THE UTILIZATION AND MANAGEMENT OF SELECTED LISTED-THREATENED OR PROTECTED SPECIES IN THE LIMPOPO PROVINCE, SOUTH AFRICA

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THE UTILIZATION AND MANAGEMENT OF SELECTED LISTED-THREATENED OR PROTECTED SPECIES IN THE LIMPOPO PROVINCE, SOUTH AFRICA

BY

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ABSTRACT

In South Africa, the harvesting of indigenous plants has been taking place for centuries, and people in rural areas still rely on them to meet their primary health care needs. In the Limpopo Province, this traditional medicine is based on various plant resources, including those that are protected by legislation, such as the Threatened or Protected Species (TOPS) Regulations promulgated in terms of the National Environmental Management: Biodiversity Act (NEMBA) of 2004. Despite a number of ethnobotanical studies conducted in this province, which briefly highlighted the overutilization of some of the TOPS-listed plants, there has been no detailed study that focused on the use and management of these plant species. This study was conducted to document the different uses, threats, local management strategies and approaches to conserving these plant species.

The study was conducted in the Capricorn, Sekhukhune, Mopani, Waterberg and Vhembe districts of the Limpopo Province. Six TOPS-listed species occurring in the Province were selected after a pilot study based on their occurrence in the Province, familiarity with participants and known vernacular name. These species included *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. Information was collected from 180 traditional healers, 110 community members, 26 traditional leaders and 15 conservation officers, using semi-structured questionnaires, supplemented with field observations.

Results indicated that the selected species are used by traditional healers and community members exclusively for medicinal purposes. Preferences were predominantly for *D*. *sanguinea*, *S*. *aethiopicus* and *W*. *salutaris*. Remedies were most often prepared using the underground parts of the plants, which were chiefly purchased from *muthi* shops or markets trading both indigenous and exotic plant and animal materials used for witchcraft and/or healing.

Just over 59% of respondents indicated that they purchase materials from *muthi* shops due to the scarcity and thus unavailability of some species in local communal lands (open access lands). In contrast nearly 40% of participants (traditional healers and

community members) disclosed that they harvest materials from open access land. Only 1.49% of participants (traditional healers and community members) sourced from their homegardens; cultivating *D*. *sanguinea* and *S*. *aethiopicus* for both proximity (quick access) and easy harvesting. Generally, participants (82%) who did not cultivate these species, however, indicated an interest to cultivate if seed/seedlings were to be provided.

An analysis of participants' perceptions regarding factors threatening the survival of these species revealed that they (93%) viewed overharvesting for medicinal use as the most significant threat. During field visits, it was observed that the degree of impact due to harvesting on populations of these species was very high. This was exacerbated by destructive harvesting techniques by collectors, including uprooting of herbaceous species such as *A*. *amatymbica*, *D*. *sylvatica*, *D*. *sanguinea* and *S*. *aethiopicus*. Woody tree species, particularly *W*. *salutaris*, were sometimes felled for easy harvesting of stem bark.

Most (65.86%) of the community members and traditional healers revealed that there was nobody managing plants on communal lands, and therefore no conservation strategies are in place. However, a minority of participants indicated that chiefs (16.55%), chiefs and indunas (senior officials appointed by the king or chief, who often act as a bridge between the people and the chief) (14.83%), government (2.07%) and indunas (0.69%) are responsible for the management of plants in their areas. Community members, traditional healers and traditional leaders mentioned that there are general community rules for conserving plants, but these mostly focused on trees used for fuelwood. Similarly, conservation officers indicated that in most cases they patrol in rural areas for fuelwood use monitoring rather than medicinal plants, because they were unable to identify medicinal plant use impact during their patrols.

The study concludes that TOPS-listed plants are unsustainably harvested for medicinal purposes in the Limpopo Province, and without adequate control or management of the resource. This is due to a limited knowledge regarding conservation by harvesters, users, community leaders and elders, as well as unsustainable harvesting by collectors. Consequently, this study recommends that effective conservation measures are urgently needed to prevent further loss of most of these species in the natural environment. It is proposed that a workshop to educate

harvesters, traditional leaders and conservation officers regarding the TOPS-listed species be held. An identification guide for conservation officers should also be compiled, to be used during field patrols. Furthermore, practical skill development should be provided to people who currently cultivate at home or have expressed interest in cultivating TOPS species. Institutions such as SANBI could play an enabling role in providing seed/seedlings for home cultivation. Traditional leaders should furthermore be encouraged to work with government agencies (e.g. SANBI, LEDET, DEAT) in implementing and strengthening traditional rules that apply to medicinal plants.

DECLARATION

I declare that the dissertation hereby submitted to the University of Limpopo for the degree of Master of Science in Botany has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

_____ _____

Marula Triumph Rasethe Date

DEDICATION

This dissertation is dedicated to my parents; Mr Solomon Seja Rasethe and Mrs Johannah Mogapu Rasethe

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LIST OF ABBREVIATIONS

ARC:	Agricultural Research Council
DEAT:	Department of Environmental Affairs and Tourism
FAO:	Food and Agricultural Organization
LEDET:	Limpopo Economic Development, Environment and Tourism
LEMA:	Limpopo Environmental Management: Act No. 7 of 2004
NEMBA:	National Environmental Management: Biodiversity Act no. 107 of 2004
NFA:	National Forest Act no. 84 of 1998
SANBI:	South African National Biodiversity Institute
STI:	Sexually Transmitted Infections
TOPS:	Threatened or Protected Species
TB:	Tuberculosis
TH:	Traditional Healer
CM:	Community Member
TL:	Traditional Leader
THA/O:	Traditional Healer's Association/Organisation

LIST OF TAXONOMIC DESCRIPTIVES

Alepidea amatymbica Eckl. & Zeyh

Brackenridgea zanguebarica Oliv

Dioscorea sylvatica Eckl

Drimia sanguinea (Schinz) Jessop

Siphonochilus aethiopicus (Schweinf.) B.L.Burtt

Warburgia salutaris (G.Bertol.) Chiov

CHAPTER 1

GENERAL INTRODUCTION

1.1 General introduction

In Africa, harvesting of plants by rural people from natural environments has been taking place for a very long time. The major reason for this exploitation is to meet their various livelihood needs, such as food, income, medicine and shelter (Petersen *et al*., 2012). In most rural areas of South Africa, these necessities are met by various plant resources, including those that are officially protected by legislation, such as the National Environmental Management: Biodiversity Act no. 107 of 2004 (NEMBA) and the Limpopo Environmental Management Act no.7 of 2004 (LEMA).

The majority of the species protected by the above-mentioned legislations in South Africa are threatened by agricultural activities (Manyama, 2007) and overexploitation, amongst others (Loundou, 2008). The situation is no different in the Limpopo Province, where the most threatening factors to wild plants include overharvesting, destructive harvesting techniques (Tshisikhawe *et al.,* 2012), ineffective management strategies (Rasethe *et al*., 2013).

It is unfortunate that these factors also pose significant dangers to some plants that have already been identified for conservation priority, and are thus listed in the Threatened or Protected Species (TOPS) Regulation (NEMBA, 2004); commonly referred to in this dissertation as TOPS-listed plant species. The list includes plant species that are known to be threatened, mostly by direct use, or are subjected to potentially unsustainable harvesting practices. Under this regulation, no one is allowed to harvest, trade or export the listed species without a permit (South Africa National Biodiversity Institute, 2011).

1.2 Motivation for the study

Studies such as Tshisikhawe (2002) and Moeng and Potgieter (2011) briefly highlighted the fact that some of the TOPS-listed plants are unsustainably harvested with no authorization (i.e. permits) in rural areas of the Limpopo Province, South Africa. These species include, amongst others, threatened Red data-listed species such as *Alepedia amatymbica* (Moeng, 2010)*, Brackenridgea zanguebarica* (Tshisikhawe, 2002; Moeng, 2010), *Siphonochilus aethiopicus* (Tshisikhawe, 2002; Moeng, 2010; Semenya *et al*., 2013) and *Warbugia salutaris* (Tshisikhawe, 2002; Moeng and Potgieter, 2011; Semenya *et al*., 2013). On the International Union for Conservation

of Nature (IUCN), Red data-listed species are taxa that are at risk of extinction and most urgently in need of conservation action. In South Africa, the list includes species such as *A*. *amatymbica*, which is currently listed as Vulnerable, *B*. *zanguebarica* and *S*. *aethiopicus*, listed as Critically Endangered and *W*. *salutaris*, listed as Endangered (South African National Biodiversity Institute, 2013).

The current study comprehensively investigated the patterns of use of the above-mentioned species and local management practices. This knowledge will lead to better local, provincial and national management of this precious resource.

1.3 Purpose of the study

1.3.1 Aim

The aim of the study was to investigate the use and local management of selected TOPS-listed plant species in the Limpopo Province.

1.3.2 Objectives

The objectives of the study were to:

I. Document different use categories of selected TOPS-listed plants. The results will contribute to the compilation of a database regarding the use of these species in the Limpopo Province.
II. Identify anthropogenic threats to each species. Findings will assist local nature conservators to identify and implement appropriate strategies to prevent further impact of the recorded threats to each species.
III. Document local strategies used to manage selected species. This finding will reveal whether these strategies are both sustainable and effective.

1.4 Research questions

I. What are the uses of the selected TOPS-listed plants in the Limpopo Province?
II. What anthropogenic action threatens each species in their natural environment?
III. Which local management strategies are applied to these plants?

1.5 Limitations of the study

Although the current study achieved its aim and objectives, there are number of limitations that must be acknowledged. For example, in the study, an interpreter was used in two districts, namely; Mopani and Vhembe. In most cases when there is an interpreter involved, some meaning or statements are lost in the interpretation.

Lack of trust was another problem, especially when I, the researcher could not talk to the person directly maybe due to lack of knowledge in the language spoken. I was then treated like an outcast, and the interviewee becomes sensitive and suspects he/she is being used to gain access to knowledge to make money and produce western medicine, which will disadvantage traditional practices. In order to protect their indigenous knowledge, interviewees may not fully disclose all information or even truthfully.

1.6 Composition of dissertation

This dissertation consists of seven chapters on several diverse, but inter-related, aspects of the utilization and local management of the selected TOPS-listed plants species.

Chapter 1 highlights the importance of plants to people, legislation protecting the TOPS-listed plant species, threats to the plants, and the purpose of the Threatened or Protected Species Regulations. Furthermore, it provides the motivation for the study, purpose of the study, research questions, limitations of the study, and composition of the dissertation.

Chapter 2 provides details on the TOPS-listed plant species included in the study; information on their botanical description, habitat and distribution, as well as their uses.

Chapter 3 reports on harvesters of TOPS-listed plants, the threats to the selected TOPS-listed plant species, current management practices, legislations and approaches to conservation and sustainable use. **Chapter 4** provides a description of the study area, description of vegetation types, species selection criteria, demographics of the human population, data collection, the ethno-botanical survey conducted, specimen collection, personal observations and data analysis.

Chapters 5, 6 and 7 report on the results of the study. More specifically, chapter 5 gives an overview on the use of the TOPS-listed plant species that are utilized to treat different ailments, diseases categories, and parts of plant used. Furthermore, the method of preparing the remedy, mode of administration, source of plant, and perception on their local availability are dealt with in this chapter. Threats to the selected species, approaches to conservation and sustainable use are presented in chapter 6. This chapter also incorporates results pertaining to the different harvesting techniques employed, perceptions on cultivation, sustainable approaches to conservation, and proposed conservation strategies. Chapter 7 consists of research findings related to management; including current local management practices implemented, the level of knowledge on legislation, and future strategies that can assist in the management of the TOPS-listed plants.

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CHAPTER 3

LITERATURE REVIEW

3.1 Uses of TOPS-listed plants

Throughout the world, many thousands of plant species make an important contribution to the life of local communities (FAO, 1999). It is estimated that around one billion people use wild plants daily (Bharucha and Pretty, 2010) which include TOPS -listed plant species.

3.1.1 In Africa

TOPS-listed plant species are highly used in different parts of the world, an estimated 80% of people in developing countries still depend on local medicine to meet their health care needs (Ribeiro *et al*., 2010). In different parts of Africa, the use of plants as medicine is high due to limited access to hospitals and other modern medical facilities are limited and they are extensively used in health care systems (Elegami *et al*., 2002 and Koduru *et al*., 2007). The use of TOPS-listed plants for medicinal purposes is a common practice among both traditional healers and lay people (Jordan *et al*., 2010).

For example, in the southern and eastern Africa, *A*. *amatymbica* is snuffed, burnt or inhaled for the treatment of pains in the stomach, for colds and chest complaints (Watt and Brandwijk, 1962). In Zimbabwe, the same species is used to treat headaches and abdominal pains (Gelfand *et al*., 1985). In the same country, it is also used as treatment for asthma, influenza, diarrhoea, and abdominal cramps and to treat colds, coughs rheumatism, and wounds (Maroyi, 2008; Gelfand *et al*., 1985). Furthermore, it is considered as one of the ten most recognised medicinal plants in this country (Maroyi, 2008). Swati people in Swaziland make a decoction of the root and drink it to treat influenza (Watt and Brandwijk, 1962).

In Zimbabwe, *D*. *sylvatica* is used as a traditional medicine for the treatment of skin problems and rheumatism, the rhizome of this species is rubbed on the skin for treatment (Cogne, 2002). In this country, it is also used for physical disorder characterised by pain and swelling of the joints, it is also rubbed on the skin and it causes an inflammation and itching on skin (Gelfand *et al*., 1985). Furthermore, used as an infusion to apply on cuts and sores, both for humans and animals (Tredgold, 1990). According to Neuwinger (1996), in Cameroon and Madagascar this species is used to treat abscesses, boils and wound infections.

In Zimbabwe, Njelele and Shamrock resettlement farmers use *D*. *sanguinea* for the treatment of bovine dermatophilosis and ticks in livestock (Ndhlovu and Masika, 2013). This species is used in Tanganyika (currently known as United Republic of Tanzania) as an arrow poison and in the western part of this area (Ufipa) it is used by the Nyika tribe in preparing an arrow poison known as *ulembe* (Watt and Brandwijk, 1962). In the eastern Botswana, Tswapong North, a study revealed that people in this area use *D*. *sanguinea* for female infertility, venereal diseases and blood purifications (Motlhanka and Nthoiwa, 2013). Another study in Botswana indicated that the pieces of this species are added into the water that the widow or widower must bath with, to remove bad luck and a piece is carried to every place they visit for the first time after the funeral (Setshogo and Mbereki, 2011).

In Uganda, *W*. *salutaris* is used for the treatment of TB (check on internet). In Tanzania, this species is used for toothache and widely in Africa for coughs and colds (Watt and Brandwijk, 1962). In Zimbabwe, this plant species is used for abdominal pains, abortion, aid to divination, headache (bark powder applied on incision), venereal diseases and remedy for all diseases (panacea) (Gelfand *et al*., 1985). In this country, another study by Mukamuri and Kozanayi (1999) indicated that it used for the treatment of diarrhoea, fever, indigestion, loss of appetite, pneumonia, snake bites and charm. These authors further indicated that it is used during the ritual strengthening of men whose wives are accused of infidelity (Mukamuri and Kozanayi, 1999). In Kenya, a study was conducted in the Sekanani valley and it was found that participants used *W*. *salutaris* for treatment of fever, malaria and chest complains or pneumonia (Bussmann *et al*., 2006).

In Swaziland, Swati people use *S*. *aethiopicus* to treat malaria, relieves pains in women during menstruation (Watt and Breyer-Brandwijk, 1962). The Igede people of Benue State of Nigeria eat the rhizomes raw as food for general wellbeing (Igoli and Obanu, 2011).

The Nyamwezi people in the South-eastern Africa use the bark of *B*. *zanguebarica* to treat wounds and the powdered herb is inserted into scarification as an antidote for snake-bite (Watt and Brandwijk, 1962).

3.1.2 In South Africa

In South Africa, approximately 300 million people depend on plant resources and they are used to fulfil different needs (Petersen *et al*., 2012) of community members and traditional healers. Meyer and Afolayan (1995) estimated that between 12 and 15 million or 60% of South Africans still use traditional remedies from as many as 700 indigenous plants species. According to Williams and Shackleton (2002), major reasons for this high utilization are due to their affordability, accessibility, and acceptability over western medicine.

Consequently, in the Eastern Cape, traditional healers and community members highly recommend *Alepidea amatymbica* for treating diarrhoea (Appidi *et al*., 2008). According to these authors, this species is also used for asthma, influenza, abnormal cramps, sore throats and rheumatism (Appidi *et al*., 2008). Furthermore, another study by Afoloyan and Lewu (2009) revealed that this species is used to treat colds, influenza, chest complaints, diarrhoea, bleeding wounds and wounds. This was also supported by Suliman *et al*. (2010) who indicated that this species is used for colds and flu. In a study by Manana (2003), the author indicated that in Pretoria area (Gauteng province) this species is used by traditional healers to treat coughs, TB, asthma, fever, colds, influenza, sore eye, smoke is used as cigarette, bee repellent from hive. Another study by Sobiecki (2008) revealed that this species is smoked or taken as snuff by diviners to assist communication with ancestors and divination and can also be used to wash the divining bones. In KwaZulu-Natal province, Zulu herbalists prescribe this plant to their patients to help preventing nervousness (Pujol, 1990). In the same province, this species was found to treat colds, chest complaints, asthma, influenza, diarrhoea and abdominal cramps, sore throat and rheumatism (Hutchings, 1996; Watt and Brandwijik, 1962)

According to Todd *et al*. (2004) B. *zanguebarica* is used to protect people against witchcraft, protect homestead from evil people, performing magical activities, treatment of wounds, swollen ankles, discouraging opponents in sporting events such as soccer. In the Limpopo province, A study by Tshisikhawe and Van Rooyen (2012) indicated that this species is used by Venda people for magical purposes and also used for treatment of wounds, worms, amenorrhea, swollen ankles and aching hands. In the same area, it was revealed that this species is used for protection of homesteads

and territories; it is believed to magically discourage enemies from entering the treated area or homestead (Mabogo, 1990). A study by Sobiecki (2002) mentioned that the powdered root is rubbed on the body to treat mental illness, the root is smoked to induce visions and it is also used for psychoactive purposes such as dream induction, mental disorder, insanity and hallucinatory.

In KwaZulu-Natal, the Zulu people use *D*. *sylvatica* to make lotion from tuber for udder in mastitis and for douche in infections of uterus in the cow (Watt and Brandwijk, 1962). In the same province, it was revealed that Zulu people use the water heated in the scooped-out tuber to treat sores and wounds in humans and animals (Kelmanson *et al*., 2000). Furthermore, McAnuff *et al*., 2002 indicated that anciently this people also use this species to treat urinary and mamillary cattle disorders. In the Eastern Cape and Western Cape, this plant species is also used for epilepsy, good luck, wounds, vomiting and chase away evil spirits (Mintsa Mi Nzu, 2009). According to Boshoff (2006) this species is used as a body wash to ward off evil. A study in the Nkokobe municipality, Eastern Cape, indicated *D*. *sylvatica* is used for treating wounds and sores (Wintola and Afloyan, 2010).

According to Marx *et al*. (2006), *D*. *sanguinea* is prepared as a tea to treat veneral disease, abdominal pain, backache, hypertension and the powder from the bulb is used for the treatment of bronchitis, asthma and influenza. Another study by Marx *et al*. (2005) indicated that this species is well known for livestock poisoning and also used to treat various ailments such as blood purifier, abortifacient, expectorants, emetics, diuretics and heart tonics. Furthermore, used to treat paralysis, sexual drive, dysmenorrhoea, excessive menstruation, and infertility and also applied to rheumatic and gouty joints (Marx *et al*., 2005). In the North-West province, it was found that Setswana-speaking people use this species as ethno-vetenary medicine for the treatment of; general intestinal diseases, internal parasites, blood cleansing, gall sickness, heart water, redwater, sores and retained placenta (Van der Merwe *et al*., 2001). In the Limpopo Province, in the Bochum area it was found that this species was amongst the three most frequently used medicinal plant species (Mongalo, 2013)

Siphonochilus aethopicus is used for the treatment of cough, asthma, menstrual cramps, abdominal pains, malaria and hysteria in humans (Neuwinger, 2000). A study by Watt and Breyer-Brandwijk (1962) revealed that the rhizomes of this species are

used for treating horse diseases; it is administered to horses as prophylactics. A study by Van Wyk *et al*. (2000) indicated that this species is used for the treatment of coughs, influenza, asthma, dysmennorhoea, hysteria and to relieve colds and can also be taken for pain relief. In Mpumalanga Province, traditional healers indicated that they use wild ginger for healing coughs, colds, flu, hysteria, malaria, menstrual disorder, to protect against lightning (Manzini, 2005). In KwaZulu-Natal province, it is used by Zulus people as a protection against lightning and snakes (Hutchings, 1996). This species is also used to treat headache, mild asthma, sinusitis, sore throat, thrush and candidacies syndrome (Lewis, 1989). This species was found to be amongst many plants used by traditional healers to treat malaria in KwaZulu-Natal (Pillay *et al*., 2008).

In Pretoria area of the Gauteng Province, *W*. *salutaris* is used for the treatment of coughs, ulcer, dyspepsia, diarrheoa, diabetes (Manana, 2003). According to Suliman *et al*., 2010 indicated this species is used to treat acute and chronic bronchitis, coughs from colds or flu, fever and emphysema. This species is used for skin care; a lotion made from leaves of this species is used to treat fungal infections (Mokoka *et al*., 2010). A study by Eloff (1998) in Kwa-Zulu natal revealed that this species is used for expectorant, rheumatism, malaria, sores, colds, coughs, venereal diseases, constipation and stomach ulcers. According to Maroyi (2013) the parts of *W*. *salutaris* are used to treat including abdominal pains, backache, blood disorders, chest complaints, colds, coughs and febrile complaints. Furthermore, indicated that it is used to treat fever, headache, inflammations, influenza, irritations, malaria, respiratory, complaints, rheumatism, sores, stomach ulcers, toothache, and venereal diseases (Maroyi, 2013). The bark of this species is known to be used for serious coughs which produce sputum-containing pus, headache and taken orally as expectorants to promote secretion of mucous from the respiratory system (Van Wyk *et al*., 2000). In Mpumalanga, a study by Manzini (2005) indicated that *W*. *salutaris* was one of the species traditional healers ranked as number one from all the species they used.

3.2 Harvesters of TOPS-listed plants

In South Africa, an estimated R2.9 billion per annum was generated in 1998 from commercial trading of plant resources (Mander, 1998), including some TOPS-listed species. Numerous studies (Williams *et al*., 2001; Botha *et al*., 2004; Magoro, 2008) noted that the activities of commercial harvesters, in addition to harvesting by local

community members and traditional healers, significantly threatened the persistence of some medicinal species (many of which are now listed in TOPS) in open access/uncontrolled communal lands (Moeng, 2010). Thus, the identification of trespassers who are active in a particular area, the legislative establishment of collection quotas, and the granting of access by local chiefs to collection areas, has become vital for species conservation.

3.3 Threats to TOPS-listed plants

According to Hilton-Taylor (1997), many of vascular species are at the brink of extinction. Kala noted in 2000 (Kala, 2000) that globally, approximately a quarter of the 250,000 species of vascular plants may become extinct in the next 50 years. Consequently, the IUCN Red Data List of Plants is used as an approach for evaluating the conservation status of each species. Categories such as Rare, Declining, Near Threatened, Vulnerable, Endangered and Critically Endangered status are of conservation priority. Criteria used to classify each species under a particular category, depends on several factors, which includes the population size, reduction rate and quantitative analysis of their population dynamic.

In South Africa, approximately 40 plant taxa are believed to be Extinct, 450 Critically Endangered, 826 Endangered, 1443 Vulnerable, 490 Near Threatened, 47 Declining and 1478 Rare (South African National Biodiversity Institute, 2013). This pattern is driven mainly by anthropogenic activities such as agricultural activities (Kala, 2000) and over-exploitation (Ali, 2010).

3.3.1 Agricultural activities

Globally, activities associated with agriculture have been negatively impacting biodiversity of plants for over 7000 years (FAO, 2013). This impact is mainly due to the clearance of land for domestication of edible cultivated species, which reduces species diversity and causes homogenisation of species over large tracts of land (Loundou, 2008). This phenomenon is ultimately caused by population growth and increased demand of certain useful plant species, which are mainly driven by high food demand (FAO, 2013).

Alepidea amatymbica is listed as vulnerable on the Red data list, its population is estimated to have declined at least 30% over the last three generations (60 years) due to loss of suitable habitat for crop cultivation and many more (Williams *et al*., 2008). The *Brackenridgea zanguebarica* species is critically endangered in its natural habitat; according to Williams and Raimondo (2008) the population of this species declined by 86% between the years 1990 to 1997 due to habitat destruction for agriculture.

3.3.2 Over-exploitation

It is estimated that 70% of people in South Africa's rural areas are poor, with an endemic poverty. This is one of the dynamics that lead to over-exploitation of wild plants for short-term financial benefits (Moeng, 2010). People have resorted to trading wild plants for cash income and this problem has led to the rise of a relatively large and expanding "cash" or informal industry (Williams *et al*., 2008). Even poor people from urban areas enter the informal industry of harvesting, processing and trading of wild-harvested products to meet their cultural and economic needs (Petersen *et al*., 2012). Furthermore, there is an increased demand for wild plants from international markets, which enlarged harvested quantities, and the number of collectors. This rising demand may result in depletion of valuable plants in the natural environment, which will cause severe long-term environmental degradation (Loundou, 2008).

A substance from *Dioscorea sylvatica* species is used to manufacture steroid hormones and from the years 1955 to 1960 which caused a huge population decline of this species (Williams *et al*., 2008). Its tubers are still exploited for local medicinal plant trade and this is preventing recovery of this species (Williams *et al*., 2008). According to Lötter *et al*. (2006), *Siphonochilus aethiopicus* is now extinct over most of its former range, due to unsustainable harvesting for medicinal plant trade and this species is considered the most hunted medicinal plant in *muthi* markets. The bark of *Warburgia salutaris* is excessively harvested for traditional medicine; there has been at least a 50% decline in the country (Williams *et al*., 2008). Due to high demand, this species is endangered and not easily accessible which resulted in imports of its bark from other countries such as Swaziland and Mozambique (Williams *et al*., 2008).

3.4 Current management practices

3.4.1 Bottom-up management approaches

Throughout South Africa, ordinary people are managing and using local natural resources in ways that enhance their lives by providing food, medicine and income (Fabricius and Koch, 2004). According to these authors, people use simple, effective and affordable measures to manage local natural resources, which include, amongst others, local rules, taboos and belief systems that have been developed in particular cultural contexts (Basnet, 1992). This system of managing natural resources is called a bottom-up approach (Basnet, 1992), because locals control resources in their immediate vicinity. For example, in southern Africa, people in some rural villages are granted permission by chiefs and headmen to cut down or collect plants, and those who do not comply are fined a certain amount of money. The money collected is then used in community revenue efforts (Fabricius and Koch, 2004). In every aspect of communal interest, local people have established unwritten laws that have over time become a way of life (Rasethe *et al*., 2013). For example, in many rural areas of South Africa, people are not allowed by cultural restrictions to fell marula trees (*Sclerocarya birrea*) because of the trees' important traditional uses. According to Fabricius and Koch (2004), there are taboos where certain resources in a community are not allowed to be used or harvested at certain times. For instance, felling trees is not allowed in graveyards because of the belief that they affect the souls of the deceased (Mabogo, 1990). Stem bark used for medicine is harvested on the eastern side of a tree because of the belief that more healing is stored on this side of a tree (Ndawonde, 2006). This method of harvesting prevents a plant from being ring-barked (Magoro, 2008). Overall, the above-mentioned beliefs and taboos assist in protecting plant resources from excessive use (Rasethe *et al*., 2013).

However, bottom-up approach has its constrains that can lead to ineffective management of natural resources. In the Limpopo Province, various reasons were reported for traditional laws that were not effective; these include, users of the resources who do not comply with the laws, traditional leaders being inexperienced in implementing and enforcing regulations, as well as very young leaders who do not command respect (Rasethe *et al*., 2013).

3.4.2 Top-down management approaches

Due to the influence of western ways of managing natural resources, state-implemented laws are not effective because local people are excluded from the planning and execution of conservation strategies (Fabricius and Koch, 2004). According to Fabricius (2004), this system of managing natural resources is called a top-down approach, because government is making all decisions and enforce them to the local people without involving the ideas of locals regarding the management of their surrounding natural resources. State agencies, however, claim that indigenous people regularly violate conservation laws that lead to the depletion of natural resources (Sodhi *et al*., 2008).

This system creates disruption and suspicion, because local communities have limited access to their surrounding natural resources (Basnet, 1992). According to Shackleton and Shackleton (2002), local people in Asia and southern Africa regularly complain about this approach, which deny them access to some natural plant resources such as firewood. According to Boonzaaier (2009), a top-down approach to managing natural resources has disappointing results in most cases, and always results in local communities being dissatisfied, consequently leading to the secret and illegal overexploitation of natural resources in communal lands (Lindemann-Matthies *et al.,* 2010).

3.5 Legislations

3.5.1 The need for appropriate legislations

Post 1994, the South African Government recognised the important role of natural resources in the livelihoods of rural communities and future economic development strategies (Lupuwana, 2008). Therefore, several initiatives such as the development of legislations and regulations have been taken to achieve the conservation of, and sustainable use of wild plant resources (Loundou, 2008). This is supported by the Constitution of South Africa, which promotes the value of conservation and the right to use products of the natural environment in a sustainable manner (Constitution of Republic of South Africa, 1997). One of the major ways to achieve sustainable use of natural resources is through legislation, including national legislation developed in order to control and monitor harvest and trade of wild plant species, especially those

that are threatened (Schippmann *et al*., 2006). Through the developed legislations, district environmental authorities were established and management of local resources was given back to the local councils. This affirmed that all land is vested in the local people and further acknowledged the need for protection of the environment (Constitution of Republic of South Africa, 1997). It charged any person that occupies or owns any piece of land to manage and utilize it in accordance with environmental legislations (NEMBA, 2004). Legislation of relevance to the Limpopo Province includes the National Environmental Management Biodiversity Act 10 of 2004 (NEMBA) and the Limpopo Environmental Management Act 7 of 2004 (LEMA).

3.5.2 National Environmental Management Biodiversity Act

The National Environmental Management: Biodiversity Act provides for the management and conservation of biological diversity within South Africa, and the sustainable use of biological resources. In terms of sections 56 and 57 of this Act, no one is allowed to harvest or trade specimens of species listed as threatened or protected without a permit. This is the only existing legislation that is able to provide for the protection of species at a high risk of unsustainable use. Categories in which species are listed in TOPS include, critically endangered, endangered, vulnerable, and protected. Restricted activities involving specimens of species listed as threatened or protected are specified in the Act. A permit is required before carrying out the following activities: collect, pick parts of, cut, uproot, trade and buy.

3.5.3 Limpopo Environmental Management Act

In the Limpopo Province, the Limpopo Environmental Management Act (LEMA) prohibits any person without a permit to pick, sell, purchase, donate, receive as gift, be in possession of, import into, export or remove protected plants or specially protected plants (LEMA, 2004). Furthermore, it prohibits any person from picking any indigenous plant on a public road, within a distance of 100 m on land next to a public road, in a provincial or private Nature Reserve, and within a distance of 50 m on either side of a natural water course (LEMA, 2004).

3.6 Conservation

3.6.1 Approaches to conservation and sustainable use

It is increasingly impossible to accurately monitor and control the exploitation of wild plant resources used for trading, primary healthcare and domestic purposes (Cunningham, 2001). This, coupled with destructive harvesting techniques and overexploitation, has placed both wild plant species and their ecosystems at real risk of extinction (Loundou, 2008). Extinction can only be avoided by ensuring their conservation (Dold and Cocks, 2002). According to Kala (2000), different approaches to conservation of wild plant resources include cultivation and sustainable harvesting practices.

3.6.1.1 Cultivation

Government and other stakeholders, such as non-governmental organisations (NGOs), encourage the cultivation of wild plant species due to their increasing decline in the natural environment (Loundou, 2008). This method is highly recommended and has been proved to have the potential to reduce the pressure exerted on wild plants used for self-medication and trade. For instance, Wiersum *et al*., (2006) found that most people in the Amatola region of Eastern Cape, cultivate species such as *Agapanthus praecox*, *Drimia elata*, *Haworthia attenuata* and *Hypoxis hemerocallidea* for both trading and self-medicating purposes. To further strengthens the community's culture of cultivating medicinal plants, Wiersum *et al*., (2006) initiated a training workshop at a medicinal plant nursery. Interestingly, after attending this work/shop the interest of community in cultivation of medicinal plants further increased. Similarly, Botha (2006) found that most influential traditional healers who participated in community outreach nurseries located in urban, rural and peri-urban areas across South Africa initiated for the past six years (starting from the duration of her study), still cultivated sufficient volumes of medicinal plants to meet their needs and no longer harvest from the wild. Semenya *et al*. (2013) noted that in the Capricorn, Sekhukhune and Waterberg districts of Limpopo Province, cultivation is becoming socially acceptable, notwithstanding a commonly held perception (Mabogo, 1990) that cultivated specimens of medicinal species are not as effective as wild specimens. Generally, positive outcomes from the afore-stated studies clearly show that cultivation

of medicinal plants, especially those that threatened can be aid in reducing harvesting pressure of similar species distributed in the wilderness.

3.6.1.2 Sustainable harvesting practices

Cocks and Dold (2002), Schippmann *et al*. (2006) and Semenya (2012) reported that sustainable harvesting techniques of wild plants does not impact the survival of the harvested plant, therefore, has a positive impact on their conservation. Furthermore, since cultivation is not always achievable due to a preference for wild harvested plants, sustainable harvesting from wild stocks is recommended (Loundou, 2008). This method is considered the best because most people in rural areas, including traditional leaders, still adhere to beliefs that prevent over-utilization (Tshisikhawe, 2010). For instance, harvesting of bark by Bapedi traditional healers is done on the eastern part of the tree (Magoro, 2009). This kind of method was noted by Kambizi and Afolayan (2006) as sustainable, because it does not affect the survival of an individual plant. According to Kabala *et al*. (2009), fruits can also be harvested sustainably by hand-picking from lower branches, shaking stems or branches, and also by picking from the ground following abscission.

Sustainable harvesting is not always achieved, especially due to high levels of poverty and extensive population growth that has let to rapidly growing informal plant trade industry (Dold and Cocks, 2002). The demand of plant products for medicinal trade has impacted negatively on the plant populations from local natural environments because of unsustainable harvesting practices (Loundou, 2008). According to Petersen *et al*. (2012) nearly 70% of all harvested flora either killed or reproductively harmed through these practices. The main drivers of unsustainable harvesting practices include illicit industry which is increasingly triggering number of resource extractors who are motivated by cash income (Botha *et al*., 2004a). As a result, the cash-driven demand for natural resources brings about profound consequences for conservation and the management of biodiversity (Botha *et al*., 2004a; Petersen *et al*., 2012).

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CHAPTER 4

MATERIALS AND METHODS

4.1 Study area

This study was carried out in the selected areas situated in the five districts of the Limpopo Province (South Africa), namely Capricorn, Sekhukhune, Mopani, Waterberg and Vhembe (Figure 4.1). With the exclusion of Haenertsburg (Tzaneen local municipality) and Lebowakgomo (Lepelle Nkumpi municipality) which are semi-urban, the rest of the studied areas are rural in nature and falls under the traditional leaderships.

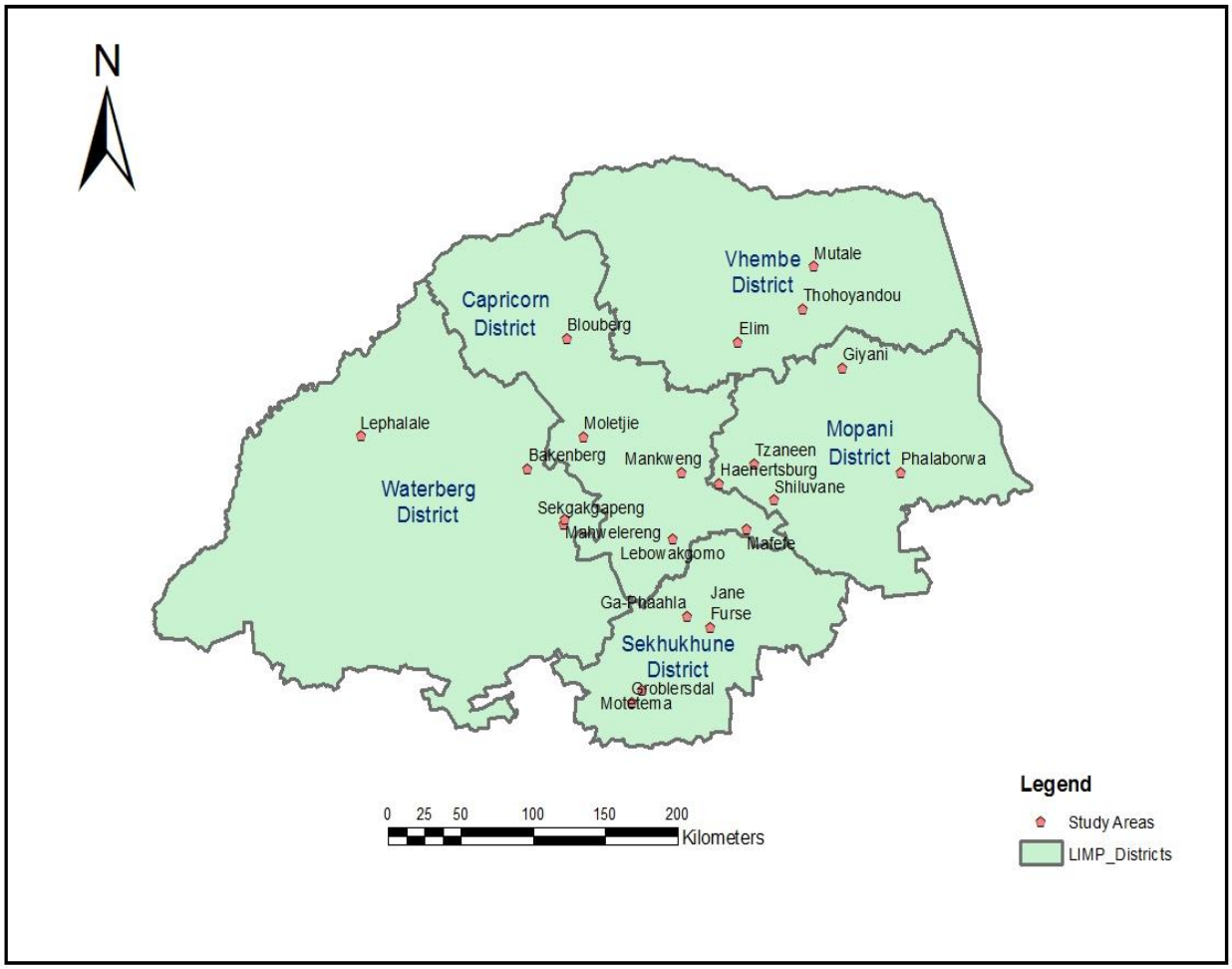

Figure 4.1: (Source: Nelwamondo, 2016) Main areas surveyed in the five districts of the Limpopo Province, namely; Capricorn, Sekhukhune, Mopani, Waterberg and Vhembe.

4.2 Description of vegetation types

The vegetation in the Limpopo Province belongs to the savanna biome, which is characterized by a mixture of trees, shrubs and grasses. Savanna woodland is characterised by a diverse flora, with useful plant species that locals utilise to meet their livelihood needs (Mucina and Rutherford, 2006). In this province, each district has a unique dominant vegetation type.

4.2.1 Vegetation types in the five districts of the Limpopo Province

According to Mucina and Rutherford (2006), the vegetation types of the Limpopo districts and villages vary with respect to their dominant species (Figure 4.2).

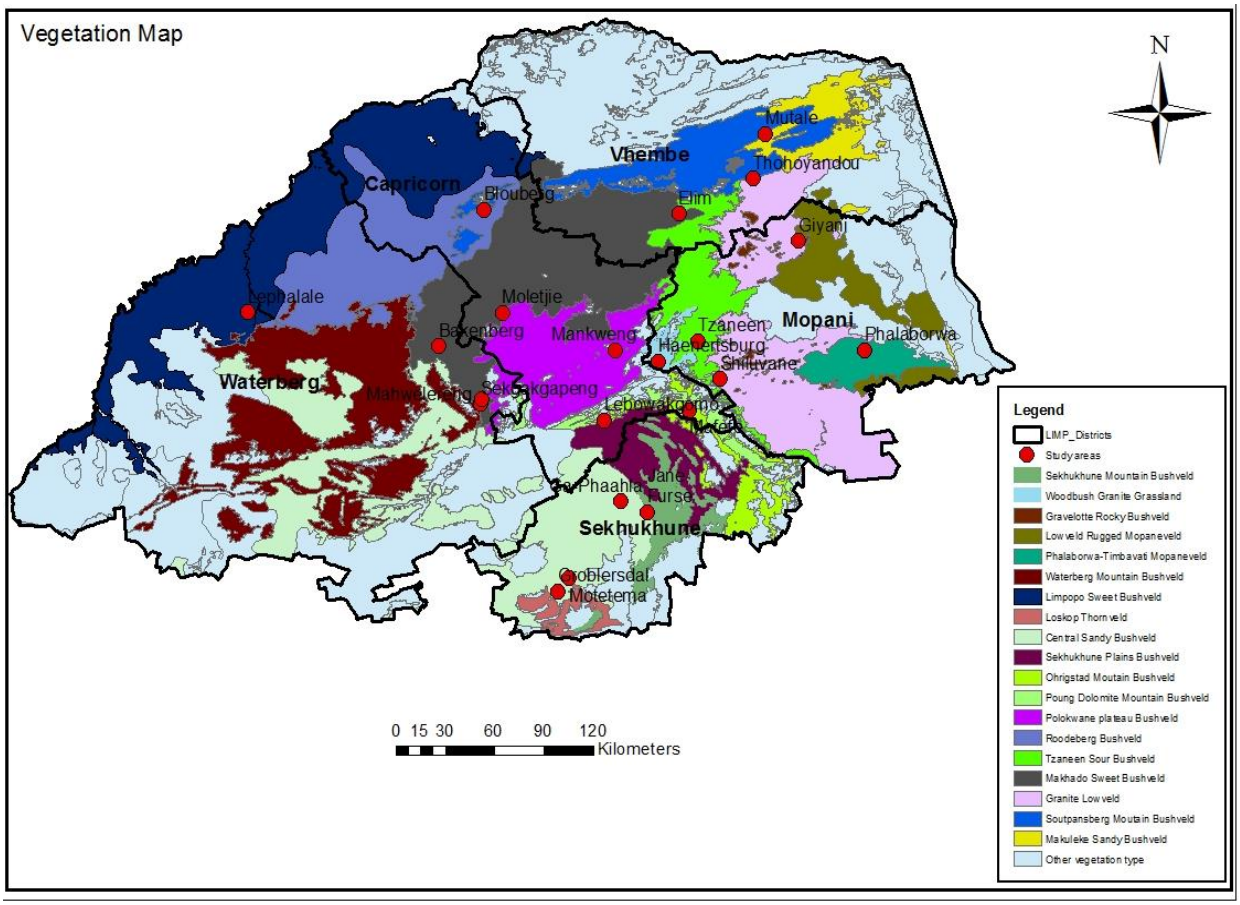

Figure 4.2: (Source: Nelwamondo, 2016) Vegetation types in the main areas surveyed in the five districts of the Limpopo Province namely Capricorn, Sekhukhune, Mopani, Waterberg and Vhembe.

In the **Capricorn district**, most areas surveyed fall under the Polokwane Plateau bushveld. This vegetation type consists mainly of trees such as **Vachelia caffra*, *A*.

rehmanniana, *Ziziphus macronata* and *Combretum molle*. The dominant shrubs species include, amongst others; *Gymnosporia senegalensis*, *Combretum hereroense* and *Euclea crispa*.

With respect to the vegetation varieties of **Mopani district** and associated studied areas, it is mainly dominated by Granite Lowveld. Common tree species in this veld type include *Combretum hereroense*, *Grewia bicolor* and *indigofera schimperi*. Herbaceous species such as *Indigofera filipes*, *cucumis africanus* and *Achyranthes aspera* and shrubby species, such as *Combretum hereroense*, *Commiphora africana* and *Pavonia burchellii*, are also widespread.

Central Sandy Bushveld is the predominant vegetation type in the **Sekhukhune district**. Generally, this vegetation type is dominated by tree species, with the common ones being *Acacia burkei*, *Sclerocarya birrea* subsp. *caffra*, *Terminalia sericea* and *Peltophorum africanum*. However, shrubby species (*Indigofera filipes*, *Felicia fascicularis*, *Combretum hereroense* and *Strychnos pungens*) and herbaceous species (*Asparagus buchananii*) are also quite prevalent in the Central Sandy Bushveld.

The Soutpansbrg Mountain Bushveld occurs in the **Waterberg district**. This vegetation type is dominated by small trees: *Acacia karroo*, *Ziziphus mucronata* and *Boscia foetida* subsp. *rhemanniana.* Tall shrubs include: *Euclea undulata, Dichrostachys cinerea* and *Grewia flava.* Herbaceous climbers includes; *Momordica balsamina* and *Rhynchosia minima* and herbs such as *Aspilla mossambicensis, Indigastrum parviflorum*, and *Nidorella hottentotica* are also prevalent.

The mountainous and hilly **district of Vhembe** is dominated by the Soutpansberg Mountain Bushveld, comprising mainly of trees such as *Acacia karroo, Catha edulis*, *Combretum molle* and *Ziziphus mucronata* and shrubs such as *Carissa edulis*, *Myrothamnus flabellifolius* and *Pavonia burchellii*. The Makhado Sweet Bushveld is dominant in the Waterberg district and sampled villages. Most of the dominant trees species include *Acacia erubescens*, *A*. *gerrardii*, *Combretum apiculatum* and *Terminalia sericea* and common shrubs include; *Commiphora pyracanthoides*, *Grewia flava* and *Barleria lancifolia*.

4.3 Demographics

In terms of its human population, the Limpopo Province has a culturally mixed population of about 5 million people (Census, 2011). In this province, the main ethnic groups are Vha-Venda, Vha-Tsonga and Bapedi. Of these ethnic groups, the Bapedi are dominant in the Capricorn, Sekhukhune and Waterberg districts, while the Vha-Venda are dominant in the Vhembe district, and the Vha-Tsonga in the Mopani district. Different demographic factors such as racial groups, gender, age, education and employment are presented below.

4.3.1 Racial composition

The statistics (Census, 2011) indicates that most people in the Limpopo Province are black, followed by whites, while Indians and coloured people constitute a very small percentage across the province (Figure 4.3). Across all districts, Waterberg has the highest percentage of whites, while Sekhukhune and Vhembe have the smallest. Blacks were the studied racial group because they are dominant in all districts of the province.

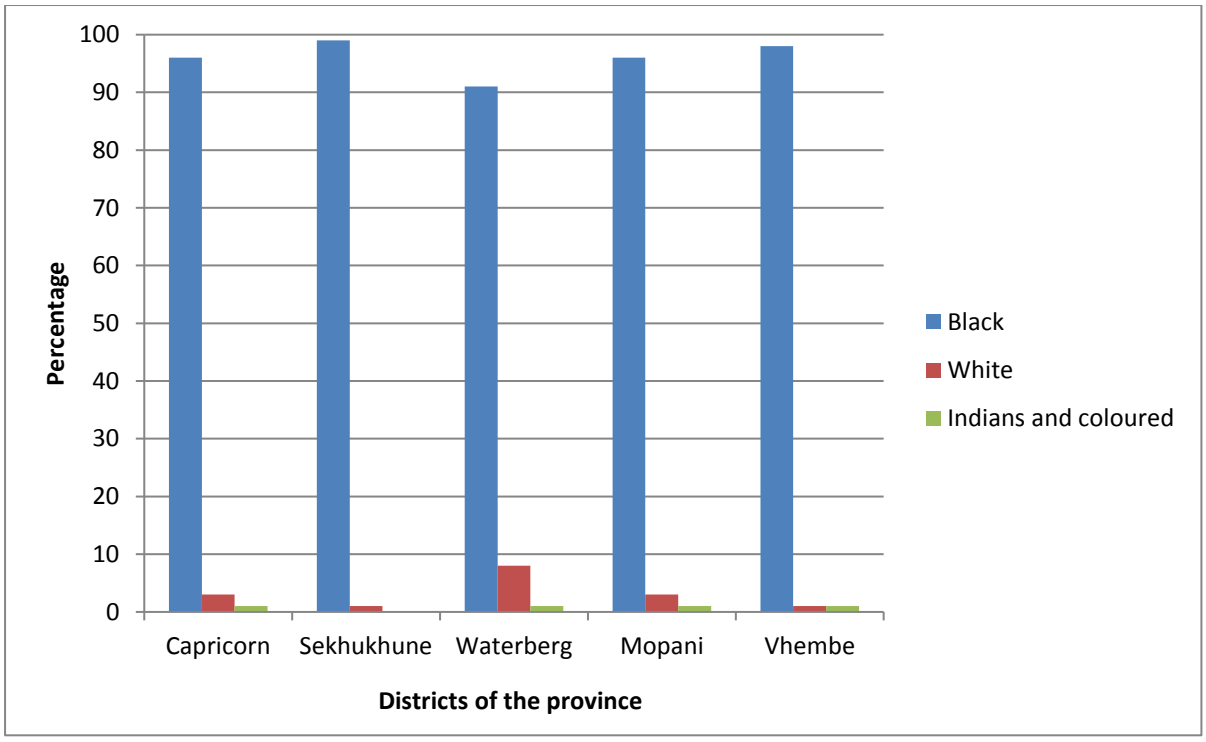

Figure 4.3: The different racial composition in the five districts of the Limpopo Province (Source: STATS SA, 2011).

4.3.2 Age

In all five districts of the province, the largest age group is 15–64; Waterberg has the highest number of people in this age group (Census, 2011). Generally, the province has few people that are older than 64 (Figure 4.4).

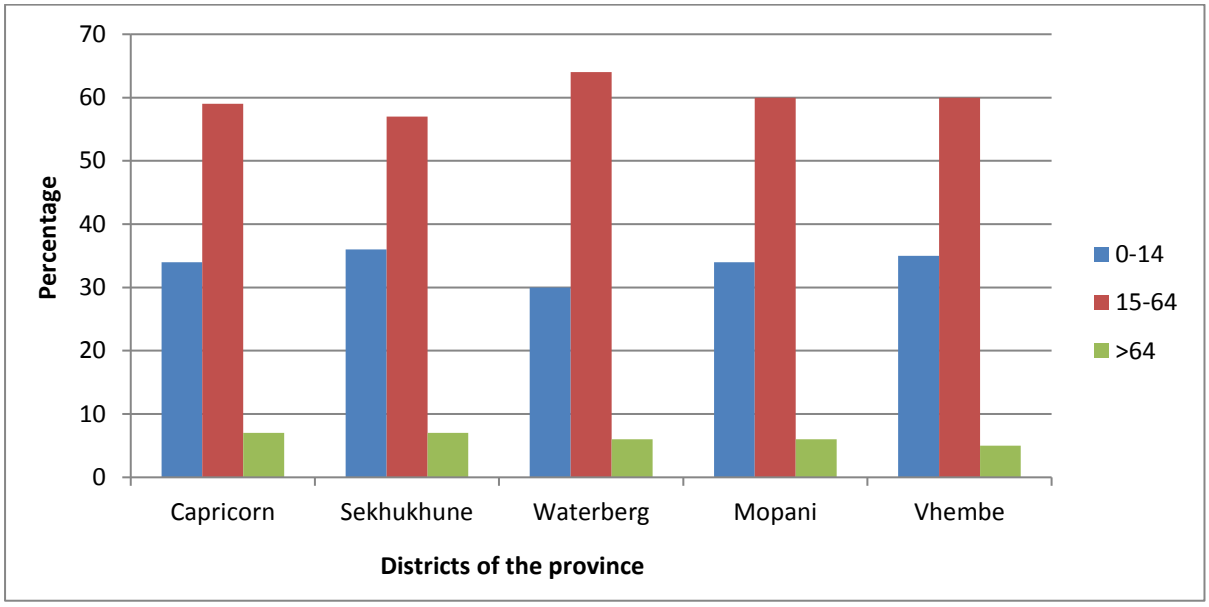

Figure 4.4: Different age groups in the five districts of the Limpopo Province (Source: STATS SA, 2011).

4.3.3 Education

In terms of education, Census (2011) indicates that there is a shortage of people with a higher (tertiary) education. Many people only attended primary schools and very few people have tertiary schooling across the five districts of the province (Figure 4.5). With regard to tertiary schooling, Capricorn district has the highest number of highly educated people of all districts.

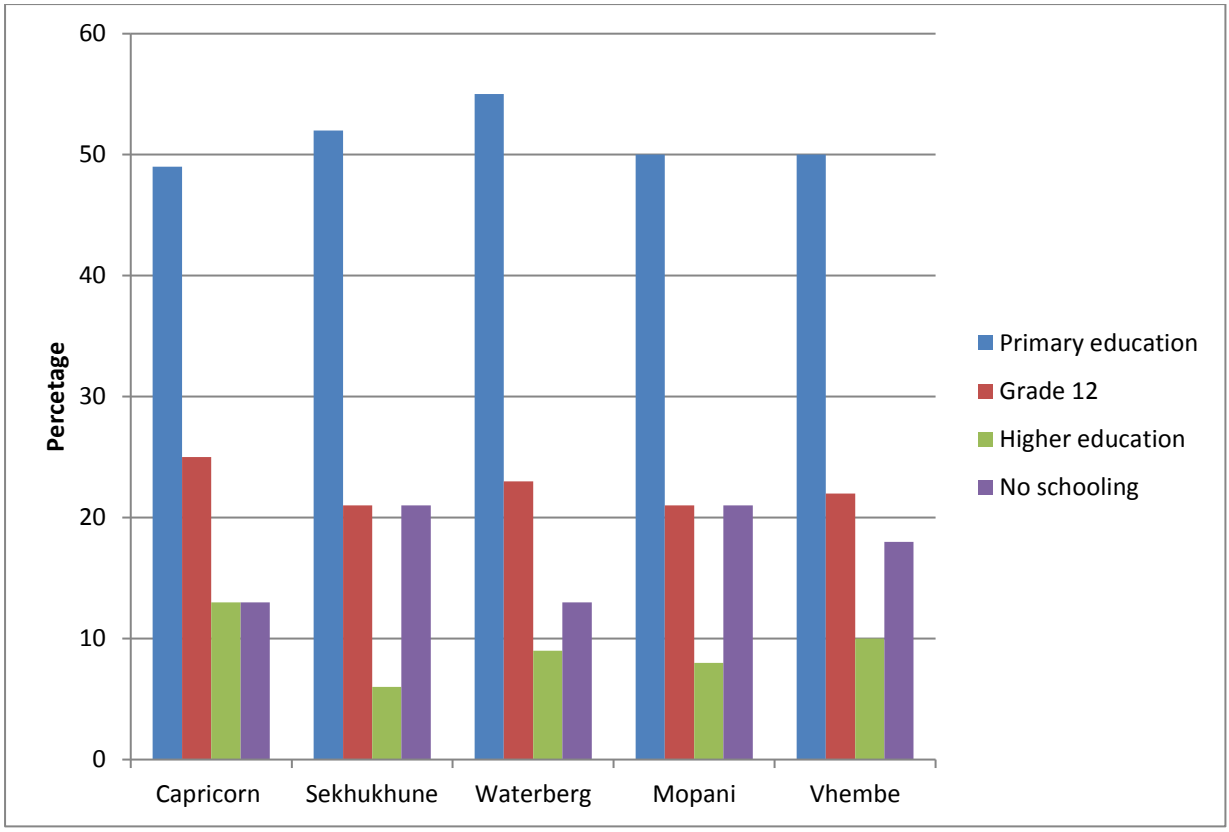

Figure 4.5: The educational levels of people in the five districts of the Limpopo Province (Source: STATS SA, 2011).

4.3.4 Employment

In the Limpopo Province, there is generally high unemployment (Census, 2011); Sekhukhune district is the only district that has a higher number of employed people than unemployed (Figure 4.6). Waterberg district has the highest number of unemployed people of all districts (Figure 4.6).

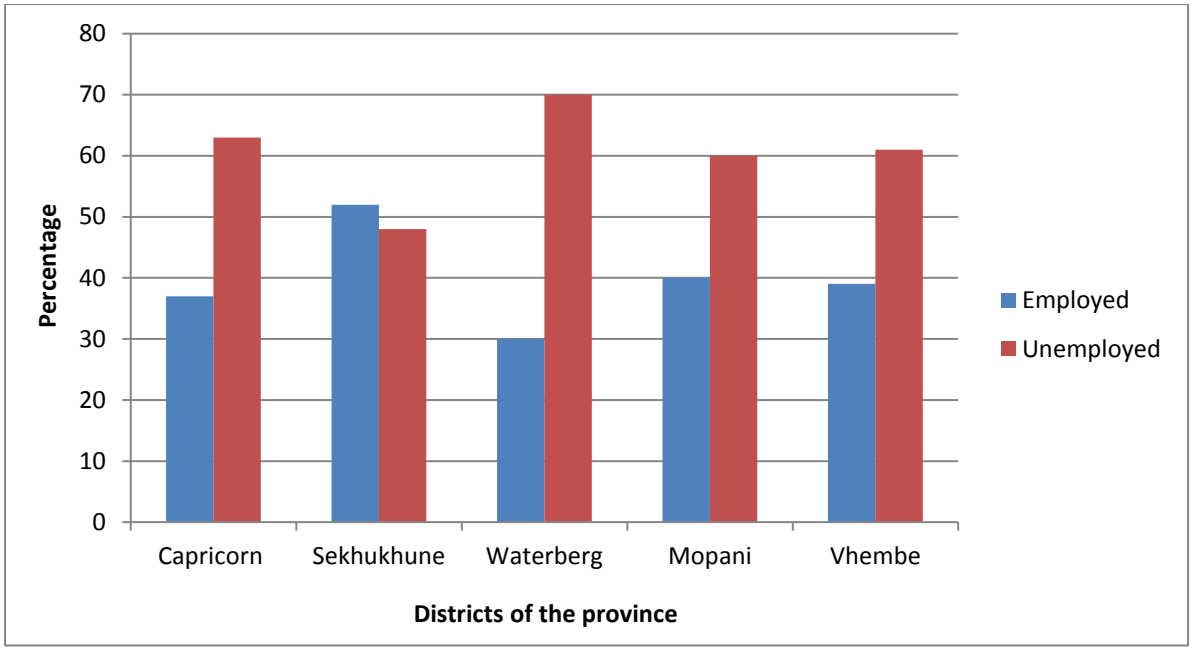

Figure 4.6: The rate of employment in the five districts of the Limpopo Province (Source: STATS SA, 2011).

4.4 Reconnaissance survey and species selection criteria

A pilot survey was first carried out in July 2013 in each studied area to obtain permission to conduct this study within the areas, and also to meet with locals (traditional healers and community members) to request them to participate in the study. Two types of sampling techniques namely random and snowball were used to identify locals. Random was used to select community members, and the latter technique was employed to locate traditional healers with the help of local traditional leaders. The local dialect, Sepedi was used in most areas, and sometimes translators were used to inform participants about the nature of the project, including the aim and objectives.

Locals were shown clear colourful photographs with different morphological features such as barks, leaves, flowers and fruits of various TOPS species occurring in the Limpopo Province. This was done to determine if the locals are aware of this species including their vernacular names and whether they utilise them or not. Most species which were known and used by most traditional healers and community members were selected for investigation in this study (Table 4.1). Importantly, per studied area 25 community members were chosen as participants based on number of people that

knew and used the species, and the selection of traditional healers generally depended on their local availability.

[1]**Table 4.1**: Selected TOPS-listed plant species occurring in the Limpopo Province.

Plant species	**IUCN Red List Status and Criteria**	**Vernacular name**	**Regulated by:**	
			LEMA	**NEMBA (TOPS)**
Alepidea amatymbica	VU A2d	Lesoko /Lesokoane (Sp)	_	X
Brackenridgea zanguebarica	CR A2ad; B1ab (ii,v)	Mutavhatsindi (V)	X	X
Dioscorea sylvatica	VU A2cd	Kgato/kgato ya tlou (Sp)	_	X
Drimia sanguinea	NT A2d	Sekanama/ Sekaname (Sp)	_	X
Siphonochilus aethiopicus	CR A4acd	Serokolo (Sp), Xirhungulo (Ts)	X	X
Warburgia salutaris	EN A2acd	Molaka (Sp), shibaha (Ts), mulanga (V)	X	X
Key: NF: Sp: Sepedi, Ts: Tsonga and V: Venda CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened LEMA: Limpopo Environmental Management Act 7 of 2004 (LEMA), NEMA: National Environmental Management Biodiversity Act (NEMA) 10 of 2004.				

4.5 Data collection and sampling methods

The survey was based on different semi-structured questionnaires to different participants, including; [2]community members, [3]traditional healers, [4]*muthi* traders, [5]traditional leaders and [6]conservation officers (Table 4.2), who were purposely selected (e.i. based on utilisation and knowledge of the selected species).

[1] The selected species are on the proposed new list for TOPS, and the final list is yet to be gazetted.
[2] "Community members" refers to the lay people in a community
[3] Traditional healer is someone who is recognise by the community in which he/she lives as capable of using traditional medicine to provide health care.
[4] *Muthi* trader is someone who sell plant and animal based materials for medicinal purposes (either in shops or along streets)
[5] Traditional leader is someone who is recognised by the community in which he/she lives in as capable of managing the community
[6] Conservation officer is someone whose work involves managing and protecting the environment.

Table 4.2: The surveyed locations and interviewee categories in the Limpopo Province.

Districts	Categories of respondents				
	Traditional healers	**Community members**	**Traditional leaders**	**Conservation Officers**	**Total**
Capricorn	40	25	6	3	74
Mopani	40	25	6	3	74
Sekhukhune	40	25	6	3	74
Waterberg	40	25	6	3	74
Vhembe	20	10	4	3	35
Total	180	110	28	15	331

4.6 Ethno-botanical survey

Surveys were conducted in selected areas of the Limpopo Province (Figure 4.1). These areas were primarily chosen based on the distribution of the selected plant species and communities that use them. Semi-structured questionnaires (Appendices 2-5) were compiled in order to acquire data on the plants use, local management initiatives, and threats, amongst others, of the selected TOPS species. The questionnaires had five sections comprising the: (i) demographic information (ii) plant resource utilization (iii) management strategies and attitudes to them, (iv) anthropogenic threats to the species, and (v) approaches for conservation and sustainable use of plants.

4.7 Specimen collection and personal observation

After interview session with community members and traditional healers, a multipurpose field excursion was organised with each of these participants. This trips was basically for plant identifications (confirmation of whether the species mentioned by participants during interviewing session was correct or not) and specimen collections, personal observations on the abundance of plants and threats, to take photos, record population co-ordinates and to verify harvesting methods used. Collected voucher species of each plant was taken to the Larry Leach Herbarium (University of Limpopo) where their taxonomic identities were confirmed.

4.8 Data analysis

Data collected were analysed quantitatively using the Microsoft Excel spreadsheet. To find the most treated ailments and disease categories, the recorded ailments were grouped into different categories, via frequency analysis.

4.9 Ethical considerations and intellectual properties agreement

The University of Limpopo Ethics Committee granted ethical approval to conduct this study. Similarly, a full consent was sought from all participants' prior data collection. To ensure that the intellectual properties of participants (especially traditional healers) are protected methods of herbal preparation and dosages associated with the investigated species were not included in the final analysis of the results. Furthermore, the a verbal agreement was reached with the participants that this research will not be used for commercial purposes but for academic purposes and to educate the local community of the Limpopo Province and South Africa at large about the TOPS species.

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CHAPTER 5

THE UTILIZATION OF SELECTED TOPS-LISTED PLANTS

5.1 Introduction

The use of traditional medicine to treat various diseases has been part of human culture since ancient times (Watt and Breyer-Brandwijk, 1962; Van der Merwe *et al*., 2001). Despite the influx of western treatments, the use of herbal remedies is still prominent in South Africa, with an estimated 27 million South Africans (in 2002) who self-medicated on traditional medicine at some stage in their lives (Cocks and Moller, 2002). Furthermore, there were approximately 200,000 registered traditional health practitioners in 2006 that are consulted by over 80% of the population (Summerton, 2006). There is a substantial body of South African literature (Mander, 1998; Makunga, 2011; Mongalo, 2013; Leso et al., 2017, amongst others), which confirmed that both traditional health practitioners and lay people mostly prefer plants in the preparation of their medicine. Dold and Cocks (2002) and Lewu (2007) also noted that plant-based materials are preferred irrespective of their conservation status.

As is common in other provinces of South Africa, in the Limpopo Province, harvesting of plants for herbal use by both traditional healers and ordinary people is an everyday practice (Semenya *et al*., 2013a). Ethno-botanical studies (Tshisikhawe, 2002; Magoro, 2008) conducted in this province indicated that medicinal plants are mostly harvested from natural communal environments. These same studies briefly highlighted that such harvesting includes the collection of plants that are officially protected by legislation, such as the Threatened or Protected Species (TOPS) Regulations. Harvesting of these species in the Limpopo Province, especially by traditional healers, is mostly triggered by the high demand for medicinal preparations (Semenya *et al*., 2013b). It is therefore significant and pertinent that a comprehensive ethno-botanical survey be undertaken to determine the extent of reliance of traditional healers and ordinary community members on TOPS-listed plants in this province.

5.2 Aim and objectives

5.2.1 Aim

The study investigated the utilization of the following TOPS-listed plant species: *Alepidea amatymbica*, *Brackenridgea zanguebarica*, *Dioscorea sylvatica*, *Drimia sanguinea*, *Siphonochilus aethiopicus* and *Warburgia salutaris* in different districts of the Limpopo Province.

5.2.2 Objectives

The study had the following specific objectives:

I. To identify different uses of TOPS-listed plant species, including disease categories and ailments treated with these species. The results will contribute to the compilation of a database regarding the TOPS-listed plant species in the Limpopo Province. Furthermore, the outcome will also reveal the principal users of these species.

II. To investigate aspects related to indigenous medicinal remedies such as method of herbal preparation, parts used in remedy preparation, and mode of administration. This will contribute towards the documentation of indigenous knowledge related to the investigated species in the Limpopo Province.

III. To determine factors related to plant collection such as source of plant material and perception of users on their local availability.

5.3 Materials and Methods

5.3.1 Species utilization

Data relating to the use of species was gathered through semi-structured questionnaires from 110 community members (Appendix 2) and 180 traditional healers (Appendix 3), who use the six-selected species. The questionnaires were designed to capture information on the various ailments and afflictions treated. Subsequently, the method used by Hutchings (1989) to categorize ailments was also used; they were grouped by symptoms. For example, high blood pressure, swollen legs and stroke were grouped under circulatory systems because both conditions can disrupt the normal blood flow.

To obtain a deeper understanding into the medicinal remedies prepared by both traditional healers and community members, semi-structured questionnaires (Appendix 2 and 3) were used. Participants were asked about plant parts harvested, and the methods used to prepare the herbal remedies. According to Quinlan (2005), this kind of questionnaire is an accurate, simple, efficient method, and a quick way to collect data for a large sample size.

5.3.2 Medicinal application of plants

Depending on an individual's knowledge with regard to their medicinal application, disease categories such as circulatory, dermatological, digestive, endocrine, immune, nervous, parapsychological, reproductive, respiratory, sexually transmitted infections and skeleto-muscular were recorded. Furthermore, the identity of the investigated plant species used by traditional healers and community members to treat the mentioned disease categories were documented. Though a number of disease categories were mentioned, the focus fell only on the most treated four. Consequently, within each category, the focus was only on the three most treated ailments. Other disease categories, including the treated ailments are presented in Appendix 6.

5.3.3 Plant collection

Information related to the collection of plants by community members and traditional healers were gathered using a data sheet. Here the participants were requested to indicate the source (area) of plant material. For example, whether they collect from homegardens or from the wild, or whether they purchase from *muthi* shops or medicinal plant traders. Participants who collected from the wild were further queried on their perceptions on species availability.

5.4 Results

5.4.1 Species utilization

The six investigated plant species, namely *Alepidea amatymbica*, *Brackenridgea zanguebarica*, *Dioscorea sylvatica*, *Drimia sanguinea*, *Siphonochilus aethiopicus* and *Warburgia salutaris*, are used medicinally in all five districts. In general, traditional healers used these species more than community members (Table 5.1). It was found that the most used species by traditional healers and community members were; *S*. *aethiopicus*, *W*. *salutaris* and *D*. *sanguinea* (Table 5.1). The least used species were *D. sylvatica* and *B. zanguebarica*.

Table 5.1: Frequency of use of investigated TOPS-listed species as cited by community members and traditional healers.

Species	Participants	Districts										Total	
		C		S		M		W		V			
		No	%	No	%	No	%	No	%	No	%	No	%
Alepidea amatymbica	CM	0	0	5	20	7	28	3	12	0	0	15	14
	TH	23	57.5	33	82.5	33	82.5	28	70	4	20	121	67
Brackenridgea zanguebarica	CM	0	0	3	12	2	8	1	4	0	0	6	6
	TH	19	47.5	13	32.5	27	67.5	13	32.5	16	80	88	49
Dioscorea sylvatica	CM	3	12	7	28	3	12	0	0	0	0	13	12
	TH	1	2.5	28	45	24	60	4	10	8	40	65	36
Drimia sanguinea	CM	17	68	15	60	21	84	25	100	6	60	84	76
	TH	37	92.5	32	80	35	87.5	39	97.5	18	90	161	89
Siphonochilus aethiopicus	CM	21	84	22	88	24	96	25	100	8	80	100	91
	TH	40	100	35	87.5	35	87.5	40	100	18	90	168	93
Warburgia salutaris	CM	23	92	19	76	15	60	21	84	5	50	83	75
	TH	40	100	37	92.5	32	80	39	97.5	18	90	166	92

Key: **Sum of: CM per district= 25 (Vhembe=10TH per district= 40 (Vhembe=20)**
C=Capricorn, S=Sekhukhune, M=Mopani, W=Waterberg, V=Vhembe, CM=Community members, TH=Traditional healers

5.4.2 Medicinal applications of plants

Alepidea amatymbica and *B. zanguebarica* were chiefly used to treat parapsychological issues by traditional healers (63.33%, n=111, 60%, n=108, respectively), and more so than community members (10%, n=11 and 20%, n=22, respectively) (Table 5.2). *Drimia sanguinea* was the preferred species for the treatment of circulatory problems (72.78%, n=131 of traditional healers and 66.36%, n=73 of community members). *Siphonochilus aethiopicus* was used predominantly by both groups of participants for treating digestive, respiratory and parapsychological ailments; while *W. salutaris* was used for circulatory, immune and respiratory problems (Table 5.2).

Table 5.2: The use pattern of the selected TOPS-listed species for each disease category.

Species	**Participants**	**Disease categories** (Numbers)													**Total** (Numbers)	
		C	**De**	**Di**	**E**	**G**	**I**	**N**	**O**	**P**	**Rp**	**Rs**	**S**	**Sm**		
Alepidea amatymbica	**CM**	1	0	2	1	0	0	1	0	11	0	2	0	0	18	187
	TH	2	2	11	0	0	4	4	0	114	5	26	0	1	169	
Brackenridgea zanguebarica	**CM**	1	0	1	0	0	0	0	0	22	0	0	0	0	24	158
	TH	4	12	5	0	0	1	3	0	108	1	0	0	0	134	
Dioscorea sylvatica	**CM**	6	1	0	0	0	0	0	0	5	0	0	0	0	12	86
	TH	20	3	3	0	0	6	0	0	42	0	0	0	0	74	
Drimia sanguinea	**CM**	73	17	4	4	0	13	0	0	10	3	2	11	0	137	392
	TH	131	19	15	3	2	16	3	0	33	10	6	16	1	255	
Siphonochilus aethiopicus	**CM**	1	6	77	1	1	1	1	0	35	1	55	2	0	181	466
	TH	2	14	69	3	0	3	8	0	68	1	115	2	0	285	
Warburgia salutaris	**CM**	22	3	3	1	0	14	1	0	5	5	57	3	0	114	380
	TH	67	19	15	2	0	35	3	1	20	5	98	1	0	266	
Total		330	96	205	15	3	93	24	1	473	31	361	35	2		

Key: CM = Community members, TH= Traditional healers, C= Circulatory, De= Dermatology, Di= Digestive, E= Endocrine, G= Genito-urinal, I= Immune, N= Nervous, O= Optical, P= Parapsychological, Rp= Reproductive, Rs= Respiratory, S= Sexually Transmitted Diseases, Sm= Skeleto-muscular.

In each disease category (Table 5.2), the mentioned species were used to treat a variety of ailments. However, shown below are only the four most treated disease categories, the three most treated ailments from each of these categories, and the three most used species. This approach was selected for conciseness of the dissertation.

Circulatory problems

In terms of specific ailments, body pains was the most frequently treated disease, followed by high blood pressure and swollen legs in this disease category (Appendix 6). The mentioned ailments were mostly treated using *D*. *sylvatica*, *D*. *sanguinea* and *W*. *salutaris*.

It was found that across all districts (except the Vhembe district); *D*. *sylvatica* was used mostly to treat swollen legs by both traditional healers and community members (Figure 5.1). Traditional healers and community members in Sekhukhune district mentioned its use for treating body pains. This species was also used to control high blood pressure by traditional healers in Sekhukhune and Mopani districts (Figure 5.1).

Drimia sanguinea was widely used by both survey groups in all districts to treat body pains. In the Vhembe district the only circulatory ailment treated using this species was body pains. This species was also used to treat high blood pressure; this use was mentioned by both groups of participants in Sekhukhune, Mopani and Waterberg districts, but only by community members in the Capricorn district. The use of this species to treat swollen legs was reported mainly by traditional healers (Figure 5.1).

Warburgia salutaris was mostly used to treat body pains by both informant groups, and across all districts, except in the Vhembe district where the knowledge of *W*. *salutaris* as medicine for this ailment was restricted to traditional healers only. Traditional healers in the Capricorn district and community members in the Mopani and Waterberg districts also use this species to control high blood pressure (Figure 5.1).

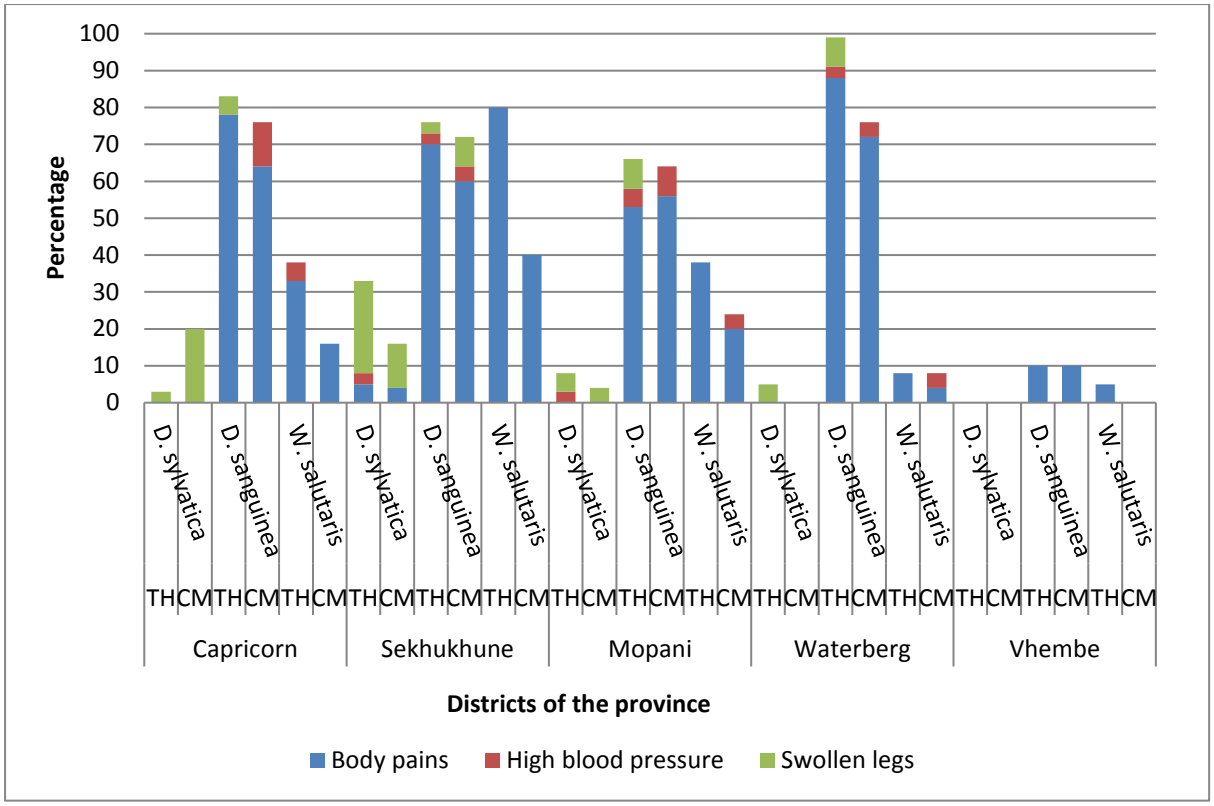

Figure 5.1: Treatment of circulatory problems in the five districts of the Limpopo Province.

Digestive problems

The most treated digestive ailments were constipation after attending funerals, stomach pains in infants and stomach ache/disorders (Appendix 6). Species such as *D. sanguinea*, *S. aethiopicus* and *W. salutaris* were the most used species for these mentioned ailments (Appendix 6).

Drimia sanguinea was only used to treat stomach ache/disorders in this ailment category. It was used by community members (CM) in the Capricorn and Waterberg districts, and also by traditional healers (TH) in the Sekhukhune district (Figure 5.2).

The most common medicinal plant used by CM and TH to treat digestive problems was *S. aethiopicus*. The species was chiefly used by TH in all districts, and to a lesser extent by CM in all districts, except in the Sekhukhune district, for stomach pains in infants. It was commonly used as a medicine for constipation after attending a funeral. This was mainly reported by CM and to a lesser extent by TH, in all districts, except Sekhukhune (Figure 5.2).

Warburgia salutaris was used mostly by TH to treat digestive problems, chiefly stomach ache, in the Mopani and Vhembe districts, and only for treating constipation after attending a funeral in the Waterberg district (Figure 5.2).

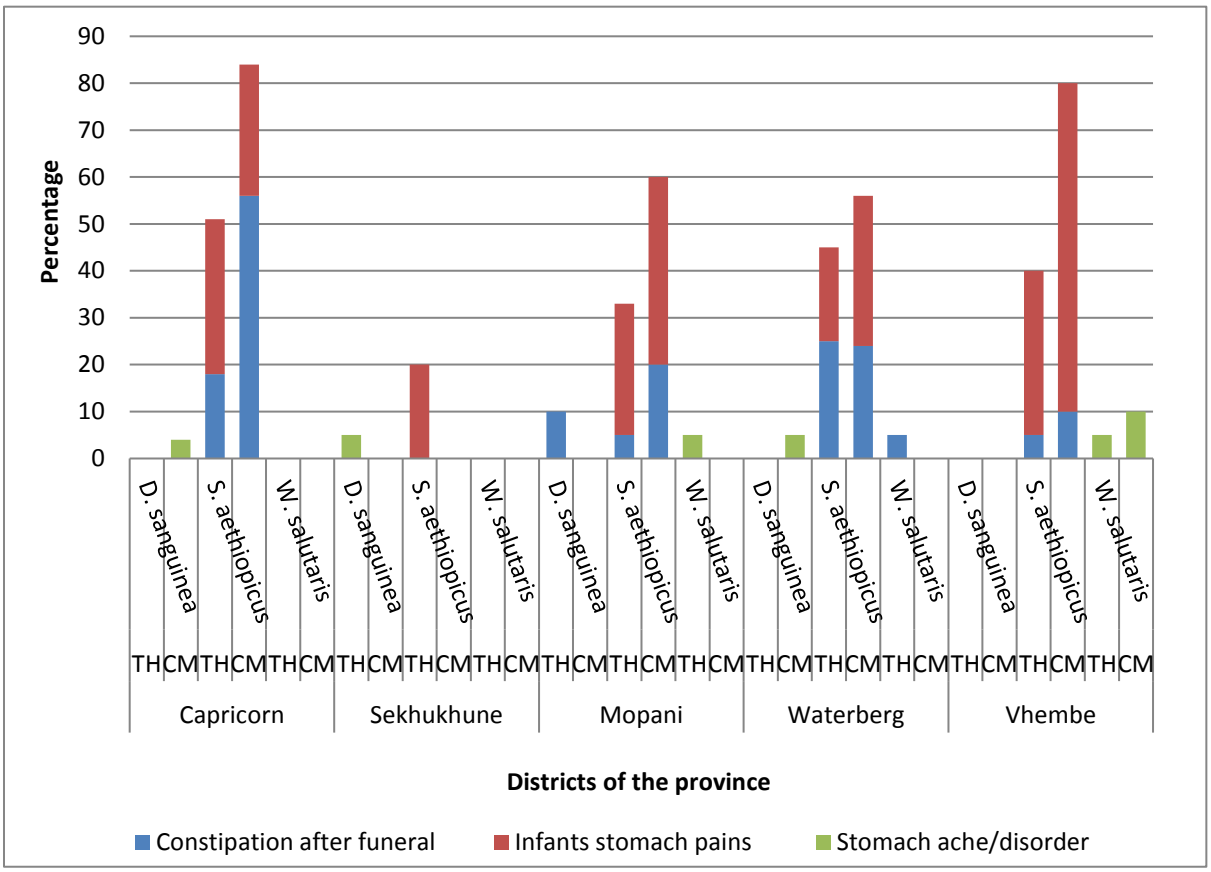

Figure 5.2: Treatment of digestive problems in the five districts of the Limpopo Province.

Respiratory problems

The most treated ailments in this category include coughs, sore throats and breathing difficulties in infants (Appendix 6). These ailments were mostly treated using *A. amatymbica*, *S. aethiopicus* and *W. salutaris* (Appendix 6).

Alepidea amatymbica was commonly used by TH to treat coughing symptoms in the Capricorn, Sekhukhune and Waterberg districts (Figure 5.3).

Siphonochilus aethiopicus were generally used by TH and CM to treat coughs in the Capricorn, Sekhukhune, Mopani and Waterberg districts (Figure 5.3). This species was only used by TH in the Capricorn and Waterberg districts and by CM in the

Sekhukhune and Mopani districts to treat breathing difficulty in infants. Furthermore, it was used to treat sore throats in all districts, except Vhembe, usually by CM.

Warburgia salutaris was used by TH and CM across all districts, to treat respiratory problems. Traditional healers and CM in the Sekhukhune district used this species to treat the two most mentioned ailments (coughs and sore throats). In the Vhembe district it was only used to treat coughs (Figure 5.3).

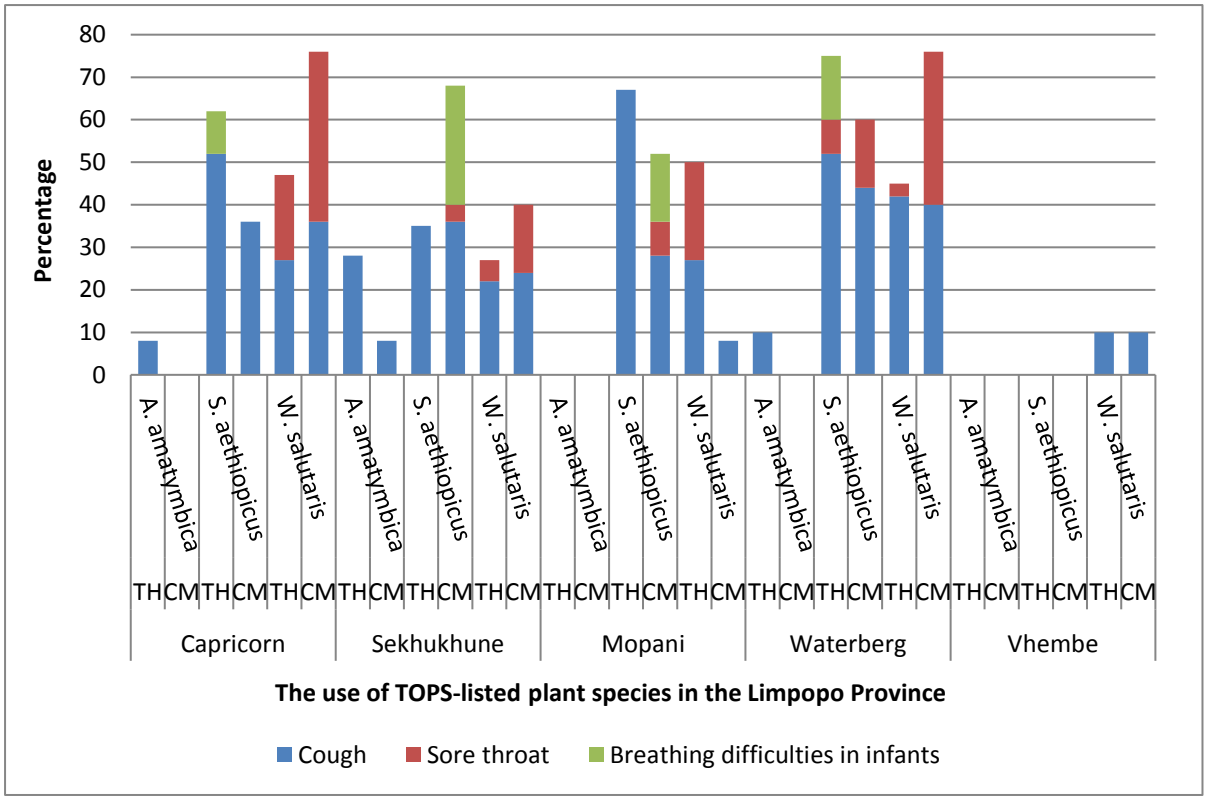

Figure 5.3: Treatment of respiratory problems in the five districts of the Limpopo Province.

Parapsychological problems

The most treated ailments included; protecting homesteads, as a catalyst for any disease, and for good luck. The most used plants species to treat these problems were *B*. *zanguebarica*, *S*. *aethiopicus* and *A*. *amatymbica* (Appendix 6). In this category it is the THs who are the ones mostly utilizing these plant species for parapsychological purposes, with very few CM prescribing these species for any parapsychological purposes.

Brackenridgea zanguebarica was mostly used by TH to protect homesteads (Figure 5.4). Only TH in the Mopani district used this species as a catalyst to treat any disease. This species was also prescribed by TH and CM for bringing luck in all districts of the province.

Siphonochilus aethiopicus was less used species for parapsychological purposes. However, this species was used as a catalyst for any disease and also for bringing luck (Figure 5.4).

Alepidea amatymbica was used mostly by TH for protecting homesteads and for bringing luck (except in the Mopani and Vhembe districts). In Waterberg and Sekhukhune districts some CM and TH also used this species as a catalyst for any disease (Figure 5.4).

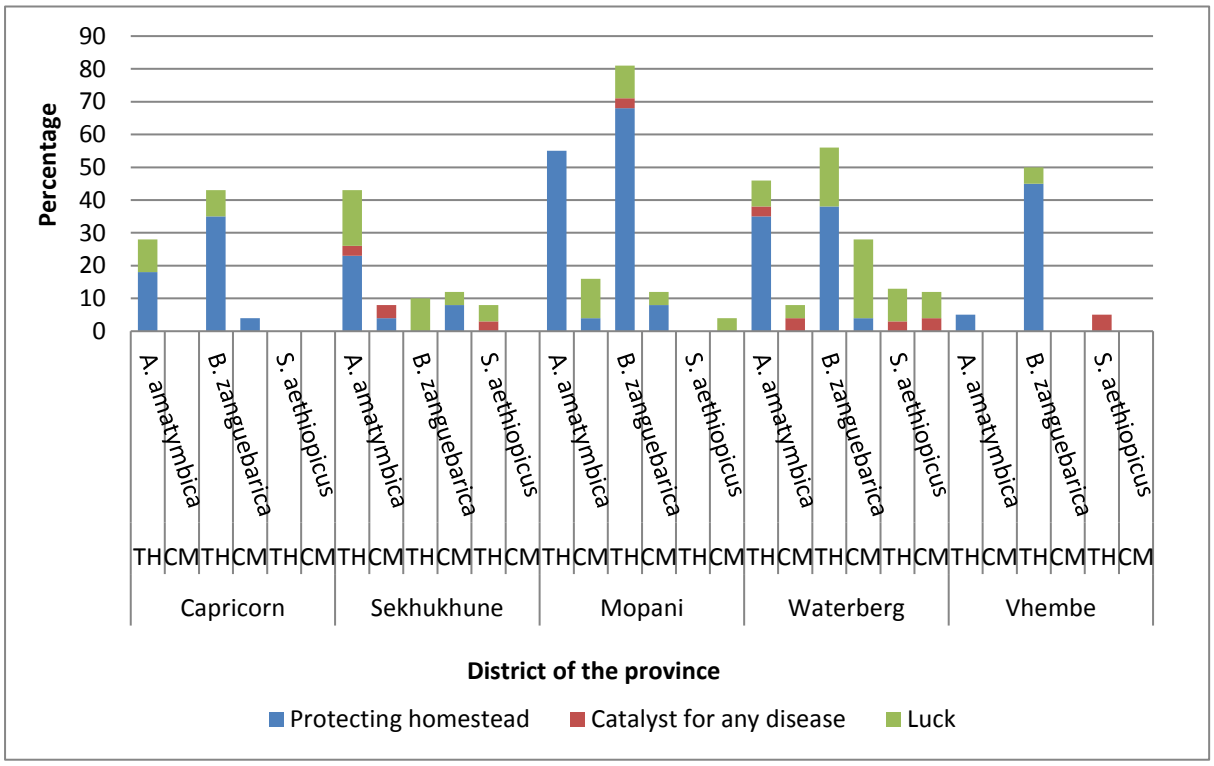

Figure 5.4: Use of study species for parapsychological purposes in the five districts of the Limpopo Province.

5.4.3 Herbal remedies

5.4.3.1 Parts used

Results indicate that underground parts (roots and tubers) of all six plant species were being harvested. However, *B*. *zanguebarica* (roots and bark) and *W*. *salutaris* (bark and leaves) were also being targeted for other parts. It was also noted that most of the parts were dried first before preparing the material for use (Table 5.3).

Table 5.3: Parts and form of parts used in the six selected TOPS-listed plant species.

Plant species	**Parts used**	**Form of plant parts**
Alepidea amatymbica	Root (100%)	Dry
Brackenridgea zanguebarica	Roots (97%) and bark (3%)	Dry
Dioscorea sylvatica	Tuber (100%)	Dry
Drimia sanguinea	Bulb (100%)	Fresh
Siphonochilus aethiopicus	Rhizome (100%)	Fresh
Warburgia salutaris	Bark (94%), roots (4%) and leaves (2%)	Dry

5.4.3.2 Method of preparation

Five different methods were identified, which include; a) the preparation of extracts (in the form of cooking or boiling), b) burn (dried plant material is burnt or put on charcoal and the smoke inhaled), c) powder (cut into small pieces, dried and then crushed to a fine powder), d) infusion (soaked in water for long hours), and e) leaving the material in a raw state. In general, 54.19% of respondents used the extract method of preparing their decoctions. Twenty five percent of interviewees used their plants in a raw state, and 16.44% as powder. However, the preparation differed between the studied species (Figure 5.5).

Siphonochilus aethiopicus was the only species that was mostly used in a raw state; all the other species were mostly used as extract decoctions, and to a lesser extent as powder (Figure 5.5). Only *A*. *amatymbica*, *B*. *zanguebarica* and *D*. *sanguinea* were reported to be burnt; sometimes before administration. Infusion as a method of preparation was only reported for *A*. *amatymbica* and *D*. *sanguinea* (Figure 5.5).

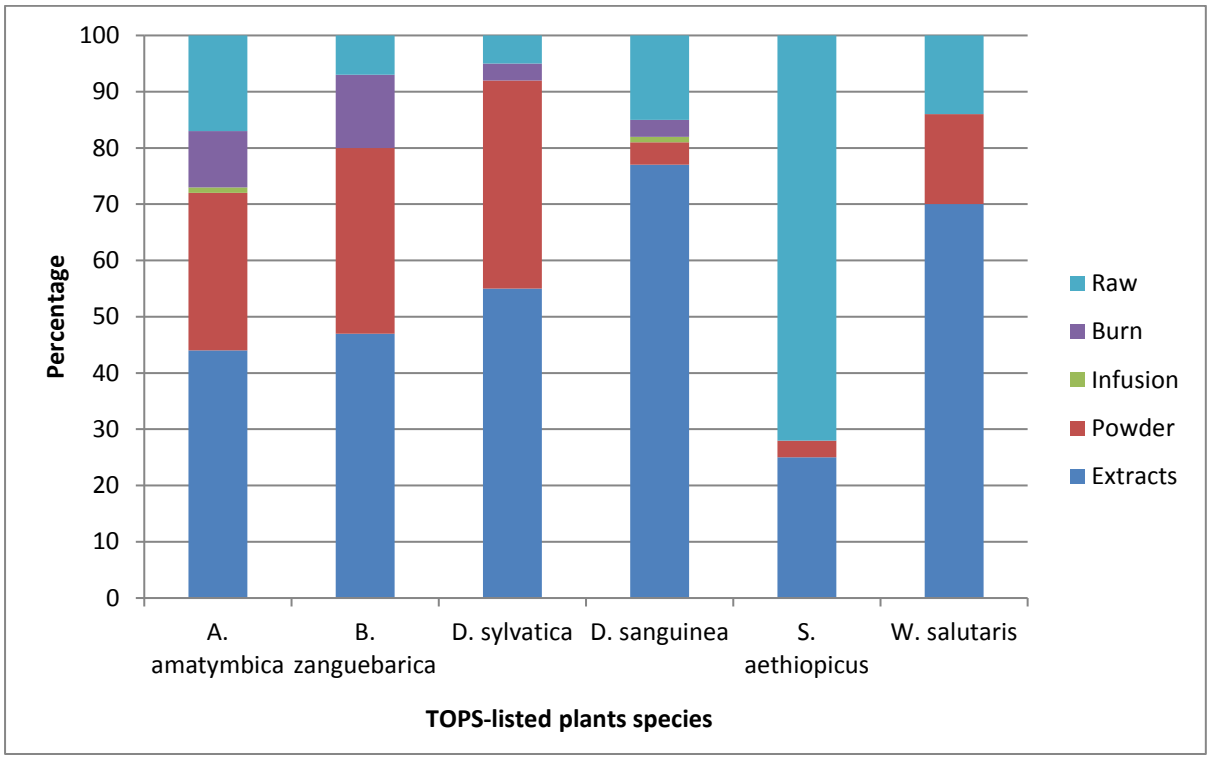

Figure 5.5: Different methods of preparation in the studied TOPS-listed plant species.

5.4.2.3 Mode of administration

Six different modes of herbal administration were documented: oral, topical, inhalation, enema, embedded and blow/sprinkled. These modes are closely linked to the methods of preparation. For example, extracts can be administered orally, topically, via an enema or blowed/sprinkled. Powder can be blown/sprinkled or taken orally, and an infusion can be administered via oral, or sprinkling. A remedy that is prepared raw can be administered either orally, topically or be blown/sprinkled. Burning can only be administered by inhalation of smoke.

The oral method of administration was mostly in the form of drinking water, milk, beer, eating soft porridge, teeth rubbing, chewing or sublingual. Topical methods included lotions, bathing, massage or incision, while sprinkling involved scattering in yards,

graveyards, or blowing in the direction of a recipient or in all directions. Enemas involved administrating anally the remedy using a bulb syringe, while embedded (mainly used for parapsychological uses) involved placing the material in their coat pockets, shoes, in traditional bones, affixing it under cars, planting the stated plant at corners of the yard or gate. Others included preparing the material as ties and necklaces for children, applying it on doors, windows and doorsteps, as well as polishing the floor with the plant material.

The most used modes of administration in the study were orally and topically (Figure 5.6). The species predominantly orally administered were *W*. *salutaris*, *D*. *sanguinea* and *S*. *aethiopicus*. *Brackenridgea zanguebarica* and *D*. *sylvatica* were administered orally less. The only species that were not administered by inhalation was *W. salutaris* and *D*. *sylvatica*. *Drimia sanguinea* was not blown/sprinkled around as a method of administration. Even though *S*. *aethiopicus* was not prepared by burning (Figure 5.5), it can be administered through inhalation, sometimes spelling to as aromatherapy (Figure 5.6).

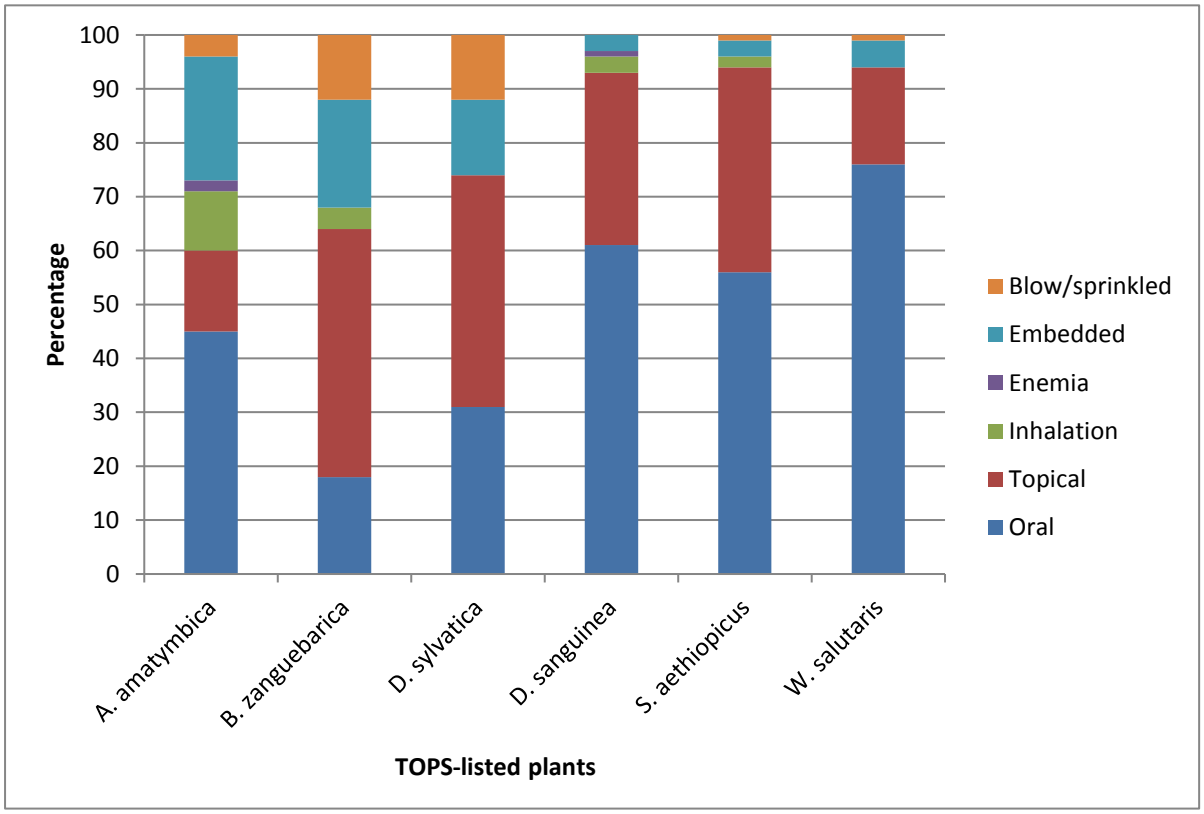

Figure 5.6: Different modes of administration of the studied TOPS-listed plant species.

5.4.4 Plant collection

5.4.4.1 Source

It was noted that 59.01% of participants sourced their plants from *muthi* traders and 39.50% from the wild. A minority (1.49%) sourced material from their homegardens. It must be noted that the source varied slightly according to the species used and the users in different districts (Table 5.4).

Alepidea amatymbica was mainly sourced by TH and CM from *muthi* shops. Only, albeit some, TH from the Sekhukhune and Mopani districts collected this species from their homegardens. This species was also obtained from wild communal areas in all the districts, except in the Vhembe district. Through field observations it was found that this species occurs in a few communal areas in the Mopani district, and in the Lydenberg area in the Mpumalanga province.

Brackenridgea zanguebarica was also chiefly sourced from *muthi* shops; none of the participants cultivated the species in their homegarden. This species was also sourced by TH from the wild, in all districts. A natural population, albeit in a nature reserve, of this species was also observed in the Vhembe district.

Both CM and TH generally sourced *Dioscorea sylvatica* from the wild (communal areas) in the Capricorn district. Wild population harvesting was very high in the Sekhukhune district, and amongst TH in the Mopani and Waterberg districts. Field observations revealed that only two natural populations of this species occur in the Sekhukhune district; the Leolo and Ga-Phaahla Mountains.

Drimia sanguinea was largely sourced from the wild, though in the Waterberg and Vhembe districts *muthi* shops featured more as a source. This species was only cultivated in homegardens by a minority of TH and CM in the Capricorn district, and to a much lesser degree by TH in the Waterberg district. This species occurred in several communal areas across the Capricorn, Sekhukhune and Mopani districts.

Traditional healers cultivated to a limited degree *S. aethiopicus* in their homegardens (3 - 7% of TH), except for those in the Mopani district, where the species is still to a

very limited extent available from communal areas. With the exception of the Mopani district, this species was more bought from *muthi* shops than collected from the wild.

Warburgia salutaris was either sourced from *muthi* shops or the wild. Participants in the Capricorn and Sekhukhune districts mostly sourced this species from the wild, while participants in other districts generally obtained material from *muthi* shops. Several populations of this species were observed in the Capricorn and Sekhukhune districts. In the Capricorn district it was collected from numerous mountains in the Blouberg and Mafefe areas.

Table 5.4: Source of TOPS-listed plant species (% of participants) used by traditional healers and community members in the five districts of the Limpopo Province.

Plant species	Participants	Capricorn district			Sekhukhune district			Mopani district			Waterberg district			Vhembe district			Total (%)		
		W	H	B	W	H	B	W	H	B	W	H	B	W	H	B	W	H	B
Alepidea amatymbica	TH	30	0	70	41	3	59	29	3	68	18	0	82	0	0	100	29	1	70
	CM	0	0	0	0	0	100	71	0	29	0	0	100	0	0	0			
Brackenridgea zanguebarica	TH	32	0	68	23	0	77	19	0	81	14	0	86	25	0	75	22	0	78
	CM	0	0	0	0	0	100	0	0	100	0	0	100	0	0	0			
Dioscorea sylvatica	TH	100	0	0	86	0	14	67	0	33	25	0	75	0	0	100	68	0	32
	CM	100	0	0	100	0	0	0	0	100	0	0	0	0	0	0			
Drimia sanguinea	TH	73	16	11	81	0	19	77	0	23	41	3	56	44	0	56	61	3	36
	CM	59	12	29	80	0	20	62	0	38	40	0	60	0	0	100			
Siphonochilus aethiopicus	TH	8	5	88	20	3	77	49	0	51	20	3	78	11	17	72	17	3	80
	CM	13	0	87	0	0	100	29	0	71	0	0	100	0	0	100			
Warburgia salutaris	TH	75	0	25	76	0	24	38	0	63	18	0	82	33	0	67	45	0	55
	CM	61	0	58	58	0	42	20	0	80	10	0	90	0	0	100			

Key: (W) Wild, (H) Homegarden and (B) Buy, (TH) Traditional healers, (CM) Community members

5.4.3.2 Perception on local availability

Even though most of the participants collected certain species from the same areas, they had different perceptions regarding the availability of these plants in the wild. In general, most species are either perceived to be fairly abundant or in decline in the wild (Figure 5.7). According to those participants who harvested the species in the wild, *A*. *amatymbica*, *B*. *zanguebarica* and *W*. *salutaris* populations are mostly declining (Figure 5.7). This dichotomy in perception also extended to *D*. *sylvatica* and *D*. *sanguinea*; some perceived them to be common in the wild, while others noted that these species are declining, and rare and thus very difficult to find. Most (76%) collectors of *S. aethiopicus* indicated that the species is either rare or declining in the wild, while a minority (24%) indicated that the species is still common (Figure 5.7).

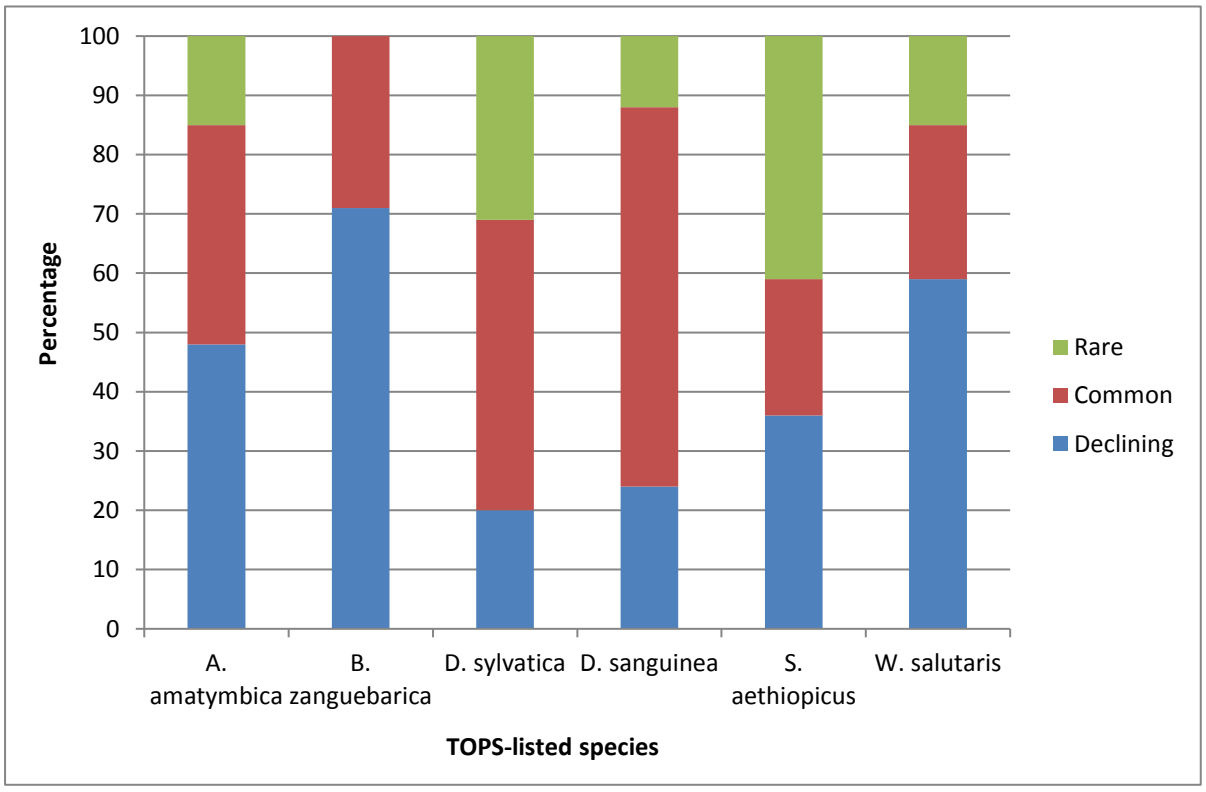

Figure 5.7: Perception of harvesters of TOPS-listed plants on their availability in the wild.

5.5 Discussion

5.5.1 Species utilization

The current study is the first to broadly focus specifically on the use of TOPS-listed plant species (i.e. species protected and regulated by national legislation), particularly by traditional healers and lay people (community members), in the Limpopo Province and South Africa at large. It is, however, important to point out that a number of general studies (indicated in the introduction section of this chapter) conducted across South Africa have repeatedly highlighted the utilization of some of the selected species.

The investigated species were used as medicine in all five districts of the Limpopo Province. Generally, across these districts, traditional healers (TH) used these species more than the community members (CM). This was to be expected as THs are known to be the main custodians of indigenous knowledge as far as herbal medicine are concerned (Mabogo, 1990; Moeng, 2010; Tshisikhawe, 2012). Coupled to this is the fact that the interest of CM towards the use of such species in home remedies is rapidly fading, as most CM are becoming members of many charismatic churches of the Christian religion, which strongly prohibits self-medication. Subsequently, most of them, when approached for an interview, mentioned that they couldn't even remember the medicinal applications of a single species.

Of the six-investigated species, *S*. *aethiopicus*, *W*. *salutaris* and *D*. *sanguinea* were the ones most used by TH and CM. The common use of these species in traditional medicine is in line with other cultures in the Limpopo Province (Moeng, 2010; Mongalo, 2012; Semenya, 2012; Tshisikhawe *et al*., 2012). This is because these ethnic groups are geographically close and able to exchange knowledge regarding the medicinal use of above-stated species (Saslis-Lagoudakis *et al*., 2014). However, these species are under severe pressure of harvesting for their medicinal value.

The species that were least used by both CM and TH were *B*. *zanguebarica* and *D. sylvatica*. None of the interviewed CM from Capricorn or Vhembe districts self-medicated with *B*. *zanguebarica*. This was expected as the harvest of this tree is associated with completed ritual performance known by people from the clan and TH (Tshisikhawe *et al*., 2012). The limited use of *B*. *zanguebarica* by TH might be due to the fact that the species now generally only occurs in protected areas, which is

inaccessible. Similarly, none of the interviewed CM residing in the Waterberg and Vhembe districts used *D. sylvatica*. This might be due to its limited distribution in these districts or lack of knowledge regarding its medicinal applications amongst participants.

5.5.2 Medicinal applications of plants

Alepidea amatymbica and *B. zanguebarica* were the medicine of choice for parapsychological purposes by both TH and CM. *Drimia sanguinea* was preferred by both CM (66.36%) and TH (72.78%) as a treatment of circulatory problems. *Warburgia salutaris* was used by the vast majority of both participant groups for treating circulatory and respiratory problems. *Siphonochilus aethiopicus* was used predominantly by both groups of participants for treating digestive, respiratory and parapsychological ailments. To the best of our knowledge there is no ethno- botanical study that reported on the extent of use of the investigated species to treat the above-listed diseases categories. Thus, the present study provides a base-line on this subject.

5.5.2.1 Circulatory problems

In this category, the three most treated ailments were body pains, swollen legs and high blood pressure. Furthermore, the three most used species to treat ailments in this category were *D*. *sylvatica*, *D*. *sanguinea* and *W*. *salutaris*.

In all districts, *D*. *sylvatica* was used to treat swollen legs. This species was also used by TH in the Sekhukhune and Mopani districts to treat high blood pressure. No medicinal applications record of *D*. *sylvatica* for high blood pressure and swollen legs were found in the literature, and these medicinal uses are thus reported in this study for the first time. However, its utilization in the treatment of body pains was also reported by Mintsa Mi Nzu (2009) or the Rastafarians in Western Cape Province, by Kelmanson *et al*. (2000) for the Zulu in KwaZulu-Natal, and by Cogne *et al*. (2001) for the Shona in Zimbabwe. The application of this species as a pain reliever thus needs further investigation regarding its bioactivity.

Drimia sanguinea was widely used in all districts to treat body pains. The extensive use of this species was also noted by Mongalo (2013) for the Blouberg area of the

Limpopo Province, and by Motlhanka and Nthoiwa (2013) in Botswana. The medicinal use of *D. sanguinea* as a blood pressure regulator was also documented by Marx *et al*. (2005). To the best of our knowledge, the medicinal use of this species to treat swollen legs is recorded for the first time in this study.

The use of *W*. *salutaris* for the treatment of body pains was widely mentioned by both groups of participants in all districts, except the Vhembe district where only TH mentioned this use. Furthermore, this species was also used to treat high blood pressure. The above-mentioned uses of this species are recorded for the first time in this study in South Africa. Such uses are, however, common in other African countries such as Tanzania (Johns *et al*., 1994) and Zimbabwe (Maroyi, 2013). Furthermore, its use to control high blood pressure is a first record.

5.5.2.2 Digestive problems

Constipation after attending funerals (cultural believe), stomach pains in infants and stomach ache/disorder were the most treated digestive ailments, using *D*. *sanguinea*, *S*. *aethiopicus* and *W*. *salutaris*. *Drimia sanguinea* was used to treat stomach disorders, which was also reported by Marx *et al*. (2006). None of the recorded uses of *S. aethiopicus* in this study for digestive purposes (i.e. treatment of constipation after attending funerals and to treat stomach pains in infants) were previously recorded in the literature. Few of the recorded uses of *W. salutaris* in this study were also documented in other countries. For instance, its use in the treatment of constipation after attending funerals as reported by TH in the Waterberg district was also documented by Phanuel *et al*. (2010) in Kenya. Furthermore, its use to treat stomach-ache/disorders is consistent with the findings of Johns *et al*. (1994) in Tanzania, and Cunningham (1993) in Swaziland.

5.5.2.3 Respiratory problems

In general, coughs, sore throats and TB were the most treated respiratory ailments with *A. amatymbica*, *S*. *aethiopicus* and *W. salutaris*. The uses of these species to treat coughs are common in South Africa and other African countries. For example, the use of *A. amatymbica* for coughs was also mentioned by Omoruyi *et al*. (2012) in South Africa and Maroyi (2008) in Zimbabwe. The medicinal use of *S. aethiopicus* (Igoli and Obanu, 2011; Semenya *et al*., 2012) and *W. salutaris* for coughs is also

reported in South Africa (Coopoosamy and Naidoo, 2012) and Zimbabwe (Maroyi, 2013). The effectiveness of some of these species against coughs is supported by scientific validation: for *A. amatymbica* (Appidi *et al*., 2008; Wintola and Afolayan, 2010) and for *W. salutaris* (Mabogo, 1990; Maroyi, 2013). Amongst the species used to treat sore throats only *W. salutaris* was previously mentioned for South Africa (Mabogo, 1990) and Kenya (Bussmann *et al*., 2006), thus the documentation of *A. amatymbica* to treat sore throats is a first (to the best of my knowledge). Furthermore, amongst species used for TB, only *S*. *aethiopicus* (Seaman, 2005) and *W. salutaris* (Tabuti *et al*., 2010) were mentioned in literature. *Siphonochilus aethiopicus* and *W. salutaris* were also used for sore throats and the same two species, in addition to *A. amatymbica*, were used as medicine for TB. These uses are reported for the first time in this study, to the best of my knowledge.

5.5.2.4 Parapsychological problems

In relation to parapsychological issues, *B*. *zanguebarica*, *S*. *aethiopicus* and *A*. *amatymbica* were used primarily for treating the following ailments; protecting homesteads from evil, a catalyst for any disease/ailment, and for bringing luck.

The use of *B. zanguebarica* for the protection of homesteads was also mentioned by Mabogo (1990) and Tshisikhawe and Van Rooyen (2012). The use of this species for luck and as a catalyst for any disease was not mentioned previously in the literature, and reported here for the first time. The use of *S*. *aethiopicus* as a catalyst was previously mentioned in the literature (Igoli and Obanu, 2011), but no record of its use for luck and for the protection of homesteads was previously mentioned in the literature. The use of *A. amatymbica* to protect homesteads was previously mentioned by Stoffersen *et al*. (2011). However, its uses as catalyst for treating any disease and for luck were recorded in this study for the first time. In fact most of the medicinal use of the investigated species to treat specific problems associated with parapsychological issues was never reported before in the literature. This shows that medicinal applications of TOPS-listed species are in general poorly recorded in Limpopo Province. It also indicates that such species are faced with extensive harvesting pressure for multiple medicinal applications.

5.5.3 Herbal remedies

5.5.3.1 Parts used

A variety of parts were used from the six studied plants for herbal preparation. The underground parts (roots, bulbs and rhizomes) were most preferred for *Alepidea amatymbica, D. sylvatica, D. sanguinea* and *S. aethiopicus*. This selective practice of harvesting the underground parts of TOPS-listed species was also reported by other researchers in South Africa and other African countries (Ribeiro *et al*., 2010; Setsogo and Mbereki, 2011; Maroyi, 2013). For example, Moeng (2010) noted the collection of *Alepidea amatymbica* and *D. sanguinea* for medicinal uses in the Limpopo Province, South Africa. Mathibela (2013) found that the bulb of *S. aethiopicus* was mostly uprooted for medicinal use in the Blouberg area of the Limpopo Province, South Africa.

The high use of underground parts in traditional medicine is mostly based on the perception that they hold the most healing properties of all parts (Shale *et al*., 1999; Semenya *et al*., 2013a). Thus it is not strange to find that the practice of using the underground parts of plants being consistently reported in different studies (Hutchings, 1996; Shale *et al*., 1999; Jeruto *et al*., 2010). Therefore, users of the TOPS-listed species in this study should be advised to use alternative parts such as leaves.

Brackenridgea zanguebarica and *W. salutaris* were the only species harvested for their various parts. *Brackenridgea zanguebarica* was mostly harvested for its roots (97%), but also for bark (3%). This finding is contrary to that reported by Tshisikhawe (2002) in the Vhembe district, who found that bark from the stems of *B. zanguebarica* was preferred over the roots. With regard to *W. salutaris*, its bark (94%) was mainly used by participants in the present study as opposed to its roots (4%) and leaves (2%). Multi-parts harvesting of this species with distinct preference of bark is common in South Africa (Mabogo, 1990; Tshisikhawe *et al*, 2012; Mathibela, 2013). High bark usage was attributed by the above-mentioned researchers due to the higher levels of healing ingredients than contained in other parts.

Most of the harvested parts of the investigated plant species were used to prepare medicine in a dry state, excluding *D. sanguinea* and *S. aethiopicus* which were used in a fresh state. The state of use of *D. sanguinea* and *S. aethiopicus* is an indication that users have these species in their homegardens for emergencies purposes. On

the other hand, species used in dry form shows that users have to travel far distances either for collection or buy, and consequently preserve the material in a dry state.

5.5.3.2 Methods of herbal preparations

Five different methods of herbal preparations were reported for the investigated plants in this study, namely; extracts (prepared with water in the form of cooking or boiling), powder (cut into small pieces, dried and then crushed to a fine powder), infusion (soaked in water for long hours), raw and burning. These are common methods used for the preparation of herbal medicine from any plant, including some of the TOPS-listed species investigated in this study such as *A. amatymbica* (Appidi *et al*., 2008), *B. zanguebarica* (Mabogo, 1990), *D. sylvatica* (Wintola and Afolayan, 2010), *D. sanguinea* (Moeng, 2010), *S. aethiopicus* (Moeng, 2010) and *W. salutaris* (Maroyi, 2013).

In this study extracts (54.19%), raw preparation (25%) and powdering (16.44%) were the most used methods compared to burning (4.03%) and infusion (0.34%). This is probably due to their simplicity of preparation. For example, infusion is normally done overnight (Semenya, 2012), while burning requires constant monitoring to ensure that materials are not completely burned to ash. However, not all of the above mentioned methods of herbal preparation were applicable to all six investigated species. *Drimia sanguinea* was the only species prepared using all five recorded methods (burning, extracts, infusion, powder and raw). This may be due to different indigenous knowledge on methods used amongst the participants in the current study. With the exclusion of *W*. *salutaris*, which was prepared as extracts, powder and raw, the rest of the species were prepared using all the methods recorded in this study except for burning.

5.5.3.3 Mode of administration

Six different modes of herbal administration were mentioned by participants, with the predominant modes being oral (53.37%), topical (30.47%) and embedded (9.09%). These are all common methods of herbal administration (Kelmanson *et al*., 2000; Saidi and Tshipala-Ramatshimbila, 2006; Omoruyi *et al*., 2012). In the present study extracts, infusions, powder and raw preparation were taken through oral, topical, embedment, enema or sprinkling. Oral administration was mostly in the form of

drinking (via water, milk, beer and soft porridge), rubbing teeth, chewing or sublingual. Substances such as milk, beer and soft porridge were used due to the belief that they increase the effectiveness of the medicine. This is a common belief amongst indigenous people in Limpopo Province (Semenya, 2012) and other provinces of South Africa, such KwaZulu-Natal (Kelmanson *et al*., 2000) and the Eastern Cape Province (Omoruyi *et al*., 2012). Topical administration was done in the form of lotion, bathing, massage or incision. These were preparations mostly made from *B*. *zanguebarica* and *D*. *sylvatica.* Topical administration of medicine prepared from *B*. *zanguebarica* was previously mentioned by Mabogo (1990) and Saidi and Tshipala-Ramatshimbila (2006) in the Vhembe district. Raw or powdered materials, mainly from *A. amatymbica*, *D*. *sylvatica* and *B*. *zanguebarica* was embedded in different ways, by placing in pockets, shoes, in traditional bones, tied under the car, planted at corners of the yard or gate. Others included necklaces for children, applying on doors, windows and doorsteps as well as polishing the floor. These were used for parapsychological purposes, and the effectiveness of their modes of administration is based on cultural beliefs.

5.5.4 Plant collection

5.5.4.1 Source

It was noted that over half of the participants sourced material from *muthi* traders (59.01%). This was expected as a number of studies have indicated that some of the investigated species, especially *A*. *amatymbica* (Moeng, 2010), *B*. *zanguebarica* (Tshisikhawe, 2002), *D*. *sanguinea* (Williams *et al*., 2007), *S*. *aethiopicus* and *W*. *salutaris* (Cunningham, 1998), have either become rare in collection sites or the distances to the collection sites are greater than in the past, and the majority of users now rely on *muthi* traders for supply. *Muthi* traders do not mind spending more hours searching for species and travelling longer distances for collections as they are interested in profit. A large percentage of participants (39.50%) in the present study harvested the selected species from the wild (communal areas), which might be perceived as an indication that the availability, and thus abundance, of some of these species varies among locations.

Only 1.49% of participants were engaged in the cultivation of some of the species. Although *Drimia sanguinea* was generally collected from communal areas, some effort by TH (16%) and CM (12%) in Capricorn, and TH in Waterberg (3%), went into cultivating it in homegardens. Participants who cultivated this species mentioned that they prefer using it in its fresh state and thus it was necessary to have it in proximity. In a study Semenya and Potgieter (2014), it was indicated that cultivation of *Drimia* species (*Drimia elata*) is important for emergency purposes, showing that cultivation of *Drimia* species is not for conservation purposes but personal benefits. In general, the low effort of participants to cultivate the investigated species calls for their education with regards to both the advantage and benefits of cultivation.

5.5.4.2 Perception on local availability

Participants' perceptions of the species availability varied between and even within the same area of collection. This was probably due to different specific locations of collection in the same area, possibly harvesting at different sub-populations in the same area. Different perceptions regarding the availability of a species was also reported by Moeng (2010) for the Limpopo Province. However, the actual status of the plants can only be determined by a scientific assessment of the population status in the collection area.

5.6 Conclusion and recommendations

The uses of the investigated TOPS-listed species are very common amongst the TH and CM residing in different districts of the Limpopo Province. Many new medicinal uses of these species showed that they are over-harvested. This is especially true and will continue since applications of some of them are supported by scientific proofs, meaning that they are effective. Furthermore, the largest utilization categories of diseases treated with the investigated species was parapsychological problems; their effectiveness is mostly based on cultural belief, which is rooted in most South Africans.

It is therefore recommended that users of the species be educated about the use of alternative parts, rather than underground ones for sustainability since they depend on the species for medicinal use. It is also important to execute a survey aimed at investigating the trade of these species including their sources. Similarly, a detailed field assessment aiming at determining the status of their populations is also needed.

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CHAPTER 6

THREATS AND TRADITIONAL APPROACHES TO CONSERVATION

6.1 Introduction

The drastic increase in the use of traditional medicine and thus its associated overharvesting has endangered medicinal plant populations (Semenya, 2012). This is because medicinal plants are harvested in an unregulated manner (Moeng and Potgieter, 2011). Thus proper conservation approaches and harvesting methods must be imposed to ensure the long term sustainability of natural populations (Tshisikhawe *et al*., 2012). There are a number of conservation approaches that have been proposed. Such approaches comprise cultivation (Cunningham, 1993; Moeng and Potgieter, 2011), and sustainable harvesting techniques (Tshisikhawe, 2002; Semenya, 2012). However, there is still insufficient knowledge on the major anthropogenic threats to the wild populations, and current traditional conservation approaches that are used to protect these populations in the Limpopo Province, especially for TOPS-listed species.

6.2 Aim and objectives

6.2.1 Aim

Investigate anthropogenic threats to selected TOPS-listed plant species in the Limpopo Province, and traditional approaches to their conservation.

6.2.2 Objectives

The specific objectives of the study were to:

I. Document anthropogenic threats, and their degree of impact, to TOPS-listed plant species. This will inform conservation measures to prevent extinction of these species.
II. Record local conservation strategies with regard to:
    a) Harvesting methods
    b) Cultivation
    c) Sustainable use approaches
III. Ascertain from the local resource users the acceptability, or not, of certain proposed conservation methods. This information can be used to inform species management and conservation plans.

6.3 Materials and Methods

Data was collected was by means of semi–structured questionnaires (Appendices 2 and 3). The questionnaires were designed to capture information about threats, harvesting methods, cultivation, sustainable use approaches, and the acceptance level of proposed conservation methods. The sample population consisted of 110 community members (CM) and 180 traditional healers (TH).

6.3.1 Anthropogenic threats and degree of impact

Community members and TH were asked to select from various options for possible reasons for the population decline of selected TOPS-listed plants in their collection areas. They had to choose from a list of possible threats, including overharvesting, agriculture, deforestation, rural expansion and urban development. This was complemented by field observations, where participants accompanied the interviewer to communal lands where these plants occur to confirm the threats, and to observe the degree of anthropogenic impact on the plants/populations.

The degree of impact of the threats was determined by researcher via observing the extent of damage (e.i. dead or dying plants due to anthropogenic threats, evidence uprooting in cases of *Alepidea amatymbica*, *Dioscorea sylvatica*, *Drimia sanguinea* and *Siphonochilus aethiopicus* and aerial parts around the excavated areas) to an individual species within each population. Subsequently, degree of impact was categorised under the following low= <10%, moderate=10–30%, high=>30–50%, very high=>50%. For instance, the population with low, moderate and very high impacts had less, high, higher, and extremely higher damages, respectively.

6.3.2 Harvesting methods

Participants were requested to choose harvesting method/s they use for each TOPS-listed plant species. The methods included; digging out, felling off bark, cutting branches, picking fruits from ground, hand picking leaves, or any other method specified. This was supplemented by field observations, where participants accompanied the interviewer to the communal lands where these plants occur to confirm the harvesting methods.

6.3.3 Cultivation

Community members and TH who use the TOPS-listed species were asked if they cultivate the plants in their own gardens/yards. Those who did not have a medicinal garden were then asked if they would grow medicinal plants if seeds or seedlings were freely supplied.

6.3.4 Sustainable use approaches

Participants were also requested to disclose the method/s they use to ensure that there are plants to harvest in the future. The questionnaires had a list of different methods which they could choose from such as; collect small amounts, do not uproot/cut down whole plant, cultivate in homegardens and collect seasonally.

6.3.5 Acceptability of conservation methods

Participants were also asked to select from a list of conservation strategies that could be implemented to assist in the sustainable use of the TOPS-listed plant species. Six suggestions were given to them; propagation, introduction of permit system, reintroduction, education on conservation, patrol and avoid veld fires. Participants were also given the opportunity to propose additional conservation methods.

6.4 Results

6.4.1 Anthropogenic threats

All TH and CM mentioned overharvesting for medicinal use as a significant threat to all the investigated TOPS-listed species. In the Mopani district, CM indicated that overharvesting of *S. aethiopicus* was not only for medicinal use, but also for domestication. In this district, people transplanted this species from wild communal areas to homegardens for commercial use. According to participants, *D. sanguinea* was the only species threatened by more than one factor; agricultural expansion (15%), rural expansion (30%), and in addition to overharvesting (55%).

The populations of almost all species showed very high degrees of impact from harvesting. Of all species, the only species that had at least one population of low degree of anthropogenic impact was *Dioscorea sylvatica* (Table 6.1)

Table 6.1: Degree of anthropogenic impact on populations of selected TOPS-listed species as observed in the field.

Species	**Populations visited**	**District**	**Degree of impact**
Alepidea amatymbica	Shilovane	Mopani	Very high
	Haenertsburg	Mopani	Very high
Brackenridgea zanguebarica	Tengwe	Vhembe	Moderate
Dioscorea sylvatica	Ga-Phaahla	Sekhukhune	Low
	Leolo	Sekhukhune	Very high
Drimia sanguinea	Blouberg	Capricorn	Very high
	Zebediela	Sekhukhune	Very high
	Lebowakgomo	Sekhukhune	Very high
	Giyane	Mopani	Very high
	Bolobedu	Mopani	Very high
Siphonochilus aethiopicus	Tzaneen	Mopani	Very high
Warburgia salutaris	Blouberg	Capricorn	Moderate
	Mafefe	Capricorn	Very high
Key: Degree of impact: Low= <10%, Moderate=10–30%, high=>30–50%, very high=>50%,			

6.4.2 Harvesting methods

All TH and CM acknowledged that most of the harvesting techniques used, such as uprooting and felling, are extremely destructive. It was found that four of the six species were uprooted (Table 6.2). Participants indicated that for *B*. *zanguebarica*, only few roots are dug out because it is a big tree. They also fell off its bark and that of *W*. *salutaris*.

Table 6.2: Harvesting techniques for selected TOPS-listed plant species.

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

6.4.3 Current conservation strategies

6.4.3.1 Cultivation

The majority of the participants (82%) do not cultivate any of the study species. Participants who were cultivating these species (18%), only did so for *D*. *sanguinea* and/or *S*. *aethiopicus*. They reasoned that these were the only plant species that grow easily and can survive different soil types. Traditional healers are more likely to cultivate compared to community members. In the Vhembe district none of the CM cultivated in homegardens, and the most cultivation was occurring in the Capricorn district (Figure 6.2).

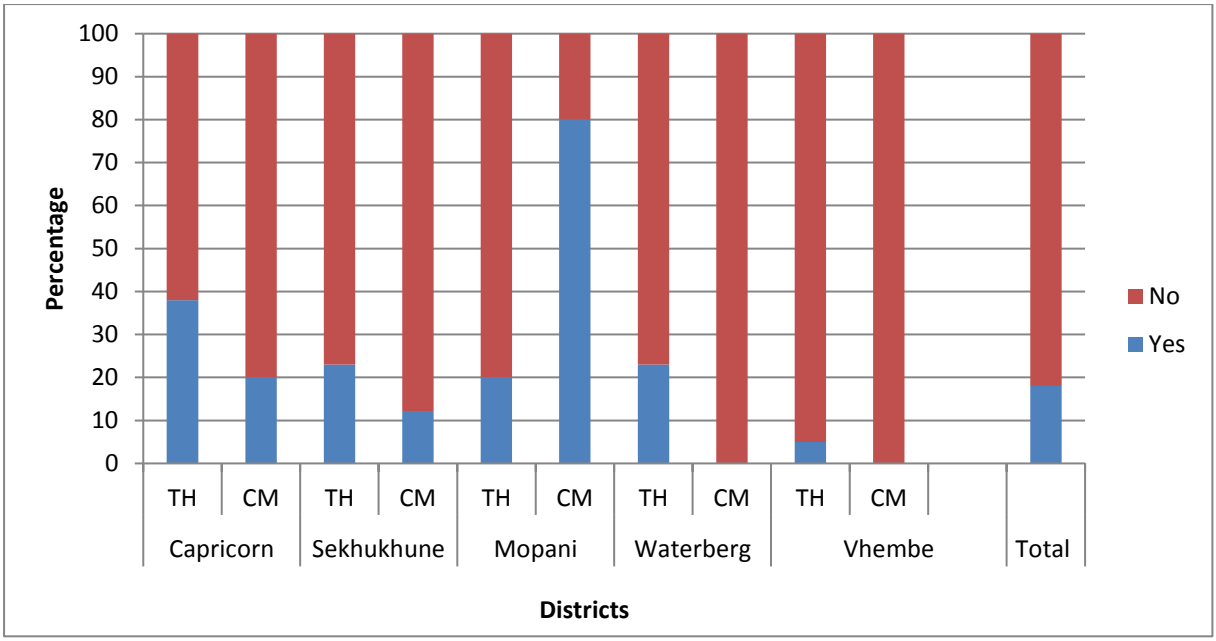

Figure 6.2: Percentage of traditional healers and community members cultivating at least one of the selected TOPS-listed plant species in their homegardens.

If provided with free seeds/seedlings, 89% of TH who are not cultivating at present showed interest in cultivating medicinal plants. Those who showed interest were younger than 60 years. The 11% of TH who showed no interest in cultivating medicinal plants in their gardens were older than 60 years old. They noted that they preferred wild plants because they are not contaminated and have more healing power. One of the traditional healers also indicated that harvesting in the wild is an ancient custom that was also practiced by their ancestors and should be continued.

Eighty two percent of CM who are not cultivating at present indicated that they would cultivate medicinal plants in their gardens if given seeds/seedlings. The reasons for not cultivating included the absence of a fence around home yards to protect plants from domestic animals. Some CM indicated that they did not have enough space in their yards, and would only cultivate medicinal plants if provided with enough land.

6.4.3.2 Sustainable use approaches

The following sustainable use methods (traditional practices) were documented; no cutting of green plants, collecting of small quantities, seasonal harvesting, regulation through collection permits, avoiding cutting down/uprooting, no cutting during

[7]initiation, leaving pieces of plants behind, closing the hole after harvesting roots, cultivation in homegardens and closed access areas. In the Waterberg and Vhembe districts sustainable use methods were only practised by TH. Sekhukhune district had the highest number of participants who indicated that they use the four sustainable methods. The four most used methods are depicted in Table 6.3.

Table 6.3: Sustainable traditional methods used by community members and traditional healers in the five districts of the Limpopo Province.

Plant species	Participants	Capricorn district	Sekhukhune district	Mopani district	Waterberg district	Vhembe district	Total (Numbers)	Total (%)
No cutting of green plants	**TH**	5	28	3	3	3	76	26
	CM	8	14	12	0	0		
Collect seasonally	**TH**	10	20	5	5	2	87	30
	CM	20	24	0	0	0		
Permit to collect	**TH**	10	20	13	0	4	61	21
	CM	4	10	0	0	0		
Only small quantity collected	**TH**	10	18	10	6	3	64	22
	CM	6	8	4	0	0		

The sustainable use methods indicated by TH and CM were confirmed by traditional leaders in their area and they also indicated that they give permission for people to harvest. Most leaders stated that they only allow for the collection of small quantities (19%). A minority (4%) of leaders mentioned that they work with community members in patrolling the place, and another 8% indicated they give environmental education to the community. Furthermore, 23% allow winter collection only when plants are dry,

[7] Initiation is a process of being formally accepted as a member of a group or organisation, typically with a ritual.

and 15% request to see a permit for harvesting of larger quantities. Only 23% of traditional leaders did not implement any measures to ensure sustainability of plants.

6.4.4 Future prospects on conservation strategies

In all districts, participants proposed some conservation strategies for the management of plants in their communities. The most cited conservation strategies were propagation and introduction of a permit system. Community members in the Mopani district noted that veld fires should be avoided because of the destructive effects on the plants (Table 6.4).

Table 6.4: 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** (numbers)
	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 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: TH=Traditional healer, CM=Community member, TL=Traditional leader																

6.5 Discussion

6.5.1 Anthropogenic threats

Overharvesting, and to a much lesser degree agriculture and rural expansion (occupying vacant land), are the main anthropogenic threats to the investigated species. These threats are common to all medicinal plant species, not only those included in this study, and are constantly being highlighted in different surveys in the Limpopo Province (Moeng, 2010; Rasethe *et al*., 2013), other provinces of South Africa (Mander, 1998; Loundou, 2008), as well as other African countries (Cunningham, 1993). It is therefore important that users of these species in the Limpopo Province be urgently advised on the dangers and disadvantages of overharvesting plants especially *A. amatymbica*, *D. sanguinea*, *D*. *sylvatica*, *S*. *aethiopicus* and *W. salutaris*. Worrying degrees of harvesting impacts were observed on populations of these species.

In 1998 Cunningham reported that *W*. *salutaris* and *S*. *aethiopicus* had been over-exploited to such an extent that they are seldom found outside protected areas across South Africa (Cunningham, 1998). *Muthi* traders interviewed by Moeng (2010) reported that populations of *W*. *salutaris* have drastically declined in wild communal areas, due to overharvesting. Moeng (2010) also reported that *S*. *aethiopicus* is being eradicated in the wild by commercial harvesters, who are now resorting to harvesting from neighbouring provinces such as Mpumalanga and even other countries, such as Swaziland.

Similarly, *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 (Mander, 1998).

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 over-collection from its natural environment for cultivation purposes is counterproductive. None of the participants who once domesticated still had the species in their garden; their cultivated species were all traded for commercial gain. Although the observed degree of harvesting impact on *B. zanguebarica* populations was moderate, it is a concern as the species is only localised in one

geographical area of South Africa, yet it is in demand throughout South Africa. Its Critically Endangered listing is thus appropriate.

6.5.2 Harvesting methods

In general, most of the harvesting techniques used by the participants were destructive. All the herbs; *A*. *amatymbica*, *D*. *sylvatica*, *D*. *sanguinea* and *S*. *aethiopicus* were harvested by uprooting. These are commonly employed techniques used by most harvesters (commercial, CM and TH) for herbaceous species in the province. For example, collection of *S. aethiopicus*, *D*. *sylvatica* and *D*. *sanguinea* via uprooting was reported by (Kambizi, 2000; (Magoro, 2008; Moeng, 2010). Harvesting by uprooting will obviously lead to the fast extinction of these species, and it is therefore important that users of the species harvest them sustainably by selecting few underground parts and leave others behind or by cutting one side of the bulb or tuber.

Harvesting the tree species *B*. *zanguebarica* and *W*. *salutaris* was also mostly unsustainable. For example, most of the participants mentioned that they collect *B*. *zanguebarica* by digging out of roots (97%) and felling off (3%) bark, which was then mostly ring-barked. These methods of harvesting not only have devastating impacts in the short term on individual plants, but will also negatively impact the population in the long term. Similarly, *W*. *salutaris* was mainly impacted via the removal of bark (94%) and digging (4%) of large amounts of roots. Only 2% of participants used leaves of this species, an aspect that should be encouraged. A few traditional healers 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 harvesting methods of bark and root are sustainable, as Kambizi (2000) noted that bark harvested from only one side of *W. salutaris* plants showed rapid regrowth due to the healing effect of the sun on the eastern side of the tree (Magoro, 2008).

6.5.3 Conservation strategies

In general most of the participants did not cultivate the investigated species in their homegardens. The few participants, who did cultivate, planted *D*. *sanguinea* and/or *S*. *aethiopicus*. This was 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 Northern Zululand area of KwaZulu-Natal. *Siphonochilus aethiopicus* was also noted to be cultivated by Manzini (2005), Moeng (2010), and Van Wyk *et al*. (2008). Propagation trials of *D*. *sanguinea* and/or *S*. *aethiopicus* in different soil types would therefore be valuable.

Despite high number of traditional healers who did not cultivate, most of them mentioned that they will cultivate if provided with seeds and seedlings, especially traditional healers of a younger age group. Only a small minority, mostly elderly traditional healers showed no interest in cultivation. Their reasons were that they preferred wild plants because it is believed that they are not contaminated and they have more healing power. The difference of age group preference shows that things are changing, the new generation is no longer bound to old believes and customs but eager to engage in conservation practices. A similar reason was given by Loundou (2008) in Cape Town, where participants who did not cultivate mentioned the lack of healing power as their main reason. Most of the community members also stated that they will cultivate if provided with seeds and seedlings. Those who indicated that they would not cultivate, mentioned a problem with fencing, which would allow domesticated animals to destroy the seedlings. Thus community-based medicinal plant gardens could be one solution to reduce wild harvesting.

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. This shows that people know how to harvest sustainably but are not doing what they are saying. Most of the indicated approaches such as no cutting of green plants, only small quantities collected and collect seasonally are also regularly mentioned by medicinal plant users and/or harvesters in other parts of South Africa (Stoffersen *et al*, 2011; Semenya, 2012) and other African countries, such as Zambia (Siangulube, 2009) and Cameroon (Mahop, 2004). The same inconsistency was observed with most traditional leaders mentioning different sustainable use strategies they employ, but field observations clearly indicate that these are not 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 of this study, with propagation, introduction of 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, as indicated by Semenya *et al*. (2013). Furthermore no single strategy is enough to ensure their long term survival. Thus, implementation of all the most important mentioned strategies such as; propagation, introduction of permit system and reintroduction and their strict adherence through appropriate regulation and compliance monitoring will be needed for the protection of TOPS-listed species in the Limpopo Province. Re-introduction 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 have reduced harvesting impact on wild populations (Wiersum *et al*., 2006).

6.6 Conclusion and recommendations

Over-exploitation and destructive harvesting methods are the main factors threatening the availability of the investigated TOPS-listed species in Limpopo Province. Cultivation and provision of seedlings of these species in addition to the various conservation techniques such as; propagation, introduction of permit system and reintroduction as suggested by participants might be useful in their conservation.

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CHAPTER 7

MANAGEMENT STRATEGIES AND LOCAL ATTITUDES TOWARDS THEM

7.1 Introduction

There is a major concern about the harvesting of indigenous plants from wild populations. A lack of resource management combined with high demand has resulted in a significant decline in the available wild populations (Mander, 1998). According to Cunningham (1993), the management of traditional medicinal plant resources is the most complex resource management issue facing conservation agencies, traditional leaders and resource users. There are relatively few studies (Cunningham, 1993; Boonzaaier, 2009) that document active involvement in the management of these plant resources, either via a bottom up (traditional rules) or top down approach (government rules) in the Limpopo Province. This chapter will endeavour to assist in this regard, especially with respect to TOPS-listed species in the province, which could also be of value to environmental managers in other parts of South Africa.

7.2 Aim and objectives

7.2.1 Aim

Investigate the current management strategies for selected TOPS-listed plant species in the Limpopo Province.

7.2.2 Objectives

The specific objectives of this study were to:

I. Document current management practices implemented to protect the selected plant species, focusing both on the bottom up approach and the top down approach.
II. Determine the community level of knowledge on regulations and protected plants. The data may be utilized by government officials to facilitate appropriate awareness programs and environmental education in communities to increase knowledge.
III. Propose future management strategies for selected TOPS-listed species.

7.3 Materials and Methods

Semi-structured questionnaires were used to gather information from community members (CM), traditional healers (TH) and traditional leaders (TL) (Chief or induna) and conservation officers (CO) The number of participants interviewed were; TH=40, CM=25, TL=6 and CO=3 per district, except in Vhembe district which had a different number of TH=20, CM=10, TL=4. The questionnaires had different sections which included; local management, regulations and future management strategies.

7.3.1 Current management practices

Participants were asked to disclose who manages plants in their communal lands. Furthermore, they were asked to indicate local rules or rules given by government, which are used to protect plant resources in their area. Participants who harvested from communal lands were asked if they needed a permit to harvest.

7.3.2 Regulations

Participants were asked if they knew about environmental legislation such as NEMBA, TOPS, CITES, NFA and LEMA. Those who used the plants were further asked if they knew that the plants they had been using are legislatively protected.

7.3.3 Future management strategies

Community members, traditional healers and traditional leaders were interviewed to gather information on future plans on how to protect and manage the use of their plants. They were asked what they think should be changed and what they think should not be changed.

7.4 Results

7.4.1 Current management practices

7.4.1.1 Management of communal lands

In all districts most CM and TH indicated that there was no one managing plant resources in their surrounding communal lands (Figure 7.1). All CM in Waterberg and Vhembe districts stated that their communal lands are not managed at all, yet some

mentioned that the [8]chief and/or [9]induna are responsible for management in their areas. Some participants (20%) stated that government intervened in the management of communal lands, across all districts excepting Mopani (Figure 7.1).

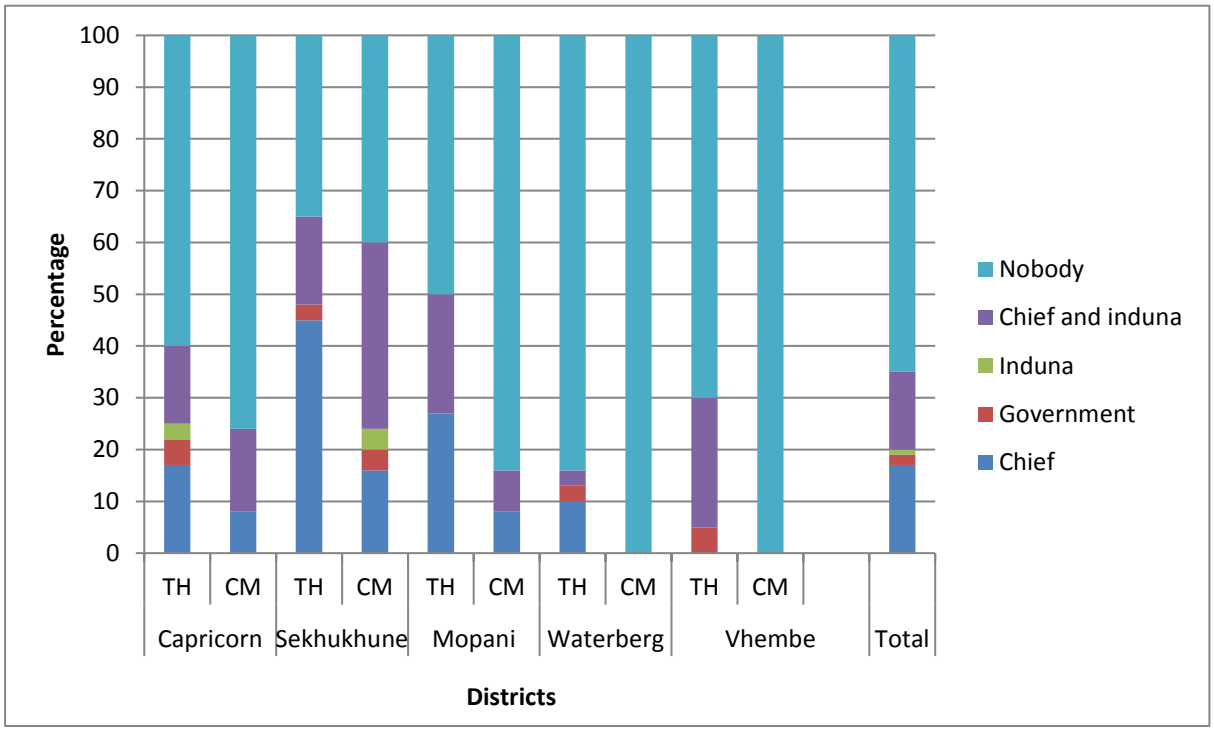

Figure 7.1: People responsible for the management of plants in communal lands of the Limpopo Province according to traditional healers (TH) and community members (CM).

The management of plants by the chiefs, indunas and government was confirmed by traditional leaders. According to traditional leaders, the following people are currently working together to manage plants in their communal lands; chief (69.23%), indunas (53.85%), government (30.77%), and only 7.69% of traditional leaders mentioned the involvement of local people. However, these responses differed by district.

In all districts, traditional leaders mentioned the involvement of government in managing plants in their communal lands (Table 7.1). In the Vhembe district, traditional leaders mentioned that they work solely with government in managing plant species. Generally, the chief councillor (the chief councillor is the representative of the council

[8] Chief is a leader or ruler of people or tribe or clan.
[9]Induna is a senior official appointed by the king or chief, who often act as a bridge between the people and the chief.

for all purposes) was not actively involved in the management of plants in communal lands and was only mentioned by traditional leaders in the Capricorn district.

Table 7.1: People traditional leaders work with in managing plant species in communal lands.

Stakeholders	Capricorn district	Sekhukhune district	Mopani district	Waterberg district	Vhembe district	Total (Numbers)	Total (%)
Government	2	1	2	1	2	8	29
Chief	2	5	5	5	0	17	60
Indunas	2	6	0	6	0	14	50
Chief councillor	1	0	0	0	0	1	4
Local people	0	0	0	2	0	2	7

7.4.1.2 Traditional rules

Forty one percent of TH indicated that traditional rules (Table 7.2) were implemented in their areas, while the rest mentioned that there were no rules. Only 23% of CM mentioned that there are rules. On the contrary, all traditional leaders, from all districts, indicated that they had rules that are implemented in their areas. According to 73.08% of traditional leaders, the rules they are currently implementing are ancestral rules created by previous chiefs. Some 26.92% of participants indicated that their rules were created by the current chief based on the prevailing situations. A large number (63.16%) of traditional leaders, who mentioned that they did not create their current rules, stated that there are satisfied with the status quo. However, the rest indicated that they would like to change them. They mostly wanted to implement a paid permit system and increase the fine money to reduce illegal harvesting.

Traditional leaders (TL), CM and TH who acknowledged that they had traditional rules, highlighted local rules that were common amongst the five districts in the Limpopo Province. However, their number of citations differed between CM, TH and TL per district (Table 7.2). In general, the most common traditional rule amongst most participants was no cutting of green plants, except for community members in the

Waterberg and Vhembe districts. Traditional leaders across all districts mentioned that they do not allow cutting of green plants. Permission to collect only small quantities was another commonly known rule amongst participants (Table 7.2).

Table 7.2: Traditional rules implemented for managing plant utilization in the five studied districts according to study participants.

Traditional rules	**Capricorn district**			**Sekhukhune District**			**Mopani district**			**Waterberg District**			**Vhembe District**				
	Participants (n)*																
	CM	**TH**	**TL**	**CM**	**TH**	**TL**	**CM**	**TH**	**TL**	**CM**	**TH**	**TL**	**CM**	**TH**	**TL**	**Total**	**%**
Small quantity collected	5	8	3	8	13	2	1	7	0	0	4	3	0	2	0	56	18
Do not cut down	3	1	0	3	1	0	2	10	2	0	0	2	0	0	4	28	9
Permit to collect	1	7	2	6	8	4	0	9	0	0	0	0	0	3	2	42	13
Seasonal collection	5	7	4	7	14	5	0	2	0	0	3	0	0	4	0	51	16
No cutting during initiation	0	4	0	1	1	3	0	0	0	0	0	0	0	3	0	12	4
No cutting of green plants	2	4	3	12	20	2	3	2	4	0	2	4	0	6	2	66	21
Closed access	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	5	2
Cultivate at home	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0.32
Closing hole after harvesting	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.64

Key: CM=Community member, TH=Traditional healer, TL=Traditional leader, ***This number contains an overlap of responses

According to the majority of participants (60%) traditional rules are followed. A smaller number of participants (8%) did not know if traditional rules are being followed, because they do not harvest in the wild and therefore never get to see people who harvest. In the Vhembe district, half of the participants stated that rules are followed, while another half think the opposite is true (Figure 7.2).

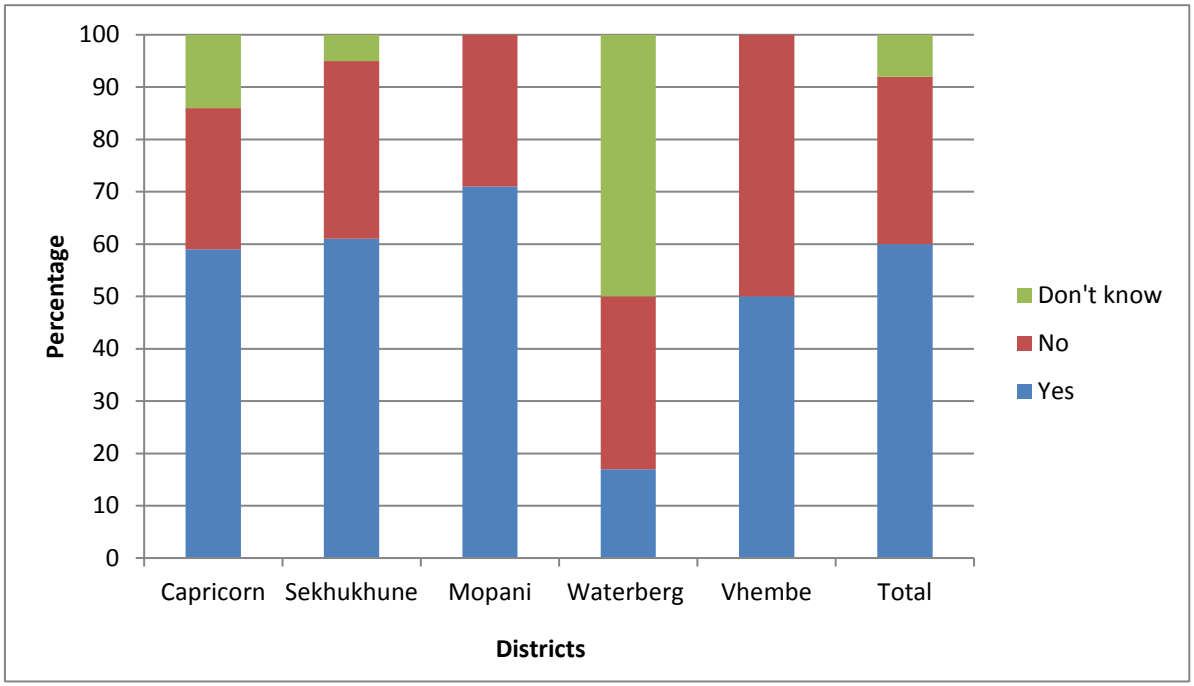

Figure 7.2: Perception of participants (TH and CM) on compliance on rules implemented in the studied districts of Limpopo Province.

Unlike TH and CM, 80.77% traditional leaders revealed that the rules are not followed in their areas. The cited possible reasons for this outcome was; lack of supervision in the field (26.92%), disrespect (19.23%), high unemployment rate (11.54%), and high number of TH (11.54%). Conversely, only 3.85% of traditional leaders mentioned that their rules are being followed. This difference in responses was consistent for all districts.

When traditional healers were asked about offenders, most thought [10]*muthi* traders were the main offenders. For instance, 55% of the TH indicated that [11]*muthi* traders were the main offenders, 21% implicated CM as offenders and 18% implicated TH,

[10] *Muthi* is a generic term used to define substances fabricated by traditional healers to either heal, harm and bring good or bad luck to people.
[11] *Muthi* traders are people who sell plant and animal material used for both witchcraft and healing practices.

while only 6% indicated that outsiders were the main offenders. However, 45% of CM indicated that the offenders were chiefs themselves, while 33% of them selected *muthi* traders, and 22% indicated that TH were the main offenders. Traditional leaders also believed that the main offenders were; *muthi* traders (46%), followed by TH (29%), and CM (21%) while 4% of traditional leaders did not know who could be breaking the law. Furthermore, half of the traditional leaders added that offenders are arrested when found breaking the law, while another 50% said that offenders are fined a certain amount of money. Overall, the afore-mentioned broad variation regarding the law offenders by participants is due to their individual perception.

7.4.1.3 Community participation

In most of the districts the majority of TH indicated that they are not allowed to help with managing plants in their area (Figure 7.3). On the contrary, the majority of CM in the Capricorn, Sekhukhune and Mopani districts said that they are allowed to help.

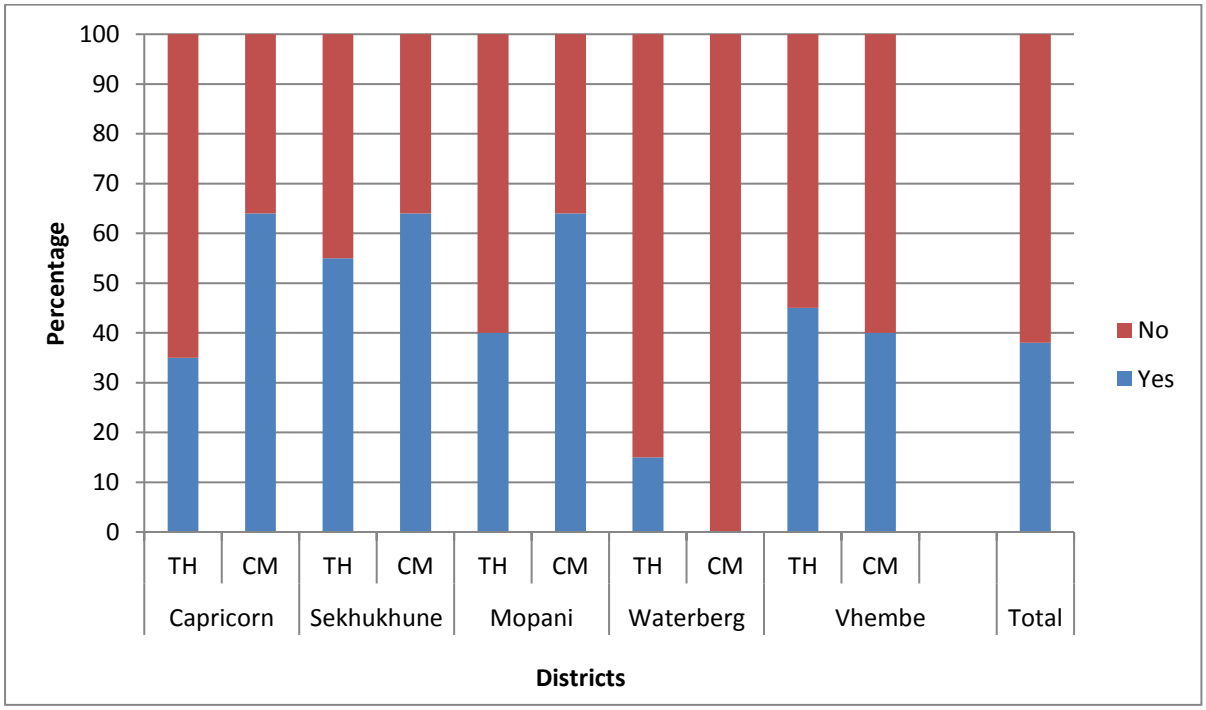

Figure 7.3: Responses of participants in relation to traditional healers' and community members' involvement in local management of medicinal plant resources.

Traditional leaders contradicted each other when it comes to the community's involvement in management, this is perhaps attributed to the fact that these leaders are from different geographical areas. Half of them indicated that the community is actively involved in managing plants in their areas, whereas the other 50% noted that

the community was not involved. Those who mentioned that the community is allowed to help, highlighted that they assist with several responsibilities such as; reporting illegal harvesting (46%), overharvesting (23%) and unsustainable methods of harvesting (15%), as well as undertaking patrols (15%). Those traditional leaders, who indicated that the community did not participate in environmental management, stated that they are afraid of harvesters who can jeopardize their safety. One of the traditional leaders claimed that he was told by the community that it is his duty to manage and not theirs.

7.4.2 Permit system

When participants (TH and CM) were asked if they need a permit to harvest, their responses varied, in some districts the majority said yes and some no (Figure 7.4). Those who indicated that they do not need a permit reasoned that it is their home; therefore they do not need permission to harvest their own resource. They also indicated that only people from outside are required to produce a permit before harvesting. Generally, more traditional healers indicated that they need a permit, which is the opposite for CM (Figure 7.4).

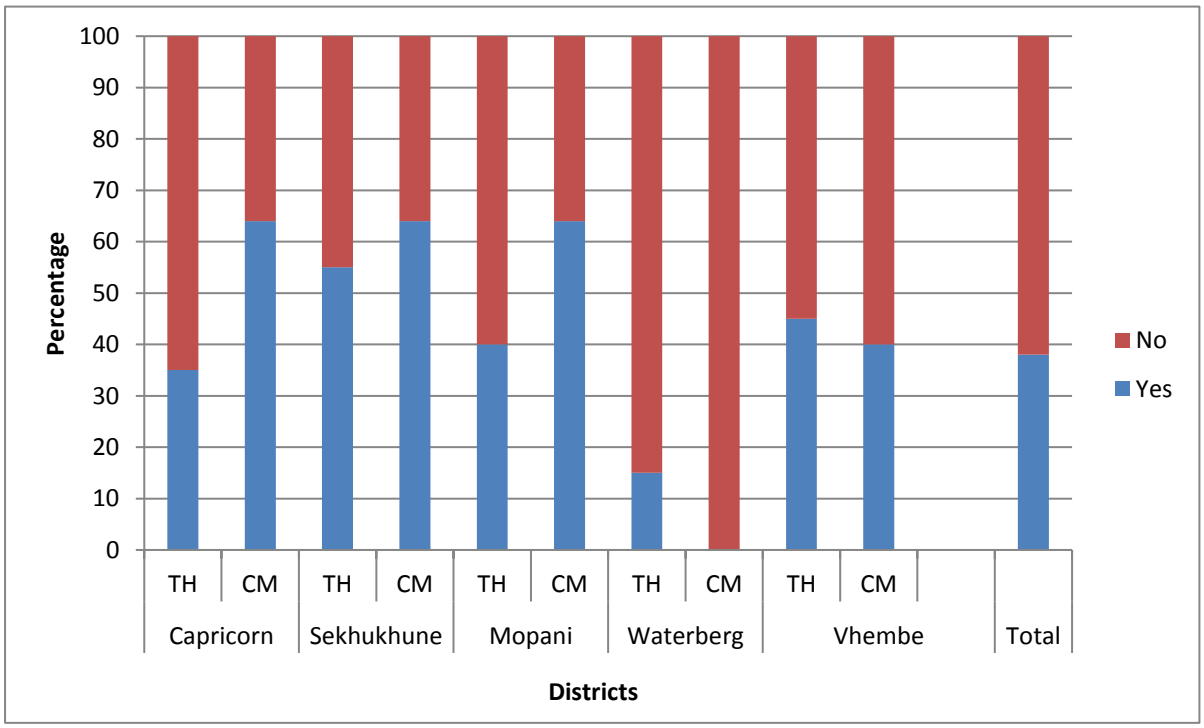

Figure 7.4: Participants' responses on whether a permit is required to harvest plants in communal areas of the Limpopo Province.

When traditional leaders in the Capricorn, Mopani and Vhembe districts were asked to validate the information given by participants, 50% of them mentioned that in their areas they use a permit system, while the other half indicated that they do not use one. In the Sekhukhune district 60% confirmed that a permit is needed, while in the Waterberg 60% indicated that there is free access to communal areas.

Participants who mentioned that a permit is required, were then asked if they had one. In general, more TH mentioned that they had a permit as opposed to CM. From all districts 71% of these TH indicated that they had permits, 24% did not have, and 4% indicated that they only obtain permits when harvesting outside their areas. From those TH who claimed to have permits, 84% indicated that they were issued cards by the Traditional Healers Association (THA), which allowed them to harvest any medicinal plant, wherever they want. Fifteen percent of participants revealed that they acquired their permit from tribal authorities, with just 1% obtaining it from government officials. Eighty three percent of CM who knew they needed permits indicated that they did not have a permit. Twelve percent of them revealed that they only obtain permits when harvesting outside their areas and only 5% of them indicated that they had it, and that they got it from tribal authorities in foreign areas.

The issuing of permits by [12]tribal authorities and the THA was confirmed by traditional leaders. About 77% of them stated that harvesters get a permit from tribal authorities, while 23% of them revealed that harvesters are given a permit by the THA. Furthermore, they indicated that the permit from THA given to TH is issued in a form of a card, and that it is their (traditional leaders) duty to check the card every time before allowing them entry onto communal lands. On the other hand, a permit given to CM and TH by tribal authorities is a written letter that allows them entry for certain number of days before it expires, and it cannot be re-used.

7.4.3 Knowledge on protected plants and legislation

Most of the participants in all districts did not know that the plants they were using were protected in legislation. More CM did not know than TH (Figure 7.5). The healers, who knew indicated that they heard it from their THA meetings or from their mentors.

[12] Tribal authorities are people (Chief and induna) that serve as the local government in the rural areas due to their closeness to the people at the grassroots.

On the other hand, CM who knew stated that they heard it from radio shows, people around them, or university students who had conducted studies in their area.

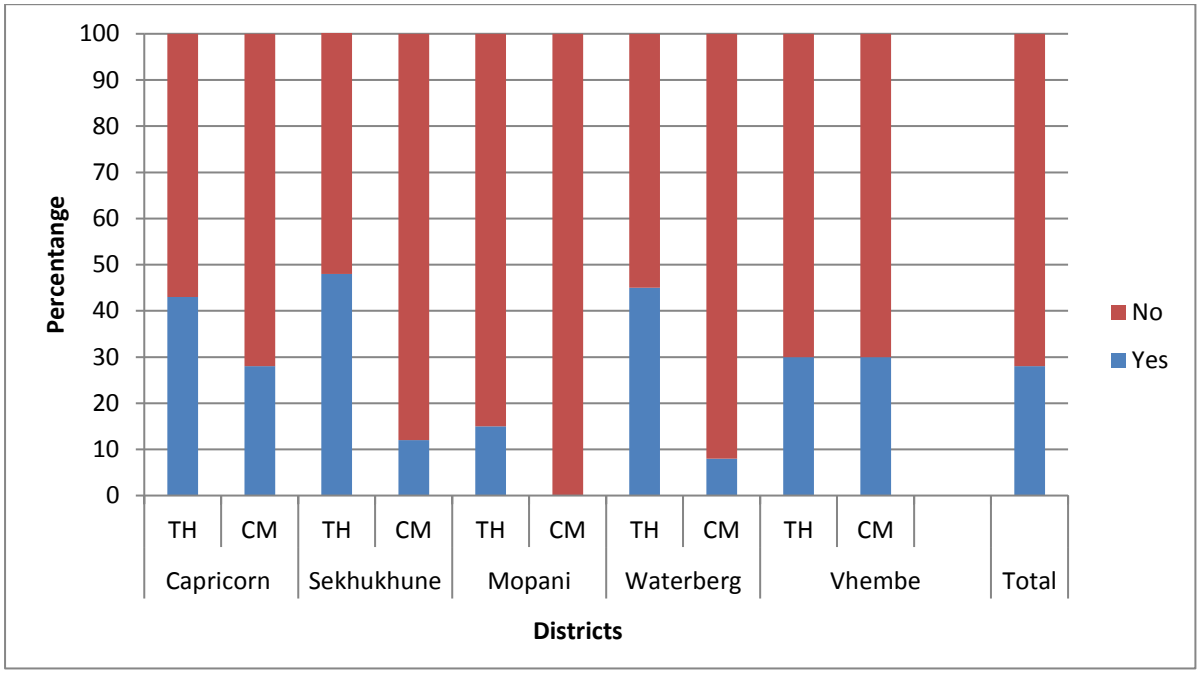

Figure 7.5: Responses of traditional healers and community members on conservation knowledge from different districts of the Limpopo Province.

Despite the lack of knowledge by a large majority of CM and TH, most of their traditional leaders (58%) had knowledge about the protected status of the medicinal plants selected for this study; 40% in the Capricorn, 40% in the Sekhukhune, 10% in the Mopani districts and all traditional leaders from Vhembe. All who knew confirmed that they were informed by government officials.

In the Capricorn and Sekhukhune districts, traditional leaders mentioned that they knew specifically about the protection of *Warburgia salutaris*, while those from the Vhembe district knew about the protection of *Brackenridgea zanguebarica*. Surprisingly, none of the traditional leaders from the Waterberg district knew about the protection of these plant species.

When participants' knowledge on environmental legislations was tested, it was found that the majority (90%) of traditional healers and community members did not know of any of the legislation they were asked about (Figure 7.6). Only a small minority (10%) of participants were aware of environmental legislations.

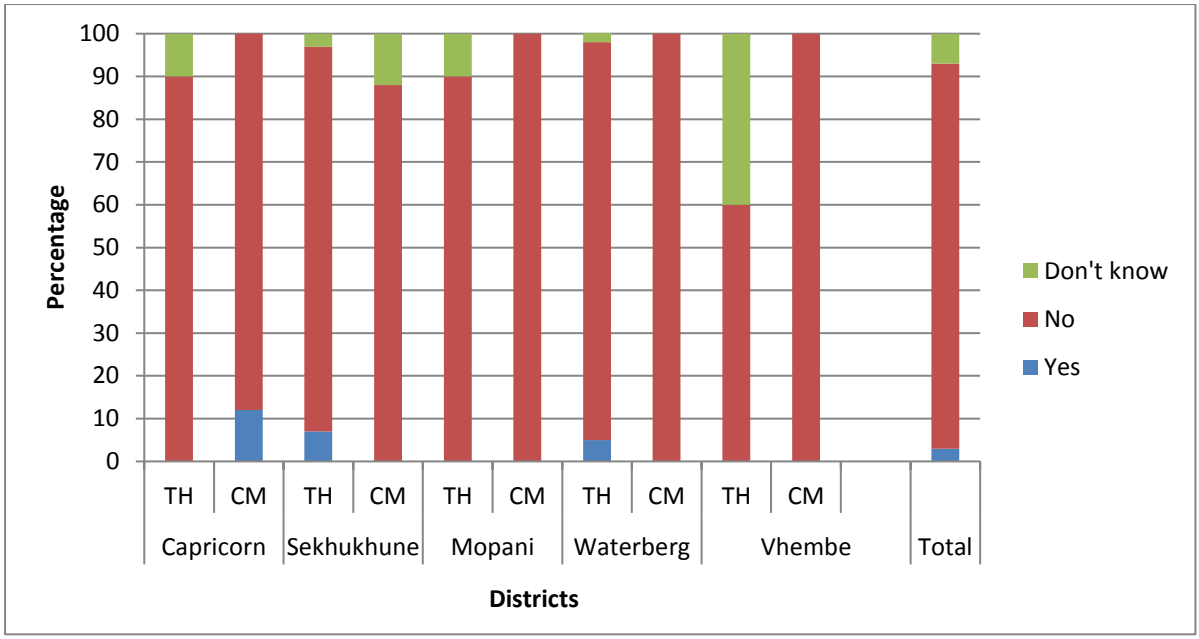

Figure 7.6: Knowledge of traditional healers and community members on environmental legislations.

It was found that 89% of traditional leaders did not know of any of the legislation they were asked about. This was also the trend within districts, where in the Sekhukhune and Mopani districts, 90% of the traditional leaders were unaware of the environmental legislation, while none of the traditional leaders in the Capricorn and Waterberg districts knew of the legislation. However, the situation was different in the Vhembe district, where 50% had this knowledge.

7.4.4 Recommended management approaches

7.4.4.1 Management strategies

When community members and traditional healers were asked if there was anything they would want changed regarding the management of medicinal plants in their areas, they mentioned a number of factors, which they thought would help to improve their management (Table 7.3). Most of them thought patrolling in the wild could improve management. Sixteen percent indicated that use of permits can improve management. The use of traditional rules and workshops was also some of the most recommended management strategies.

Table 7.3: Responses of community members and traditional healers on factors they thought would improve management of medicinal plants in their communal areas.

Strategies	Capricorn district		Sekhukhune district		Mopani district		Waterberg district		Vhembe district		Total (n)	%
	Number (n) of participants											
	CM	TH	CM	TH	CM	TH	CM	TH	CM	TH		
Do patrols	8	8	5	15	2	4	0	7	0	5	54	27
Ensure arrest of offenders	1	2	1	0	0	0	0	0	3	1	8	4
Government should intervene	3	2	1	2	3	0	2	0	0	3	16	8
Enforce closed access	4	2	0	1	0	0	0	0	0	0	7	4
Enforce traditional rules	1	8	0	4	0	4	0	0	4	0	21	11
Workshops to increase knowledge	5	2	0	0	6	1	3	3	0	0	20	10
Use permit	4	6	3	7	2	0	0	3	0	6	31	16
Reintroduce in camps	2	6	1	7	0	0	0	2	0	0	18	9
Free access for TH	0	0	0	0	0	0	2	1	0	0	3	2
Quotas	2	2	3	5	0	0	0	1	0	0	13	7
Cultivation	0	2	2	0	0	0	0	0	0	0	4	2
Key: Community members (CM) and traditional healers (TH)												

According to 95% of traditional leaders, in order to improve management of medicinal plants in communal lands, government should intervene. Traditional leaders opposed to government intervention were of the opinion that government disrupts traditional management structures, and community members become rebellious to traditional rules and this upsets the ancestors.

Traditional leaders who wanted to work with government mentioned that they need help because of a shortage of money to appoint field patrollers (54%), and lack the knowledge on conservations issues, which requires environmental education (39%). Furthermore, they need help with strengthening traditional rules (12%), establishing nature reserves (8%), and providing free seeds for cultivation (4%).

7.4.4.2 Management leadership

Traditional healers and CM showed different preferences as to who should manage plants in their areas. However, they both mostly preferred the chief and government. Traditional healers indicated that their first choice was the chief and government (28%), followed by chief and indunas (23%), government (15%), chief and local residents (10%), chief (8%) and local residents (6%). However, some (10%) indicated that they did not know who is/are the right person/people to manage plants in their areas.

The preferences expressed by CM included; chief and government (39%), chief (18%), chief and induna (15%), government (14%), chief and local residents (6%), and local residents (6%). Just 4% indicated that they did not know who should manage their plants, and 2% indicated that no one should manage their plants as they have a right to use them anyway they want.

7.4.5 Management of plants by conservation officers

7.4.5.1 Legislation and plants prohibited from use

Conservation officials were asked about the legislation they use to manage medicinal plants. Forty five percent of them mentioned that they use NEMBA, while 22% indicated that they use LEMA, and 33% said that they did not know which legislation they should use.

With regard to protection of species using the above mentioned legislation, 64% of conservation officials did not know any of the TOPS-listed plants species in the current study and therefore did not regulate their use. A considerable number (29%) knew *Brackenridgea zanguebarica* and prohibit its harvest, particularly those interviewed in the Capricorn and Vhembe districts. The harvest of *Siphonochilus aethiopicus* was only prohibited by officers in the Capricorn district.

7.4.5.2 Patrols

Conservation officials (CO) indicated that their main management strategy is through enforcement of the law by patrolling. Those who indicated that they knew the TOPS-listed plants of this study mentioned that they patrol and inspect in order to prevent the harvest of these species. However, those who did not know the species revealed that they only do patrols to regulate the harvest of fuelwood species. Sixty-seven percent of CO stated that they patrol in rural areas to monitor whether local people are utilizing threatened species. The most common reason for not patrolling was that they only attend to complaints, while some mentioned that they are old and are no longer fit enough for patrolling.

All CO in the Capricorn and Sekhukhune districts said that they do patrol in rural areas, while 67% of the officials in the Mopani and Waterberg districts did not patrol in rural areas.

In general, most (60%) of the CO interviewed said that they inspect *muthi* shops to see whether protected species are sold. They mentioned that they also check for trading permits. The major reasons for not inspecting *muthi* shops were that most plants in *muthi* shops are already processed or are traded as parts (e.g. roots) which are impossible or not easy to identify. All officials in the Mopani and Vhembe districts indicated that they do inspect *muthi* shops, while inspections of *muthi* shops are not taking place in the Waterberg district at all. In the Capricorn district, 67% of officials inspect *muthi* shops, while only 33% of officials in the Sekhukhune district conduct *muthi* shop inspections. Eighty percent of CO consider the *muthi* traders to be the main offenders, but the other 20% thought that the traditional healers were the main offenders.

7.4.5.3 Problems encountered with managing plants

When asked why they do not inspect or undertake patrols, most conservation officials indicated that their main problems are; limited staff, lack of vehicles, lack of knowledge on the plants and their distribution (Figure 7.7). Many officials have retired or are too old to be actively involved in inspections and patrols. Officials (mostly female (60%)) in the Vhembe district exclusively stated that they do not inspect/patrol because the area is too risky. Two officials in the Vhembe district indicated that their working hours limit patrols, since *B. zanguebarica* is culturally collected at night and they only work during working hours (7:30 am to 4:30 pm).

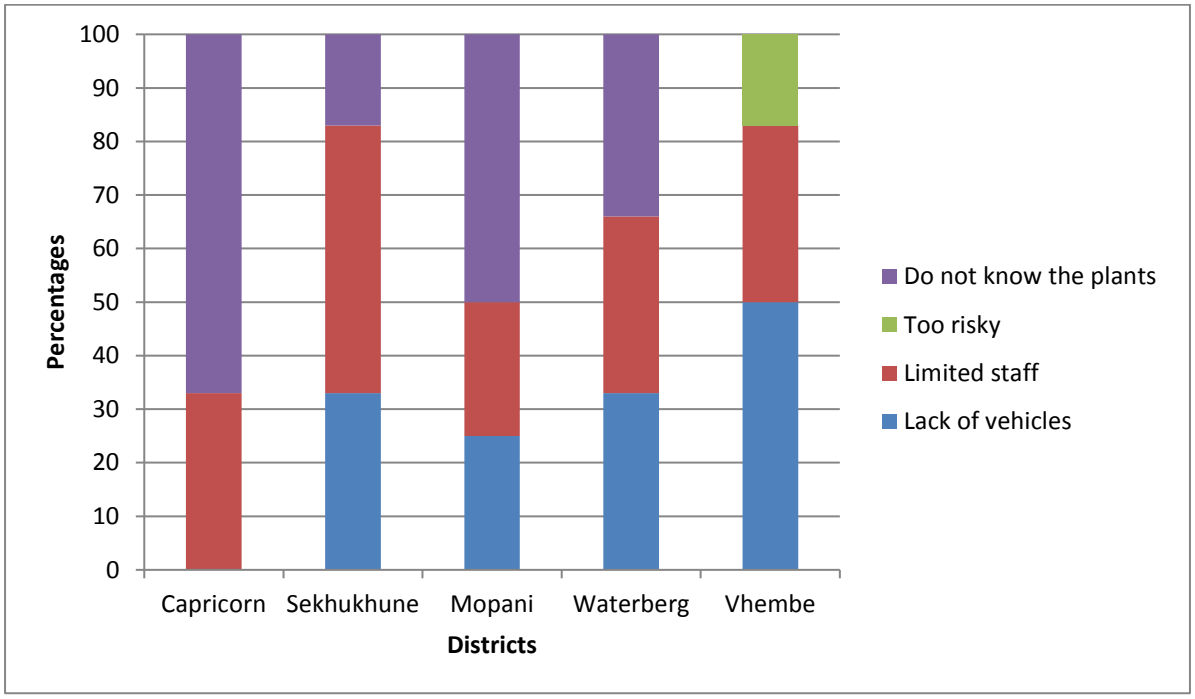

Figure 7.7: Problems encountered by conservation officials in relation to managing plants in the surveyed districts of the Limpopo Province.

When officials were asked how many of them are responsible for doing patrols and inspections in their districts, 60% of them indicated that there are 10 officials responsible, while 40% mentioned that there are less than 5 officials in the district. Seven percent of officials stated that they do not have cars for patrolling, while 73% of them had access to less than five cars, and 20% had 20 cars allocated for patrols in their districts.

Sixty percent of conservation officials rely on the user's knowledge to identify plants during patrols or inspections; they indicated that harvesters tell them the name of the plants they harvested. Thirty four percent of the officials indicated that they use traditional knowledge to identify the plants since they are themselves familiar with them, while 6% of them sometimes conduct patrols and inspections with botanists who help to identify plants especially in *muthi* shops.

7.5 Discussion

7.5.1 Current management practices

Generally the majority of participants across most districts in this study mentioned that there is nobody managing plants in their communal lands. This is contrary to the findings of different researchers in African countries such as Lesotho (McCullum, 2000), Swaziland (Simelane, 2009) and Zimbabwe (Clarke, 1994), who found that traditional leaders are responsible for the management of plants in the communal lands. The absence of management measures for plant resources in the communal lands of Limpopo Province as indicated by this study needs to be addressed urgently. In KwaZulu-Natal the lack of on ground management has led to the local extinction of *W*. *salutaris* (Coopoosamy and Naidoo, 2012). This same species was also reported as being locally extinct in Zimbabwe, due to the absence of management of communal lands (Maroyi, 2008).

Some of the participants in this study did indicate that their chiefs or indunas manage plants in their areas. This finding is not unexpected as it is commonly known amongst Black Africans that traditional leaders are responsible for the management and control of local natural resources. Some participants also mentioned that the management of plants by the traditional leadership is applicable to all the plants irrespective of their conservation status. This therefore creates doubts about the capability of traditional leaders in managing specific TOPS-listed plant species, which require special management (NEM:BA, 2004). It was concerning to find that very few participants in all studied districts indicated the involvement of government in the management of local plant resources, especially since there are government employees who are trained professionals in plant management and conservation. Furthermore, few traditional leaders involved local people in the management of plant resources, a lost opportunity for raising awareness on the status of local species availability.

All traditional leaders mentioned that they had traditional rules to manage plant resources in general in their communal lands. On the contrary, less than one in four community members and less than half of traditional healers were aware that there are traditional rules for the management of plant resources in their areas. The use of traditional rules as part of a broader suite of management rules was previously reported by other studies in South Africa (Saidi and Tshipala-Ramatshimbila, 2006; Rasethe *et al*., 2013) and in other African countries such as Zambia (Siangulube, 2009) and Zimbabwe (Cunningham, 1993).

The most mentioned rules were “no cutting of green plants”, “collection of small quantities of plants”, “restricted chopping down of trees”, and “seasonal collection”. Some of these traditional rules are common to other parts of South Africa (Ndawonde, 2006) and other African countries (Cunningham, 1993). However, other studies especially in South Africa have reported different rules. In the Vhembe district for example, collection of species, including *B*. *zanguebarica*, is allowed under the supervision of an officer from the tribal authority to ensure sustainability (Mungoni, 2003). Collection of plants in general, including *A*. *amatymbica*, in the Eastern Cape is done via a permit from tribal offices (Stoffersen *et al*., 2011). Although the traditional rules in the present study were not mentioned specifically in relation to the TOPS-listed species included in this study, adherence of the users of these species to these rules will certainly contribute to their sustainability. “Closed access”, “cultivation at home” and “refilling of hole after harvesting” were the least mentioned management rules in this study. The limited use of cultivation as a management strategy of plants was disappointing, as it is a known fact that plant propagation reduces the harvesting pressure on wild populations (Semenya and Potgieter, 2014).

In general, the majority of participants mentioned that the traditional rules used to manage the plants are mostly being followed. However, most participants implicated the medicinal plant traders in breaking these rules. This was not unexpected as it is a widely held perception that many medicinal traders are more concerned with income generation than with the sustainability of species (Mander, 1998; Mungoni, 2003; Moeng and Potgieter, 2011). According to traditional leaders interviewed in this study, offenders are arrested or fined. Similar findings were reported by Mahop (2004) in Cameroon, where it was found that offenders were required to bring a token of palm

wine or oil to traditional leaders. Illegal activities continue in Limpopo Province despite the punishment meted out. This is possibly due to the socio-economic status of the offenders. Since the current traditional rules were mostly formulated by ancestral chiefs, there is a need to amend the rules or create new effective ones that are more relevant to the current generation.

It was encouraging to find that the majority of the community members in most of the districts are allowed to assist with the management of plant resources in their areas. This finding was unexpected because healers are generally known to be the harvesters and holders of local knowledge of medicinal plants, and one would expect that more traditional healers would be included in the management of plant resources (Rasethe *et al.,* 2013).

7.5.2 Permit system

Generally most (16%) of the participants in the districts indicated that a permit is not needed when collecting the investigated species. There was a perception that only outsiders are required to produce a permit before harvesting in their communal lands. This seems to be a common practice in South Africa as was previously reported in different provinces such as the Eastern Cape (Stoffersen *et al*., 2011), the Western Cape (Loundou, 2008), and Limpopo (Tshisikhawe, 2002; Rasethe *et al*., 2013; Moeng, 2012). It is anticipated that the evasion of permit requirements will affect the local availability of species as it is likely that harvesters will collect as much material as they need without regulation of quantity. Cunningham (1998) reports that local *muthi* traders are known to re-use the same permit to harvest a population to extinction, all for financial gain.

In this study the majority of traditional healers who claimed to have permits, considered the cards issued by the Traditional Healers Association (THA) as permits allowing them to harvest any medicinal plants wherever they want. These traditional healers are thus in non-compliance with national (NEM:BA, 2004) and provincial (LEMA, 2004) legislation. TOPS-listed species may not be harvested without a permit issued by the delegated authority (LEDET). Members of the THA may not be knowledgeable with respect to relevant legislation, but there is an opportunity for collaboration between the THA and government. Such partnership would empower THA leaders with respect to

conservation issues, which in turn can be transferred to the traditional healers across the province. The same partnership should be formed with traditional leaders, since a small percentage of participants in this study mentioned that they acquired a permit from tribal authorities, allowing them to collect required amounts of the investigated TOPS-listed species whenever needed for a certain period of time. Surprisingly, only 1% of the collectors of the investigated TOPS-listed species mentioned that they obtained a permit from government. This warrants further investigation.

7.5.3 Knowledge on protected plants and legislation

Most of the participants in all districts, especially community members, did not know that the six investigated plants which they were using were protected in legislation. This was not surprising as this has been reported in the Limpopo Province before (Moeng, 2010; Semenya, 2013), and there is an apparent breakdown in communication between the local conservators and rural communities. Similar findings were reported in a study by Mintsa Mi Nzu (2009) in Cape Peninsula. It is essential that public awareness on these matters is increased.

7.5.4 Recommended management approaches

Amongst the numerous management strategies recommended by the participants as crucial for the six investigated species, a majority suggested patrolling the areas where the plants grow. However, this will only be successful if patrols are executed during the day and night. Boonzaaier (2009) found that the vast majority of harvesters in some areas of the Limpopo Province overexploit the medicinal materials during the night to avoid patrolling officers.

Other management techniques recommended by the considerable number of participants such as enforcement of traditional rules, use permit and patrols in the communal lands were the population occurs are practically and easily feasible. Any management interventions can be strengthened by information sharing from government agencies, such as LEDET and SANBI.

Both traditional healers and community members showed a preference for the species to be managed by the chief and government. Indeed if this partnership is executed

successfully it will contribute immeasurably to the sustainable management of plants. However, most of these traditional healers claimed that if government is given a full control to manage their plants they will undermine the tribal authorities, thus suggesting both parties should collaborate. Interestingly, 95% of traditional leaders also support the notion that government should collaborate with them in the management of local plants.

7.4.5 Management of plants by conservation officials

In general conservation officials interviewed across the five districts mentioned that they mostly use NEMBA and LEMA to manage the six investigated species. Indeed section 56 of NEMBA of 2004 and schedule 12 in LEMA of 2003 deals with the conservation or management of TOPS-listed species. Of concern, a third of the officials interviewed in this study stated that they did not know which legislation to use. There is also a general lack of knowledge amongst conservation officials concerning the species themselves, and officials did not know that they were required to regulate them. This therefore shows a lack of training and leadership in the provincial conservation agency (LEDET).

Conservation officials who knew the TOPS-listed plants in the study mentioned that they patrol in rural areas, and inspect *muthi* shops in order to regulate use of these species, however, some did not inspect shops since most of the plants are processed and thus impossible to identify. This indeed is a major challenge that is yet to be solved, especially since most of the conservation officials considered the *muthi* shop owners to be the main offenders. It is therefore of great importance that these officials be trained on how to use DNA barcoding method for identifying various threatened species sold at the *muthi* shops as materials (with lack of characteristic plant parts). This technique was successfully used to expose illegal trading of threatened species sold at traditional markets in KwaZulu-Natal and Gauteng provinces of South Africa (Williamson *et al*., 2016).

Generally, problems experienced by conservation officials when managing protected plants including the investigated species were similar in the five districts. Most cited lack of staff as an aggravating factor; a similar finding was highlighted by Moeng (2010), also for the Limpopo Province. A lack of knowledge in relation to species

identification in the field and their distribution was also mentioned as a limitation by most officials interviewed in the current study. Capacitating these officials through appropriate training is essential. Equally, a considerable number of officials stated shortage of vehicles for patrolling as a major challenge relating to the management of the protected species. Therefore, the provision of more vehicles will be of great assistance in this regard.

7.6 Conclusion and recommendations

The majority of participants across most districts in this study reported that no one is managing the investigated species in their communal lands, thus suggesting that such plants might face local extinction through overexploitation. However, in areas where plant species are managed, traditional leaders use indigenous rules which are applied in general to all plant species. In general it was the participants' perceptions that that government plays a minor role in the management of these plant species. This shows a lack of communication between the local conservation officials and people at grass root levels. It is therefore understandable that most of the interviewed people (community members, traditional healers and traditional leaders) were not aware of the conservation status of the TOPS-listed species nor did they have any knowledge on the legislation regulating the species. However, the finding that there are provincial conservation officials who lack knowledge on the legislation managing the investigated species, and who also cannot identify specimens of these species, was unexpected.

Key recommendations include:

- Collaborative partnerships between government and traditional leaders in relation to managing the TOPS-listed medicinal plant species in communal lands.
- Workshops with the Traditional Healers Association to raise awareness amongst members in relation to legislation and permitting requirements.
- Capacitating provincial conservation officials in legislation and identification of TOPS-listed species.
- DNA barcoding of TOPS-listed medicinal plant species to aid in the identification of parts and derivatives in *muthi* shops.

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APPENDICES

APPENDIX 1: PARTICIPANTS INFORMED CONSENT FORM

Dear participants,

My name is Marula Triumph Rasethe (student number: 201218793), and I am a Masters student (in Botany) at the University of Limpopo (Turfloop Campus), Limpopo Province. To complete my studies, I am expected to conduct a research study and cite a report on my findings.

Founded that many plant species that are continuously used are threatened to extinction, I am interested in learning about certain plant species that are used in your community. In short, the study will seeks to document the use, management strategies and threats of certain plant species in your community. In order to find approaches that can be implemented to ensure sustainable use of those plants.

Please note that your participation in this study is entirely voluntary and you can refuse to participate or stop at any time without prejudice. You can also withdraw your consent at any time, before, during or at the end of the interview. Most important, please note that the results of this study will be processed in to a report but will not include any information that identify you as a participants, you are thus guaranteed to remain anonymous.

PARTICIPANTS CONSENT FORM:

I hereby, confirm that Ms M.T. Rasethe has informed me, about the nature and conduct of the study. I have also received, read, and understood the information about this study. I am aware that the information will be recorded and that the results will be anonymously processed in to a study report. Furthermore, I have had sufficient opportunity to ask questions and declare myself prepared to participate in the study.

Name of participant	Signature	Date
_____	_____	_____
Name of researcher	Signature	Date
_____	_____	_____

QUESTIONNAIRE NO:

APPENDIX 2: QUESTIONNAIRE: Community members

The utilization and management of selected CITES and TOPS-listed plant species in the Limpopo Province, South Africa

District: _____
Area: _____
GPS: _____
Date: _____

PLEASE ANSWER THE FOLLOWING QUESTIONS BY CROSSING (x) THE RELEVANT BLOCK OR WRITING DOWN YOUR ANSWER IN THE SPACE PROVIDED.

SECTION A- DEMORAPHIC INFORMATION

1. Gender

Male	1	Female	2

2. Age

<20	1	20-29	2	30-39	3	40-49	4	50-59	5	>60	6

3. Level of education

No formal education	1	Primary	2	Secondary	3	Tertiary	4

4. Employment

Unemployed	1	Employed by company	2	Self employed	3	Other (specify)	4

5. Income per month

< 1000	1	1001-2000	2	2001-3000	3	3001-4000	4	4001-5000	5	>5000	6

6. Size of household

Lives alone	1	2	2	3	3	4	4	5	5	6	6	>7	7

7. How long (in years) have you lived in this area?

<10	1	10-19	2	20-29	3	30 and more	4

SECTION B- PLANT RESOURCE UTILIZATION

8. Below is a list of plants, tick the plants that you use.

Plant species	**Vernacular names**	**Source of plants**	**Area of collection**	**Quantity collected**	**Frequency of harvest**	**Most used/harvested plants(rank)**	**Local availability**
Scientific names	1= Sepedi 2= XiVenda 3= XiTsonga	1=wild 1=Your communal land, other villages, other districts, other provinces. 2=garden 1=own 2=somebody else 3=buy 1=*Muthi* shop 2=Street vendor 3=Traditional healer 4=Other:		Grams/period -how long does it last?	1=Everyday 2=Once a week 3= Once a month 4= Other (specify)	1=most used 2= moderately used 3=least used 4=never used 5=other (specify)	1=common 2=declining 3=rare
Acacia sekhukhuniensis							
Alepidea amatymbica							
Ansellia africana							
Bowiea volubilis							
Brackenridgea zanguebarica							

Dioscorea sylvatica							
Drimia sanguinea							
Eulophia speciosa							
Gasteria batesiana							
Mondia whitei							
Prunus africana							
Siphonochilus aethiopicus							
Warburgia salutaris							

Plant species	**Parts harvested**	**Form of plant parts(dried/fresh)**	**Uses**	**Method of preparation**

9. Why do you prefer to use these plants (most used plants)?

_____

_____

11. How many years have you been using these plants?

<10	1	10-19	2	20-29	3	30 and more	4

12. Do you sell any of the above mentioned plants for cash income?

Yes	1	No	2

13. If yes, which of these plants do you sell and for how much?

A. sekhukhuniensis	R	*A. amatymbica*	R	*A. africana*	R	*B. volubilis*	R	*B. Zanguebarica*	R
D. sylvatica	R	*D. sanguinea*	R	*E. speciosa*	R	*G. batesiana*	R	*M. whitei*	R
P. africana	R	*S. aethiopicus*	R	*W. salutaris*	R				

14. Who is your main customer base? (Rank)

Traditional healers	1	General public	2	Other: specify	3

15. Which procedures are followed when collecting?

_____

_____

_____

SECTION C−MANAGEMENT STRATEGIES AND ATTITUTES TO THEM

16. Do you need a permit to collect these plants?

Yes	1	No	2	I don't know	3	Others	4

17. Do you have a permit to collect these plants?

Yes	1	No	2

17.1 If yes, where did you get it?

Tribal authority	1	LEDET offices	2	DWA offices	3

17.2 If no, why don't you have it?

Don't know where to get it	1	Difficult to get	2	It is not important	3	Didn't know I should have it	4	Others	5

18. Do you know that the plants you have been using are protected and threatened?

Yes	1	No	2

18.1 If yes, how did you get informed?

_____

19. Which of these legislations do you know?

NEMBA (TOPS)	1	CITES	2	NFA	3	LEMA	4	None	5

20. Who manages plants in your communal land?

Chief and local residents	1	Chief and Indunas	2	Chief and government	3	Chief	4	Gover nment	5	Local residents	6
Nobody	7	Other	8								

Other (specify) _____

If the answer above is **nobody**, skip **question 21** and move to **question 22**.

21. Tick rules and regulations that are given to protect plants in your area (including taboos)?

No cutting of green plant		1
No soil collection in the communal land		2
No plant collection in times of initiation schools		3
Woman are not allowed to collect plants during menstruation periods		4
Pregnant woman are not allowed in communal lands		5
Some species are only harvested during certain seasons		6
Some species are only harvested for their leaves		7
Certain parts of communal lands are restrictive only		8
Leaving bits of the plant behind and closing the hole		9
Only small quantity of plant are collected		10
Frequency of collection e.g. return intervals		11

Others: _____

21.1 Do people (including you) in your community follow these rules/regulations?

Yes	1	No	2

21.2 If no, according to you who are the main offenders?

Community members	1	Traditional healers	2	*Muthi* traders	3	Street vendors (trading wild plants)	4

Others: _____

21.3 What penalties are given to them?

_____

21.4 If yes, what are the advantages of following these rules?

Reduce overutilization	1	Allow equal access	2	Maintains availability of plants	3	Reduce illegal harvesting	4

Others: _____

21.5 Who makes sure that these rules are implemented?

Community members	1	Traditional leaders	2	Indunas	3	Government	4

22. Are there any rules or regulations from the government that restrict you from harvesting plants from your communal area?

Yes	1	No	2

22.1 If yes, which plants does the government restrict from use?

A. sekhukhuniensis	1	*A. amatymbica*	4	*A. africana*	7	*B. volubilis*	10	*B. zanguebarica*	12

D. sylvatica	2	*D. sanguinea*	5	*E. speciosa*	8	*G. batesiana*	11	*M. whitei*	13
P. africana	3	*S. aethiopicus*	6	*W. salutaris*	9				

22.2 How do you feel about these restrictions?

Happy	1	Neutral	2	Not happy	3	Others	4

Reason: _____

23. Do you think the use of plants should be controlled?

Yes	1	No	2

23.1 If yes, why?

_____

23.2 If no, why?

_____

24. Are you given the right to help in managing plants in your communal area?

Yes	1	No	2

24.1 If yes, how?

_____

24.2 If no, would you like to help in managing plants in your community?

Yes	1	No	2

24.3 If no, why not?

_____

24.4 If yes, how would you like to help?

Report illegal harvesting	1	Report overharvesting	2	Report unsustainable methods of harvesting	3	Do patrols	4

Others: _____

25. In your own opinion, regarding the management of plants in your area

25.1 What should be changed?

_____

_____

25.2 What should not be changed?

_____

_____

25.3 Who do you think should manage plants in your area?

Chief and local residents	1	Chief and Indunas	2	Chief and government	3	Chief	4	Government	5	Local residents	6

SECTION D− ANTHROPOGENIC THREATS TO PLANTS

26. Do you think plants in your area are declining?

Yes	1	No	2

27. What could be the possible reasons for the decline in these species?

	Over-harvesting	Agriculture	Deforestation	Afforestation	Rural expansion	Urban development	Invasive alien
Acacia sekhukhuniensis	1	2	3	4	5	6	7
Alepidea amatymbica	1	2	3	4	5	6	7
Ansellia africana	1	2	3	4	5	6	7
Bowiea volubilis	1	2	3	4	5	6	7
Brackenridgea zanguebarica	1	2	3	4	5	6	7
Dioscorea sylvatica	1	2	3	4	5	6	7
Drimia sanguinea	1	2	3	4	5	6	7
Eulophia speciosa	1	2	3	4	5	6	7
Gasteria batesiana	1	2	3	4	5	6	7
Mondia whitei	1	2	3	4	5	6	7
Prunus africana	1	2	3	4	5	6	7
Siphonochilus aethiopicus	1	2	3	4	5	6	7
Warburgia salutaris	1	2	3	4	5	6	7

Other (specify): _____

SECTION E− APPROACHES FOR CONSERVATION AND SUSTAINABLE USE OF PLANTS

28. Do you plant wild plants in your own gardens/yard?

Yes	1	No	2

28.1 If yes, which plants and why?

Species	Reasons	
Acacia sekhukhuniensis		1
Alepidea amatymbica		2
Ansellia africana		3
Bowiea volubilis		4
Brackenridgea zanguebarica		5
Dioscorea sylvatica		6
Drimia sanguinea		7
Eulophia speciosa		8
Gasteria batesiana		9
Mondia whitei		10
Prunus africana		11
Siphonochilus aethiopicus		12
Warburgia salutaris		13

29. What do you do to ensure that there are plants to harvest in the future?

Collect small amounts	1	Do not uproot/cut down whole plant	2	Cultivate in homegardens	3	Collect seasonally	4

Others: _____

30. Which harvesting methods do you use for these species listed below?

	Digging out	Felling off bark	Cutting branches	Picking fruits from ground	Picking leaves from plant	Others (Specify)
Acacia sekhukhuniensis	1	2	3	4	5	6
Alepidea amatymbica	1	2	3	4	5	6
Ansellia africana	1	2	3	4	5	6
Bowiea volubilis	1	2	3	4	5	6
Brackenridgea zanguebarica	1	2	3	4	5	6
Dioscorea sylvatica	1	2	3	4	5	6
Drimia sanguinea	1	2	3	4	5	6
Eulophia speciosa	1	2	3	4	5	6
Gasteria batesiana	1	2	3	4	5	6
Mondia whitei	1	2	3	4	5	6
Prunus africana	1	2	3	4	5	6
Siphonochilus aethiopicus	1	2	3	4	5	6
Warburgia salutaris	1	2	3	4	5	6

31. Are there any cultural procedures followed when harvesting these plants?

Yes	1	No	2

31.1 If yes, explain

_____
_____

32. Are there any physical or other challenges associated with the harvesting of these species?

Yes	1	No	2

32.1 If yes, explain

_____
_____

33. Which conservation strategies can be implemented to assist in the sustainable use of medicinal plants?

Propagation and cultivation of plants	1	Re-vegetation/ reforestation	2
Permits to collect plants	3	Others	4

Others (specify):

_____

34. If seeds of the above mentioned plants species could be freely supplied, would you grow them?

Yes	1	No	2

34.1 If no, give reasons

_____

_____

SECTION F−DISTRIBUTION AND ABUNDANCE OF SPECIES

This section will be done in the field by the use of a simple data field form (appendix 5) that will be used to assess the species distribution and abundance. Field observations will be done to confirm threats and harvesting methods used in the field.

THANKS FOR YOUR TIME

APPENDIX 3: QUESTIONNAIRE: Traditional healers

QUESTIONNAIRE NO:

The utilization and management of CITES and TOPS-listed plant species in the Limpopo Province, South Africa

District: _____
Area: _____
GPS: _____
Date: _____

PLEASE ANSWER THE FOLLOWING QUESTIONS BY CROSSING (x) THE RELEVANT BLOCK OR WRITING DOWN YOUR ANSWER IN THE SPACE PROVIDED.

SECTION A- DEMORAPHIC INFORMATION

1. Gender

Male	1	Female	2

2. Age

>20	1	20-29	2	30-39	3	40-49	4	50-59	5	>60	6

3. Level of education

No formal education	1	Primary	2	Secondary	3	Tertiary	4

4. How long (in years) have you lived in this village?

<10	1	10-19	2	20-29	3	30 and more	4

5. How long (in years) have you been in practice?

<10	1	10-19	2	20-29	3	30 and more	4

SECTION B- PLANT RESOURCE UTILIZATION

6. Below is a list of different plants species, please tick plants that you use from your communal land.

Plant species	**Vernacular names**	**Source of plants**	**Area of collection**	**Quantity collected**	**Frequency of harvest**	**Most used/harvested plants(rank)**	**Local availability**
Scientific names	1= Sepedi 2= XiVenda 3= XiTsonga	1=wild 1=Your communal land, other villages, other districts, other provinces. 2=garden 1=own 2=somebody else 3=buy 1=*Muthi* shop 2=Street vendor 3=Traditional healer 4=Other:		Grams/period -how long does it last?	1=Everyday 2=Once a week 3= Once a month 4= Other (specify)	1=most used 2= moderately used 3=least used 4=never used 5=other (specify)	1=common 2=declining 3=rare
Acacia sekhukhuniensis							
Alepidea amatymbica							
Ansellia africana							
Bowiea volubilis							
Brackenridgea zanguebarica							

Dioscorea sylvatica							
Drimia sanguinea							
Eulophia speciosa							
Gasteria batesiana							
Mondia whitei							
Prunus africana							
Siphonochilus aethiopicus							
Warburgia salutaris							

Plant species	Parts harvested	Form of plant parts(dried/fresh)	Uses	Method of preparation

7. Why do you prefer to use these plants (most preferred plants)?

_____

_____

9. How many years have you been using these plants?

<10	1	10-19	2	20-29	3	30 and more	4

10. Do you sell any of the above mentioned plants for cash income?

Yes	1	No	2

11. If yes, which of these plants do you sell and for how much?

A. sekhukhuniensis	R	*A. amatymbica*	R	*A. africana*	R	*B. volubilis*	R	*B. zanguebarica*	R
D. sylvatica	R	*D. sanguinea*	R	*E. speciosa*	R	*G. batesiana*	R	*M. whitei*	R
P. Africana	R	*S. aethiopicus*	R	*W. salutaris*	R				

SECTION C−MANAGEMENT STRATEGIES AND ATTITUTES ON THEM

14. Do you need a permit to collect these plants?

Yes	1	No	2	I don't know	3	Others	4

15. Do you have a permit to collect these plants?

Yes	1	No	2

15.1 If yes, where did you get it?

Tribal authority	1	LEDET offices	2	DWA offices	3	Others	4

Others:

_____

15.2 If no, why don't you have it?

Don't know where to get it	1	Difficult to get	2	It is not important	3	It is expensive	4	Others	5

16. Are you registered with the Traditional healers Association?

Yes	1	No	2

16.1 If no, why not?

_____

_____

_____

17. Do you know that the plants you have been using are protected?

Yes	1	No	2

17.1 If yes, how did you get informed?

_____
_____

18. Which of these legislations do you know?

NEMBA (TOPS)	1	CITES	2	NFA	3	LEMA	4	None	5

19. Who manages plants in your communal land?

Chief and local residents	1	Chief and Indunas	2	Chief and government	3	Chief	4	Government	5	Local residents	6
Nobody	7	Other	8								

Other (specify) _____

If the answer above is **nobody**, skip **question 21** and move to **question 22**.

20. List rules and regulations that are given to protect plants in your area (including taboos)?

No cutting of green plant		1
No soil collection in the communal land		2
No plant collection in times of initiation schools		3
Woman are not allowed to collect plants during menstruation periods		4
Pregnant woman are not allowed in communal lands		5
Some species are only harvested during certain seasons		6
Some species are only harvested for their leaves		7
Certain parts of communal lands are restrictive only		8
Leaving bits of the plant behind and closing the hole		9
Only small quantity of plant are collected		10
Frequency of collection e.g. return intervals		11

Others: _____

20.1 Do people (including you) in your community follow these rules/ regulations?

Yes	1	No	2

20.2 Who are the main offenders?

Community members	1	Traditional healers	2	*Muti* traders	3	Street vendors (trading wild plants)	4

20.3 What penalties are given to them?

_____

20.4 If yes, according to you what are the advantages of following these rules?

Reduce overutilization	1	Allow equal access	2	Maintains availability of plants	3	Reduce illegal harvesting	4

Others: _____

20.5 Who makes sure that these rules are implemented?

Chief and local residents	1	Chief and Indunas	2	Chief and government	3	Chief	4	Government	5	Local residents	6

21. Are there any rules or regulations from the government that restrict you from harvesting plants from your communal area?

Yes	1	No	2

21.1 If yes, which plants does the government restrict from use?

A. sekhukhuniensis	1	*A. amatymbica*	4	*A. africana*	7	*B. volubilis*	10	*B. zanguebarica*	12
D. sylvatica	2	*D. sanguinea*	5	*E. speciosa*	8	*G. batesiana*	11	*M. whitei*	13
P. Africana	3	*S. aethiopicus*	6	*W. salutaris*	9				

21.2 How do you feel about these restrictions?

Happy	1	Neutral	2	Not happy	3	Others	4

Reason: _____

22. Do you think the use of plants should be controlled?

Yes	1	No	2

22.1 If yes, why?

_____
_____

22.2 If no, why?

_____
_____

23. Are you given the right to help in managing plants in your communal area?

Yes	1	No	2

23.1 If no, would you like to help in managing plants in your community?

Yes	1	No	2

23.2 If no, why not?

_____

23.3 If yes, how would you like to help?

Report illegal harvesting	1	Report overharvesting	2	Report unsustainable methods of harvesting	3	Do patrols	4

Others: _____

24. In your own opinion, regarding the current management of plants in your area

24.1 What should be changed?

_____
_____

24.2 What should not be changed?

_____
_____

25. Who do you think should manage plants in your area?

Chief and local residents	1	Chief and Indunas	2	Chief and government	3	Chief	4	Government	5	Local residents	6

SECTION D– ANTHROPOGENIC THREATS TO PLANTS

26. Do you think plants in your area are declining?

Yes	1	No	2

27. What could be the possible reasons for the decline in these species?

	Over-harvesting	**Agriculture**	**Deforestation**	**Afforestation**	**Rural expansion**	**Urban development**	**Invasive alien**
Acacia sekhukhuniensis	1	2	3	4	5	6	7
Alepidea amatymbica	1	2	3	4	5	6	7
Brackenridgea zanguebarica	1	2	3	4	5	6	7
Dioscorea sylvatica	1	2	3	4	5	6	7
Drimia sanguinea	1	2	3	4	5	6	7
Siphonochilus aethiopicus	1	2	3	4	5	6	7
Warburgia salutaris	1	2	3	4	5	6	7

Other (specify)

_____

SECTION E− APPROACHES TO CONSERVATION AND SUSTAINABLE USE OF PLANTS

28. Do you plant wild plants in your own gardens/yard?

Yes	1	No	2

28.1 If yes, which plants and why?

Species	Reasons	
Acacia sekhukhuniensis		1
Alepidea amatymbica		2
Brackenridgea zanguebarica		5
Dioscorea sylvatica		6
Drimia sanguinea		7
Siphonochilus aethiopicus		12
Warburgia salutaris		13

30. How long can you keep medicinal plants before they lose their healing properties?

<5 days	1	A week	2	A month	3	>a month	4

31. Do you throw them away after losing healing properties?

Yes	1	No	2

32. What do you do to ensure that there are plants to harvest in the future?

Collect small amounts	1	Do not uproot/cut down whole plant	2	Cultivate in homegardens	3	Collect seasonally	4

Others: _____

33. Which harvesting methods do you use for these species listed below?

	Digging out	**Felling off bark**	**Cutting branches**	**Picking fruits from ground**	**Picking leaves from plant**	**Others (Specify)**
Acacia sekhukhuniensis	1	2	3	4	5	6
Alepidea amatymbica	1	2	3	4	5	6
Brackenridgea zanguebarica	1	2	3	4	5	6
Dioscorea sylvatica	1	2	3	4	5	6
Drimia sanguinea	1	2	3	4	5	6
Siphonochilus aethiopicus	1	2	3	4	5	6
Warburgia salutaris	1	2	3	4	5	6

34. Are there any cultural procedures followed when harvesting these plants?

Yes	1	No	2

34.1 If yes, explain

_____

_____

35. Are there any physical or other challenges associated with the harvesting of these species?

Yes	1	No	2

35.1 If yes, explain

_____

_____

36. Which conservation strategies can be implemented to assist in the sustainable use of medicinal plants?

Propagation and cultivation of plants	1	Re-vegetation/ reforestation	2
Permits to collect plants	3	Others	4

Others
(specify):_____

37. If seeds of the above mentioned plants species could be freely supplied, would you grow them?

Yes	1	No	2

37.1 if no give reasons

_____

_____

SECTION F−DISTRIBUTION AND ABUNDANCE OF SPECIES

This section will be done in the field by the use of a simple data field form (appendix 5) that will be used to assess the species distribution and abundance. Field observations will be done to confirm threats and harvesting methods used in the field.

THANKS FOR YOUR TIME

QUESTIONNAIRE NO:

APPENDIX 4: QUESTIONNAIRE: Traditional leaders

The utilization and management of CITES and TOPS-listed plant species in the Limpopo Province, South Africa

District: _____
Area: _____
GPS: _____
Date: _____

PLEASE ANSWER THE FOLLOWING QUESTIONS BY CROSSING (x) THE RELEVANT BLOCK OR WRITING DOWN YOUR ANSWER IN THE SPACE PROVIDED.

SECTION A- DEMORAPHIC INFORMATION

1. Status

Chief	1	Indunas	2

2. Gender

Male	1	Female	2

3. Age

>20	1	20-29	2	30-39	3	40-49	4	50-59	5	>60	6

4. Level of education

No formal education	1	Primary	2	Secondary	3	Tertiary	4

5. How long (in years) have you lived in this area?

<10	1	10-19	2	20-29	3	30 and more	4

SECTION B- PLANT RESOURCE UTILIZATION

6. Do you harvest plants from the communal land yourself?

Yes	1	No	2

6.1 If no, who harvests for you?

_____

7. Are they instructed on how to harvest these plants?

Yes	1	No	2

7.1 Who gives them instructions?

_____

8. Below is a list of plants species, which of these plants do you use from your communal land?

Plant species	**Vernacular names**	**Source of plants**	**Area of collection**	**Most used/harvested plants(rank)**	**Local availability**
Scientific names	1= Sepedi 2= XiVenda 3= XiTsonga	1=wild 1=Your communal land, other villages, other districts, other provinces. 2=garden 1=own 2=somebody else 3=buy 1=*Muthi* shop 2=Street vendor 3=Traditional healer 4=Other:		1=most used 2= moderately used 3=least used 4=never used 5=other (specify)	1=common 2=declining 3=rare
Acacia sekhukhuniensis					
Alepidea amatymbica					
Brackenridgea zanguebarica					
Dioscorea sylvatica					
Drimia sanguinea					
Siphonochilus aethiopicus					
Warburgia salutaris					

9. Why do you prefer to use these plants (most used plants)?

_____

_____

SECTION C−MANAGEMENT STRATEGIES AND ATTITUTES ON THEM

11. Do people in your area need a permit to collect these plants?

Yes	1	No	2	I don't know	3

12. If yes, where do they get it from?

Tribal authority	1	LEDET offices	2	DWA offices	3

13. Do you know that plants they/you are using are protected and threatened?

Yes	1	No	2

13.1 If yes, how did you get informed?

_____

14. Which of these legislations do you know?

NEMBA(TOPS)	1	CITES	2	NFA	4	LEMA	5	Others	6

15. Are you the one giving rules in managing the use of plants in your area?

Yes	1	No	2

15.1 If no, who does?

_____

_____

15.2 If it's you, who do you work with in managing the use of plants in your area?

Government	1	Chief	2	Indunas	3	Local people	4

Others: _____

16. If you are currently not working with the government, would you like to work with them in managing these plants?

Yes	1	No	2

16.1 If no, why not?

_____

_____

16.2 If yes, what specifically would you want them to help you with in improving the current management of plants in your area?

_____

_____

17. In your own opinion, do you think that local people follow the rules implemented?

Yes	1	No	2

17.1 If no, what could be the reason for that?

_____

_

17.2 According to you, who are the main offenders?

Community members	1	Traditional healers	2	*Muti* traders	3	Street vendors (trading wild plants)	4

17.3 What penalties are given to them?

_____

_____

18. Are the local people in your area given the right to help in managing plants in the communal area?

Yes	1	No	2

18.1 If yes, how are they helping?

Report illegal harvesting	1	Report overharvesting	2	Report unsustainable methods of harvesting	3	Do patrols	4

18.2 If no, why not?

_____

_____

19. Do you think that the management of natural resources is strong in your area?

Yes	1	No	2

19.1. If no, what could be the problem?

_____

20. In terms of rules implemented currently, who create the rules?

Chiefs based on current situations	1	Previous chiefs (ancestral rules)	2	The government	3

20.1 If you do not create the rules yourself, are you satisfied with the current rules implemented?

Yes	1	No	2

20.2 If no, what would you like to change or add to the current rules?

_____
_____
_____

21. Tick rules and regulations that are given to protect plants in your area (including taboos)?

No cutting of green plant		1
No soil collection in the communal land		2
No plant collection in times of initiation schools		3
Woman are not allowed to collect plants during menstruation periods		4
Pregnant woman are not allowed in communal lands		5
Some species are only harvested during certain seasons		6
Some species are only harvested for their leaves		7
Certain parts of communal lands are restrictive only		8
Leaving bits of the plant behind and closing the hole		9
Only small quantity of plant are collected		10
Frequency of collection e.g. return intervals		11

Others: _____

SECTION D– ANTHROPOGENIC THREATS TO PLANTS

22. Do you think plants in your area are declining?

Yes	1	No	2

23. What could be the possible reasons for the decline in these species?

	Over-harvesting	**Agriculture**	**Deforestation**	**Afforestation**	**Rural expansion**	**Urban development**	**Invasive alien**
Acacia sekhukhuniensis	1	2	3	4	5	6	7
Alepidea amatymbica	1	2	3	4	5	6	7
Ansellia Africana	1	2	3	4	5	6	7
Bowiea volubilis	1	2	3	4	5	6	7
Brackenridgea zanguebarica	1	2	3	4	5	6	7
Dioscorea sylvatica	1	2	3	4	5	6	7
Drimia sanguinea	1	2	3	4	5	6	7
Eulophia speciosa	1	2	3	4	5	6	7
Gasteria batesiana	1	2	3	4	5	6	7
Mondia whitei	1	2	3	4	5	6	7
Prunus Africana	1	2	3	4	5	6	7
Siphonochilus aethiopicus	1	2	3	4	5	6	7
Warburgia salutaris	1	2	3	4	5	6	7

Other (specify): _____

SECTION E− APPROACHES FOR CONSERVATION AND SUSTAINABLE USE OF PLANTS

24. Do you plant wild plants in your own gardens/yard?

Yes	1	No	2

24.1 If yes, which plants and why?

Species	Reasons	
Acacia sekhukhuniensis		1
Alepidea amatymbica		2
Ansellia Africana		3
Bowiea volubilis		4
Brackenridgea zanguebarica		5
Dioscorea sylvatica		6
Drimia sanguinea		7
Eulophia speciosa		8
Gasteria batesiana		9
Mondia whitei		10
Prunus Africana		11
Siphonochilus aethiopicus		12
Warburgia salutaris		13

26. As the chief/ Induna what do you do to ensure that there are plants for people in the community to harvest in the future?

_____
_____
_____
_____
_____

27. Which harvesting methods do you use for these species listed below?

	Digging out	**Felling off bark**	**Cutting branches**	**Picking fruits from ground**	**Picking leaves from plant**	**Others (Specify)**
Acacia sekhukhuniensis	1	2	3	4	5	6
Alepidea amatymbica	1	2	3	4	5	6
Brackenridgea zanguebarica	1	2	3	4	5	6
Dioscorea sylvatica	1	2	3	4	5	6
Drimia sanguinea	1	2	3	4	5	6
Siphonochilus aethiopicus	1	2	3	4	5	6
Warburgia salutaris	1	2	3	4	5	6

28. Are there any cultural procedures followed when harvesting these plants?

Yes	1	No	2

28.1 If yes, explain

_____

_____

29. Are there any physical or other challenges associated with the harvesting of these species?

Yes	1	No	2

29.1 If yes, explain

_____

_____

__

30. Which conservation strategies can be implemented to assist in the sustainable use of medicinal plants?

Propagation and cultivation of plants	1	Re-vegetation/ reforestation	2
Permits to collect plants	3	Others (specify)	4

Others:

_____

31. If seeds of the above mentioned plants species could be freely supplied, would you grow them?

Yes	1	No	2

31.1 If no, give reasons

_____

_____

SECTION F−DISTRIBUTION AND ABUNDANCE OF SPECIES

This section will be done in the field by the use of a simple data field form (appendix 5) that will be used to assess the species distribution and abundance. Field observations will be done to confirm threats and harvesting methods used in the field.

THANKS FOR YOUR TIME

APPENDIX 5: QUESTIONNAIRE: Conservation officers

QUESTIONNAIRE NO:

The utilization and management of CITES and TOPS-listed plant species in the Limpopo Province, South Africa

District: _____
Area: _____
Date: _____

PLEASE ANSWER THE FOLLOWING QUESTIONS BY CROSSING (x) THE RELEVANT BLOCK OR WRITING DOWN YOUR ANSWER IN THE SPACE PROVIDED.

1. Which legislation/s do you use to protect/manage overutilization of protected or threatened plants?

NEMBA (TOPS)	1	CITES	2	NFA	3	LEMA	4

Other (specify) _____

2. Do you prohibit use of any of the plants species listed below?

Acacia sekhukhuniensis	1
Alepidea amatymbica	2
Ansellia Africana	3
Bowiea volubilis	4
Brackenridgea zanguebarica	5
Dioscorea sylvatica	6
Drimia sanguine	7
Eulophia speciosa	8
Gasteria batesiana	9
Mondia whitei	10
Prunus Africana	11
Siphonochilus aethiopicus	12
Warburgia salutaris	13

3. Which criterion is used to prohibit use of such plants?

_____
_____

4. Do you do patrols to see if local people in rural areas use these protected or threatened plants?

Yes	1	No	2

4.1. If no, why not?

_____
_____

5. Do you do patrols to see if traditional healers in rural areas use these protected or threatened plants?

Yes		No	

5.1. If no, why not?

_____
_____

6. Do you inspect *Muthi* markets/shops to see if traders sell these protected or threatened plants?

Yes		No	

6.1. If no, why not?

_____
_____

7. If you do patrols/inspections,
Who are the main offenders?

Community members	1	Traditional healers	2	*Muthi* traders	3	Street vendors (trading wild plants)	4

8. How do you enforce the law in *Muthi* markets/shops, rural communities (including traditional healers)?

_____
_____
_____

9. What penalties are given to them?

10. If you do not do patrols/inspections, why?

No vehicles	1	Limited staff	2	Too risky	3	Too much admin work	4

Other (specify):

_____

11. In your department,

11.1 How many people are responsible for doing patrols/inspections?

0	1	<5	1	10	2	20	3	30	4

11.2 How many cars are allocated for patrolling?

0	1	<5	1	10	2	20	3	30	4

11.3 How often do you do patrols/inspections?

Everyday	1	Once a week	2	Once a month	3	Once in three months	4

Others:

_____

12. If you do patrols/inspections, how do you identify plants during patrols/inspections?

_____
_____

13. Who provides you with information regarding illegal use of protected or threatened plants?

_____
_____
__

14. How is your relationship with the community members?

_____

15. Is training provided to these communities, in terms of these legislations?

Yes	1	No	2

16. What kind of training?

_____
_

17. Do you think the implementation of your legislation is practical regarding the management of threatened or protected plants?

Yes	1	No	2

18. If no, why not?

_____

19. In your own opinion, what do you think should be done to improve the current management of threatened or protected plants?

_____
_____
_____

THANKS FOR YOUR TIME

APPENDIX 6: Disease categories and ailments treated using the selected TOPS-listed plants in the Limpopo Province.

Disease categories	Specific ailments	Participants (%)	Species																													
			Alepidia amatymbica					*Brackenridgea zanguebarica*					*Dioscorea sylvatica*					*Drimia sanguniea*					*Siphonochilus aethopicus*					*Warburgia salutaris*				
			Districts																														
			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
Circulatory system	Body pains/blood circulation	CM	-	-	-	4	-		-	-	4	-	-	4	-	-	-	64	60	56	72	10	4	-	-	-	-	16	40	20	4	-
		TH	-	-	-	2.5	-	2.5	2.5	-	-	-	-	5	-	-	-	77.5	70	52.5	87.5	10	-	5	-	-	-	32.5	80	37.5	7.5	5
	High blood pressure	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	4	8	4	-	-	-	-	-	-	-	-	4	4	-
		TH	-	-	-	-	-	-	-	-	-	-	-	2.5	2.5	-	-	-	2.5	5	2.5	-	-	-	-	-	-	5	-	-	-	-
	Stroke	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	2.5	-	-	2.5	-	-	-	-	-	5	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
	Sugar diabetes	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
	Swollen legs	CM	-	-	-	-	-	-	-	-	-	-	20	12	4	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	2.5	-	-	-	-	-	-	-	-	-	2.5	25	5	5	-	5	2.5	2.5	7.5	-	-	-	-	-	-	-	-	-	-	-
	Swollen tummy	CM	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
Dermatological	Abscess	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-
	Cause foot cancer to someone	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	5	-	10	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heal foot cancer	CM	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	-	2.5	-	-	-	-	7.5	-	-	2.5	2.5	-	-	-	2.5	5	7.5	-	-	-	-	-	-	-	-	-	-	-
	Insect repellent	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	4	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Leprosy	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	Prevent measles from going inside	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Reduce body temperature	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	12	4	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	10	15	2.5	2.5	-	-	-	-	-	-
	Skin rash	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	5	-	-	-	-	-
	Sores on body	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	32	-	-	-	-	-	-	-	8	-	-	10
		TH	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	5	7.5	2.5	7.5	-	-	-	-	-	-	10	7.5	-	27.5	10
	Wounds on humans	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-		-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wounds on livestock and pets	CM	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	2.5	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
Digestive	Cleanse stomach (act as laxative)	CM	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
		TH	-	-		2.5	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	2.5	-	-	-	-	-	-	-	-	2.5	5
	Constipation after attending funeral	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-	20	24	10	-	-	-	-	-
		TH	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	17.5	-	5	25	5	-	-	-	5	-
	Constipation in children	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	20	-	32	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	2.5	-
	Facilitates digestion in infants	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Gall	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
	Ingestion	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	2.5	-	-	-	2.5	-	-	-	2.5	-	-	-	-
	Malnutrition	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Piles	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
	Prevent livestock poisoning	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
	Reduce bad breath	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-
	Reduce cigarette smell	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-
		CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Remove poison from system		C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
		TH	-	-	-	-	-	-	2.5	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Stomach ache/disorder	CM	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	10
		TH	5	-	-	-	-	2.5	-	-	-	-	-	-	2.5	-	-	-	5	-	5	-	-	-	-	-		-	-	5	-	5
	Stomach pains in infants	CM	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	40	32	70	-	-	-	-	-
		TH	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32.5	20	27.5	20	35	-	-	-	-	-
	Stop diarrhoea	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	2.5	-	5	2.5	-	-	-	-	-	-	-	-	2.5	-	-
	Vomiting	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Endocrine	Brings back menstruation	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
	Pain killer	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Period pains	CM	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	4	4	-	4	-	-	-	-	4	-	-	-	-	4	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	2.5	5	-	-	-	-	-
	Reduce labour pains	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
	Supress sexual desire	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
Genito-urinal	Kidney problems	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
	Trouble in urinating	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
Immune	Energy booster	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fatigue	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	2.5	-
	Immune booster	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
	Malaria	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-
	Sores in stomach	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	12	12	12	10	4	-	-	-	-	24	-	12	12	20
		TH	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	7.5	5	10	10	20	-	-	5	-	-	27.5	10	7.5	30	30
	Unconscious due to illness	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
Nervous	Epilepsy	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	Heals fontanel	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	2.5	-	5
	Headache	CM	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
		TH	-	2.5	-	7.5	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	7.5	5	-	-	-	-	-
	Mental illness	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
		TH	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	2.5	-	-	-	-	2.5	-	-	-
		CM	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
	Relieves stress	TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optical	Eyesight	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
Parapsychological	Act as sleeping pill	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Attract customers	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-
	Baby constantly crying	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.5	-	-	-	-	-	-
	Bring back lost lover	CM	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bring back someone who went missing	CM	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Clean hands after attending funeral	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	7.5	-
	Catalyst for any disease	CM	-	4	-	4	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-
		TH	-	2.5	-	2.5	-	-	-	2.5	-	-	-	12.5	7.5	5	10	2.5	-	2.5	2.5	5	-	2.5	-	2.5	5	-	-	-	2.5	-
	Cause lightning	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	Chase away customers in other's businesses	CM	-	-	4	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		CM	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Chase away evil spirits (tokoloxi/ghosts)		C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
		TH	-	-	-	17.5	-	-	-	2.5	-	-	-	-	2.5	-	-	2.5	2.5	-	2.5	-	-	-	-	-	-	-	-	-	5	-
	Chase away wild animals when they harvest in the wild	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
	Cleanse widower	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Depress someone who is against you	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	5	-	-	-	-	10	-	-	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
	Encourage hair-growth	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-
	Enhance biting of dog	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	5
	Enhance dignity	CM	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	10	-	-	-	-	10	-	-	-	-	7.5	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-
	For dogs to run faster when hunting	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Healing belly button in newborn	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-
	Helps athletes win	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Helps steal in a house	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Helps to win fight	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
	Helps win gambling	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Helps you to be released from prison	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Improves growth of cultivation	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Increase ancestral spirit in trainees	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Increase fertility in livestock	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-
	Luck	CM	-	-	12	4	-	-	4	4	24	-	-	-	-	-	-	4	16	-	12	-	4	-	4	8	-	-	-	-	-	-	-
		TH	10	17	-	7.5	-	7.5	10	10	17.5	5	-	-	-	-	-	7.5	5	10	10	5	-	5	2.5	10	-	-	-	-	-	-	-
	Painful cheek veins in children	CM	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Prevent fights when drinking alcohol	CM	-	-	4	-	-	-	-	-	8	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	5	7.5	2.5	-	-	-	-	-	-	-	2.5	7.5	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-
	Prevent illness after drinking traditional beer	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Prevent lightning	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Prevent you from arrest	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
		CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Prevent reproduction		C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
		TH	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Prevent thunderstorms and clouds	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Prevent transmission of diseases to young children	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	44	-	28	20	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	55	27.5	17.5	10	-	-	-	-	-
	Protect from theft	CM	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
		TH	15	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Protect homestead	CM	-	4	4	-	-	4	8	8	4	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
		TH	17.5	22.5	55	35	5	35	-	67.5	37.5	45	-	10	15	-	-	-	10	2.5	10	-	-	-	-	-	-	2.5	7.5	7.5	5	10
	Protect initiation school	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Protect livestock from theft/killed by wild animals	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Protect livestock-control them to and from home	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Protect you from catching infection/diseases	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Protect you from harm	CM	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	10	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Protect your car from accidents/hijack	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
	Softens a person	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	2.5	-	-	-	-
	To call customers	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-
	To cause madness/stupidity	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	2.5	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	To handle all remedies and traditional bones	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	17.5	-	20	-	-	-	-	-
	To poison people especially in taverns	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	To win elections-to be a leader	CM	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Treat dead body before burying it	CM	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Used as magic to fly at night	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-
	Used by pregnant women to protect the unborn	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	5	-	-	-	-	-	-	-
	Weaken people who are against you	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Win court cases	CM	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	7.5	-	7.5	5	-	2.5	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
	Win in sports-marathon	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reproductive	Abortion	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	Erectile dysfunction	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	-	2.5	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	5	-	-
	Female infertility	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	2.5	-	-	-	2.5	-	-	2.5	-	-	-	5
	Improves sexual drive	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	4	4	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	Increase birth	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pain on manhood	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-
	Womb problems	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	4	-	4	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	2.5	-
Respiratory	Asthma	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
		TH	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	2.5	-	2.5	-	-	2.5	-	2.5	-
	Breathing difficulty in infants	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	16	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	15	-	-	-	-	-	-
	Chest complaints	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	4	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	2.5	-	-	-	2.5	-	4	-
	Cough	CM	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	-	36	36	28	44	-	36	24	8	40	10
		TH	7.5	27.5	-	10	-	-	-	-	-	-	-	-	-	-	-	2.5	5	2.5	2.5	-	52.5	35	67.5	52.5	-	27.5	22.5	27.5	42.5	10

			C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V	C	S	M	W	V
	Sinus	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	15	-	-	-	-	-	-
	Sores in mouth	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	2.5	-	15	-	25	-	-
	Sores on throat	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	4	8	16	-	40	16	-	36	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	7.5	-	20	5	22.5	2.5	-
	Tuberculosis	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
		TH	5	2.5	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	10	-	-	-	2.5	-	-	-
	Tonsils	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	2.5	2.5	-
	Ulcer	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	5
STI's	AIDS	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
	Chlamydia	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	4	10	-	-	4	-	-	-	-	12	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	10	10	-	-	-	-	5	-	-	-	2.5	-
	Gonorrhoea	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	8	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5	-	-	-	-	-	5	-	-	-	-	-
Skeleto-muscular	Arthritis	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Minor fracture	CM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Keys: Community members, Traditional healers, C=Capricorn, S=Sekhukhune, M=Mopani, W=Waterberg and V=Vhembe, STI's=Sexually Transmitted Infections