African Journal of Hospitality, Tourism and Leisure 2025, Vol. 14 No. 3 pp. 654-663
ISSN: 2223-814X

Sustainable Rural Agri-Tourism: Leveraging Cultural Heritage and Institutional Support to Promote Beekeeping and Mopane Caterpillar Enterprises for Socio-Economic Growth

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Abstract

Cultural heritage underscores enterprises such as beekeeping and mopane caterpillar farming, which are fundamental for socio-economic growth in most rural areas. The objectives of this study were to (1) explore how these two enterprises can become sustainable businesses, (2) assess how training and institutions can support these enterprises. Data was collected using questionnaires, focus group discussions, regarding beekeeping, and a detailed interview with a mopane caterpillar business owner. The respondents spanned different communities and provinces, age groups and genders. The respondents agreed that the beekeeping courses offered were relevant and that beekeeping contributed to environmental, nutritional, and economic benefits. Respondents stated that there was a lack of support from the government and the private sector. Despite mopane caterpillars being widely consumed and sold, the respondent listed several barriers to their marketability. No training is available for the sustainable harvesting of mopane caterpillars and preserving mopane woodlands. The findings show that beekeeping and mopane caterpillar enterprises present significant sustainable development opportunities. However, collaboration with government, universities and the private sector is necessary to realise this potential fully. Training should embrace digital apps, sustainable practices, and business management to ensure the establishment of sustainable enterprises.

Keywords: Agri-tourism, beekeeping, mopane caterpillar, sustainable enterprises, institutional support

How to cite this article: Mashele, N., Rudolph, M. & Ramaila, M. (2025). Sustainable Rural Agri-Tourism: Leveraging Cultural Heritage and Institutional Support to Promote Beekeeping and Mopane Caterpillar Enterprises for Socio-Economic Growth. African Journal of Hospitality, Tourism and Leisure, 14(3):654-663. DOI: https://doi.org/10.46222/ajhtl.19770720.648

Introduction

South Africa (SA) offers a rich and diverse cultural heritage with multiple protected areas showcasing fauna and flora, annually attracting millions of tourists (Gumede & Mdiniso, 2022; Timothy, 2023). These protected areas are often bordered by rural villages where poverty is pervasive (Strickland-Munro et al., 2010; Buthelezi et al.,2024). Rural areas in developing countries face significant challenges, including poverty, unemployment, and limited access to basic services (Munthali, 2007; Horman, 2013; Nyawo & Mashau, 2019). In SA, this is partly due to the history of segregation and forced removals, where most of the population was settled in remote areas with poor agricultural soils, minimal infrastructure, and employment opportunities (Perret et al., 2005; Rusenga, 2022). Furthermore, government inefficiencies such as poorly allocated or unspent budgets hinder rural growth and development as essential services such as healthcare, infrastructure and education are compromised. These challenges restrict people's access to food security and good nutrition (SDGs 2) and access to Sustainability Development Goal 8, namely, Decent work and economic growth (SDG 8) which often competes e with environmental protection against people's survival needs (Boley & Green, 2015). The relationship between tourism and environmental sustainability is complex, as tourism can positively and negatively impact the environment (Gossling & Peeters, 2020; Thullah & Jalloh, 2021). On the one hand, tourism is increasingly recognized as a significant contributor to environmental degradation, loss of biodiversity, and climate change. Studies indicate that the expansion of tourism often correlates with increased environmental pressures, including pollution and habitat destruction, which can ultimately affect the attractiveness of destinations for tourists (Magazzino et al., 2023). Yet on the other hand, environmental impact is particularly concerning in regions like southern Africa, where predicted increases in temperatures could deter tourists, thereby reducing tourism revenues (Coldrey & Turpie, 2020; Kyara et al., 2022; Mtapuri et al., 2024; Sewando, 2023). Innovative approaches towards sustainable economic growth and rural development are needed to address these challenges. These approaches include agri-tourism coupled with non-timber forest products (NTFPs) to drive rural development. NTFPs are forest products (excluding timber); such as fruits, nuts, leaves, gum, resin, essential oils, dyes, tannins, edible insects and honey (Shackleton & Shackleton, 2004). NTFPs have a low-cost entry level, making it easier for those with minimal education and finances to make an income by selling products such as honey and mopane caterpillars (Imbrasia belina) (Baiyegunhi et al., 2015; Baiyegunhi & Oppong, 2015; Ramukumba, 2024). It must be noted that although honey is an NTFP, honey from conventional beekeeping does not fall under NTFPs. The African honeybee (Apis mellifera scutellata) is responsible for pollinating agricultural and wild vegetation. Furthermore, the bees produce honey which offers nutritional and medicinal benefits. The global market for hive products has increased due to their versatility in use and application (Amulen et al., 2019; Wakgari & Yigezu, 2021). Despite the potential of these enterprises, there remain challenges associated with building successful beekeeping businesses for rural communities (Munien, 2016; Ricketts & Shackleton, 2020). The study objectives were to (1) explore how beekeeping and mopane caterpillar enterprises can become

sustainable businesses (2) assess how training and institutions can support beekeeping and mopane caterpillar enterprises for sustainable socio-economic growth, stemming from the minimal training and resources allocated towards teaching and training rural communities about these enterprises. Furthermore, it explored the types of institutional support available for these enterprises. Other aspects of this project scrutinised how cultural heritage, beekeeping, and edible worm farming can be used to promote socio-economic growth in rural areas of South Africa and delve into the challenges these enterprises face. The first part of the article provides a brief literature review highlighting the significance of rural agri-tourism enterprises such as beekeeping and mopane caterpillar enterprises as income-generating streams. Section two provides the background for case study design and the data collection tools used to collect primary data for this study. The third section outlines results from the focus groups, questionnaires, and in-depth interviews, followed by the discussion. The last section provides the conclusion.

Literature review

Tourism has been identified as a viable tool to drive rural development, presenting opportunities for income generation, employment, and cultural preservation (Driver et al., 2018; Leu, 2019). Anthropogenic factors and climatic factors have resulted in the degradation and loss of biodiversity upon which tourism is dependent. Thus, sustainable rural agri-tourism must be carefully considered (Boley & Green, 2015; Mtapuri et al., 2024; Ramukumba, 2024). Because of the low-cost entry level required for NTFPs, rural communities can investigate and establish small businesses that combine NTFPs and cultural heritage as income generators (Baiyegunhi, et al., 2015; Masilela et al., 2024; Ramukumba, 2024). An estimated 1.6 billion people worldwide depend on NTFPs as a source of livelihood (Sherpa, 2025; Shackleton et al., 2007, Shackleton & Shackleton, 2004). The use of and reliance on NTFPs is more pronounced in rural communities where most inhabitants are poor. They collect, process, trade, and sell various forms of NTFPs (Makhado et al., 2014; Shackleton et al., 2007). The African honeybee pollinates both exotic and indigenous plants (Masehla, 2017). Beekeeping enterprises have the potential to increase the livelihoods of rural communities. Studies have shown that individuals and groups who have taken up beekeeping received training from non-government organizations (Amulen et al., 2017). NGOs, such as Bees for Development have been at the forefront of improving rural livelihoods through beekeeping advocacy, especially in underdeveloped countries in Africa and Asia. The African honeybee (Apis mellifera scutellate) is native to central and southern Africa and is one of two subspecies in South Africa – the other being the Cape honeybee (Apis mellifera capensis), which is found in the winter rainfall area (South African National Biodiversity Institute, 2024). Honeybees live in colonies and play a vital role in the ecosystem, providing essential pollination across South Africa. Furthermore, they produce large quantities of honey, with some colonies reportedly making as much as 100 kg a year. However, climate change has impacted African honeybees' distribution and abundance (Frazier et al., 2024). Beekeeping has been practised for centuries, providing a source of income for many rural communities. With the increasing focus on sustainable livelihoods, beekeeping has emerged as a viable option for income generation for rural households. Poinsan (2023) in Tanzania found that beekeeping improved livelihoods, with 70% of beekeepers reporting increased income. Beekeeping has a low environmental impact, making it a sustainable practice. Furthermore, it has the potential for long-term income generation through ecotourism. The beekeeping industry in South Africa cannot keep up with the annual demand for honey, resulting in about 1000 tons of honey being imported. This shows that there is a need for more people to take up beekeeping to meet the deficit (Ricketts & Shackleton, 2020). Despite the potential benefits of beekeeping, the industry faces several challenges. These include theft of beehives, vandalism, and honey adulteration (Masehela, 2017; Yusuf et al., 2018; Wakgari & Yugezi, 2021; Hendriks & Masehela, 2024). A study in Ethiopia found that beekeepers faced significant challenges, including lack of access to markets, inadequate training, and pests and diseases (Shanku & Ijara, 2024).

South Africa has several initiatives and frameworks to support ecotourism, particularly those integrating indigenous knowledge systems and community-based approaches. The Department of Environmental Affairs and Tourism has developed a comprehensive manual guiding responsible tourism practices. This manual includes practical actions for tourism businesses and associations to operate sustainably and responsibly (Spenceley et al., 2002). Indigenous knowledge systems are increasingly integrated into climate change adaptation and natural resource management strategies. This integration helps to ensure that ecotourism practices are culturally appropriate and sustainable. These frameworks and initiatives highlight the importance of community involvement and the use of indigenous knowledge in promoting sustainable ecotourism in South Africa. Universities are crucial in promoting ecotourism related to beekeeping and mopane caterpillars through research, education and community engagement. Applied research on sustainable beekeeping practices can benefit local beekeeping ecosystems by identifying how honey production can be increased whilst preserving biodiversity and mitigating negative effects (Patel et al., 2021; Prodanovic et al., 2024). By studying the economic impact of mopane caterpillar enterprises, research can help develop strategies to boost the livelihoods of rural communities such as market opportunities and developing value-added products for mopane worms. Universities can add value by working with local communities to improve local operations and document and preserve traditional knowledge related to mopane caterpillar harvesting and processing. This will maintain cultural heritage and promote the sustainable use of natural resources. In the northern parts of South Africa (SA), the Mopane caterpillars (Imbrasia belina), a nutritious protein-rich delicacy, are harvested widely for household consumption (Makhado et al., 2009, Sekonya, 2016; Swemmer et al., 2020; Dube & Chitakara, 2024). The caterpillar and the tree, Colosphospermum mopane, that enables its existence, are indigenous to Southern Africa, covering an area of 550 000 km2 (Makhado et al., 2009; 2012). In South Africa, mopane woodlands comprise 30-35% of the savanna biome, occurring in 23 000 km2 in communal, private and government land in the Limpopo and Mpumalanga provinces (Baiyegunhi & Oppong, 2015; Baiyegunhi, et al., 2015; Sinthumule, 2024). The trees are also found in countries such as Mozambique and Botswana where they are targeted for use in highly commercialised industries such as charcoal. In Namibia, much of the woodlands have been destroyed due to harvesting

for firewood purposes. In Zambia, the trees are sought after for charcoal as they produce good quality, slow-burning charcoal (Makhado et al., 2014; Sinthumule, 2024). Several factors determine the availability of mopane caterpillars. Mopane caterpillars appear seasonally, occurring between December-January and April-May and are subject to climate (temperature and rainfall), habitat, harvesting pressure, and predators (Makhado et al., 2009; Sekonya, 2016; Swemmer et al., 2020). The number of households that sell mopane caterpillars in South Africa is relatively small. However, the income generated from sales made a significant contribution to their economic well-being (Swemmer et al., 2020). Many rural households rely on mopane caterpillars for survival, and hence sustainable harvesting techniques and regulations must be put in place to ensure the conservation of these woodlands. Despite the potential benefits of rural agri-tourism, its development faces multiple challenges, including limited infrastructure and resources, lack of or access to information and training; lack of marketing and promotion, and inadequate policy support (Tew & Barbieri, 2012). Therefore, resources must be made available to rural municipalities to enable them to participate in activities that can be of economic benefit (Mtapuri et al., 2024; Ramukumba 2024)

Methods

An exploratory and descriptive case study approach was used to generate an in-depth, multi-faceted understanding of the complex issue (beekeeping training) in its real-life context (Stake, 2005; Crowe et al., 2011; Gustafsson, 2017). The study envisaged multiple outcomes through the training, both during and after. Qualitative and quantitative methods were used to gather information regarding training content in different demographic areas to establish institutional support from universities, the government, and the private sector. Tools such as questionnaires, ground truthing (obtained through direct field observation), focus group discussions, and semi-structured interviews were utilised to collect data. Data collection took place in three different provinces, Venda, Northwest and Gauteng between 2022 and 2024. The research was conducted in phases and can be categorised according to the interest and type of enterprise. Category 1, being institutional support, involved face-to-face in-depth meetings conducted with the executive committee of the University of Venda in 2022 on the university campus. This was to establish institutional support and research. Upon formalisation of the relationship, a 3-day beekeeping short learning program pilot study was conducted with 50 willing participants at a lecture hall in the University of Venda. The participants were residents from communities around the university who were involved in or interested in beekeeping. Questionnaires were administered at the end of the training about course content. Category 2 involved beekeeping training, and two purposefully selected groups were identified for the training. Group One, consisted of ten residents from Masana township who were trained in the community hall in September 2023. Group Two, consisted of eight participants from various areas in the Gauteng province. The participants received practical training in 2024 on Idle Winds farm in Gauteng, thereafter, a focus group was conducted to collect data on the beekeeping enterprise and eco-tourism. Category 3 was the Mopani Caterpillar enterprise. A mopani caterpillar products business owner was engaged through an in-depth interview in 2024 via Microsoft Teams.

Research and institutional support: BeeAfrican partnership with the University of Venda

The institutional support engagement was with the University of Venda, in the Vhembe District, Limpopo province.
BeeAfrican, beekeeping company was founded in 2019 by Memme Ramaila after training from beekeeping experts from the Netherlands. She further attended local beekeeping training and researched the industry, enabling her to identify that the course content she'd been exposed to was Eurocentric and exclusive. It would not be easily understood by rural communities, this motivated her to work on transforming the existing beekeeping course content into a narrative that would be transferrable to South African participants, specifically rural communities. Furthermore, the content needed to be adapted for rural people in a language that they can understand. Recognising the value of partnerships and institutional support, Ms Ramaila approached the Chancellor of the University of Venda and the University Executive Committee in 2022 to pitch the concept of starting a Bee Academy that would cater to students and the surrounding rural community. The University would serve as the research base for the academy which would capacitate students and representatives from the local community with beekeeping skills to enable them to start beekeeping enterprises. A herb garden was established (Figure 1) on the university grounds in 2023 that serves as a living lab where students and the local community can learn about beekeeping. This garden also serves as a mini ecotourism experiment, specifically for university guests. Continuous engagement with the university resulted in buy-in from the manager of the Local Economic Development in Vhembe District Municipality who fully supported the initiative due to the benefits it would bring to local communities and the rural economy. The Bee Academy was launched in April 2024 at the University of Venda (Figure 2).

Multiple stakeholders from local government, private businesses, community leaders, and the Bee African personnel were in attendance including the Chancellor, Advocate Mojanku Gumbi, the vice chancellor and other academics from the university, the Vhembe district local development manager Mr Mushapi; Mr Makaepea from the Gauteng Department of Agriculture & Rural Development. In addition to the University of Venda's support, the University of Pretoria engages in research on sustainable beekeeping and offers training programs for local communities and the University of Limpopo conducts studies on the ecological and economic aspects of mopane worm harvesting, working closely with rural communities to promote sustainable practices. These efforts by universities not only support sustainable ecotourism but also contribute to the conservation of biodiversity and the economic well-being of local communities. Memme Ramaila facilitated a 3-day Pan-African Sustainable Beekeeping Short Learning Programme attended by 50 delegates, 35 of whom were female and 15 were male. The diverse age group ranging between 25 and 70 facilitated rich inter-generational knowledge. The elders shared their indigenous knowledge on calming aggressive bees without using smoke but by gently brushing themselves with a twig that had

certain Indigenous herbs whose aroma repels the honeybees. Traditional beekeepers shed light on their preference for log beehives (as they mimic natural bee habitats and hence a better honey yield) over Langstroth beehives, which are considered sustainable beehives.

Figure 1: the Bee Academy living lab at the University of Venda.

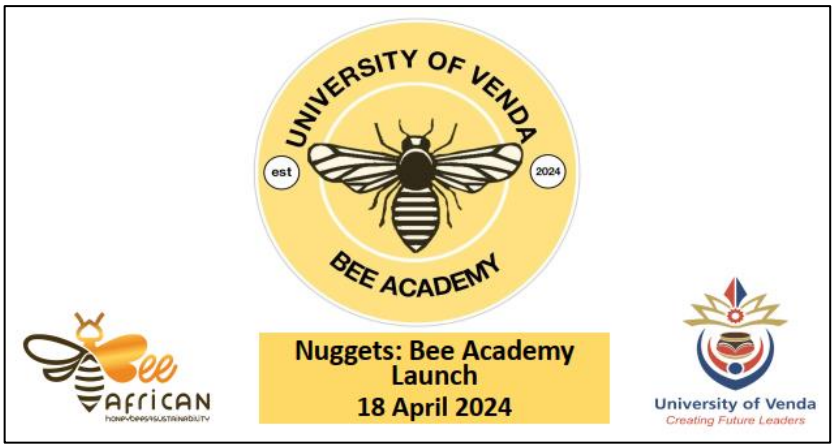


Figure 2: The Bee Academy Launch invitation

Beekeeping training

Two groups of participants were trained, Firstly, Masana township (a pseudonym has been used due to the sensitivity of the case) is the Bojanala district in the North-West Province. The sampling was purposive (Rahi, 2017), the sponsor identified the participants to attend the beekeeping training workshop along with beehives and PPE to upskill them to start their businesses. The second group of beekeeping participants was chosen based on their expressed interest in beekeeping and willingness to pay for the training. These participants came from Gauteng and North-West provinces. Beekeeping training material was developed that would be easy for participants to understand. The first training event was conducted in Masana township. The group consisted of Ten participants, aged between 25-48, chosen by a sponsor at the two-day "Essentials of Beekeeping training in September 2023 at Masana community hall. The objective of the course was to build capacity by using inclusive training material for the aspirant beekeepers in Masana township. All trainees had no prior beekeeping knowledge. The training outcome was to impart knowledge and equip delegates about managing their beekeeping enterprises for optimal honey production. The training was interactive, allowing for the assimilation of the information through reflection, and discussion. The sessions were supported through prompts, YouTube clips; formative assessments; a PowerPoint presentation, handouts on the essentials of beekeeping, and a practical session on beehive management. Each delegate received beehives, beekeeping protective clothing, and beekeeping tools of trade (Figure 3). At the end of each training session, the participants were asked to complete questionnaires to help the facilitator ascertain the relevance of the training structure and content. Participants were further prompted for suggestions about the course.

The three core prompts were:

- Learning material was properly structured
- Length of training was appropriate
- Content was properly laid out and clear.

The questions were designed as a 3-point Likert scale, participants chose between strongly agree, agree, and disagree.

Figure 3: Bee hives for the participants

Group 2 was situated in Idle Winds Country Lodge. BeeAfrican enterprise has been operating at Idle Winds Country Lodge in Centurion since 2021, focusing on these core activities: beekeeping, beehive production line; honey extraction and processing facility, and beekeeping training. Eight participants aged 25-55 responded to an invitation to learn about honeybees and honey extraction, honey bottling and sustainable beekeeping training in October 2024. A day-long training course was offered to participants who paid for the course which included a tour of the bee-friendly garden and apiary followed by a presentation on bees and biodiversity. Thereafter, they put on beekeeping PPE and each participant was allowed to open a beehive and experience the magic of the bees (Figure 4).

Figure 4: Idle Winds trainees in their beekeeping PPE

The participants were taught about bee life cycles and overall health and to demonstrate this, brood frames where the brood (baby bees) develop into mature bees were inspected the brood pattern also demonstrated the Queen bee's productivity (Figure 5). Robust conversations followed as participants reflected on their individual experiences and expressed keen interest in getting involved in the beekeeping sector. The participants were asked to complete questionnaires about the training, ecotourism, and beekeeping as an enterprise.

Figure 5: Brood frame inspection

Mopane caterpillar enterprises

For this component, two mopane caterpillar enterprises were identified however, only one business owner was available for an in-depth discussion regarding the business challenges and opportunities. These enterprises were chosen because they have developed other edible products using mopane caterpillar powder such as protein bars, spices, and snacks. The research was explorative, and an interpretive paradigm was used to analyse the data using key phrases to identify themes or patterns. The key informant Phuti Kabasa, founder of Mopani Queens was interviewed virtually using Ms Teams in October 2024 using semi-structured open-ended questions to gain insight from her vast experience and expertise. Mopani Queens, was founded in 2019, focused on selling dried mopane worms and went on to develop a range of ready-to-eat high-protein snacks, spices, protein powder, and cereals. (Figure 6)

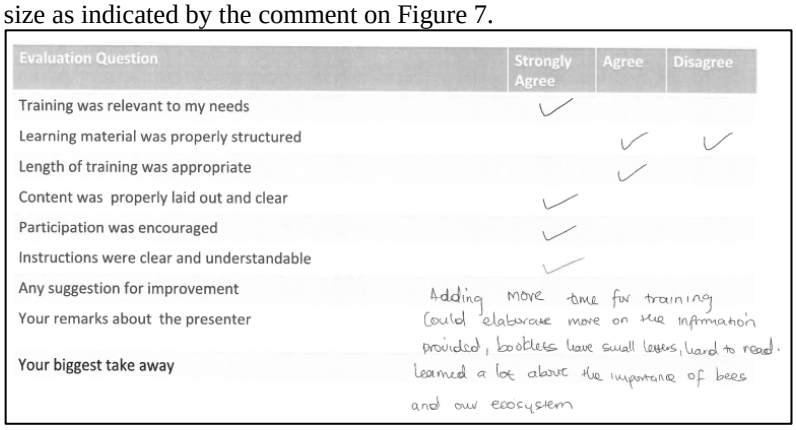
Figure 6: Products developed/infused with mopane caterpillar powder.

The Mopane caterpillars are sustainably sourced from South Africa, Botswana, Namibia, and occasionally from Zambia. The company prioritises the ethical and sustainable harvesting of mopane worms by harvesting mopane caterpillars at the right time (when the caterpillars are ready to expel their guts without being squeezed, which is the typical way people harvest them) this ensures that as much of the protein remains in the caterpillar and is not lost due to forceful evisceration. The business owner also offers training on how to prepare mopani worm dishes and has had multiple occasions where she shared information and recipes with culinary students.

Results

Beekeeping

The trainees from Masana Township completed a questionnaire evaluating the course structure and content. All the respondents found the course relevant and clearly communicated. One respondent suggested a longer time frame for the training to ensure thorough comprehension and practical application. Furthermore, some found the material hard to read due to the font style and size as indicated by the comment on Figure 7.



Evaluation Question	Strongly Agree	Agree	Disagree
Training was relevant to my needs	✓		
Learning material was properly structured		✓	✓
Length of training was appropriate		✓	
Content was properly laid out and clear	✓		
Participation was encouraged	✓		
Instructions were clear and understandable	✓		
Any suggestion for improvement	Adding more time for training		
Your remarks about the presenter	Could elaborate more on the information provided, booklets have small letters, hard to read.		
Your biggest take away	Learned a lot about the importance of bees and our ecosystem		

Figure 7: Questionnaire responses from a participant

The participants from Masana township were predominantly female with a mixture of youth and adults as illustrated in Figure 8.

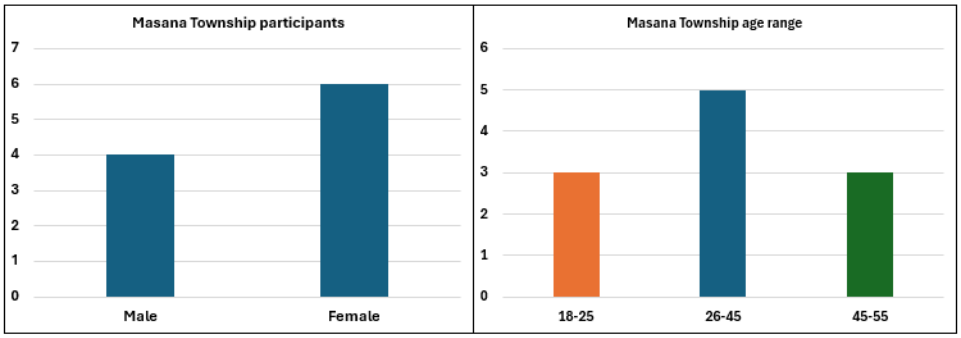


Figure 8: Demographics of the Masana Township participants

An older participant in the group shared an experience about eating bee larvae as 'seshabo' (a form of a savoury companion to maize-based porridge) when he was a young lad. This information evoked much curiosity amongst the other trainees. The training facilitator suggested they ask the elders in the community if honey larvae were edible. The feedback confirmed that indeed larvae were edible and shared recipes of how to cook bee larvae as a source of protein. Additionally, participants learned that some people used bee larvae for religious ceremonies. A subsequent literature review confirmed that bee larvae are considered a delicacy and a source of protein in most Asian and African countries (Matuszewska-Mach et al.,2024; Ghosh, Meyer-Rochow &Jung, 2021).

Idle Winds participants

A questionnaire on beekeeping tourism, the economic value of beekeeping, beekeeping capacity building, government support, beekeeping and biodiversity, and the nutritional value of honey was administered. The participants were predominantly female, and only one participant was categorised as youth (Figure 9).

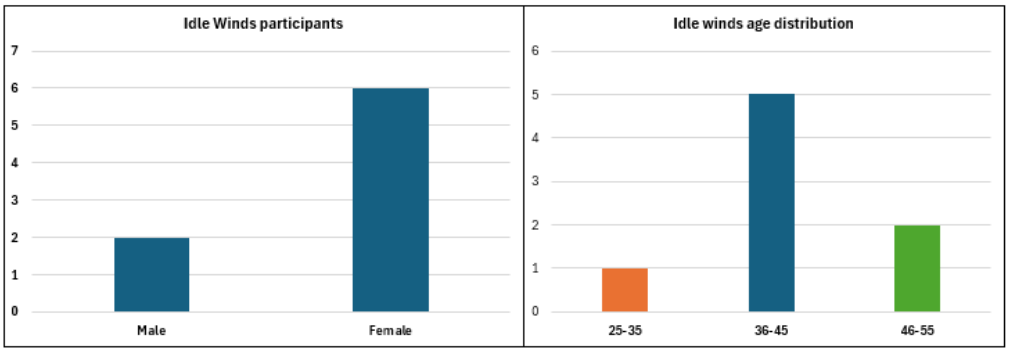


Figure 9: Idle Winds age and gender distributions

A focus group discussion about beekeeping and eco-tourism was conducted in English. A follow-up questionnaire was sent to participants via email and only six participants completed the questionnaires. The responses from the focus group and questionnaires were categorized into four themes, job creation, food security and nutrition, lack of support and sustainability and conservation. All 6 respondents strongly agreed that there is potential for beekeeping eco-tourism in their areas of residence and that formal beekeeping events would stimulate the unexploited beekeeping eco-tourism. There was strong support for the beekeeping sector as a stimulus for job creation and township and rural economy. All 6 respondents emphasised the need for properly co-ordinated and practical beekeeping training programmes. In addition, 5 respondents agreed that beekeeping products have the potential to enhance local economic growth due to the growing consumer demand for natural products and in particular bee products, and all respondents strongly agreed that honey has nutritional benefits. There was consensus that communities should be encouraged to establish food gardens in their backyards for food security and for attracting bees which would then increase the harvest yield, owing to the role of bees as pollinators. All 6 respondents stated a lack of support from the government and private sector for community beekeeping. The respondents strongly agreed that there is a direct nexus between beekeeping and biodiversity, which drives conservation and preservation of natural habitats since bee pollination enhances biodiversity and thus enables not only food production but food security as well.

Results and challenges identified in the mopane caterpillar industry

Mopane Caterpillars are classified as contaminants by the South African Bureau of Standards, despite being widely consumed and sold in the northern parts of South Africa. This classification creates a barrier to the uses and even marketability of the mopane worms. The Mopane harvesting season is short whilst the high demand for the products for livelihoods far outweighs the mopane woodlands in SA. Businesses such as Mopane Queens had to import mopane worms from neighbouring countries to meet the demand. There is no training material or course content available for teaching about the sustainable harvesting and

preservation of Mopane woodlands. There are no available standards for the classification or valuation of mopane worms. There are no formal markets, rules, and regulations for mopane worms besides those in tribal/traditional settings. There is no institutional support for mopane caterpillar businesses. There is inadequate processing machinery in South Africa to process mopane worms into a powder. The machinery comes from China and is not necessarily designed for mopane caterpillars, so some equipment needs to be re-engineered resulting in high costs. However, the culinary world is interested in mopane worms which can stimulate eco-tourism. Mopane can be developed into other products and marketed for its low carbon footprint and high protein content.

Discussion

The findings show that eco-tourism related to beekeeping and mopane worms presents significant opportunities for sustainable development. The interviews suggested that eco-tourism initiatives can create jobs in hospitality, conservation, and other related fields, thereby reducing poverty levels and improving the quality of life for locals. Both beekeeping and mopane worm harvesting offer viable business opportunities. However, beekeeping and mopane caterpillar enterprises in rural areas are limited due to various external factors. The infrastructural needs and poor service delivery in rural areas hinder amongst others, logistics and transport, communication and the development of suitable accommodation which may deter tourists (Mugobo & Ukpere, 2012; Adewumi & Kelser, 2020). Training should be inclusive as articulated by one of the objectives and the training with the Masana group sought to deliver on this. The participants found the material relatable and could link it to past experiences. The presence of older people (above 55) in the Venda group during the pan-African training supports the notion that anyone can learn if the material is designed to accommodate any level of learning. The group at the University of Venda although the focus was institutional support showcased inter-generational knowledge where new concepts were discussed due to the relevant and inclusive nature of the training material the facilitator brought forward. Training programs should focus on modern techniques such as digital apps, sustainable practices, and business management to give participants a competitive edge in establishing and managing successful enterprises. The Idle Winds beekeeping participants were willing to pay for the training and represent a group of people who can adapt and use technology to grow their businesses. All the beekeeping trainings showed a similar trend, there was a higher presence of female participants over males. Females were not by any criteria except willingness more favoured than males. The willingness to participate to gain beekeeping skills in hopes of starting their businesses might be because women often carry the burden of caring for their families and ensuring that there is enough food to eat for their households.

Institutional support, through universities can offer important research, development, training and broader management. In the case of University of Venda, the training initiative highlighted existing initiatives and fostered a meaningful collaboration between the university, the municipality, private sector and the local community. These multi-stakeholder projects aimed at community development may prove to be more resilient in building sustainable local businesses that can positively contribute toward socio-economic growth than initiatives with only one group of individuals where support is usually limited. The involvement of universities further adds creditability to these initiatives and can assist setting up relevant and inclusive trainings led by local committees that also oversee planning and implementation. The Mopane caterpillar business faced multiple challenges chiefly, the classification of mopane caterpillars as insects by the SABS, which not only stigmatises but deters those unfamiliar from exploring and benefiting from the highly nutritious caterpillar. Mopane caterpillars are a rich source of protein and potential income for rural communities; however, the harvesting season is too short to meet the high demand from locals collecting for livelihood needs and those looking to sell. Local authorities (including tribal authorities) are aware of the high value of mopane worms and thus could as a form of service delivery, collaborate with institutions such as universities to offer education on sustainable harvesting and conservation of mopane caterpillars and mopane woodlands respectively. Growth in the beekeeping and mopane caterpillar harvesting businesses should also look further than primary production to expand returns through technical and institutional support, innovation and management, processing, and marketing. To maximise the potential, capacity building is essential for the success of beekeeping and mopane caterpillar harvesting initiatives

Conclusion

Providing incentives for reporting unsustainable harvesting or use of natural resources requires commitment and buy-in from local communities which in turn would support environmental stewardship. It is important to establish management briefs and regulations for communal resource uses. Successful agri-tourism requires collaboration among community members. Despite these challenges, with proper planning, training, mentoring, and support, rural communities can overcome these obstacles and successfully implement scaling production and agri-tourism initiatives. There remains a huge research gap that universities can help close by engaging with all provinces and much larger samples. Because of the role the honeybees and mopane caterpillars play in job creation, food security and nutrition, biodiversity and tourism, it is imperative that policies endorse and foster engagements that will prioritise and implement sustainability-oriented training.

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