

THREATS AND TRADITIONAL APPROACHES TO THE CONSERVATION OF SELECTED THREATENED OR PROTECTED PLANTS IN THE LIMPOPO PROVINCE, SOUTH AFRICA

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Abstract

Harvesting wild indigenous plants for traditional medicinal purposes is a common practice in various areas across South Africa, including in Limpopo province. Traditional medicines are derived from various wild plant resources, some of which are protected by legislation. The aim of this study was to assess the anthropogenic threats and traditional approaches to the conservation of six medicinal plant species protected by the Threatened or Protected Species (TOPS) Regulations, promulgated in terms of the National Environmental Management: Biodiversity Act, 10 of 2004 (NEMBA). Data were gathered via semi-structured questionnaires and field observations across the five districts of the Limpopo province. Findings indicated that overexploitation and destructive harvesting methods are the main factors threatening the survival of the six study species. Participants suggested the cultivation of these species and various conservation strategies, including the introduction of a permit system and plant reintroduction, as fundamental to the long-term conservation of the species. A biodiversity management plan as provided for by NEMBA would be a useful mechanism to ensure the future sustainability of these valuable plant resources.

Key words: Cultivation, Destructive harvest, Local conservation, Sustainable, Overexploitation, Conservation of threatened or protected plants.

Introduction

In Africa, rural people have been harvesting wild plants for a very long time, mostly to meet their various livelihood needs for food, medicine, shelter and income (Petersen *et al.*, 2012). In most rural areas of South Africa, these needs are met by exploiting various plant resources, including those that are protected by legislation such as the National Environmental Management: Biodiversity Act, 10 of 2004, and the Limpopo Environmental Management Act, 7 of 2004. According to previous surveys, the majority of these species are threatened by agricultural activities (Manyama, 2007) and overexploitation, as well as by other human activities (Loundou, 2008). The Limpopo province is no different, with wild plant resources being threatened by overharvesting, destructive harvesting techniques (Tshisikhawe *et al.*, 2012) and ineffective management strategies (Raseth *et al.*, 2013).

Species requiring legal protection from overexploitation are listed in the Threatened or Protected Species (TOPS) Regulations. Permits are required for various restricted activities, such as harvesting, trading or exporting. Appropriate conservation approaches are essential to ensure the long-term sustainability of natural populations (Tshisikhawe *et al.*, 2012), such as cultivation (Cunningham, 1993; Moeng & Potgieter, 2011), and sustainable harvesting techniques (Tshisikhawe, 2002; Semanya, 2012). There is still insufficient knowledge about the major anthropogenic threats to the wild populations of traditionally harvested plants and the current traditional conservation

approaches to protecting these populations in the Limpopo province. This is despite a number of ethnobotanical studies in the province that highlight the overutilization of some of these legally protected species (Moeng, 2010; Semanya, 2012; Mathibela, 2013).

This study aimed to investigate the anthropogenic threats and traditional conservation approaches to six TOPS-listed plant species occurring in the Limpopo province, namely *Alepidea amatymbica* Eckl. & Zeyh., *Brackenridgea zanguebarica* Oliv., *Dioscorea sylvatica* Eckl., *Drimia sanguinea* (Schinz) Jessop, *Siphonochilus aethiopicus* (Schweinf.) B.L. Burtt and *Warburgia salutaris* (G.Bertol.) Chiov.

Materials and Methods

Study area: The study was conducted in all five districts of the Limpopo province, namely the Capricorn, Sekhukhune, Mopani, Vhembe and Waterberg districts (Fig. 1). The vegetation in the province forms part of the savanna biome and is characterized by a mixture of trees (e.g. *Vachellia tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr., *Vachellia tenuispina* (I. Verd.) Kyal. & Boatwr., *Colophospermum mopane* (J. Kirk ex Benth.) J. Kirk ex J. Léonard), shrubs (e.g. *Grewia occidentalis* L. var. *occidentalis*, *Dovyalis zeyheri* (Sond.) Warb., *Cussonia spicata* Thunb.), and grasses (*Cenchrus ciliaris* L., *Panicum maximum* Jacq., *Heteropogon contortus* (L.) Roem. & Schult.). There is generally a diverse flora with plant species that locals use to meet their livelihood needs (Mucina & Rutherford, 2006).

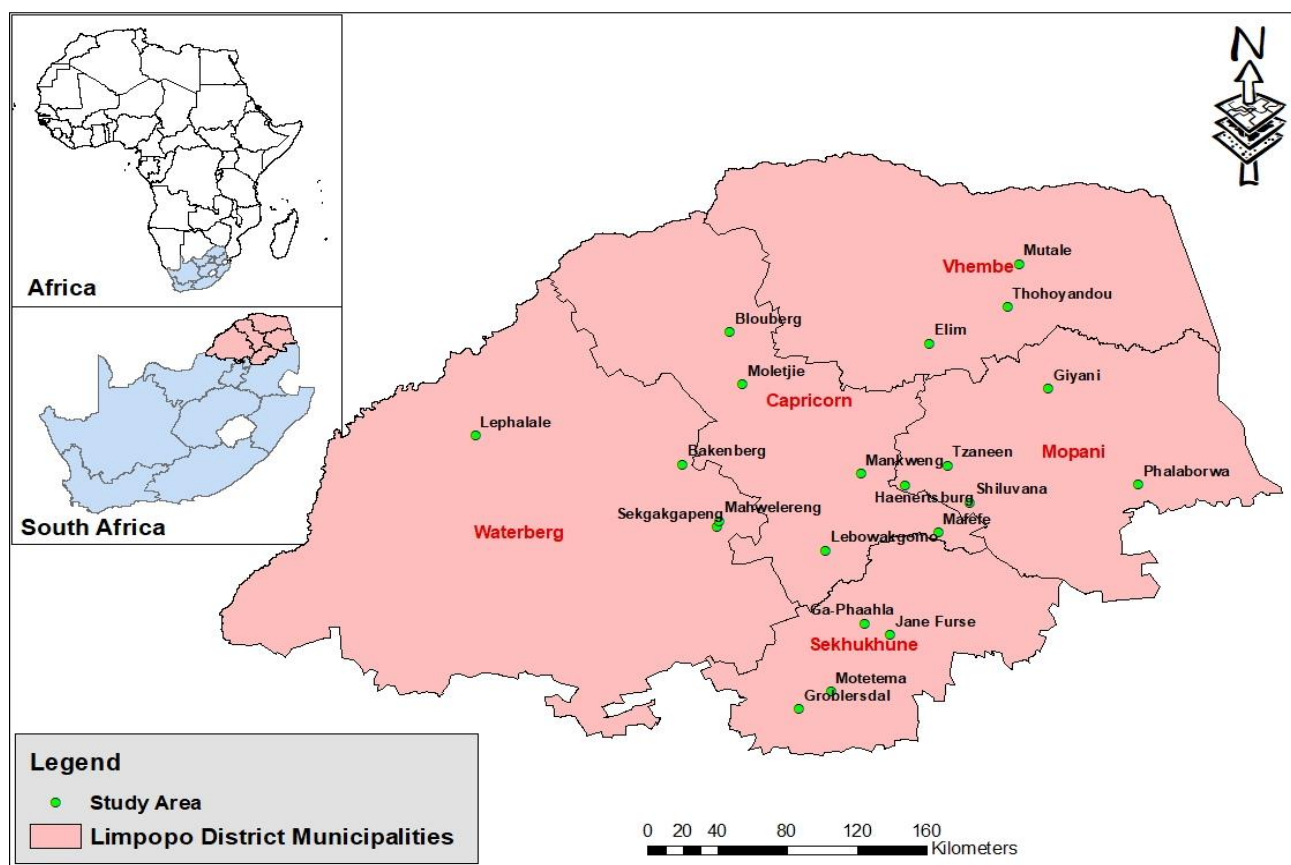


Fig. 1. Main study areas surveyed in the five districts of the Limpopo province, South Africa. The threatened or protected plant species.

The study involved six threatened plant species that are legally protected in South Africa. The species are highly sought after by traditional healers and community members to treat different ailments or to use for magical purposes. These plant species included *Alepidea amatymbica* (Endangered), which is a herbaceous perennial plant with dark green leaves arising from a single or branched rhizome. In South Africa, this species is distributed across the Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo and Mpumalanga provinces. *Drimia sanguinea* (Near-threatened) is distributed across the Free State, Gauteng, Limpopo, Mpumalanga, Northern Cape and North West provinces. This species is a perennial herb, produces flowers before leaves and has a bulb that can grow 5–8 cm wide, with reddish fleshy scales. The critically endangered *Brackenridgea zanguebarica* is a single-stemmed tree with rough bark and yellow pigment underneath the bark if scratched. In South Africa, it is only found in one area of the Limpopo province. Another critically endangered plant included in the current study was *Siphonochilus aethiopicus*, a forest floor plant with aromatic rhizomatous roots. It is the most sought after plant on the South African medicinal market. Due to the demand, this species is now extinct over most of its former range in KwaZulu-Natal, Limpopo and Mpumalanga, where it is known to occur. *Dioscorea sylvatica* (vulnerable) is a semi-tropical slender twining herb with annual stems growing from a massive, reticulated tuberous

rootstock. This species has a wide distribution range, provincially distributed across the Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga and Western Cape. The last species is *Warburgia salutaris* (endangered), which is distributed across three provinces, namely KwaZulu-Natal, Limpopo and Mpumalanga. This plant species is an evergreen, slender tree that grows from 5 to 10 m tall. The dark green, glossy leaves are paler green below and have a bitter, peppery taste.

Data collection: A semi-structured questionnaire was used to capture information on threats, harvesting methods, cultivation, sustainable use approaches, and the acceptability of proposed conservation methods in relation to the six selected TOPS-listed plant species. Altogether 110 community members (CMs), 180 traditional health practitioners (THPs) and 12 traditional leaders (TLs) were interviewed. Community members were randomly selected, while THPs and TLs were purposively selected.

Anthropogenic threats: Community members and THPs were asked to list possible reasons/factors for any population declines among the selected TOPS-listed plant species present in their collection areas. This was complemented by field observations, where participants accompanied the interviewer to areas where these plants are known to be harvested to confirm the threats and to observe the degree of anthropogenic impact on the plant populations. Populations were ranked from low to very

high impact. Low impact populations were dominated by healthy individuals (with <10 dead individuals). Healthy individuals outnumbered dead individuals in the moderate impact populations, while around half of the plants in high impact populations were recorded as dead. Very high impact populations had few healthy individuals.

Harvesting methods: Participants were requested to indicate which of the method/s they use to harvest each of the study species, including uprooting/digging out, felling off bark, cutting branches, picking fruits from ground, hand-picking leaves, or any other method specified. This was again confirmed in the field during visits to the communal lands where these plants are known to be harvested.

Cultivation: The community members and THPs who use the six study species were asked if they cultivate the plants in their own gardens/yards, or if they did not own a garden, whether they would grow medicinal plants if seeds or seedlings were freely supplied.

Sustainable use approaches: Participants were requested to disclose the method/s they use to ensure that harvesting is sustainable so that plants can continue to be harvested in the future. The choice of methods in the questionnaire included collecting small amounts, not uprooting/cutting down whole plants, cultivating in home gardens and collecting seasonally.

Future prospects for conservation strategies: Participants were asked to select from a list of conservation strategies that could be implemented to provide for the sustainable use of the six study species, including propagation, introduction of a permit system,

reintroduction, education on conservation, patrolling and prevention of veld fires. Participants were also given the opportunity to propose additional conservation methods.

Ethics considerations: Prior informed consent was obtained from TLs, THPs and CMs to conduct this study in their jurisdiction. As required by the University of Limpopo’s ethics committee, participants gave their informed consent for the publication of all results and any accompanying images before commencing with the interviews.

Data analysis

Data were analysed by means of simple descriptive statistics.

Results

Anthropogenic threats: All THPs and CMs from all districts mentioned overharvesting for medicinal use as a significant threat to the six study species (Fig. 2). In the Mopani district, CMs indicated that *S. aethiopicus* was not only harvested for medicinal use, but also to plant in home gardens for domestication and commercial use. According to participants, *D. sanguinea* was the only species threatened by additional factors (agricultural activities and the expansion of rural settlements).

Field observations indicated that almost all populations showed very high degrees of anthropogenic impact (Table 1). A low impact was observed in only one population (*D. sylvatica*), while a moderate impact was observed in only two populations (*B. zanguebarica* and *W. salutaris*).

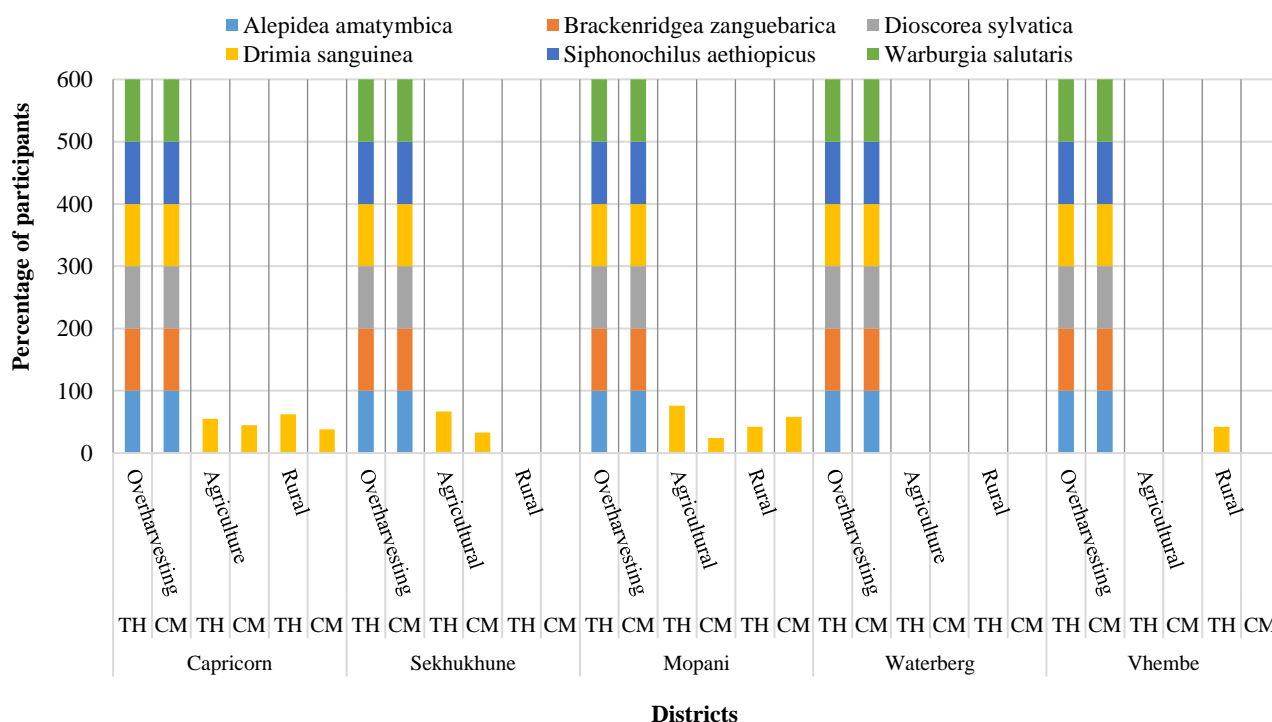


Fig. 2. Threats to selected TOPS-listed plants species in the Limpopo province as indicated by THPs and CMs, including overharvesting, agricultural activities and expansion of rural settlements.

Table 1. Degree of anthropogenic impact on the populations of the six study species as observed in the field.

Species	Populations visited	Districts	Degree of impact
<i>Alepidea amatymbica</i>	Shilovane	Mopani	Very high
	Haenertzburg	Mopani	Very high
<i>Brackenridgea zanguebarica</i>	Tengwe (<i>Brackenridgea</i> Nature Reserve)	Vhembe	Moderate
<i>Dioscorea sylvatica</i>	Ga-Phaahla	Sekhukhune	Low
	Leolo	Sekhukhune	Very high
<i>Drimia sanguinea</i>	Blouberg	Capricorn	Very high
	Zebediela	Sekhukhune	Very high
	Lebowakgomo	Sekhukhune	Very high
	Giyane	Mopani	Very high
	Bolobedu	Mopani	Very high
<i>Siphonochilus aethiopicus</i>	Tzaneen	Mopani	Very high
<i>Warburgia salutaris</i>	Blouberg	Capricorn	Moderate
	Mafefe	Capricorn	Very high

Table 2. Methods used to harvest the six study species as reported by THPs and CMs.

Species names	Harvesting methods
<i>Alepidea amatymbica</i>	Uprooting (100%)
<i>Brackenridgea zanguebarica</i>	Digging out roots (97%) and felling off bark (3%)
<i>Dioscorea sylvatica</i>	Uprooting (100%)
<i>Drimia sanguinea</i>	Uprooting (100%)
<i>Siphonochilus aethiopicus</i>	Uprooting (100%)
<i>Warburgia salutaris</i>	Felling off bark (94%), digging out roots (4%) and hand pick (2%)

Harvesting methods: All THPs and CMs acknowledged that most of the harvesting techniques used, such as uprooting and felling, are extremely destructive. Four of the six species are being uprooted (Table 2). Participants indicated that because *B. zanguebarica* is a big tree, only a few roots are dug out at a time. Bark is also removed from these trees and from *W. salutaris* trees.

Cultivation: The majority of the participants are not cultivating any of the study species, and participants who are cultivating these species only did so for *D. sanguinea* and/or *S. aethiopicus*. They reasoned that these are the only plant species that grow easily and can survive different soil types. Overall, more THPs than CMs are cultivating the species. In the Vhembe district none of the CMs cultivated the study species in home gardens, as opposed to 80% of CMs in the Mopani district (Fig. 3).

If provided with free seeds/seedlings, 82% of THPs who are not cultivating at present showed interest in cultivating medicinal plants, though some (mostly of the older generation) also indicated that they preferred wild plants because they perceive them to have more healing power and to be uncontaminated. One THP also indicated that harvesting wild plants is an ancient custom that was practiced by their ancestors and should be continued. The absence of a fence around home yards to protect plants from domestic animals was given as a reason for not cultivating the study species, while other CMs indicated that they did not have enough space in their yards, saying that they would only cultivate medicinal plants if provided with enough land.

Sustainable use approaches: Methods to ensure the sustainability of the wild plant resources cited by the participants included not cutting green plants, collecting only small quantities, seasonal harvesting, regulation through collection permits, avoiding cutting down/uprooting, no cutting during initiation, leaving pieces of plants behind, closing the hole after harvesting roots, cultivation in home gardens and closed access areas. The employment of sustainable use methods was most prevalent among participants from the Sekhukhune district (Fig. 4). In the Waterberg and Vhembe districts sustainable use methods were only practised by THPs.

The sustainable use methods indicated by THPs and CMs were confirmed by TLs, who also indicated that they give permission for people to harvest. Most TLs stated that they only allow for the collection of small quantities, and 15% ask to see a permit for the harvesting of larger quantities. Twenty-three percent of TLs allow winter (April to August) collection only. A minority (4%) of TLs mentioned that they work with CMs in patrolling, while another 8% indicated that they educate the community on environmental matters. Twenty-three percent of TLs indicated that they do not implement any measures to ensure the sustainability of the plants.

Future prospects for conservation strategies: Participants proposed some conservation strategies for the management of plants in their communities. The most cited conservation strategies were propagation and the introduction of a permit system. CMs noted that veld fires in the Mopani district have been destructive for the plants and should be avoided (Table 3).

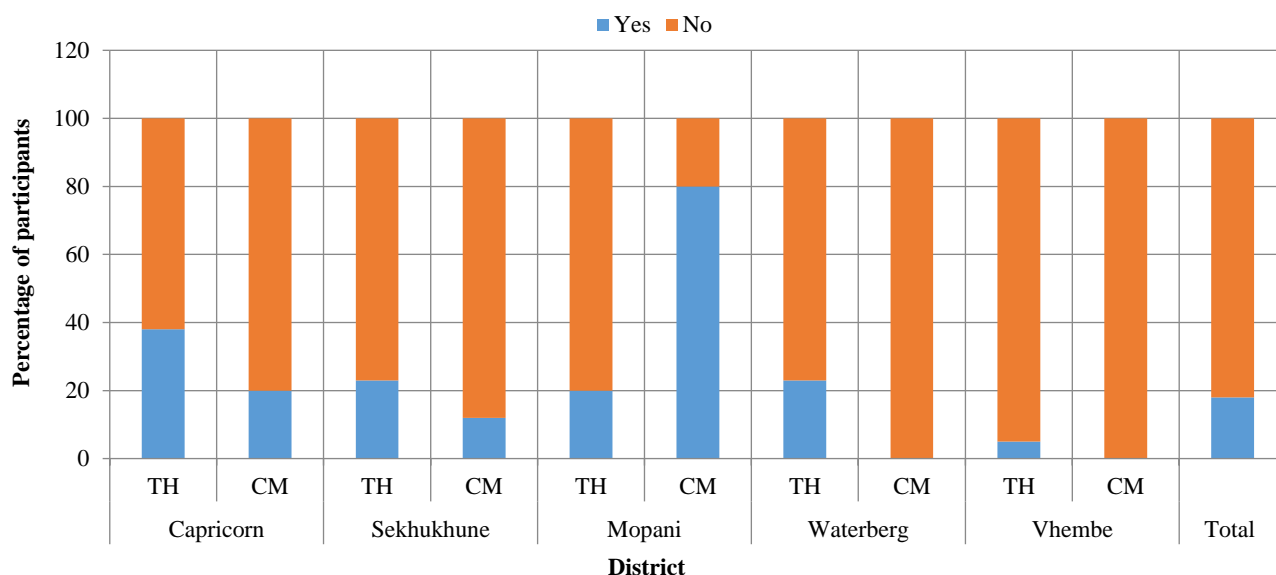


Fig. 3. Percentage of THPs and CMs cultivating the study species in their home gardens.

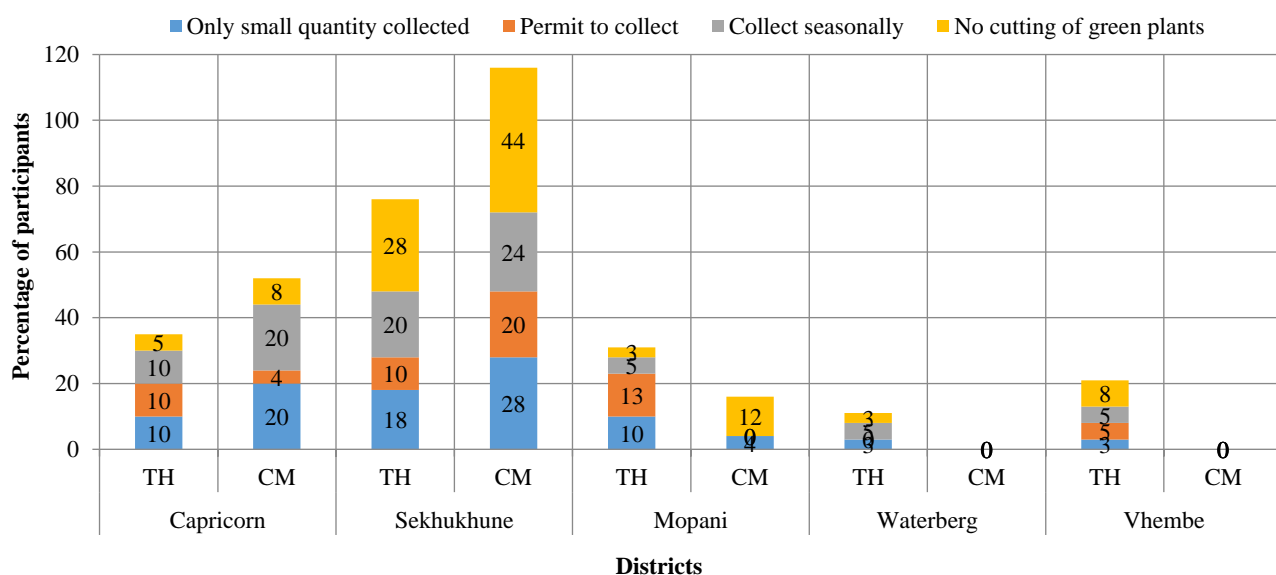


Fig. 4. The four predominant sustainable use methods practiced by CMs and THPs in the five districts of the Limpopo province (Note that in Sekhukhune district some CMs indicated the use of more than one method, hence a maximum value of >100%).

Discussion

According to the participants interviewed for this study, overharvesting, and to a much lesser degree agricultural activities and the expansion of rural settlements, are the main anthropogenic threats to the six study species in the Limpopo province. These threats are common to all medicinal plant species and have been frequently highlighted in different surveys in the Limpopo province (Moeng, 2010; Raseth et al., 2013), in other provinces of South Africa (Mander, 1998; Loundou, 2008), as well as in other African countries (Cunningham, 1993). It is therefore important that users of these species be advised of the risks and disadvantages of overharvesting plants urgently, especially *A. amatymbica*, *D. sanguinea*, *D. sylvatica*, *S. aethiopicus* and *W. salutaris*. The high levels of harvesting impacts evident in populations of these species in Limpopo province are concerning.

In 1998, Cunningham reported that *W. salutaris* and *S. aethiopicus* had been overexploited to such an extent that they were seldom found outside protected areas across South Africa. In 2010 *muthi* traders interviewed by Moeng reported that populations of *W. salutaris* had declined drastically in communal areas due to overharvesting. Moeng (2010) also reported that *S. aethiopicus* was being eradicated in the wild by commercial harvesters, who were in 2010 already resorting to harvesting from neighbouring provinces such as Mpumalanga and even from other countries, such as Swaziland. Similarly, Mander reported in 1998 that *A. amatymbica* populations were becoming increasingly difficult to obtain in South Africa and as a result were being imported from neighbouring countries such as Lesotho, Mozambique and Swaziland.

Table 3. Responses from participants on proposed conservation strategies to ensure the sustainability of medicinal plants.

Conservation strategies	Capricorn district			Sekhukhune district			Mopani district			Waterberg district			Vhembe district			Total (Nums)
	Participants (n)			Participants (n)			Participants (n)			Participants (n)			Participants (n)			
	TH	CM	TL	TH	CM	TL	TH	CM	TL	TH	CM	TL	TH	CM	TL	
Propagation	11	7	2	15	12	1	24	7	2	19	14	0	5	3	0	122
Introduction of a permit system	18	12	3	20	10	4	9	6	1	12	5	3	8	6	0	117
Reintroduction	9	2	1	5	2	0	4	4	1	9	6	1	0	1	0	45
Education on conservation	0	4	0	0	0	0	2	2	2	0	0	1	4	0	1	16
Patrol	2	0	0	0	1	1	1	3	0	0	0	1	3	0	3	15
Avoid veld fires	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2

Key: THP = Traditional Health Practitioner, CM = Community Member, TL = Traditional Leader

Although the observed degree of harvesting impact on the *B. zanguebarica* population assessed in this study was moderate, it should nevertheless be of concern since the species is localised to only one geographical area of South Africa, yet it is in demand throughout the country. Its critically endangered (A2ad; B1ab(ii,v)) status in the Red List of South African plants (Williams & Raimondo, 2008) is thus appropriate.

In general, most of the harvesting techniques participants use are destructive. All the herbaceous species, i.e. *A. amatymbica*, *D. sylvatica*, *D. sanguinea* and *S. aethiopicus*, are harvested by uprooting. These are commonly employed techniques used by most harvesters (commercial, CMs and THPs) for herbaceous species in the province. Moeng (2010) also reported uprooting of *S. aethiopicus*, *D. sylvatica*, *D. sanguinea*. Such harvesting methods will rapidly lead to the extinction of these species, and it is therefore important that users of the species switch to more sustainable methods, such as harvesting only a few underground parts or by removing just one side of the bulb or tuber.

Methods for harvesting the tree species *B. zanguebarica* and *W. salutaris* are also mostly unsustainable. For example, most of the participants mentioned that they collect *B. zanguebarica* by digging out the roots, while *W. salutaris* was mainly harvested by felling off the bark. These methods of harvesting not only have devastating effects on individual plants in the short term, but will also negatively influence the population in the long run. Only 2% of participants used leaves of *W. salutaris*, an aspect that should be encouraged. A few THPs mentioned that they only collect a few roots from a single plant. They also claimed that they do not ring-bark, but only harvest from the eastern side of the tree. These ways to harvest bark and roots are sustainable – Kambizi (2000) noted that bark harvested from only one side of *W. salutaris* plants showed a rapid regrowth due to the healing effect of the sun on the eastern side of the tree (Magoro, 2008).

In general, most of the participants do not cultivate the investigated species in their home gardens, though there were a few participants who had been cultivating *D. sanguinea* and/or *S. aethiopicus*. This could be expected due to the ease of cultivating these species. Cultivation of these species has been reported in other parts of South Africa. Ndawonde (2006) reported the cultivation of *D. sanguinea* by traders in the northern areas of KwaZulu-Natal, while Manzini (2005), Moeng (2010) and Van Wyk *et al.*, (2008) noted the cultivation of *S. aethiopicus*. Propagation trials of *D. sanguinea* and/or *S. aethiopicus* in different soil types would therefore be valuable. Participants in this study indicated that *S. aethiopicus* is being harvested for medicinal use and for domestication. While the domestication of *S. aethiopicus* is a sound conservation initiative, its overcollection for cultivation purposes is counter-productive.

Despite the high number of THPs who indicated that they do not cultivate the six study species, most of them did indicate that they would cultivate the species if provided with seeds and seedlings. Only a small minority, mostly elderly THPs, showed no interest in cultivation,

indicating that they preferred wild plants because they consider them to be uncontaminated and imbued with more healing power. It thus appears that the new generation is no longer bound to old beliefs and customs and seem eager to engage in conservation practices. A study conducted by Loundou (2008) in Cape Town (South Africa) also found that participants who did not cultivate the plants they used cited the lack of healing power as their main reason. The small number of CMs who indicated that they would not cultivate if provided with seeds and seedlings mentioned a lack of fencing to protect plants from domesticated animals as the main problem. Community-based medicinal plant gardens could be one solution to reduce wild harvesting.

The sustainable use approaches mentioned by participants in this study were common across the districts. However, field observations of the applied harvesting methods show a discrepancy between the stated (sustainable) and actual (destructive) harvesting methods. Most of the indicated sustainable use approaches, such as not cutting green plants, collecting only small quantities, and collecting seasonally, are also regularly mentioned by medicinal plant users and/or harvesters in other parts of South Africa (Stoffersen *et al.*, 2011; Semanya, 2012) and in other African countries, such as Zambia (Siangulube, 2009) and Cameroon (Mahop, 2004). The same inconsistency was observed in these studies, with most traditional leaders mentioning different sustainable use strategies they employ, but field observations clearly indicating that these are not being implemented. Although these are good conservation approaches, it is difficult to ascertain their effectiveness (if really applied), since the populations are not monitored.

Although different conservation strategies were indicated by participants as being appropriate for the conservation of the TOPS-listed species investigated in this study, with propagation, the introduction of a permit system and reintroduction being mentioned as the most preferred, their conservation can only be effective if a cohesive strategy is followed by all stakeholders (Semanya *et al.*, 2013). Furthermore, no single strategy is enough to ensure the long-term survival of the species in the wild. Rather, a combination of strategies would be prudent, along with appropriate regulation and compliance monitoring. Reintroduction of *W. salutaris* in Zimbabwe was shown to be effective in the conservation of the species (Maroyi, 2013), and the cultivation of *A. amatymbica*, and *D. sanguinea* in the Eastern Cape province has reduced harvesting impacts on wild populations (Wiersum *et al.*, 2006).

Conclusion

This study provides baseline information regarding the threats and traditional conservation approaches pertinent to *A. amatymbica*, *B. zanguebarica*, *D. sylvatica*, *D. sanguinea*, *S. aethiopicus* and *W. salutaris* populations in the Limpopo province, South Africa. This study also indicates that these species are highly threatened by overexploitation and destructive harvesting methods, and there is therefore a dire need to address

these threats. Some of the conservation approaches documented in this study to ensure the sustainability of the resource base have merit and should be further explored through a biodiversity management planning process as provided for in the National Environmental Management: Biodiversity Act, 10 of 2004

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(Received for publication 6 July 2021)