Perceptions on utilization, population, and factors that affecting local distribution of *Mimusops zeyheri* in the Vhembe Biosphere Reserve, South Africa

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Abstract. *Lubisi NP, Ramarumo LJ, Manyaga M, Mbeng WO, Mokgehle S. 2023. Perceptions on utilization, population, and factors that affecting local distribution of* Mimusops zeyheri *in the Vhembe Biosphere Reserve, South Africa. Biodiversitas 24: 6432-6439.* *Mimusops zeyheri* Sond., was once an important plant species to local communities in Southern Africa but nowadays is considered as underutilized plant. Undoubtedly, the neglect of indigenous knowledge associated with *M zeyheri* could lead to its gradual disappearance. This study aimed to evaluate local people's perceptions about the contribution of *M. zeyheri* to their livelihoods, population status and factors affecting its local distributions in the Vhembe Biosphere Reserve, Limpopo Province, South Africa. Semi-structured research questionnaires were administered to 52 randomly selected respondents. The majority of respondents (67.31%) perceived the decline in the population of *M. zeyheri* within the studied sites. More than three-quarters of laypeople (78.6%), two-thirds of farmers (66.7%), and 57.1% of environmentalists stated that *M. zeyheri* possessed more economic benefits than other livelihood benefits. A total percentage of 44.20% of participants perceived fire as the main factor that negatively affects the distribution of *M. zeyheri* in the studied regions. Documenting information about people's perceptions regarding the contributions of *M. zeyheri* to local livelihoods and assessing factors that affect its local distribution is a fundamental step toward understanding its associated sociocultural values, socio-economic, and threats. Future studies should incorporate both ethnobotanical and ecological data-gathering methods and validations.

Keywords: Distribution, *Mimusops zeyheri* Sond., underutilized plant species, utilization, Vhembe Biosphere Reserve

INTRODUCTION

Since human civilization, ancient indigenous people from various tribal groups have been utilizing various wild botanical resources for countless purposes (Mwinga et al. 2019; Atyosi et al. 2019; Mallik et al. 2020; Bersamin et al. 2021; Wani et al. 2022; Rasethe et al. 2023). As civilization develops, some plant resources are still continuously utilized, while others are underutilized or neglected. Underutilized plants refer to those that were part of addible wild biodiversity in the past but are now deserted by their users due to various factors, including cultural dilutions, and modernization of indigenous traditions (Padulosi and Hoeschle-Zeledon 2004).

Mimusops zeyheri Sond. once played an important role and was utilized by indigenous communities in the Southern Africa region (Omotayo et al. 2020). This can be seen from the vernacular name given to *M. zeyheri* since indigenous people in this region only give vernacular names to plant species they utilize (Ramarumo and Maroyi 2020). In the Limpopo Province of South Africa, various tribal groups, including the Bapedi, Vatsonga, and Vhavenḓa people, use different but associated vernacular names when referring to *M. zeyheri*. For example, the Pedi people referred to it as Mmupudu (Semenya et al. 2012), while Vendas called it Mububulu (Magwede et al. 2019), and the Tsongas referred to it as Mibubulu (Liengme 1981). While it was important for local people, this species is now considered as underutilized plant in Southern Africa (Omotayo et al. 2020). Undoubtedly, the neglect of indigenous knowledge associated with *M. zeyheri* could lead to its gradual disappearance.

Based on the existence of vernacular names of *M. zeyheri*, it is noticeable that this species is widely distributed across distinctive tribal regions in the Limpopo Province, including in the Vhembe Biosphere Reserve. Yet, little is known about its distribution and population in the Vhembe Biosphere Reserve, and its importance to local livelihoods. Although some regional studies have reported medicinal uses of *M. zeyheri* in the Vhembe region (Constant and Tshisikhawe 2018; Mokganya 2019; Magwede et al. 2019), none of those studies mentioned anything about the ailments it remedies, nor its preparational techniques nor its administration modes. No literature studies have ever reported any other utilization of *M. zeyheri* in the Vhembe Biosphere Reserve, except its uses as fruit and for medicinal purposes. This fortifies the need for socio-ecological evaluations of local people's perceptions associated with the contributions of *M. zeyheri* to their daily strive and also explores factors that affect its regional population and distribution.

Since the ancient people were using a variety of plant species, including those categorized as underutilized, plants like *M. zeyheri* could still be utilized to enhance the fight against malnutrition and increase food security. According to Akinola et al. (2020), underutilized wild fruits, including *M. zeyheri*, could improve the nutritional status of poor and marginalized rural villages. Regardless of the world's political spectrum and economic instability in South Africa and the Vhembe Biosphere Reserve, people still want to eat various foods daily. Therefore, to sustain their food basket security, it is fundamental to understand all factors that could negatively affect their food source or fruits, including *M. zeyheri* fruits.

The current study aimed to evaluate people's perceptions about the contribution of *M. zeyheri* to local livelihoods in the Vhembe Biosphere Reserve, and to assess its population and factors affecting its local distributions as perceived by local people. This study could not only preserve the gradually disappearing cultural heritage associated with the utilization of *M. zeyheri* for any purpose other than medicinal but also contribute to the promotion and realization towards achieving some priorities listed under Version 2030 of the South African National Development Plan (Zero hunger, and promotion of local innovations) through the use of local innovations (Nel-Sanders and Thomas 2022). The results of this study are expected to contribute to preserving local knowledge associated with *M. zeyheri* and the realization of the United Nations' Sustainable Development Goals, especially the issues about responsible consumption and production.

MATERIALS AND METHODS

Study area

This study was undertaken in five villages (i.e. Duthuni, Ha-Manyuwa, Khalavha, Tshirenzheni, and Tshivhiliḓulu) within the Soutpansberg Region of the Vhembe Biosphere Reserve (Figure 1). These five villages are geographically located between 22º54′12.596″ to 22º58′22.552″ S and 30º13′6.891″ to 30º23′36.531″ E.

The study sites were selected based on the abundance distribution of *M. Zeyheri*. Climatically, the study areas are categorized as humid, with the most rainfall occur in the summer season (October to April), and the least rain occur in the winter (May to September) (Mpandeli 2014). The area received the mean annual rainfall ranges between 755mm and 798mm (Odhiambo et al. 2019), and the typical temperatures are between 18°C during winter and 28°C in the summer season (Ramarumo and Maroyi 2020; Ruwanza and Thondhlana 2022). The land use in the study sites consists of various agricultural activities such as home gardens, orchards, stock farming, tea, and forestry silviculture in both communal and state land.
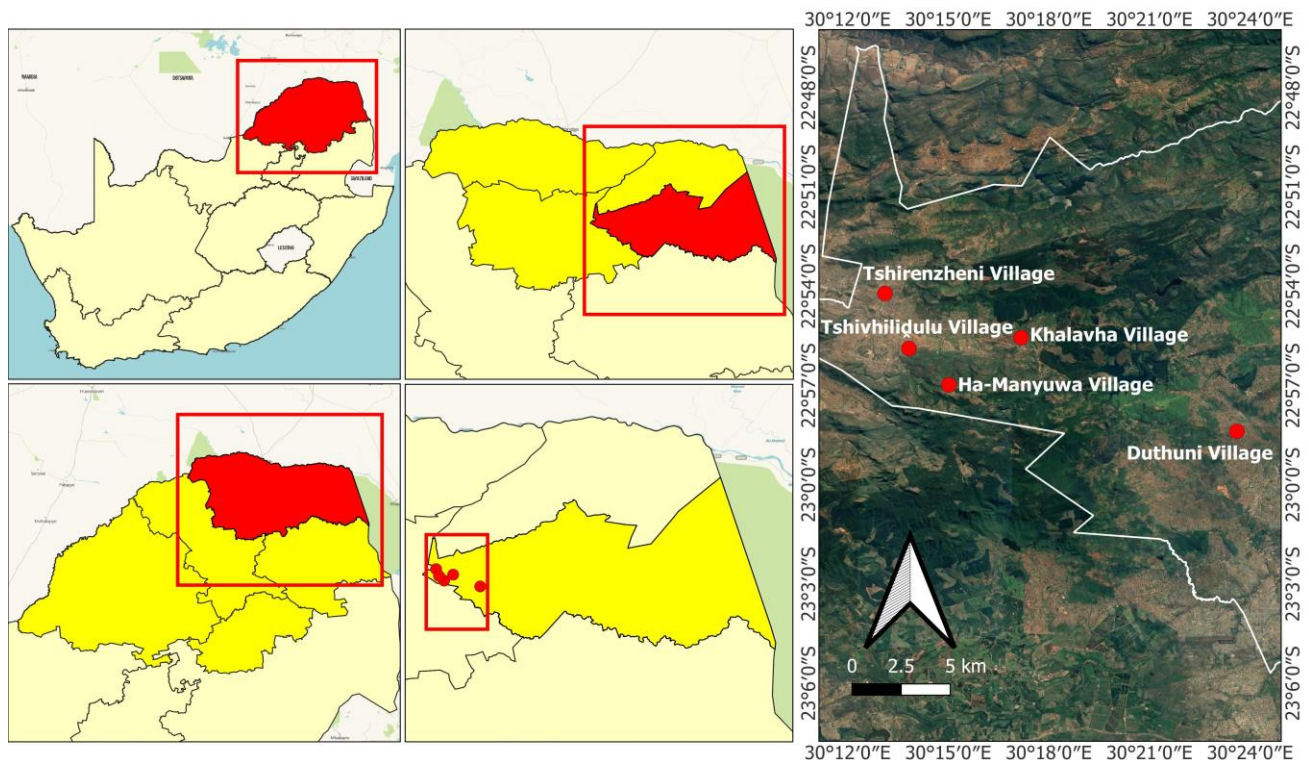

Figure 1. Map of study area showing five villages in the vicinity of Vhembe Biosphere Reserve, Limpopo Province, South Africa sites

Geologically, the regional features have formation of the Bushveld Igneous Intricacy, the Soutpansberg's Wylie Poort Geological Formation Group, Kalahari Cratons, Limpopo Belt, Karoo System, and the Archaean Cratons (Hahn 2011; Malaza 2014; Kori et al. 2019). The entire region is considered the center for botanical endemism and plant diversity refugia in Southern Africa (Hahn 2017; Constant and Tshisikhawe 2018). The area is typically a savanna biome with the vegetation type characterized by a varied and constant mixture of vegetation units, which ranges from the Soutpansberg Mountain Bushveld with territories of Afromatane Forest surrounded by semi-dessert scrubland (Mucina and Rutherford 2006; Luseba and Tshisikhawe 2013; Hahn 2017; Ramarumo and Maroyi 2020). The Soutpansberg Mountain Bushveld is dominated by species including *Syzygium legatii*, *Diospyros whyteana*, *Rothmannia capensis*, *Englerophytum magalismontanum*, *Brachylaena transvaalensis*, *Zanthoxylum capense*, *Schefflera umbellifera*, *Cussonia spicata*, *Celtis africana*, *Rhoicissus tomentosa*, *Xymalos monospora*, *Kiggelaria africana* (Mucina and Rutherford 2006; Mostert et al. 2008; Hahn 2017; Constant and Tshisikhawe 2018). Furthermore, the Soutpansberg Arid Areas are dominated by plant species, including *Tribulus terrestris*, *Ziziphus mucronata* subsp. *mucronata*, *Grewia hexamita*, *Euphorbia confinalis*, *Terminalia prunioides*, and *Combretum hereroense* (Mostert et al. 2008; Hahn 2017; Constant and Tshisikhawe 2018).

Data collection procedures

Information on the utilization of *M. Zeyheri* in the Vhembe Biosphere Reserve, perceptions on its population structure, distributions, and contributions to local livelihoods were collected through semi-structured and structured questionnaires in interview sessions with 52 randomly selected respondents. The sample size of 52 respondents was determined based on the duration scheduled to complete this study. Therefore, this decision also aligned with evidence-based scientific studies emphasizing that for any heterogenous sample, the total number of informants should be at least 12 or more (Crouch et al. 2006; Guest et al. 2006; Latham 2013). However, it is worth indicating that traditional leaders from all five target villages endorsed the commencement of this study during the pilot survey. After they endorsed the commencement of the current study in their jurisdiction villages, traditional leaders were requested to introduce the research team to their people and inform them about the team's presence in their respective villages. People were informed about the current study's objectives after the traditional leaders introduced the research team during the traditional gathering. Participatory rural appraisal research techniques were applied to gather information associated with the following aspects systematically: (i) Participants demographic details; (ii) Utilization categories of *M. zeyheri* across the study sites; (iii) People's perceptions about *M. zeyheri* population structures and its contribution to livelihoods; and (iv) Participants' perceptions on factors that affect its distribution in the studied sites.

The field visits were conducted, accompanied by the participants, to validate some of the given information and observe some factors known to affect the distribution of *M. zeyheri* in the Vhembe Biosphere Reserve. Data collection was conducted in two months between June and July 2023. During the data collection, the 52 randomly selected respondents, including males and females, were visited in their homesteads and interviewed individually, using their home language. All the interview sessions lasted an average of one hour and thirty minutes. Similar questionnaires were administered to all the respondents to validate the authenticity of the provided data. Furthermore, it should be noted that although the current study was questionnaire-based, gathered data, mainly information associated with factors affecting the distribution of *M. zeyheri* and its population across the study sites, was supplemented by naked-eye observations and guided field visits accompanied by the respondent.

Ethical considerations

The current study was endorsed by the University of Mpumalanga's research ethics committee (Reference number: UMP/Lubisi/BSc Hons/2023). All the respondents gave their informed consent before the interview sessions commenced. The respondents were also informed that their participation is voluntary and that their information will be utilized only for research purposes, including journal publication, conference presentations, and other scientific works. During the gathering, all the study recruits were informed about the objectives of this study, and their autonomous rights and right to quit any time they wish were guaranteed.

Data analysis

The collected data were qualitative; however, some convertible information was converted to become quantitative and analyzed statistically. All the analyses were executed using Microsoft Office Excel. All the questionnaire gathered data were coded and arranged into various themes while considering their similarities and distinctiveness and then analyzed using formulas derived from Ramarumo and Maroyi (2020), Fidelity Level of percentage (FL%), and Relative Frequency of Citations (RFC). This was to determine important utilization categories of *M. zeyheri* across the studied sites. The following formulas were derived from the study by Ramarumo and Maroyi (2020):

$$FL\% = \frac{N_P}{N} \times 100,$$

Np denoted the number of respondents who cited *M. zeyheri* for a particular utilization category, while N represented all the respondents.

$$RFC = \frac{FC}{N} \ (0 < RFC < 1)$$

The FC serves a similar purpose as the Np, while N is all respondents. Therefore, the RFC value ranges between 0 and 1, with a value closer to 1 illustrating the cultural importance of the cited utilization category. One-way Analysis of Variance (ANOVA), known as ANOVA single factor, was also used to test for the significant difference

between participants' perceptions of factors that affect the distribution *of M. zeyheri* within the studied sites.

RESULTS AND DISCUSSION

Demographic profiles of the respondents

Among the 52 respondents, there were 20 males (38.46%), 32 females (61.54%). In terms of occupation, there were 28 laypeople (53.84%), 15 farmers (28.85%), seven environmentalists (13.85%), and two traditional health practitioners (3.85%) (Figure 2). Respondents above the age of 35 but below 52 years old constitute the majority (34.62%) of all the participants, while those above the age of 86 constitute the minority (1.92%). More than 63% of informants attended formal schools up to secondary education, while those who did not possess formal education and those who had primary education and tertiary constituted 11.54%, 7.69%, and 17.31 respectively. About 53.85% of the respondents were married, while singles and widows or widowers constitute 34.62% and 11.53%, respectively (Figure 2).

General uses of *Mimusops zeyheri* in the Vhembe Biosphere Reserve

The results of this study revealed that local people within the study sites associate *M. zeyheri* with five use categories (Table 1). The most commonly known and essential use categories as demonstrated by their FL(%) and RFC values, were fruit (FL = 34.60%; RFC = 0.346), firewood (FL = 28.80%; RFC = 0.288), cooking oil and flavoring (FL = 19.20; RFC = 0.192) (Table 1). Other respondents also mentioned that *M. zeyheri* is also used in traditional medicine (FL = 13.50%; RFC = 0.135) and for beautifying or ornamentals (FL = 3.80; RFC = 0.038) (Table 1). The low portion of respondents who utilized *M. zeyheri* for medicinal purposes was because most of the respondents were laypeople who knew nothing about the medicinal plant species. Semenya et al. (2012) reported the medicinal usage of *M. zeyheri* in the Limpopo Province, while Mngadi et al. (2019) reported similar issues in Gauteng and North-West Provinces of South Africa. In the Vhembe Biosphere Reserve, only a single study by Magwede et al. (2019) reported the medicinal utilization of *M. zeyheri*. However, all these studies, either in the Vhembe region or elsewhere, failed to articulate how it is prepared to remedy which ailments or diseases. Although almost all of the documented *M. zeyheri* use categories were reported elsewhere before, for the first time, this study revealed that local people in the region also utilized the species for making cooking oil and flavoring. So far, no literature study has ever reported this in the Vhembe Biosphere Reserve or elsewhere. This illustrates the innovativeness and capabilities of local indigenous people to resolve daily challenges. Ramarumo et al. (2019) argued that being innovative is not something optional for dwellers in rural villages with scant resources but a strive to survive in daily life.

Changes in the population of *Mimusops zeyheri* and its contributions to local livelihoods as perceived by respondents

Figure 3 illustrates people's perception on population and the contributions of *M. zeyheri* to their local livelihoods. When asked if there are changes in terms of population of *M. zeyheri* within the studied region, the majority of respondent (67.31%), said "yes" indeed, there are some noticeable changes in its population (Figure 3A). In comparison, 32.69% of their counterparts disagreed with them and stated that there is "no" visible change in the population of the target species. About 54.14% of those who have noticed the change in terms of the population of *M. zeyheri* highlighted that the species is gradually depleting, with others indicating that it is now mostly found growing in valleys (31.43%) and scattered far away (11.43%) (Figure 3A). This concurs with the literature evidence emphasizing that wild fruit species, mainly those valued, are gradually disappearing (Janeček et al. 2019). Masekoameng and Molotja (2019) also made similar observations in the Sekhukhuni region of the Limpopo Province, South Africa.

All the participants, including the laypeople, farmers, environmentalists and traditional health practitioners, highlighted that *M. zeyheri* contributes to their livelihoods (Figure 3B). They perceived the contribution of *M. zeyheri* to their daily life can be categorized into four benefits: therapeutic, economic, intrinsic value, and social benefits (Figure 3B). More than three-quarters of laypeople (78.6%), two-thirds of farmers (66.7%), and 57.1% of environmentalists perceived that *M. zeyheri* possessed more economic benefits than any other livelihood benefits. Such results are not unusual since they were also reported in various literature studies countrywide (Dube et al. 2016; Mngadi 2017; Mngadi et al. 2019). According to Omotayo et al. (2020), *M. zeyheri* presents significant economic potential, while Mashela et al. (2013) stated that the benefits derived from this species are incomparable. In contrast, all the traditional health practitioners (100%) indicated that *M. zeyheri* provides multiple medicinal benefits (Figure 3B). Similar results were also shown in previous ethnobotanical studies in the region (Constant and Tshisikhawe 2018; Magwede et al. 2019; Mokganya 2019).

Respondents' perceptions of factors that affect the distribution of *Mimusops zeyheri* in the studied sites

A total of 44.20% of the respondents perceived fire as the main factor that negatively affects the distribution of *M. zeyheri* in the studied regions (Table 2). Even though Doherty et al. (2022) emphasize that fire induces a change in plant community structures, the results of the current study differ from the scientifically accepted notation, stating that fire promotes plant species richness (He et al. 2019). In contrast, recent scientific evidence stated that highly intense and recurring fire regimes as one of the main factors that threaten species with extinction risk (Kelly et al. 2020; Munstermann et al. 2022). This was supported by Irwin and Geschke (2023), who alluded that fire regimes drastically drive species towards extinction risk.

Therefore, it is arguable that the results of the current study fortify the findings observed by Lindenmayer (2023). Other respondents argued that cutting down of *M. zeyheri* for firewood, habitat destruction due to the expansion of residential areas, and drought constitute more than two-quarters (55.8%) of all the factors that affect the distribution of *M. zeyheri*, respectively (Table 2). These results suggest that different participants differ in their perceptions, mainly regarding factors that affect the distributions of the target species. Table 3 shows the significant differences (*P-value*<0.05) in respondents' perceptions regarding factors that affect the distribution of *M. zeyheri* in the studied sites. This was not a surprise since it is an acceptable norm for people from different educational backgrounds to differ in their perceptions and views (Coffé and Theiss-Morse 2016).
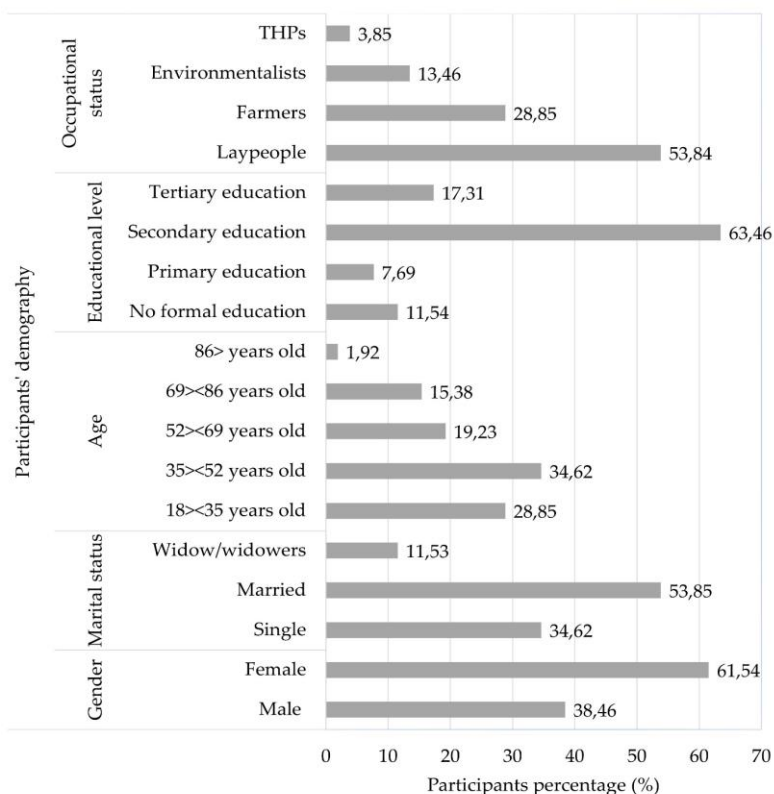

Figure 2. Demographic profiles of the respondents

Tabel 1. General uses of *Mimusops zeyheri* in the Vhembe Biosphere Reserve, South Africa

Use category	Part	n=52	FL (%)	RFC	Use cited elsewhere
Fruits	Fruit	18	34.60	0.346	Mokganya et al. (2018); Nkosi et al. (2020); Omotayo et al. (2020); Sibiya et al. (2021); Dalu et al. (2021); Trytsman et al. (2023)
Firewood	Whole plant	15	28.80	0.288	Semenya (2020)
Traditional medicine	Bark, root, and fruit	7	13.50	0.135	Magwede et al. (2019); Moiketsi et al. (2023)
Onormentals/ beautifying	Whole plant	2	3.80	0.038	Mutshinyalo and Siebert (2010)
Cooking oil and flavoring	Seeds	10	19.20	0.192	None

Table 2. Factors affecting the distribution of *Mimusops zeyheri* as perceived by respondents

Factors	Laypeople	Farmers	Environmentalist	THP	%
Fire	11	7	5	0	44.20
Cutting down the trees for firewood	6	6	2	2	30.80
Habitat distraction due to the expansion of residential areas	6	2	0	0	15.40
Drought	5	0	0	0	9.60

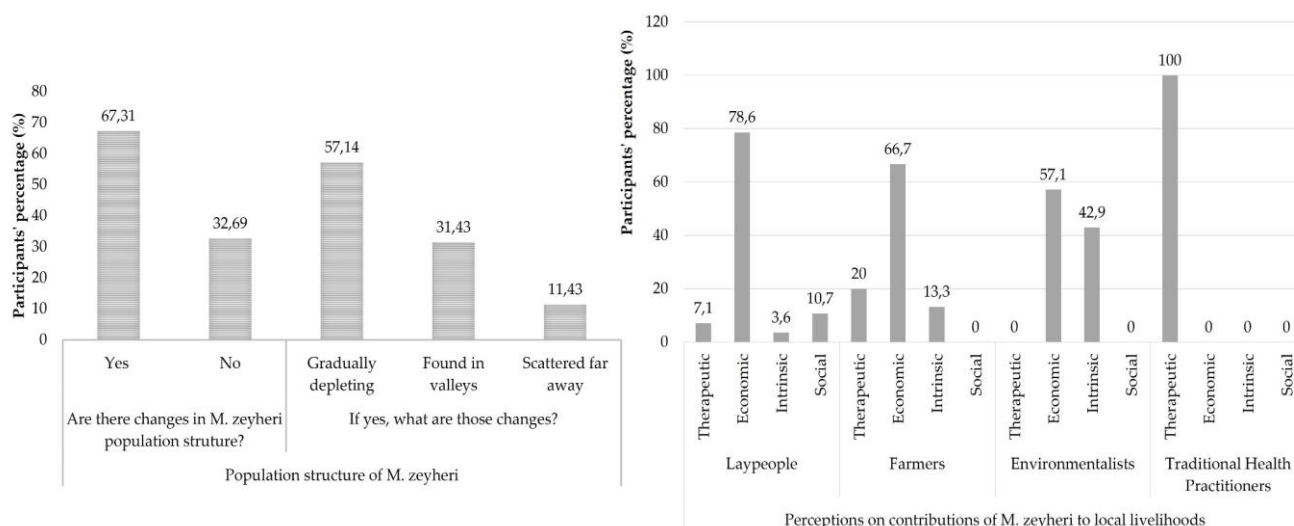Note: THP: Traditional Health Practitioners

Figure 3. Respondents' perception of population and contributions of *Mimusops zeyheri* to local livelihoods

Table 3. Statistical comparison of factors that affect the local distribution of *Mimusops zeyheri* as perceived by respondent

Groups	Count	Sum	Average	Variance	F	P-value
Cutting down the trees for firewood	4	28	7	7,333	5,181	0,016
Habitat distraction due to the expansion of residential areas	4	15	3,75	10,917		
Drought	4	7	1,75	5,583		
Fire	4	2	0,5	1		

Anova: Single Factor - Statistical Summary

In conclusion, *Mimusops zeyheri* is considered an underutilized plant species in South Africa. Therefore, documenting information about people's perceptions regarding its contributions to local livelihoods and assessing factors that affect its local distribution is a fundamental step toward understanding its associated socio-cultural values, economic importance, and threats. Such baseline information is also paramount for assessing the conservation status or risk assessment for the species. For the first time, the current study reported the utilization of *M. zeyheri* seeds for extracting cooking oil and flavorings. Such a finding has never been reported before in the Vhembe region or elsewhere. The current study, therefore, recommends that future studies focus more on evaluating indigenous technological knowledge used in the extraction of cooking oil and flavoring substances from *M. zeyheri* seeds to provide substantial information required to initiate the patent registration and commercialize those products. The research method used in this study was ethnobotanical; therefore, all the gathered information was validated following ethnobotanical means of validating information, including administering similar questionnaires to all the informants. In this regard, it is arguable that future studies should incorporate both ethnobotanical and ecological means of data validation. This study contributes to preserving local indigenous knowledge associated with utilizing *M. zeyheri* from being lost.

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