

Conservation and Theft of Endangered Plants in South African Rural Communities: A Review of Literature

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Abstract

Human destruction and neglect of biodiversity simultaneously destroy life-giving resource bases. The aim of this study was to explore the conservation and theft of endangered plants in South African rural communities. From a qualitative standpoint, this study adopted the exploratory research design. Various academic databases were visited for data collections. The reviewed literature studies on this subject were purposefully selected, restricted from 1990 to 2023 [Not in order of importance and sequence]. The study used inductive Textual Content Analysis (TCA) to analyse its data. The findings of this study discovered that the indigenous plants from selected rural communities are endangered by human activities. These human activities are, among others, theft, limited to 'illegal harvesting and theft of endangered indigenous plants, invading the boundaries and limited knowledge about conservation.' Therefore, rural communities are taking intervention measures to ensure that these plants are protected and do not become extinct due to theft and illegal harvesting. It is concluded that conservation of endangered plants should be highly prioritised by the local municipalities of rural South African communities. The study recommended the Provincial and National spheres of government should support this initiative by communities to avoid extinction resulting from the mentioned practices. Importantly, the conservation of these plants becomes mandatory.

Keywords: Conservation, Endangered plants, illegal harvesting, South African rural communities, Theft

Introduction

Plant biodiversity are important to humanity and continues to be used worldwide as a source of food, basic healthcare and technological use (Hassan, 2012). About 27 million South Africans depend on indigenous plants for their primary healthcare needs, and for income generation (Mander, Ntuli, Diederichs & Mavundla, 2007). Most of the people in the rural communities of developing

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countries depend largely on indigenous natural resources for the sustainability of their livelihood (Cunningham, 1991; and Shackleton, Hall & Pate, 2001). The large population of rural people depends largely on the natural resources around them for fuel wood and for medicine (Kasagana & Karumuri, 2011). Moreover, plant resources were used and continued to be a central focus for food, health care, and technological purposes and other relevant purposes, as a result, good management and conservation of these species are necessary for their continued availability (Stern, Bidlack, Jansky & Uno, 2000).

In general, they are lowly educated and poor people who continuously exploit the resources in order to get as much cash as possible for their subsistence without thinking of the future (Cunningham, 1991). Human destruction and neglect of biodiversity simultaneously destroy life-giving resource bases, to this course; humankind had a greater impact on status of biodiversity, than other components of the natural environment (Steenkamp, 2002, Willis, 2006; and Van Wyk, 2011). Richards (1990) confirms that human activity is the biggest cause of degradation of biodiversity. The associated risks are not based on rural South African residents, but to the economies of the country (Maluleke & Shibambu, 2021). Tribal plant uses and botanical knowledge are of more than academic or historical importance and may be linked directly to plant utilisation and conservation (Zhang & Zhou, 2019). However, a lack of sustainable use and management of plant diversity may strip the natural environment in communal [Rural] communities (Eberhard 1990; and Katewa, Chaudhary, Jain & Galav, 2003). King, Rosmarin, and Friedmann (2005) prove that unsustainable use of native plant species constrains the productivity, composition and diversity of terrestrial ecosystems. Human communities possess a special ability to influence the management and conservation of biodiversity, while recognising the role of humans in the ecosystem, as biodiversity plays a key role in human welfare by providing agricultural, economic, and health benefits (Zhang & Zhou, 2019). Hawksworth and Bull (2007) maintain that plant diversities would continue to grow exponentially without human interference.

Therefore, the aim of this study was to explore the conservation and theft of endangered plants in South African rural communities. Also, the study closely focused on existing contributing factors to theft of endangered plants and available conservation methods to protect and preserve these plants.

Literature review

a) Theft of endangered plants in South African rural communities

Illegal harvesting and collection of natural resources (i.e. Poaching and theft) is a global problem affecting protected natural areas (Gavin, Solomon & Blank, 2010). Worldwide, managers of natural areas are increasingly searching for

technological solutions to enhance protection of natural resources within budgetary and staffing constraints (Young, van Manen & Thatcher, 2011). In South Africa rural communities with high quality habitat and easy access, the risk of illegal exploitation of resources is potentially high (Young *et al.*, 2011). According to Shibambu, Malatji and Maluleke (2021), due to the purposes such as maintenance of good health, food, fuel, and fodder for livestock, construction and manufacturing of household utensils theft of plant species have been evident.

Furthermore, majority of threats facing endangered indigenous plants are similar to that causing biodiversity endangerment, while, most serious notably threats relates to the habitat loss, degradation because of illegal [Over]-harvesting and theft (Hamilton, 2004). Traditionally, the gathering of medicinal plants was restricted to trained traditional healers, some received strict instruction to dig for plants just before winter and after seed set (Ngqobe, 1993) and seldom were medicinal plants ring-barked or uprooted (Cunningham, 1991). Increasing demand and fewer wild stocks coupled with commercial incentive have led to a disregard for traditions (Wild & Mutebi, 1997). More than half of South Africans use traditional medicine (Van Wyk, 2011) and traditional healers need to harvest more plants to meet the need of the growing client base (Ndou, Stam, Tshisikhawe, Alabi & Adeeyo, 2021). These have major effects on both local and global availability of medicinal plants (Van Wyk, 2011). Poaching in South African rural communities is observed in the most accessible parts of the reserves (Ndou *et al.*, 2021). Moreover, the theft of these plants is becoming a distinctive crime currently affecting many rural communities across the world. They are threatened, leading to scarcity nor extinction; this is owed to the negative intensive use of natural resources and related theft (Albrecht & McCue, 2010).

International demand for South African succulents fuels criminality and threatens biodiversity. The Succulent Karoo is being stripped of its unique biodiversity to supply illegal markets. Illegal harvesting to supply the international horticultural market threatens some of South Africa's endemic succulent species. The plants, sought for their beauty, rarity and often whimsical shapes, face near-extinction in the wild, Bruwer (2023). Although already Red Listed in South Africa, several of the illegally harvested and traded species were recently added to the global International Union for Conservation of Nature (IUCN) Red List of Threatened Species. Many Succulent Karoo plant species are now classified as endangered and critically endangered. This is only one step away from extinction in the wild, like the last two remaining northern white rhinos. There are fears that Namibia's succulents may face a similar fate, Bruwer (2023).

Unemployment was also mentioned as a contributing factor to poaching and theft of indigenous plants (Bamigboye, Tshisikhawe & Bonta, 2018). Distances from roads and the edges of nature reserves have been associated with human access and poaching (Trombulak & Frissell, 2000). The theft of endangered indigenous plants is increasing, contributed by expected trade globalisation, global warming, urbanisation and changes in human behaviour, all of which providing multiple opportunities for the potential criminals to infiltrate this sector and evolves into different new forms (Maluleke & Shibambu, 2021). Whereas habitat models are very useful for enhancing protection efforts for rare plants by mapping prime habitats, other geographic factors such as the locations of entry and exit points along a natural area's boundary, the ease of road or trail access, or the difficulty of travel across steep terrain or through dense vegetation could also influence poaching pressure also influence the threat of natural resource theft at particular locations (Young *et al.*, 2011). Concurrently, a growing international demand for plant and animal products with medicinal or cultural value increases the incentives and economic rewards for illegal harvest of those resources (Young *et al.*, 2011).

Zimu-Biyela (2016) highlights that unsustainable harvesting of medicinal plants for the primary health care and commercial purposes should be re-emphasised as these plants remains pivotal. In another separate incident, it was reported that South African and international 'Poachers' often target endangered indigenous plants, due to high prices on the black market, this referred to wild 'character-filled' plants, which are touted to fetch higher prices than the cultivated ones (Maluleke & Shibambu, 2021). The complete removal of plants are discussed as threatening their continuous existence, while removal of plant bark disrupts the energy flow within the plants (Bamigboye & Tshisikhawe, 2020; and Adeeyo, Edokpayi, Alabi, Msagati & Odiyo, 2021). Between 35 000 and 70 000 tons of plant parts (I.e. Roots, stem, and bark, amongst others) were consumed annually in South Africa, and over 700 000 tons of plants materials were illegally harvested from the wild (Spring, 2004). It is recorded that a large number of plant are collected and traded annually, most of them illegally (Regmi & Bista, 2002). However, the need to earn an income motivates many of the harvesters to continue harvesting medicinal plants illegally (Department of Water Affairs and Forestry, 2005) and the possibility of arrest (Botha, Witkowski & Shackleton, 2004).

b) Conservation of Endangered Plants

Lack of both management and knowledge of conservation strategies are also threats to indigenous medicinal plant species (Semenya & Maroyi, 2019). Therefore, it remains essential for the relevant stakeholders to share available skills and knowledge for the protection and preservation from a possible illegal harvesting

and theft (Martin, 1995). Equally, the threatening of these plants in South African rural communities can be restored and recovered by proper implementations and breeding, clearly focusing on good management and conservation of biodiversity (Mabogo, 1990). South Africa, as a signatory to the Convention on Biological Diversity (CBD), is committed to the implementation of a national strategy to conserve plants that aligns with the Global Strategy for Plant Conservation (Raimondo, 2015). The South African National Biodiversity Institute (SANBI) and the Botanical Society have worked together with South Africa’s botanists and conservationists to compile South Africa’s Strategy for Plant Conservation (Raimondo, 2015).

In contrary, SANBI faces a grim choice of which plants to save, due to the limited available resources, focusing on the ones that are closest to extinction on the IUCN Red List and those known to exist only in a single location. Therefore, the species that will be marked with a red or orange marker for priority care, while those with green markers (i.e. Least concern category) have to take their chances, should space and staff become available. The mandate of SANBI is to save as many plant patients as possible after they have been ripped from the veld, there is just not enough space or capacity in the few botanical ‘hospitals’ across the country, with Western Cape and Northern Cape, urgently calling for rescue operations for confiscated succulent plants (Carnie, 2023).

Until recently (2023), many of the confiscated plants had been stored in hot conditions, piled up in trays and largely unclassified by their rarity in the waiting rooms, they often had to be sorted through their importance to draw-up priority care protocols. To complicate things, the severity of the recent poaching onslaught on some species means that their conservation status is now dynamic. Thus, the ‘Red List for *Conophytums*’ had to be updated in 2020/21 because of the poaching surge - and all *Conophytums* species are now threatened (Carnie, 2023). Importantly, the 2023 IUCN Red List colour coding status is as follows (Refer to Table 1):

Table 1: IUCN Red List - Colour coding to follow for prioritising planting (The colour-coded Red List used for succulent plant triage)

Colour coding	Meaning attached
	Critically endangered
	Endangered
	Vulnerable
	Near threatened
	Least concern

Source: Carnie (2023)

Steenkamp (2002) expresses that human community possess a special ability to influence the management and conservation of biodiversity, and therefore, it is important to realise that people form an integral part of the ecosystem. The conservation and management of biodiversity remain a national concern as research in many parts of the world is focused on sustainable use of the natural resources for human development (Shibambu *et al.*, 2021). Many of the natural resources, especially indigenous plants, have been used and are still used for food and other purposes. As a result, good management and conservation of these species are necessary for their continued availability (Stern *et al.*, 2000). One of the aims of conservation biology as a scientific discipline that developed in response to the current crises of rapid and large-scale biodiversity loss due to theft, is to protect and conserve as much of all levels of biodiversity as possible (Rankoana, 2001).

Politically, there are many approaches being implemented with minimal involvement of local people's participation. This led the forest conservation efforts to fail in implementation in implementation of conservation measures thereby resulting in increased deforestation rate (Rasekgala, 2018). Traditional ecological knowledge is a cultural asset that provides a base for synthesis of conservation planning. It can be used for the recognition and preservation of valuable species as well as habitats in long term management (Dung & Webb, 2008; Gaikwad Wilson & Ranganathan, 2011, and Jules, Adamsb, Berkesc, de Athayded, Dudleye, Hunnf, Maffig, Miltonh, Rapporte, Robbinsi, Sterlingi, Stoltonk, Tsingl, Vintinnerk & Pilgrimm, 2009). The prevailing poverty and expansion of agricultural land are the main causes of habitat and biodiversity loss and must be addressed when designing policies (Gorenflo & Brandon, 2005).

According to the IUCN and the World Wildlife Fund, there are between 50,000 and 80,000 flowering plant species used for medicinal purposes worldwide. Among these, about 15,000 species are threatened with extinction from overharvesting and habitat destruction (Chen, Luo, Wu, Li & Steinmetz, 2016) and 20 % of their wild resources have already been nearly exhausted with the increasing human population and plant consumption (Ross, 2005). Various sets of recommendations have been compiled regarding their conservation, including the establishment of systems for species inventorying and status monitoring, and the need for coordinated conservation practices based on both in situ and ex situ strategies (Hamilton, 2004). Probably, the single most important 'role' for medicinal plants in biological and ecological conservation stems from the foundations that they can provide for the involvement of people in conservation of natural habitats (Schopp-Guth & Fremuth, 2001).

Conservation goals, needs collaboration of various governmental and non-governmental agencies involved in natural resources management (Fosaa, 2004; and Mucina, 1997). The use of indigenous knowledge in conservation led to the new of 'ethno-conservation' in the late 1990s which is now a popular conservation approach around the globe (Jules *et al.*, 2009). Cunningham (1991) highlights that to ensure the availability of raw material and to explore future developments, sustainability of medicinal plants and preservation of the variability of germplasm are necessary. Concerns regarding the conservation of medicinal plant species are receiving much attention due to overharvesting and exploitation (Van Wyk & Prinsloo, 2018).

In an attempt to indicate specific gaps, inconsistencies and controversies resulting from the sampled studies, the researchers provided synthesis of relevant literature, demonstrating familiarity with the key authors, texts and, central concepts relevant to this study by showing offered contributions in terms of what is known, to fill the niche/gap identified in the introduction and literature review sections. This study was situated within the academic, industry and societal domains, while guided by the main objective. Sources of high academic standings, offering integrated ideas on this subject were considered.

The uniqueness of this study present rare research from a rural perspective, with the sampled studies discovering that the inhabitants are reportedly living in fear for extinctions of endangered plants, coupled with theft. The conservation measures of these plants seem to be limited. Furthermore, protection, preservation and prevention of the identified plants remain a worrying factor. Theft of endangered plants in South African rural communities continue increasing and their conservation offer ineffective interventions, fuelling possible extinction and theft opportunities. Furthermore, the South African rural communities' are allegedly losing confidence over the local 'Municipality Management,' CBD, SANBI, Botanical Society and IUCN Red List, as well as various governmental and non-governmental agencies, based on management and knowledge of conservation strategies, thus, efficient preservation, prevention and combative strategies seem to be foreign. It then becomes evident that a review of current strategies to respond to proper conservation and prevention of endangered plants from theft can be of utmost importance to create awareness of the associated effects thereof. Summarily, this study contributes to the literature by providing a more complete, integrated view of conservation and theft of endangered plants in South African rural communities.

Methodology

Supporting the adoption of the non-empirical research design: Systematic review in this study, Gough, Thomas and Oliver (2012) and Punch (2013) explain

that this form of research design identifies, describes available research literature ‘using systematic and explicit accountable methods and pre-specified formalised tools for searching and integrating literature, aided by qualitative research approach. To accomplish data collection methods, seminal literature [Documentary] sources were selected. Creswell and Creswell (2017) reveal that researchers may collect qualitative documents, such as the public documents, such as newspapers, minutes of meetings or official documents and they can also ask questions to documents in the same ways as one might ask questions of the study participants (Matthews & Ross, 2010; Maluleke, 2016; and Maluleke, 2020). This study used the medicinal plants media releases, South African online newspapers and media reports, journal articles and internet searches (i.e. Electronic databases - Science Direct, Frontier, Google Scholar, Taylor and Francis Online, EbcoHost, Emerald Insight, Jstor, ProQuest, Springer, Sabinet, Sage Online, amongst others) to collect its data.

Other seminal publications like the SANBI, the Botanical Society of South Africa (BotSoc SA), the ‘Network of South African Botanists and Conservationists and the Southern African Botanical Diversity Network (SABONET), among others (Creswell & Creswell, 2017; and Maluleke, 2020) were also used for data collection. The sampling methods involved the ‘non-probability: Purposeful sampling’ focusing on data primarily relevant to the study subject. The keywords/phrases were used to filter information relevant to reach data saturation of the research problem, while applying the Qualitative Content Analysis (QCA) to identify the themes to respond and verify the study objective. This was applied to present honesty reporting relating to the consulted literature (Liamputtong, 2013; and Mokwena & Maluleke, 2020). The reviewed data were restricted to 1990-2023 (i.e. 33 years’ projection, not in order of importance and sequence) to demarcate inclusion/exclusion criterion. For data analysis, the inductive TCA was adopted, solely depending on a very detailed analysis of the collected data, Mokwena, Motsepe, Maluleke and Shandu (2020).

Study findings and discussions

Kasagana and Karumuri (2011) presented that the large population of rural people depend largely on the natural resources around them for fuel wood and for medicine. Furthermore, Stern (2000) stated that plant resources were used and continued to be a central focus for food, health care, and technological purposes and other relevant purposes, as a result, good management and conservation of these species are necessary for their continued availability. Hassan (2012) corroborate that plant biodiversity are important to humanity and continue to be used worldwide as a source of food, basic healthcare and technological use. Based on this notion, plants species are used in majority of South African rural communities for various

reasons which may include health care, food and technological purposes among others. Due to these needs, there is an evident increase in the overexploitation and theft of plant species.

Moreover, Steenkamp (2002) presented that human destruction (theft of plant species included) and neglect of biodiversity simultaneously destroy their life-giving resource base. Willis (2006) and Van Wyk (2011) confirmed that humankind had a greater impact on the status of biodiversity than on any of the other components of the natural environment. Further, Maluleke and Shibambu (2021) revealed that the theft of endangered indigenous plants are increasing, contributed by expected trade globalisation, global warming, urbanisation and changes in human behaviour, all of which providing multiple opportunities for the potential criminals to infiltrate this sector and evolves into different new forms. As presented in these results, although there are various factors that contribute to the loss of plant species, human destruction such as theft and poach contribute largely to the existence of these plants. Moreover, the result also presents that due to theft, plants species survival is threatened and has greater impact of on their status.

Furthermore, according to Gavin *et al.*, (2010) mentioned that illegal harvesting and collection of natural resources (i.e. Poaching) is a global problem affecting protected natural areas. Young *et al.*, (2011) reiterated that in South African rural communities with high quality habitat and easy access, the risk of illegal exploitation of resources is potentially high. Hamilton (2004) confirms that majority of threats facing endangered indigenous plants are similar to that causing biodiversity endangerment, while, most serious notably threats relates to the habitat loss, degradation because of illegal [over]-harvesting and theft.

Concurrently, Young *et al.*, (2011) presented that a growing international demand for plant and animal products with medicinal or cultural value increases the incentives and economic rewards for illegal harvest of those resources. Furthermore, Spring (2004) showcased that between 35 000 and 70 000 tons of plant parts (i.e. roots, stem, and bark, amongst others) were consumed annually in South Africa, and over 700 000 tons of plants materials were illegally harvested from the wild. Department of Water Affairs and Forestry (2005) displayed that the need to earn an income motivates many of the harvesters to continue harvesting medicinal plants illegally and this increases the possibility of arrest. Based on these results, it is evident that plant species are being stolen or illegally harvested in most rural area in South Africa. Moreover, the high demand of plant species and need for basic income contribute to the theft of plant species and this could lead into possible arrest as reported in some cases.

Besides, Stern (2000) highlighted that plant resources were used and continued to be a central focus for food, health care, and technological purposes and other relevant purposes, as a result, good management and conservation of these species are necessary for their continued availability. Zhang and Zhou (2019) stated that tribal plant uses and botanical knowledge are of more than academic or historical importance and may be linked directly to plant utilisation and conservation. Zhang and Zhou (2019) supported that human communities possess a special ability to influence the management and conservation of biodiversity, while recognising the role of humans in the ecosystem, as biodiversity plays a key role in human welfare by providing agricultural, economic, and health benefits. Based on this notion, although there is a high demand of plant species for the sustainability of the livelihood of individuals, there is a great need for conservation for them to be still available for future use.

Consequently, Semenya and Maroyi (2019) contended that lack of both management and knowledge of conservation strategies are also threats to indigenous medicinal plant species. Martin (1995) corroborated that it remains essential for the relevant stakeholders to share available skills and knowledge for the protection and preservation from a possible illegal harvesting and theft. Equally, Mabogo (1990) suggested that the threatening of these plants in South African rural communities can be restored and recovered by proper implementations and breeding, clearly focusing on good management and conservation of biodiversity. Based on these results, it is evident that lack of both management and knowledge of conservation strategies or poor conservation strategies make the plant species to be vulnerable to theft. It is therefore essential for relevant stakeholder to put relevant measures into the conservation and protection of these plants for their sustainable use and high possibility of their availability in the future and decreasing the chances of threat.

Furthermore, Rankoana (2001) presented that one of the aims of conservation biology as a scientific discipline that developed in response to the current crises of rapid and large-scale biodiversity loss due to theft is to protect and conserve as much of all levels of biodiversity as possible. Stern (2000) mentioned that good management and conservation of these species are necessary for their continued availability. Moreover, Shibambu *et al.*, (2021) corroborated that the conservation and management of biodiversity remain a national concern as research in many parts of the world is focused on sustainable use of the natural resources for human development. The notion of these results is that conservation and management of should be prioritised in order to preserve the plants species for future use.

Politically, there are many approaches being implemented with minimal involvement of local people's participation. This led the forest conservation efforts to fail in implementation of conservation measures thereby resulting in increased deforestation rate (Rasekgala, 2018). Traditional ecological knowledge is a cultural asset that provides a base for synthesis of conservation planning. It can be used for the recognition and preservation of valuable species as well as habitats in long term management (Dung and Webb, 2008; Gaikwad *et al.*, 2011, and Jules *et al.*, 2009). The prevailing poverty and expansion of agricultural land are the main causes of habitat and biodiversity loss and must be addressed when designing policies (Gorenflo & Brandon, 2005).

The researchers discovered that the inhabitants [i.e. Many families within the rural setting] are living in fear for the protection and preservation of these rare plants as stated in the introductory section of this study. Therefore, these rural communities have taken measures of intervention to ensure that these plants do not become extinct, in anticipation of having a significant effect on the resulting urbanisation. Furthermore, there exists a cloud of no confidence in South African rural communities' municipality management and other relevant stakeholders to restore the protection of these plants, as effective preservation strategies seem unfound. It becomes evident that a review of the current strategies can be of paramount importance to create awareness of the effects of urbanisation on these plants, with a greater chance of extinction.

The Identified Study Themes and Challenges

a. Illegal harvesting and theft of endangered indigenous plants

The illegal harvesting and thefts of these plants for food and medicinal purposes, as well as urbanisation, among others affect the availability of these plants species in rural communities (Hamilton, 2004).

b. Invading the boundaries

Some of the illegal collectors find ways to invade the boundaries especially at night to commit theft (Raimondo *et al.*, 2009).

c. Limited knowledge about conservation

Lack of both management and knowledge of conservation strategies are also threats to indigenous medicinal plant species (Semenya & Maroyi, 2019). Therefore, it remains essential for relevant stakeholders to share available skills and knowledge for the protection and preservation from a possible illegal harvesting and theft (Martin, 1995).

Conclusion

The aim of this study was to explore the conservation and theft of endangered plants rural communities of South Africa. It was established that theft of these plants has become one of the major factors that affect the existence of these plants. Therefore, the conservational methods should be enhanced to help protect the endangered plants. The call for long clandestine operations involving the South African Police Service Stock Theft Units (SAPS STUs) and Endangered Species Unit, Crime Intelligence, Border Intelligence, Technical Support Units, Department of Environmental Affairs and other relevant stakeholders should be conducted frequently. This can result in arrest of potential suspect and seizure of a large amount of endangered indigenous plants across South African rural communities.

In conclusion, the main factors exist on how endangered indigenous plants are threatened and subjected to illegal harvesting and theft through invading the boundaries of protected areas and having easy access to areas where these plants grow or are often found, with the illegal harvesters or collectors and thieves taking advantage of that. Although institutions such as the Community-based Natural Resource Management (CBNRM) are touted to protect and preserve South African medicinal plants, this study confirmed that some of these plants are not fully protected. Therefore, this study proves that indigenous plants in South African rural communities are endangered due to theft and illegal harvesting. People also invade the protected indigenous plants threatening them with extinction.

Recommendations

Therefore, several recommendations of the identified themes and challenges are therefore provided to improve study objective:

- The 'illegal harvesting and theft of endangered indigenous plants can be effectively improved by ensuring that legal actions are taken against any person who illegally harvest or steal indigenous plants, also any person who is found in position of large quantity of indigenous plants illegally.
- The 'invading of boundaries' should be addressed adhering to strict rules of regulations, based on tightening security mandates on conservation areas to preserve and protect indigenous plants. This can also prevent individuals from invading existing boundaries.
- To enhance the 'limited knowledge about conservation,' it is recommended by this study that education and awareness about the importance of conservation of indigenous plants should be made available to all members of the communities.

- This study further recommends that conservation of endangered indigenous plants should be highly prioritised by local municipalities of rural South African communities, fully supported by the provincial and national spheres of government to avoid extinction resulting from theft and illegal harvesting.
- It also recommended that education and awareness about the importance of protecting indigenous plants should be available to all members of the communities. Lastly, it also recommends that legal action should be taken against anyone who is found in possession of large quantity of indigenous plants illegally.

Stemming from the study findings, it was revealed that indigenous plants are under a serious threat of extinction due to theft and limited conservation strategies. Therefore, conservation of these plants remain crucial and the inhabitant of South African rural communities should always strive to protect them. From a rural perspective, it is important to note that the inhabitant need to manage challenges presented by theft of endangered plants and induct valuable conservation strategies. Equally, from an academic perspective, this systematic study offers insights into the importance of effective endangered plants conservation, while understanding the effects of theft within the rural setting.

Therefore, future research studies can focus on quarterly quantity and value of stolen indigenous plants, while identifying their hotspot of theft. Widely communication and documentation of conservation methods should form part of future research studies. Overall, the findings of this study may also be transferred to other rural areas facing similar problem of limited conservation of theft of endangered plants, suggesting multi-disciplinary approaches to respond to these practices. Moreover, envisaged studies may be geared towards developing a comprehensive theory-empirical model can be of benefit.

References

- Adeeyo, A.O., Edokpayi, J. N., Alabi, M.A., Msagati, T.A., & Odiyo, J.O. (2021). Plant active products and emerging interventions in water potabilisation: disinfection and multi-drug resistant pathogen treatment. *Clinical Phytoscience*, 7(1), 1-16.
- Albrecht, M.A., & McCue, K.A. (2010). Changes in demographic processes over long time scales reveal the challenge of restoring an endangered plant. *Restoration Ecology*, 18, 235-243.
- Bamigboye, S.O., Tshisikhawe, P.M., & Bonta, M.A. (2018). Review of extinction risks in South African cycads used for traditional medicine. *South African Journal of Botany*, 115, 279.
- Bamigboye, S., & Tshisikhawe, M.P. (2020). The impacts of bark harvesting on a population of *Encephalartos transvenosus* (Limpopo cycad), in Limpopo Province, South Africa. *Biodiversitas Journal of Biological Diversity*, 21(1).
- Botha, J., Witkowski, E.T.F & Shackleton CM. (2004). 'Market profiles and trade in medicinal plants in the Lowveld. *Environmental Conservation*, 31, 38-46.
- Bruwer, C. (2023). Succulents under threat as thieves steal Karoo's unique plant heritage. February 24, *Farmers Weekly [Online]*. <https://www.magzter.com/stories/business/farmers-weekly/succulents-under-threat-as-thieves-steal-karoos-unique-plant-heritage>.
- Carnie, T. (2023). South Africa resorts to triage as casualties pile up in devastating rare succulent poaching spree. 23 May, *Mail Maverick [Online]*. [https://www.dailymaverick.co.za/article/2023-05-23-south-africa-resorts-to-triage-as-casualties-pile-up-in-devastating-rare-succulent-poaching-spree/](https://www.dailymaverick.co.za/article/2023-05-23-south-africa-resorts-to-triage-as-casualties-pile-up-in-devastating-rare-succulent-poaching-spre/).
- Chen, S.L., Yu, H., Luo, H. M., Wu, Q., Li, C.F., & Steinmetz, A. (2016). Conservation and sustainable use of medicinal plants: problems, progress, and prospects. *Chinese medicine*, 11(1), 1-10.
- Creswell, J.W., & Creswell, J.D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications: London.
- Cunningham, A.B. (1991). *Medicinal plant: policies and priorities: Conservation of medicinal plants*. Cambridge University Press: New York.
- Department of Water Affairs and Forestry. (2005), Medicinal Plants Trade. Forestry Subsector Studies, Briefing 5. Pretoria: Government of South Africa.
- Dung, N.T., & Webb, E.L. (2008). Combining local ecological knowledge and quantitative forest surveys to select indicator species for forest condition monitoring in central Viet Nam. *Ecological indicators*, 8(5), 767-770.
- Eberhard, A.A. (1990). Energy consumption patterns and supply problems in underdeveloped areas in South Africa. *Development Southern Africa*, 7(3), 335-346.
- Fosaa, A. M. (2004). Biodiversity patterns of vascular plant species in mountain vegetation in the Faroe Islands. *Diversity and Distributions*, 10(3), 217-223.
- Gaikwad, J., Wilson, P.D., & Ranganathan, S. (2011). Ecological niche modeling of customary medicinal plant species used by Australian Aborigines to identify

- species-rich and culturally valuable areas for conservation. *Ecological Modelling*, 222(18), 3437-3443.
- Gavin, M.C., Solomon, J.N., & Blank, S.G. (2010). Measuring and monitoring illegal use of natural resources. *Conservation Biology*, 24(1), 89-100.
- Gough, D., Thomas, J., & Oliver, S. (2012). Clarifying differences between review designs and methods. *Systematic Reviews*, 1(1), 1-9.
- Gorenflo, L.J., & Brandon, K. (2005). Agricultural capacity and conservation in high biodiversity forest ecosystems. *AMBIO: A Journal of the Human Environment*, 34(3), 199-204.
- Hamilton, A.C. (2004). Medicinal plants, conservation and livelihoods. *Biodiversity & Conservation*, 13(8), 1477-1517.
- Hassan, B.A.R. 2012. Medicinal plants (Importance and uses). *Pharmaceutica Analytica Acta*, 3 (10), 1112.
- Hawksworth, D.L., & Bull, A.T. (Editors). (2007). *Biodiversity and conservation in Europe*. Springer Science and Business Media: United Kingdom.
- Jules, P., Adamsb, B., Berkesc, F., de Athayded, S.F., Dudleye, N., Hunnf, E., Maffig, L., Miltonh, K., Rapporte, D., Robbinsi, P., Sterlingi, E., Stoltonk, S., Tsingl, A. Vintinnerk, E. and Pilgrimm, S. (2009). The Intersections of Biological Diversity and Cultural Diversity: Towards Integration. *Conservation and Society*, 7(2): 100-112.
- Kasagana, V.N., & Karumuri, S.S. (2011). Conservation of medicinal plants (Past, present and future trends). *Journal of Pharmaceutical Sciences and Research*, 3(8), 1378.
- Katewa, S.S., Chaudhary, B.L., Jain, A., & Galav, P. (2003). Traditional uses of plant biodiversity from Aravalli hills of Rajasthan. *Indian Journal of Traditional Knowledge*, 2(1), 27-39.
- King, D.N., Rosmarin, T., & Friedmann, Y. (2005). Biodiversity and ecosystem health: background research paper produced for the South Africa environment outlook report on behalf of the department of environmental affairs and tourism. *South Africa Environment Outlook*. 4(11), 1-18.
- Liamputtong, P. (2013). *Qualitative research methods*. 4th Ed. Victoria: Oxford.
- Mabogo, D.E.N. (1990). *The ethnobotany of the Vhavenda*. Unpublished M.Sc. Dissertation. University of Pretoria: Hartfield.
- Maluleke, W. (2020). The African scare of fall armyworm: Are South African farmers immune? *International Journal of Social Sciences and Humanity Studies*, 12(1), 192-206.
- Maluleke, W. (2016). *The use of Deoxyribonucleic Acid in combating stock theft in South Africa*. Unpublished Doctor Technologiae: Policing. Soshanguve South: Tshwane University of Technology.

- Maluleke, W., & Shibambu, N.F. (2021). Exploring illegal harvesting and theft of the selected South African endangered indigenous plants on the Red data list: Case studies of rural areas. *ADRRI Journal of Arts and Social Sciences*, 18(3 (6 October-December), 244-295.
- Mander, M., Ntuli, L., Diederichs, N., & Mavundla, K. (2007). Economics of the traditional medicine trade in South Africa care delivery. *South African health review*, 2007(1), pp.189-196.
- Martin, G.M. (1995). *Ethnobotany: A methods manual*. Chapman and Hall: London.
- Matthews, B., & Ross, L. (2010). *Research methods. A practical guide for the social sciences*. Essex: Pearson.
- Mokwena, R.J., Motsepe, L.L., Maluleke, W & Shandu, S.N. (2020). A study of land restitution to rural communities in South Africa: An analysis of traditional leaders perceptive. *Gender and Behaviour Journal*, (18(3), 16132-16144.
- Mokwena, R.J., & Maluleke, W. (2020). South African rural communities and the land restitution process: The application of criminological and legal theories in identifying obstacles to rightful allocations of land. *Gender and Behaviour Journal*, 18(3), 16145-16156.
- Mucina, L. (1997). Classification of vegetation: Past, present and future. *Journal of Vegetation Science*, 8(6), 751-760.
- Ndou, T.M., Stam, E.M., Tshisikhawe, M.P., Alabi, M.A., & Adeeyo, A.O. (2021). Poaching of *Encephalartos transvenosus*, in the Limpopo Province, South Africa. *Resources*, 10(12), 119.
- Ngqobe, Z. (1993). The roots of black conservation. *New Ground*, 11, 12-15.
- Punch, K.F. (2013). *Introduction to social research: Quantitative and qualitative approaches*. Sage: London.
- Raimondo, D. (2015). South Africa's strategy for plant conservation. *Veld and Flora*, 101(3), 132.
- Rankoana, S.A. 2001. Plant-based medicines of the Dikgale of the Northern Province. *South African Journal of Ethnology*, 24 (3): 99-104.
- Rasekgala, M.T. (2018). *The ethno-ecological assessment of Cassia abbreviata Oliv. at Matsa village, Limpopo Province, South Africa*. Unpublished Master of Science Dissertation. University of Venda: Thohoyandou.
- Regmi, S., & Bista, S. (2002). Best practices in collection and cultivation of medicinal plants for sustainable livelihoods in Himalayan communities. In *regional workshop at wise practices and experimental learning in the conservation and management of Himalayan medicinal plant* (pp. 15-20).
- Richards, J. F. (1990). Land transformation. *The Earth as transformed by human action: Global and regional changes in the biosphere over the past 300 years*, 163-178.

- Ross, I.A. (2005). *Medicinal plants of the world, volume 3: Chemical constituents, traditional and modern medicinal uses*. Humana Press Incorporated: Totowa, New Jersey.
- Schopp-Guth, A., & Fremuth, W. (2001). Sustainable use of medicinal plants and nature conservation in the Prespa National Park area, Albania. *Medicinal Plant Conservation*, 7, 5-8.
- Semenya, S.S., & Maroyi, A. (2019). Source, harvesting, conservation status, threats and management of indigenous plant used for respiratory infections and related symptoms in the Limpopo Province, South Africa. *Biodiversitas Journal of Biological Diversity*, 20(3), 789-810.
- Shackleton, N.J., Hall, M.A & Pate, D. (2001). Pliocene stable isotope stratigraphy of site 846. *Proc Ocean Drill Program Science Results*, 138, 337-355.
- Shibambu, N.F., Malatji, M.K & Maluleke W. (2021). The effects of urbanisation on the availability of medicinal plants (red data species) in Limpopo province, South Africa: a literature analysis. *Social Science International Conference*, 1-16.
- Spring, W. (2004). *Introduction of traditional medicinal plants into cultivation in KwaZulu-Natal: A way to preserve medicinal plants and educate the public*. <https://www.jstor.org/journal/humanecology?typeAccessWorkflow=login>.
- Steenkamp, Y. (2002). *The concept of Endemicism and the conservation of plant diversity impact*. Pamsgale: Impact Printers.
- Stern, KR, Bidlack, J.E, Jansky, S & Uno, G. (2000). *Introductory plant biology*. New York: California State University-Chico.
- Trombulak, S.C., & Frissell, C.A. (2000). Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology*, 14(1), 18-30.
- Van Wyk, B.E. (2011). The potential of South African plants in the development of new medicinal products. *South African Journal of Botany*, 77(4), 812-829.
- Van Wyk, A.S & Prinsloo, G. (2018). Medicinal plant harvesting, sustainability and cultivation in South Africa. *Biological Conservation*, 227, 335-342.
- Wild, R.G., & Mutebi, J. (1997). *Bwindi impenetrable forest, Uganda: Conservation through collaborative management*. Nature and Resources: United Kingdom.
- Willis, C.K. (2006). *Conserving South Africa's plants: a South African response to the global strategy for plant conservation*. South African National Biodiversity Institute: Brummeria, Pretoria.
- Young, J.A., van Manen, F.T., & Thatcher, C.A. (2011). Geographic profiling to assess the risk of rare plant poaching in natural areas. *Environmental Management*, 48(3), 577-587.

Zhang, Z & Zhou, J. (2019). From ecosystems to human welfare: the role and conservation of biodiversity. *Ciência Rural, Santa Maria*, 49 (05), 1-17.

Zimu-Biyela, A.N. (2016). *The management and preservation of indigenous knowledge in Dlangubo Village in KwaZulu-Natal, South Africa*. Unpublished Doctor of Literature and Philosophy: Information Science. University of South Africa: Muckleneuk, Pretoria.