, but livestock are considered more as an asset or as savings, rather than a regular cash-earner. Whilst it is not surprising that beekeepers rate honey as the most important forest product in terms of cash, it is striking that non-beekeepers also recognize the same, with 67% of non-beekeepers rating honey as the most important forest product for the community as a whole. Though not explored in depth, non-beekeepers gave a number of examples of how they too benefitted indirectly from honey income, e.g., by working for beekeepers, such as digging, weeding, making bricks and building houses.

The results suggest that beekeepers are slightly better-off than non-beekeepers, but these results have a gender dimension as women, who reported lower incomes than men, fall mainly into the group of non-beekeepers. Twenty percentage of beekeepers own cattle, whilst 7.7% of non-beekeepers own cattle, although cattle ownership was generally low. When self-reporting about economic well-being beekeepers were the group which gave the highest frequency of positive answers, to each question. Nearly 60% of beekeepers said they considered themselves better off than 5 years ago compared to 40% of non-beekeepers and just over 30% of former beekeepers said this. For all three questions, former beekeepers seemed to give the highest number of answers indicating lower economic well-being. If, as elsewhere mentioned, beekeepers tend to become former-beekeepers as a result of injury, sickness and old age this might explain this finding. Seven percentage of beekeepers said they “did not invest,” for example in crop-farming, whereas for non-beekeepers this figure was 26%.

Beekeepers are ready to admit that all sources of income are important. This is consistent with existing literature on livelihood diversification which show that rural people in remote and difficult environments depend on a mix of income sources (Mutamba, 2007; Loison, 2015). Diversification stems from the need to spread risk, to take advantage of different sorts of resources (labor, money, land, forest) at different seasons and depending on availability (Jones et al., 2016), for income smoothing (Ellis, 1998) and out of dire need (Larsson, 2005). In the case of forest beekeeping the evidence points to a relationship whereby forest beekeeping generates “free cash,” which feeds into other livelihood activities which need a cash injection, notably farming. The most important conclusion from the self-reported metrics on well-being is that beekeepers are not less well-off than others. This helps to dispel ideas that beekeeping is a poverty-trap, as is sometimes the case for other NTFP-harvesting activities. A poverty trap has been described as a “deadlock scenario” and occurs where an activity yields low returns and “paradoxically, trying to raise these returns might make the situation worse for poor producers” (Angelsen and Wunder, 2003, p. 24).

These results also suggest that beekeeping is more than a safety-net. A safety net is something to fall back on in times of stress or desperation. Forest products are often, “a source of emergency sustenance in times of hardship, i.e., when crops fail, when economic crisis hits, in times of conflict or war, or when floods wash away homes” (Sunderlin et al., 2003, p. 3). The results of the Focus Group Discussions do not support the idea that beekeeping is done in times of stress or desperation. It is deliberately chosen because of the perceived gain. This suggests beekeeping is more than a safety-net.

Beekeeping Trend

The results show a clear trend that beekeepers are investing more effort, by increasing their hive numbers. There is also some evidence that the rate of adoption of beekeeping is increasing. Forest beekeeping is a very physically demanding job, and it takes time to accumulate hives. It would be normal, perhaps, to expect men to start beekeeping in their youth, increase their hive numbers and then to do less beekeeping as they get older. What is interesting here is that of those that started beekeeping in 2015, half are over the age of 45. Given that the ages of the sample of beekeepers, range from 18 to 95, with the 92% being 30 years old or above—it is a little unexpected that 44% of the sample have started beekeeping in the last 5 years when a beekeeping “career” could span well over 40 years. These results suggest that people are choosing to join and invest more effort in beekeeping.

During the Focus Group Discussions many respondents said that more people are joining beekeeping and many of those interviewed were relatively new to beekeeping. Young men are by default, probably, new to beekeeping but many new beekeepers were older. It was notable how many people said they were taking up beekeeping because they saw beekeepers doing well. And in at least one group (in Sakunda), the respondents said that beekeeping was new to the community as a whole “they used to be farmers only.”

TABLE 9 | Responses about investment of capital from all respondents.

How capital is used	Beekeepers <i>n</i> = 152	Former beekeepers <i>n</i> = 9	Non-beekeepers <i>n</i> = 46
Buy fertilizer	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 labor	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
Invest in potato farming	0	0	1
Honey trading	1	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: Data collected from questionnaire survey in 2016.

The reasons given for increasing hive numbers, both through discussions and from the questionnaire results, indicate a clear “pull” of the market, with price increases and market accessibility being the lead reasons for further effort invested. Many respondents said that the company, Forest Fruits Ltd. was responsible for this rise in confidence as they were a reliable buyer, were able to buy large volumes of honey and helped with logistics such as bucket distribution prior to harvest. This existing confidence contrasted with former times. One beekeeper from Jimbe who said he had been keeping bees for 40 years, explained, “In the old days there was no market. We used to crop honey for home consumption and to make beer.” This study did not explore the dynamics of honey pricing in detail. Beekeepers gave, “the price is better” as the primary reason for investing more effort in beekeeping, whilst at the same time expressing a desire for higher prices. The two are not mutually exclusive!

Hanging in, Stepping-Up and Stepping-Out

Following Dorward et al.'s (2009) schema on the aspirations of the poor, it is useful to consider whether beekeeping, as an activity, enables people to survive (Hanging-In), enables them to get closer to achieving what they want or need (Stepping-Up), or whether it gives them an opportunity to move on to something different (Stepping-Out). In terms of managing the resource which underpins any particular livelihood strategy one might expect people to manage resources which allows them to step-up. Hanging-in is what people do out of desperation, it is not a desired state. Investing effort in maintaining a non-desirable state is unlikely. Likewise, a stepping-out strategy is also unlikely to motivate actions to maintain the resource, as the individual is planning to not need that strategy in future.

They will have moved on. The stepping-up strategy is one where the individual sees that a particular activity has promise. It is viable in the long term and is meeting their needs. It is this strategy most likely, one could argue, to incentivise actions to maintain it.

The research results strongly suggest that beekeeping is a stepping-up strategy. It is too important and valuable to be considered “hanging-in.” People are being drawn to beekeeping, for positive reasons, “to live well, to sleep well, to move well,” and existing beekeepers are investing more in the activity by increasing their hive numbers. It does not fit the description of a poverty trap where people have to do more to stay the same; people are doing more, to do better. On being asked about trends in beekeeping people readily admitted that beekeeping was become more attractive because of the reliable market provided by Forest Fruits Ltd. and they compared the current market environment with less-favorable former times. Beekeepers explained that they valued the company Forest Fruits Ltd. because they provide buckets ahead of the harvest season, at no cost provided they are returned, are steadfast in their reliability, pay on time and—importantly—are ready to buy an increasing supply of honey. This was compared other buyers who sometimes tempt beekeepers by offering a higher price per bucket, but on delivery only then take a small proportion of the honey. Not every feedback about Forest Fruits Ltd. was wholly positive. Some beekeepers said that buckets were not always delivered on time, they said they wished the company would build them honey collection premises and pay higher prices, but on further probing they admitted that it would be “a disaster” if the company were to leave, “because no other buyer can buy all the honey we harvest.” The literature does provide evidence that an accessible market for bee products is not wholly new, as

TABLE 10 | Areas of expenditure of income earned from selling honey in early 2016.

Area of expenditure	Answers about how honey income is spent <i>n</i> = 152	Primary area of expenditure of honey income <i>n</i> = 152
School fees	123	53
New house	29	17
House improvements	35	12
Crop inputs	67	16
Livestock	27	8
Motorbike	5	1
Food	87	5
Labor for farming	69	17
Other expenditures e.g., bail, hospital	7	3
Invested in carpentry or shop	3	1
Invested in trading e.g., fish, honey ¹	7	5
Hives	9	
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

¹Trading honey, i.e., buying and selling honey, is different from earning money from the primary production of honey through harvest. Data collected from questionnaire survey in 2016.

evidenced by the historical records research done by Pesa (2014) and the overview study undertaken by Mickels-Kokwe (2006). This is not a contradiction. If it were not for the saleability of honey and beeswax over the preceding 100 years or more the beekeeping skills may not have persisted, and it is these skills, coupled with the underlying natural resource abundance which attracted the company to this part of Zambia.

Is it a stepping-out strategy? Beekeepers are not stepping-out of beekeeping. They are not using beekeeping income to change their lives to such an extent that they give up beekeeping altogether. Beekeeping remains part of their mixed livelihood and it is normal that income from beekeeping is invested in farming, trading and in small businesses, but this is all part of “income smoothing,” saving and making full use of resources, seasonal opportunities, and meeting all needs. Most beekeepers declared their strong intention to continue beekeeping, even as they develop other activities. If one considers inter-generational changes the picture may be different. Beekeepers are investing in their children’s education, so that they may step-out of a farming existence into employment. The beekeepers are stepping-up to enable their children to step-out. Despite these hopes it is inevitable that not all young people are able to find jobs in town, as one beekeeper said, “Some [of my children] will be educated and get jobs, some will be beekeepers like me.”

People’s mix of livelihood activities are not static, but they are shaped by place, labor and financial resources. Maize growing is a constant, but it is capital intensive and not reliably profitable. Pineapple growing is attractive at present, but the market can be erratic. At present traders are coming by lorry from Lusaka but at certain times of year, when the roads are less passable, unsold

pineapples can be left to rot. Road access is a challenge also for Forest Fruits Ltd. but honey can wait—it does not perish. Non-beekeepers can and do become beekeepers should they choose to do so. Beekeepers do not rely on beekeeping alone and when asked what they would do if beekeeping were, for some reason curtailed, they said they would put more effort into farming. These are options—albeit constrained. The prevailing prices and market opportunities impact on the decisions they make about allocating resources. In this regard beekeeping is serving as a stepping-up strategy at present, because of the current favorable marketing context. If this were to falter for some reason, people may not give up beekeeping but they may do less, as producing a surplus of honey would be of no benefit.

CONCLUSION

The results suggest that beekeeping is an important source of income, both absolutely and relatively. This fact is recognized also by non-beekeepers, some of whom benefit indirectly from the cash injection into the community which follows honey sales. Income from honey selling is used as a source of cash to invest in crop-farming, to pay school fees and to meet household needs. Beekeeping is attracting new adopters, including some older men, because it does not require any cash investment, and is therefore readily accessible. The ready market and increasing honey price is an incentivising factor which appears to be increasing the rate of adoption, and increasing the effort invested by existing beekeepers, i.e., acquiring more hives. The results suggest that beekeepers are very slightly better-off than non-beekeepers. It would appear that beekeeping is more than a safety-net activity,

and contributes more to meeting the livelihood aspirations of the poor, than survival only. It helps poor people do a little better. Beekeepers maintain their beekeeping activities alongside other activities. Old-age, illness and injury are the main reasons to stop beekeeping. Many beekeepers are investing in their children's education in the hope that their children will find employment. They value beekeeping highly for themselves, but some hope their children will have different lives.

The indications are that beekeepers are deriving direct economic gain from the forest, through beekeeping, and the way they are benefitting is significant. This economic gain may help underpin and provide an incentive to manage the forest. Beekeeping may make the forest "worth managing." Further analysis and study will reveal whether this economic incentive is manifested in forest conservation actions.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

In accordance with the University of Huddersfield Business School Research Ethics Policy a No Specific Ethics Risk Declaration form was submitted to and accepted by JL's Ph.D.

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- supervisors. This research was considered to pose no specific ethical risk because it did not involve children or vulnerable adults, did not involve research into a potentially sensitive topic, did not involve students as research assistants and posed no danger of psychological or physical harm for the researcher or subject. Full and informed consent was provided by all interviewed beekeepers who were free to decline being interviewed and free to withdraw from any interview. All names have been anonymized. Data is held securely.

AUTHOR CONTRIBUTIONS

JL is responsible for the entirety of this research and the article.

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Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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