

## Article

# Honey Harvesting from Wild (Unmanaged) Honeybee Colonies (*Apis mellifera scutellata* L.) Supports Rural Community Livelihoods in the Vhembe District, Limpopo Province, South Africa

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**Abstract:** Honeybees provide a variety of services and products that are beneficial to humans, including pollination, honey, propolis, and other harvested products. In South Africa, it is believed that honey harvesting from wild (unmanaged) honeybee (*Apis mellifera* L.) colonies is widely practiced. However, there is limited knowledge regarding this practice. Using structured questionnaire surveys and site visits for validation, we aimed to (1) confirm the practice of honey harvesting and ascertain the extent to which it is practiced; and (2) quantify the economic benefits of this practice to communities' livelihoods. We found that honey and other products (i.e., brood and pollen) harvesting from wild honeybee colonies is still a common practice among the rural communities of selected areas within the Vhembe District, which was confirmed by 44% of the respondents. These products are either consumed by the harvesters or sold, helping to generate total household incomes ranging from R500.00 (\$26USD) to R2000.00 (\$112USD) South African Rands (ZAR), which contribute towards offsetting various household costs. Although the overall population and health status of the wild honeybees in the area is unknown, the survey respondents (29%) indicated that they are generally healthy. From these findings, we were able to establish a good level of dependence on wild honeybee colonies by rural communities for income generation, albeit at a small scale. Given the wide array of pressures on insect pollinators, particularly honeybees, from factors such as habitat loss, climate change, pests, pathogens, and pesticides, our findings serve as a strong basis for considering protection and preservation mechanisms for these populations. These could be accommodated under various local and provincial conservation efforts, especially those preventing habitat loss.

**Keywords:** *Apis mellifera scutellata*; conservation; honeybee; honey harvesting; wild colony; Limpopo Province



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## 1. Introduction

Harvesting honey by hunting wild bee colonies has been practiced for centuries around the world before the development of different strategies to save bees and ensure the continuation of the colony's development cycle [1–3]. On the African continent, studies

from countries such as Kenya, Mozambique, and Tanzania have documented this practice, linking it to cultural practices as well as the human interactions with honeyguides (*Indicator indicator*) [4–6]. In countries such as Australia, Brazil, Cuba, Nepal, and Peru, studies have documented the activities of hunters and trappers of honey and other bee related products covering several bee genera, such as *Geotrigona*, *Melipona*, *Plebeia*, and *Tetragonisca*, while the *Apis* genus was represented by *A. mellifera*, *A. cerana*, and *A. laboriosa* [7]. The practice varies seasonally across countries and continents, with the hunters/harvesters also spending variable lengths of time on research, depending on the landscape, terrain, and number of days they are required to travel from home and back. For example, in Kenya, harvesters could travel up to 20 km in search of nests, while others took a full day [4,5]. In Mozambique, honey gathering from wild honeybee colonies is reported to be carried out by groups of five to seven men, who walk around 5 to 20 km from their villages [8]. In some instances, these groups are likely to carry out their search while staying in the forest for up to 10 days. Today, honey harvesting from wild colonies is still practiced in various parts of the world, mostly by rural communities [9,10], and particularly in areas where wild honeybee colonies are abundant [11]. However, the trend has declined across cultures due to a lack of interest, often influenced by civilization and the emergence of new practices linked to apiculture through the use of man-made beehives [4]. This type of honey harvesting entails the harvesting of honey from wild colonies using smoke and tools, without the removal or trapping of bees. In some instances, the practice can be destructive to the bees (and their nest) whereby the entire tree is cut down to access the bees' nest [12]. The hunters and gatherers are conscious of the well-being of bees as the survival of bee colonies is indispensable to honey harvesting, therefore ensuring that the harvest does not lead to the colony absconding [2,4,12]. During the harvest, other products besides honey are also harvested in the process; these include products such as beeswax, bee larvae, bee venom, and propolis [13]. Honey harvesters in rural areas rely on harvesting honey from wild colonies to maintain their daily livelihoods [14].

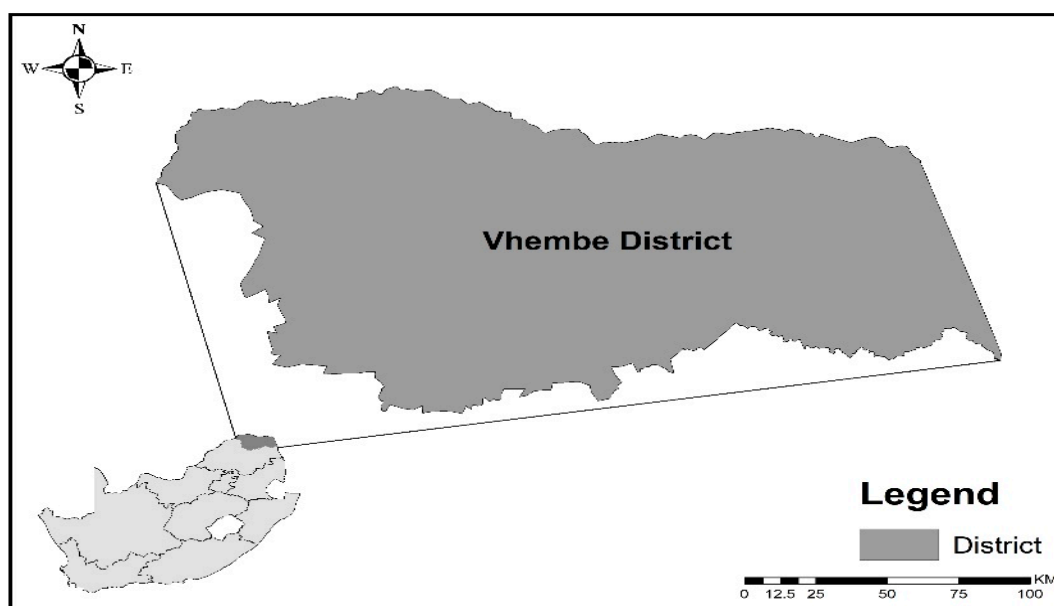
In South Africa, honeybees occur naturally within landscapes and are also actively managed by beekeepers [15]. Two subspecies of honeybees exist and are confined to distinct regions of the country. The northern region (summer rainfall areas) is home to *Apis mellifera scutellata*, (the African/Savanna honeybee), while *Apis mellifera capensis* (the Cape honeybee) is found in the southernmost region of the country (in winter rainfall areas). Historic evidence shows that honey harvesting in South Africa has been practiced since 1497, prior to the establishment of organized and commercial bee farming (beekeeping), although it has been restricted to certain areas [16]. The 2016 Rural Apicultural Report for the Limpopo Province, which was conducted by the Industrial Development Corporation (IDC), reports that traditional beekeeping and honey hunting still takes place in the province, whereby hives are made by stripping the bark from the trunks of large trees to produce a hollow cylinder, which is then plugged at both ends and suspended by bark ropes in large trees [17]. The report further confirms that honey hunting and or traditional beekeeping is still being practiced by previously disadvantaged rural communities. In Kenya, the Awer people learnt to honey hunt with honeyguides from their fathers and other elders in the village by mastering the signaling calls and whistles that they use to communicate with honeyguides [4]. In places such as the Amazon, honey hunting from stingless bees seems to be more specialized, with the activity taking place at night during the spring water season whereby the rise in the water level of the lake and the rivers provides better access to the tree branches of canopies, and easy access to bee nesting cavities [7].

Although honey harvesting from wild colonies has been practiced for centuries, not much is known about the current status of the practice in South Africa. Thus, there is a need to explore the extent of this practice and to quantify its importance to rural livelihoods. In

South Africa, the contribution of natural resources to rural livelihoods has been described as a biodiversity economy (that is, businesses and activities that depend on biodiversity for their core business or that contribute to the conservation of biodiversity through their activities). This provides for a modern way of capturing and valuing these practices, which are of economic benefit to rural communities. This study aimed to (1) ascertain to what extent honey harvesting is practiced by rural communities in the Vhembe District of South Africa; and (2) quantify the economic benefits of this practice to the communities' livelihoods. In turn, this study attempts to make the case for putting in place provisions for their sustainable use, management and conservation.

## 2. Methods

**Study area:** This study was conducted in the northern region of South Africa, the Vhembe District of the Limpopo Province (Figure 1). The Vhembe District is generally subjected to high rainfall due to its complex topography, especially the Soutpansberg mountain range. The area receives the majority of its annual rainfall in the summer season (from October to March), while the peak rainfall months are January and February. Generally, Vhembe is a semi-arid area, with a mean rainfall of approximately 450 mm, while temperatures range from 16 °C to 30 °C during summer and 6 °C to 14 °C in the winter [18–20]. The district has a variable topography with high mountains in the Soutpansberg mountain range, which have a high impact on the weather and climate in the area, while the geology comprises of granite gneiss from the Precambrian age [18,21,22]. There are roughly 24 different vegetation types within the district, of which 2 are classified as threatened ecosystems, while 13 are endemic and 5 are near endemic [23]. This is a summer rainfall region and home to the Savanna honeybee. The presence of the Cape honeybee as a “capensis social parasite” is known for the managed colonies [24]. The Vhembe District is predominately rural to semi-rural and largely dominated by agricultural activities (i.e., crop cultivation and livestock grazing) [25,26]. The majority of the population comprises the VhaVenda ethnic group (83%) and the main source of income in the region is procured through agricultural pursuits [27]. An average household consists of 3.9 persons [28].



**Figure 1.** Map of South Africa, showing the study area (the Vhembe district) in the Limpopo Province.

Data gathering from participants using semi-structured questionnaires: A semi-structured questionnaire, prepared in both English and Tshivenda (a local language in the area), was used to collect data regarding honey harvesting. Ethical approval, Ref: HS19/6/23, for the questionnaire usage was obtained for the purpose of this research through the Research Ethics Committee within the Research and Innovation Division at the University of the Western Cape. Honey harvesters from 16 villages were randomly approached to participate in the study, with the assistance of Mr. Richard Nekhavambe from the Limpopo Province's Department of Agriculture. Potential respondents were identified through consultation with several community members. A total of 43 individuals were identified and approached to complete the questionnaire, but only 19 (44%) honey harvesters agreed to participate and completed the questionnaire. All respondents were black Tshivenda speaking males and above the age of 19.

The questionnaire validation process: A representative sample of seven (constituting 37% of the respondents) of the survey respondents was selected for the validation process. Physical visits were conducted together with informal interviews to evaluate the relevant aspects of the questionnaire that detail the activities completed/captured through the different responses. These visits were conducted within the villages where the honey harvesters reside. Honey harvesters were accompanied around the villages, where they demonstrated how they locate wild honeybee colonies and harvest honey and other products from these colonies. During this activity, the methods used and how these affected the colonies were closely observed. In addition, other harvested products (besides honey) were also documented.

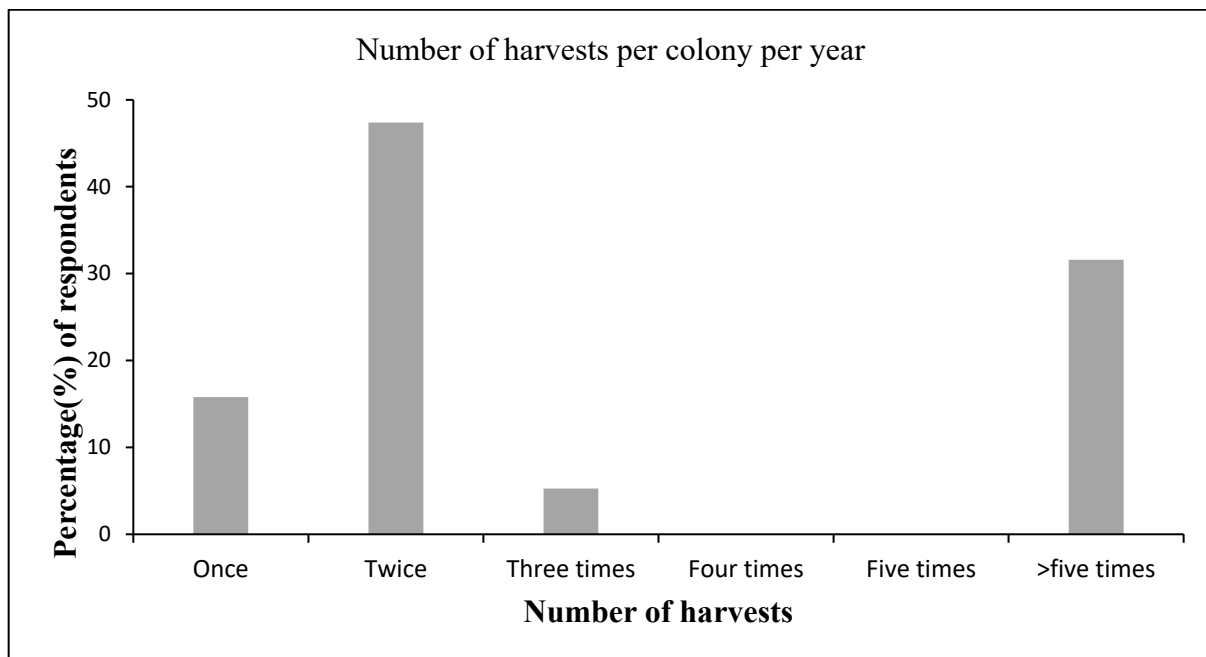
### 3. Data Analysis

Honey harvesting from wild colonies of honeybees: A descriptive analysis approach was used to compare the frequency distribution of each response for the “uses of harvested honey”. For each type of use, the number of occurrences and the percentage relative to all other types of uses was displayed.

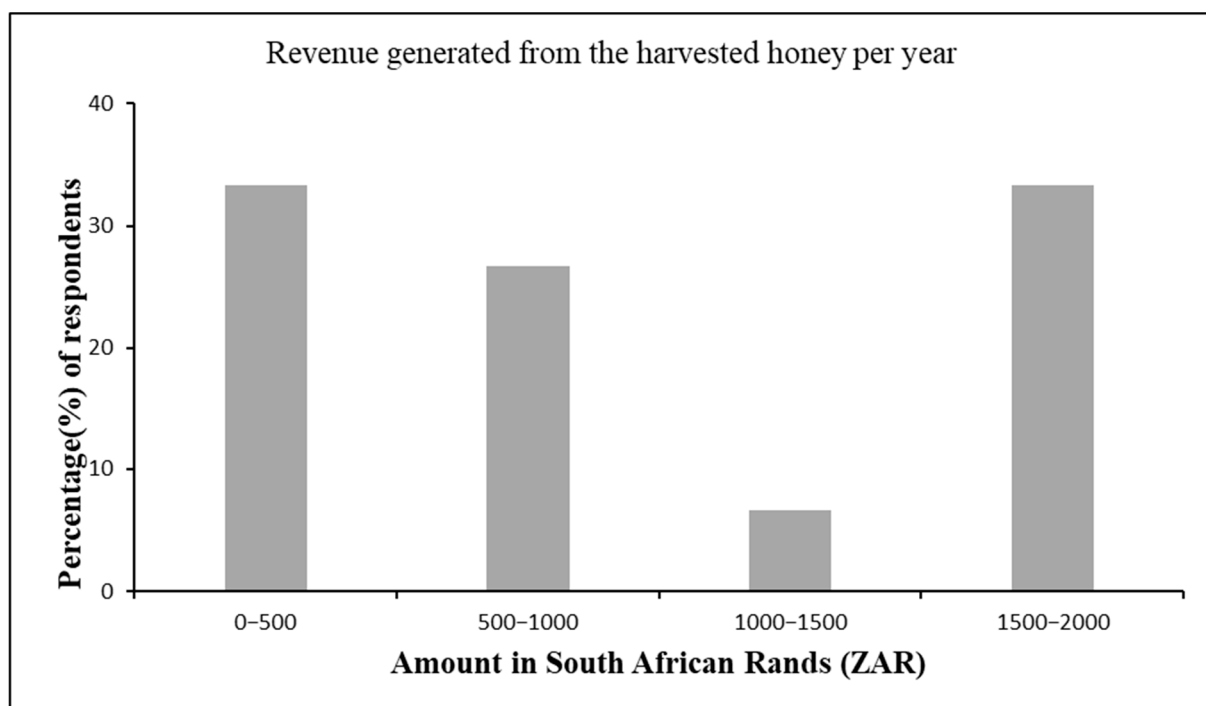
The effect of methods for sustainable harvesting: Honey harvesters indicated from the three choice methods used when harvesting honey from wild colonies as to what happens to the bees (wild colonies). A descriptive analysis approach was used to show effects across the three methods, allocated as a percentage (%) of the respondent across the three categories.

### 4. Results

For the category of honey harvest per colony per year, respondents were given six options. They could indicate whether they harvest honey once, twice, three times, four times, five times, or more than (>) five times a year. Honey was harvested twice per colony per year (40% of honey harvesters). Only 16% of honey harvesters indicated that they harvest honey once a year per colony and 32% harvested more than five times in a year (Figure 2). Honey sales generated a general income with a maximum range of R1500 to R2000 (South African Rands; ZAR; equivalent to \$79 to \$106 USD) a year for 33% of honey harvesters and a minimum of R0.00-110 R500 (\$0.00-\$26USD) for 33% of honey harvesters. Other honey harvesters manage to generate between R500 (\$26USD) to R1000 (\$53USD) (27%) and R1000 (\$53USD) to R1500 (\$79USD) (7%) (Figure 3).



**Figure 2.** The number of honey harvests per colony per year.



**Figure 3.** The different price ranges for selling harvested honey.

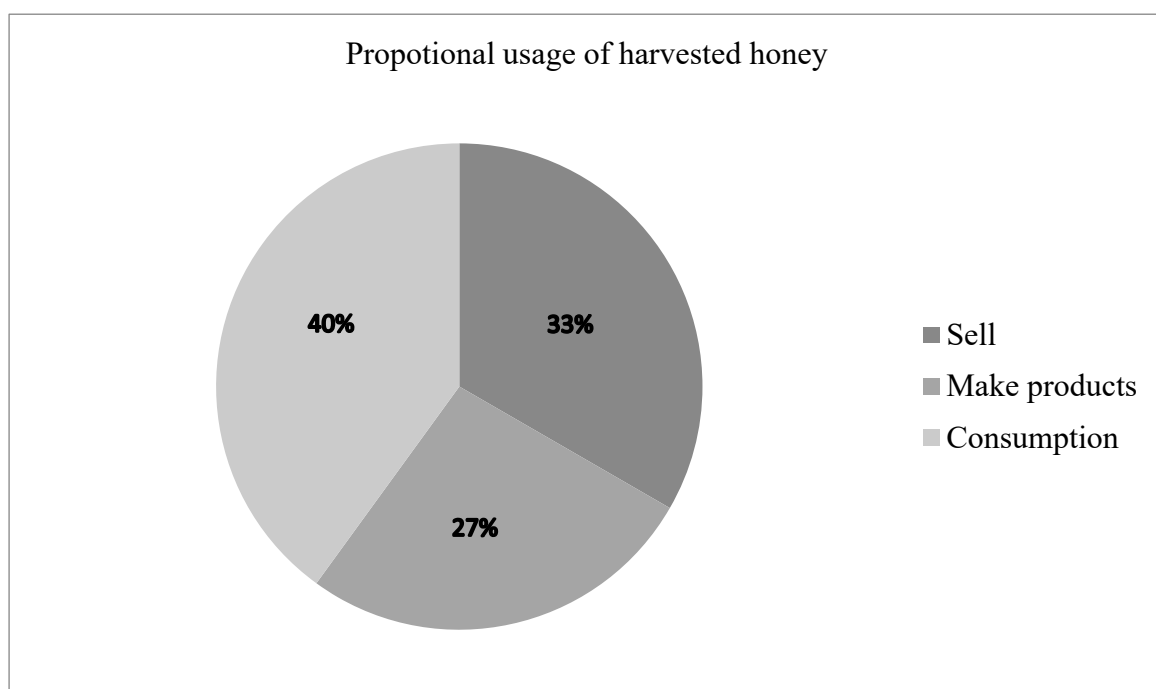
A correlation analysis was done between the number of harvests per colony per year and the revenue generated, to establish any relationship between the number of harvests and the income generated. For this analysis, the four and five times harvesting frequency options were excluded since they had no responses ( $n = 0$  for each). Table 1 shows that there was a positive but weak correlation when harvests were done either twice and more than five times with income generations between R0-R500 (\$0-\$26USD). There was a strong positive correlation when harvests were carried out more than five times, producing an income range from R500 (\$26USD) to R1000 (\$53USD). There were negative correlations

between some of the harvest frequency options and the income generated, although these correlations were weak.

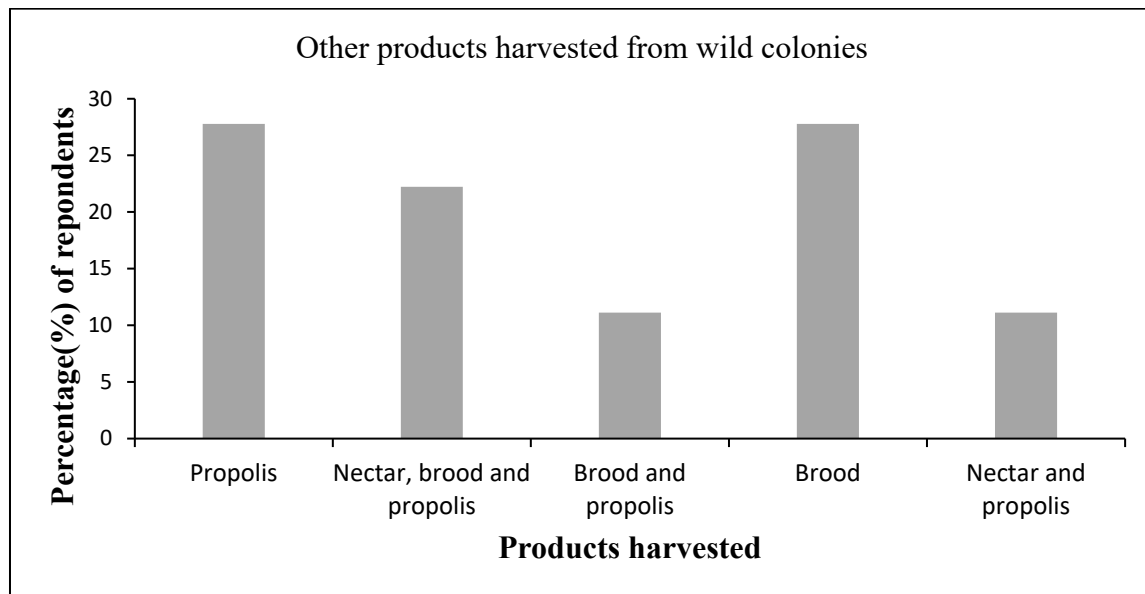
**Table 1.** Correlation analysis results, indicative of the relation between the harvest frequency options and income generation by respondents (honey harvesters).

	Once	Twice	Three Times	>Five Times
0–500	0.3968	−0.3276	−0.1409	0.1083
500–1000	−0.2236	−0.2313	−0.1217	0.4824
1000–1500	−0.1021	0.2485	−0.0556	−0.1601
1500–2000	0.0690	0.1512	−0.1409	−0.1489

The respondents needed to indicate the proportion of use for the harvested honey. They indicated that honey harvested was primarily used for family consumption (40% of the honey harvesters), followed by sales (33% of the honey harvesters), then production of other bee related products (27% of the honey harvesters) (Figure 4). Additional products harvested alongside the honey included brood, nectar (which may also refer to honery or unripened honey), and propolis (Figure 5). Honey harvesters indicated that the methods used when harvesting honey from wild colonies do not kill all the bees. However, 84% of the honey harvesters indicated that some of the bees die, whereas 16% of the honey harvesters indicated that at times none of the bees die. The harvesters were divided in responding to the question on the status of wild bee populations in their area. Most harvesters (29%) indicated that the population of wild colonies has increased, while 22% reported a decline in wild colonies.



**Figure 4.** Proportional usage of harvested honey in the Vhembe District.



**Figure 5.** Other products harvested from wild honeybee colonies in the Vhembe District.

## 5. Discussion

### 5.1. Honey and Other Bee Related Harvesting from Wild Colonies of Honeybees

Our study confirmed the continued practice of wild honey harvesting in rural communities in South Africa. Despite the low numbers sampled and our focus on one locality, the study offers a snapshot of the harvesting methods, sustainable practices, and the economic practices associated with honey harvesting. Honey and other bee related products have been recognized to benefit communities as a source of nutrition and for medicinal applications [13,29]. The honey harvesters involved in this study indicated that the harvested honey was valuable in many ways. They sold the honey, used it for flavoring, as a sweetener, for supplementation, and for medicinal purposes. The majority (67%) of the honey harvesters indicated that they use honey to treat sore throats and influenza (flu). The use of honeybee products for medicinal properties, referred to as apitherapy, has been practiced for centuries worldwide [30]. Apitherapy includes the use of propolis, honey, bee venom, royal jelly, and pollen from wild honeybee colonies for their medicinal properties [2,13,31,32]. Apitherapy continues to play a major role in modern medicine using managed bee colonies, given its role in promoting health by reducing inflammation, improving circulation, and stimulating the immune system [32]. Thus, honey harvesters and their families could possibly absorb medicinal costs by using honey, while their health and well-being is maintained. In ancient cultures, the healing properties of honeybee products have been a valuable indigenous knowledge which is passed on from elders to descendants, especial in rural communities [2,33].

During the questionnaire validation interactions, honey harvesters shared their indigenous knowledge on the medicinal use of bee related products. In addition, they indicated their different uses for harvested honey, brood, propolis, pollen, and nectar. Honey harvesters in the villages use the brood that bees store in the comb as source of protein and pollen as a nutritional source. Honey harvesters indicated how brood is in demand and makes good sales among the villagers. Villagers who cannot afford other sources of protein ingest brood either cooked or raw as a substitute or supplement in their diet.

Honey harvesters indicated that the income generated from honey sales depends on the number of harvests they perform per year and on the seasonal demand for honey. This was also evident in the correlation analysis for the number/frequency of harvests versus income generated as there were positive relations (albeit weak) among some of the



categories (see Table 1). Interviewed honey harvesters acknowledged the financial gains made through products harvested from wild colonies, although they at times struggled to make ends meet during drought seasons (long dry winters and hot summers with little to no rain). An additional issue that was uncovered while conducting the validation interviews is that conflicts exist between wild honey harvesters and beekeepers in the area. Beekeepers may be under the impression that that honey harvesters no longer harvest from wild colonies, but rather illegally harvest (steal) honey from their managed beehives. Furthermore, beekeepers believe that the practice of honey harvesting contributes to increasing rates of hive theft and vandalism in the area. Unfortunately, the scope of this study could not account for these events. However, acts of theft and vandalism are not new in the South African beekeeping industry and have been previously reported in a handful of studies [3,15].

### 5.2. Sustainable Harvesting

The impacts of honey harvesting from wild colonies have been of concern because some of the methods used are disruptive to the colonies and tree species [12,34]. For example, irresponsible honey harvesting could result in fires, which are caused during the smoldering of various types of fuels (mostly wood) to generate smoke that will subdue the bees [1], or the cutting down of trees during the process of opening the hive to acquire honey and related products. Honey harvesters are encouraged to use traditional methods that allow for sustainable harvesting, since most of the methods used today are destructive [34]. These traditional methods include the use of *Diplorhynchus condylocarpum* green leaves wrapped around a kindling to make a smoke torch, then the smoke torch is placed below the tree in a cleared area to provide the smoke [15]. In addition, plants such as (*Ampelocissus obtusata*, *Namalungo pequeno*, and *Namalungo grande*) can be used to prevent the harvesters from receiving bee stings by spreading them on their skin and around the opening of the beehive [35].

We asked honey harvesters about the different methods they use when harvesting honey from wild colonies and how these methods affect the bees. Our findings revealed that some bees die during the process of extracting honey from the colonies. This was indicated by the majority (84%) of the honey harvesters. In contrast, very few (16%) indicated that none of the bees die during the extraction of honey from wild colonies. During the validation visits, it was observed how honey harvesters started a fire using grass to then burn cow dung to create smoke. This would be the equivalent of using a smoker in beekeeping. There were no fire accidents observed as they put out the fire when the harvesting was done. In instances where the colony was in a tree trunk (about 3 m or more above the ground), they climbed the tree to extract honey instead of cutting the tree. This can be viewed as one form of harvesting that protects the bees' environment and contributes to sustainable harvesting. This practice is supported by research done in the miombo woodlands, whereby honey harvesters were educated about the sustainability of honey harvesting [15].

Our study indicates that sustainable harvesting can be ensured by climbing trees instead of cutting them when harvesting honey in wild colonies, which prevents the destruction of the original hive [15]. Furthermore, the use of certain repelling plants to prevent bee stings is recommended instead of creating fire to use smoke [15]. The use of repelling plants was demonstrated to be effective in a study that tested the use of *Hoslundia opposita* and *Adenia cissampeloides* [35]. However, if not done properly, honey harvesting can be destructive [34]. When a honeybee colony is disturbed, bees move to the nearest branch, location, or area. If honey harvesters only extract the crest of the comb leaving the brood comb, honeybees can rework the comb and store honey again [36]. Honey harvesting is



not always sustainable as honey harvesters often take both honey and brood leaving the colony struggling to recover. Our results showed that 37% of honey harvesters take both honey and brood and do not leave food for the bees. Therefore, this harvesting practice does not give honeybees an advantage in replenishing their colonies.

The decline of honeybee populations is of great concern in some areas of South Africa [37], and honey harvesting is considered to be one of the great threats to wild honeybee colonies [38]. However, our findings did not indicate any severe negative impacts resulting from honey harvesting practices. Instead, honey harvesters indicated that there is an increase in wild honeybees in the area. Their estimations are based on the number of colonies they find per season. There are no previous studies that have looked at the population dynamics of wild honeybees within the Vhembe area.

## 6. Conclusions

Through our results, it is evident that wild honey harvesting is still currently practiced in the Vhembe District of South Africa. Furthermore, in addition to household consumption, harvesters also generate income from selling honey and related products harvested from wild bee colonies. Honey harvesting and the harvesting of other bee products thus play an important role in sustaining livelihoods, both directly and indirectly. This is an important element that demonstrates the benefits obtained from natural resources (the biodiversity economy). In this instance, it is evident that this benefit cannot be maintained without wild honeybee colonies. Therefore, wild honeybee colonies must remain viable and healthy in order to allow for such practices to continue within rural communities. This makes it important for conservation planners and biodiversity managers to ensure that various measures are in place to preserve wild honeybee colonies. Furthermore, more research is necessary to contribute towards a more in-depth understanding of this practice and other indigenous knowledges demonstrated by the honey harvesters, in order to protect livelihoods and implement appropriate conservation measures regarding wild honeybee colonies.

**Author Contributions:** This article (and project) was contributed to by all authors as follows: (1) V.S.—Student and responsible study design, data collection, analysis, and writing; (2) T.S.M.—Primary supervisor and responsible for conceptualizing the project, data collection, oversight of analysis, and writing; and (3) V.C. and N.P.M.—Secondary supervisors and contributed to project concept, project oversight, administration roles, and writing. All authors have read and agreed to the published version of the manuscript.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee within the Research and Innovation Division at the University of the Western Cape, South Africa.

**Informed Consent Statement:** Informed consent was obtained from all participants involved in the study.

**Data Availability Statement:** All datasets can be made available on request from the authors.

**Conflicts of Interest:** The authors declare no conflicts of interest.

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