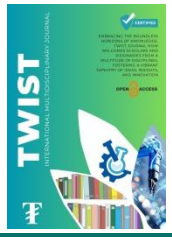
DOI 10.5281/twist.10049652#000

TWIST, 2025, Vol. 20, Issue 4, pp. 22-32

TWIST

Journal homepage: www.twistjournal.net



Indigenous Knowledge and Its Role in Biodiversity Conservation:

A Case Study Approach

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Abstract
The pursuit of Sustainable Development Goals (SDGs) 1, 2, and 3 remains challenging, with food insecurity being a significant global issue. Indigenous communities rely on wild plant resources for nutrition and income. However, wild edible plants, particularly wild edible fruit plants, are increasingly endangered due to human activities. This study examines traditional methods for protecting these plants. Semi-structured interviews with 160 participants of various genders and ages documented indigenous conservation practices. Participants highlighted the role of tribal authorities in enforcing rules to prevent deforestation, such as penalizing those who collect firewood or cutting wild edible fruit trees. The study concludes that involving local communities, conservers, educators, and other stakeholders is crucial for implementing indigenous knowledge in conserving these natural resources.

Keywords
Wild edible fruit plants, Local communities, Conservation, Tribal authorities, Indigenous knowledge

INTRODUCTION

The ongoing struggle to achieve Sustainable Development Goals (SDGs) 1, 2, and 3 is marked by persistent food insecurity, a major global issue (Ebert, 2014). The global food supply heavily relies on agricultural products, which face numerous challenges in maximizing production. A promising solution is to incorporate natural resource-based livelihood strategies to mitigate hunger during periods of limited agricultural output (Legwaila et al., 2011). Despite these alternative food sources, sustainably managing natural plant food resources remains difficult. This study focuses on indigenous methods used to conserve wild edible fruit plants in the Vhembe region.

Significance of Wild Food Plants

Plant diversity is crucial for meeting global food demands (Bhattarai et al., 2009). Historically, millions of people, especially in developing countries, have relied on plant resources for daily needs such as food and income (Schippman et al., 2002). A study in Botswana by Motlhanka et al. (2008) found that locals use parts of wild edible fruit plants for various daily needs, a practice also observed in the Vhembe region, South Africa. Mokganya et al. (2018) documented the essential uses of 27 wild edible fruit plants, while Magwede et al. (2019) highlighted their role in food provision and health improvement in the Vhembe region.

Despite the availability of wild plants for various uses, they often receive insufficient attention and utilization. Sahoo et al. (2021) noted that neglected and underutilized wild plant resources are fundamental to biodiversity in developing countries. Maroyi & Cheikhyoussef (2017) emphasized that wild edible fruit plants provide rural communities with essential goods and ecosystem services. Wild edible fruit plants are vital for local communities, serving as medicine, construction material, firewood, furniture, forage, craft materials, and sources of income (Motlhanka et al., 2008). However, these plants are endangered in their natural habitats due to human activities such as agriculture, fires, firewood collection, and selective harvesting (Suwardi et al., 2020). These activities can severely damage wild edible fruit plant species. Studies by Balemie & Kebebew (2006) and Amente (2017) identified agricultural expansion as a primary threat to these plants. Consequently, many wild fruit species are at risk, leading to the encroachment of newly grown parts of woody species. Nguanchoo et al. (2022) found that age, education level, literacy, and social media use among community

members influence the transmission and retention of traditional medicinal knowledge. Despite the rich indigenous knowledge of useful plants in the VhaVenda region documented by Magwede et al. (2019), more research is needed to address the conservation of wild edible fruit plants. This study explores indigenous methods to protect wild edible fruit plant species and enhance local livelihoods.

RESEARCH METHODOLOGY

Study Area

The study area is bordered by Botswana to the northwest, Zimbabwe to the north, and Kruger National Park to the east (Fig. 1). Vhembe District spans approximately 2,771 km² and has an average altitude of 400 meters above sea level (Lombard et al., 2006). The Vhembe District Municipality is located between 22°56'S and 30°28'E (LSOER, 2004), and it is divided into four local municipalities: Makhado, Mutale, Musina, and Thulamela (Fig. 1).

The region receives an average annual rainfall ranging from 378 mm to 810 mm (LSOER, 2004). The climatic conditions in parts of the Vhembe District Municipality support diverse vegetation types, including north-eastern mountain bushveld, mixed bushveld, sour mixed bushveld, and mopane bushveld (Venter & Witkowski, 2011). These vegetation types are part of the savanna biome in Limpopo province. Additionally, woodlands along the Soutpansberg mountain range feature thickets and pockets resembling well-developed Afromontane forests (LSOER, 2004). The reason for the choice of Vhembe District is due to several factors for conservation efforts: 1) Biodiversity Hotspot: The diverse vegetation types, including mountain bushveld, mixed bushveld, and mopane bushveld, create a rich habitat for various plant and animal species. This biodiversity makes the region a critical area for conservation efforts (Flaber et al., 2009). 2) Climatic Conditions: The range of annual rainfall (378 mm to 810 mm) supports different vegetation types, which in turn support diverse ecosystems.

However, variations in rainfall can also pose challenges for conservation, as some species may be more vulnerable to changes in precipitation patterns (Flaber et al., 2009). 3) Human Activities: The proximity to agricultural lands, urban areas, and Kruger National Park means that human activities such as agriculture, deforestation, and tourism can impact conservation efforts.

Effective management strategies are needed to balance human needs with conservation goals (Reddy & D´avalos 2003). 4) Indigenous Knowledge: The presence of indigenous communities with traditional knowledge of local flora and fauna can be a valuable asset for conservation. These communities often have sustainable practices that can be integrated into modern conservation strategies (Reddy & D´avalos 2003). 5) Geographical Barriers: Natural barriers like the Soutpansberg mountain range can help protect certain areas from human encroachment, but they can also limit the movement of species and genetic exchange between populations (Flaber et al., 2009). By understanding these geographical factors, conservationists can develop more effective strategies to protect the unique biodiversity of the Vhembe District.

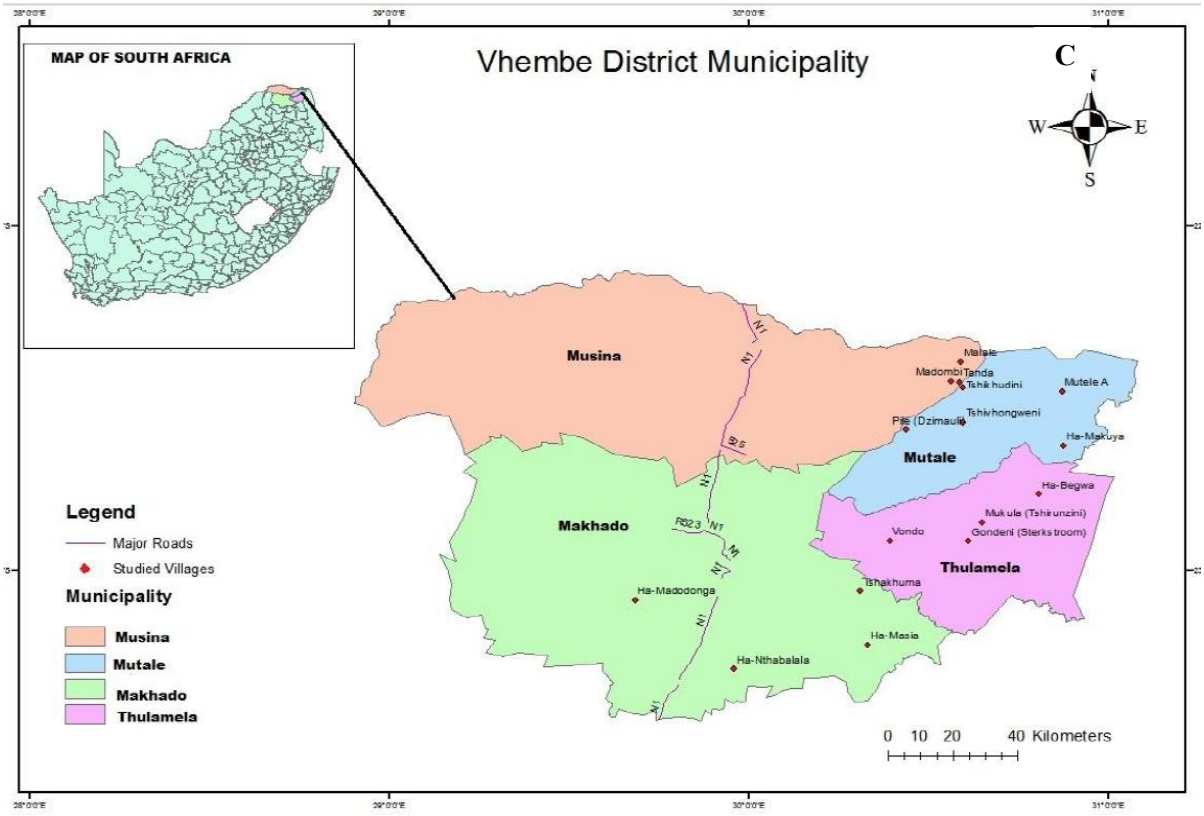

Fig. 1 Map of the Vhembe District Municipality with its borders and local municipalities (Rampedi & Olivier 2013; Mokganya et al., 2018)

Study design

The study focused on Venda-speaking residents of selected deep rural villages within the four local municipalities of the Vhembe District, conducting an ethnographic field study. During the pilot phase, participants for the main research were identified and approached for permission. Field trips were conducted to collect samples for herbarium purposes.

Study Population

Given the significant lifestyle changes in many rural areas transitioning towards urbanization, a purposive sampling technique was used. This method allows for a focused examination of issues pertinent to the study. Interviews were conducted with residents of deep rural areas, based on the belief that they still utilize wild edible plants. Purposive sampling is beneficial in research for: 1) selecting informants with specific knowledge or skills, and 2) making powerful comparisons of cultural practices (Neupane et al., 2002).

A total of 160 community members from each selected village were interviewed, including both females and males. Females were included because they are typically responsible for food preparation in households, while males, who often herd cattle, gain knowledge about wild edible fruits. Harris & Mohammed (2003) noted that traditional healers and herders, who spend significant time away from home, are key holders of knowledge about wild foods. The elderly population in this study included individuals aged 36 to 80 and above. A study on indigenous fruit plant species among the Mapulana of Enhlanzeni District Municipality in Mpumalanga province, South Africa, found that elders possess more knowledge about traditional fruit plants (Mashile et al., 2019).

Data collection

Permission to carry out this research was verbally granted by the tribal authorities of each village within the local municipalities. All selected participants were asked to sign a consent form. Background data on wild edible fruit plants was gathered from all four local municipalities using semi-structured interviews addressing the following questions:

1) What roles do wild edible fruit plants play in the livelihoods and food security of indigenous communities in the Vhembe region?
2) What are the traditional methods used by local communities to protect wild edible fruit plants from deforestation and other human activities?
3) What are the socio-economic benefits of conserving wild edible fruit plants for local communities?
4) How do indigenous knowledge systems contribute to the conservation of wild edible fruit plants in the Vhembe region?

The South African National Biodiversity Institute (SANBI) red list was referenced to verify the conservation status of any wild edible fruit plant species with additional uses. The principal researcher, along with some research assistants, conducted all the interviews.

RESULTS AND DISCUSSION

This paper documents the conservation information of 27 wild edible fruit plant species, each with additional uses. These species belong to 19 different plant families (Table 1). The most frequently represented families include Annonaceae (3 species), Malvaceae (3 species), Apocynaceae (2 species), Anacardiaceae (2 species), Loganiaceae (2 species), and Sapotaceae (2 species). Thirteen of the families mentioned in the study are represented by only one species each (Table 1).

Figure 2 illustrates the findings of the SANBI (South African National Biodiversity Institute) Red List, revealing that 21 fruit plant species are classified as of least concern, while six species remain unassessed. The unassessed tree species include *Hexalobus monopetalus*, *Boscia albitrunca* (Burch.) Gilg and Gilg-Ben, *Opuntia ficus-indica*, *Psidium guajava* L., *Passiflora subpeltata* Ortega, and *Bequaertiodendron magalismontanum* (Sond.) Heine & J.H.Hemsl.

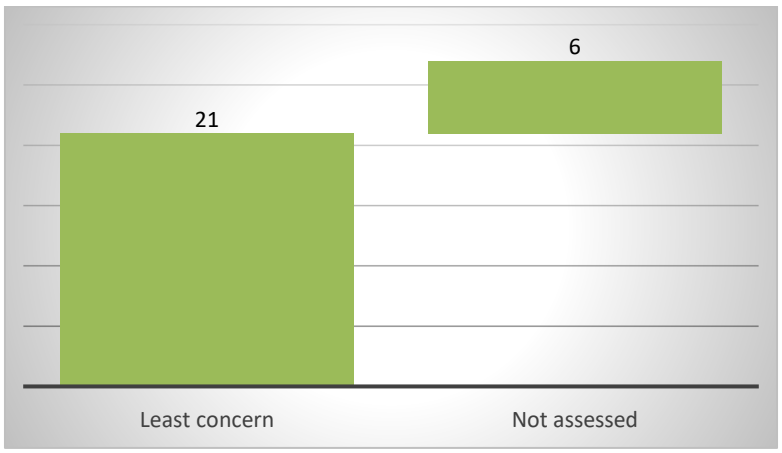

Fig. 2 SANBI Red List Statuses of wild edible fruit plant species

Table 1 Wild edible fruit plants with additional uses and newly documented uses in bold. Information about other uses was gathered from WV= Welcome & Van Wyk (2019); MA= Magwede et al., (2019), and MTM= Mbambala et al., 2017

Family	Scientific name	Vernacular (V) and Common name (E)	Use categories cited during interviews	Edible fruits of wild edible fruit plants	Literature used
Anacardiaceae	*Sclerocarya birrea* (A.Rich.) Hochst. subsp. caffra (Sond.) Kokwaro, MMG45	Mufula (V), Cider tree, Marula (E)	8:beer,oil, jam, cooking soda, candies, snack, seasoning, medicine		WV and MA
	Lannea discolor (Sond.) Engl., MMG43	Munie (V), Tree Grape, Wild plum (E)	2:dye, firewood		WV and MA
Annonaceae	*Annona senegalensis* Pers, MMG33	Muembe (V), Custard apple (E)	1: firewood		WV and MA
	Artabotrys brachypetalus Benth., MMG40	Mudzidzi (V), Red Hook-berry (E)	1: firewood		WV and MA
	Hexalobus monopetalus (A.Rich.) Engl. & Diels MMG37	Muhuhuma (V), Mudzidzi (V)Purple Hook-berry (E)	1: firewood		WV and MA
Apocynaceae	*Landolphia kirkii* Dyer ex Hook.f., MMG35	Muvhungo (V), Rubber Vine (E), San Apricot-vine (E)	3:firewood, roofing, medicine		WV and MA
	Carissa bispinosa (L.) Desf.ex Brenan, MMG42	Murungulu (V), Fork-spined Carissa, Red Num Num (E)	1:medicine		WV and MA
Brassicaceae	*Boscia albitrunca* (Burch.) Gilg & Gilg-Ben, MMG59	Muthobi (V), Sheperd's tree (E)	1: medicine		MA
Cactaceae	*Opuntia ficus-indica* (L.) Mill., MMG50	Mudoro (V), Prickle pear, Spineless Cactus (E)	2: beer, jam		WV and MA

Chrysobalanaceae	*Parinari curatellifolia* Planch. ex Benth., MMG41	Muvhula (V), Mobola Plum, Cork tree (E)	3: beer, juice, porridge cooking		WV and MA
Ebenaceae	*Diospyros mespiliformis* Hochst.ex A.DC., MMG44	Musuma (V), Jackal-berry (E)	1: firewood		WV and MA
Fabaceae	*Pterocarpus angolensis* DC, MMG62	Mutondo (V), Blood wood (E)	2:beer, porridge cooking		MA
Loganiaceae	*Strychnos spinosa* Lam., MMG79	Muramba (V), Monkey orange (E)	3:juice, firewood, artifact		WV and MA
	Strychnos pungens Soler, MMG46	Mukwakwa (V), Spiny-leaved Wild Orange (E)	5:juice, firewood, medicine, artifact, beer		WV and MA
Malvaceae	*Adansonia digitata* L. MMG47	Muvhuyu (V), Cream of tartar tree (E)	2:cooking soda, firewood		WV and MA
	Grewia microthyrsa K. Schum. Ex BurretMMG53	Mufuka (V), Sand Raisin (E)	1:porridge cooking		WV and MA
	Grewia villosa Willd MMG74	Mupunzu (V), Mallow raisins (E)	1:porridge cooking,		WV and MA
Meliaceae	*Trichilia emetica Vahl susp. emetica* Sond, MMG54	Mutshikili (V), White Mahogany (E)	2: seasoning, medicine		WV and MA

Moraceae	*Ficus sycomorus* L. subsp. *Sycomorus,* MMG52	Muhuyulukuse (V), False Cluster Fig (E)	1: lotion		WV and MA
Myrtaceae	*Psidium guajava* L. MMG57	Mugwavha (V), Apple Guava, Yellow Guava (E)	2: beer, juice		WV and MA
Ochnaceae	*Ochna pulchra* Hook. F. MMG51	Tshitoni (V), Granite ochna (E)	1: firewood		WV and MA
Olacaceae	*Ximenia caffra* Sond. var. *caffra* MMG56	Muthanzwa (V), Blue Sour Plum (E)	1: firewood		WV and MA
Passifloraceae	*Passiflora subpeltata* Ortega MMG61	Mugurunandela (V), Mufuranta (V), Wild granadilla (E)	1: firewood		MTM
Rhamnaceae	*Ziziphus mucronata* Willd.subsp. *mucronata* MMG60	Mutshetshete (Mukhalu) (V), Buffalo thorn (E)	1:firewood		WV and MA
Rubiaceae	*Vangueria infausta* Burch MMG38	Muzwilo (V), Velvet Wild-medlar (E)	2:firewood, medicine		WV and MA
Sapotaceae	*Mimusops zeyheri* Sond. MMG31	Thaladzi/ Mbubulu (V), red milkwood (E)	1:medicine		WV and MA
	Bequaertiodendron magalismontanum (Sond.) Heine & J.H.Hemsl, MMG36	Munombelo (V), Milkplum (E)	4:beer, firewood, jam		WV and MA

Eighty-six respondents emphasized the importance of conserving wild edible fruit plants. They cited four main reasons: ensuring future generations can recognize these plants, preserving the ability to enjoy the fruits in the future, addressing the scarcity of remaining fruit plants, and acknowledging their significance to the community (Fig. 3). Additionally, 23 respondents agreed with the need for conservation but did not provide specific reasons for their support.

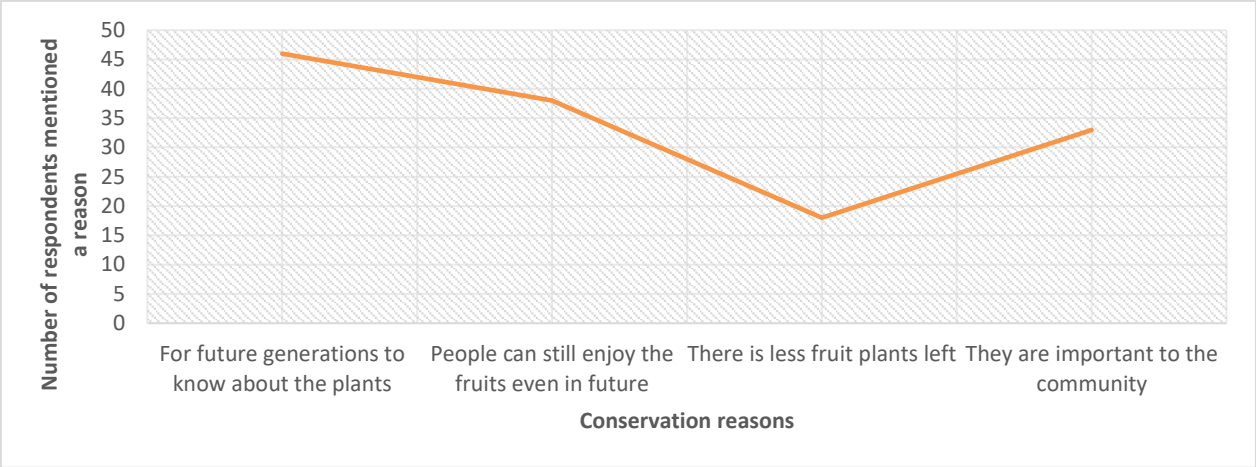

Fig. 3 Conservation reasons of wild edible fruit plant species.

Figure 4 shows that 66 respondents acknowledged the role of tribal authorities in conserving wild edible fruit plants by imposing fines on residents who cut or collect these trees for other purposes. Fifty-seven respondents noted that people adhere to the tribal authority's rule prohibiting the cutting of trees for firewood. However, 37 respondents indicated that no such law exists from the chief's kraal.

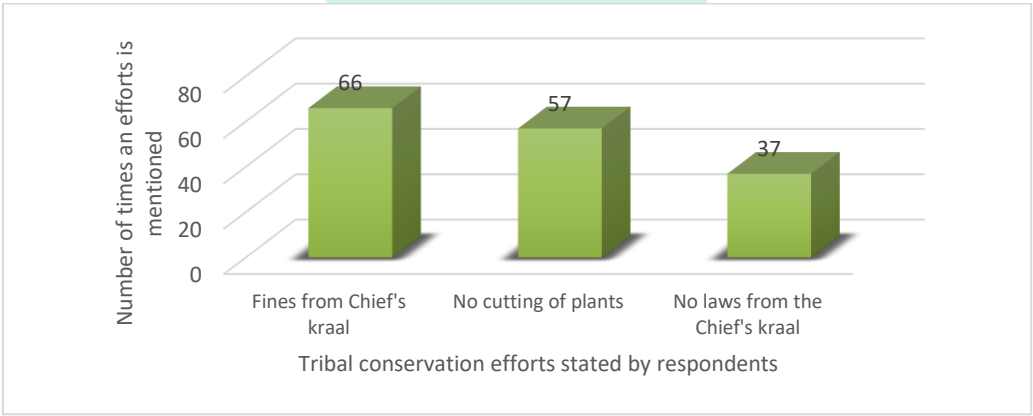

Fig. 4 Tribal conservation efforts of wild edible fruit plant species

The study conducted by Abdullahi et al. (2013) in Kpashimi Forest Reserve, Niger State, Nigeria, revealed that royal traditions, taboos, and myths play a crucial role in forest conservation. This indicates that the sustainable use and conservation of wild edible plant species can be significantly enhanced if local rules and regulations are enforced and respected. Furthermore, the sustainable management of these natural resources is vital for the well-being of local communities and biodiversity conservation, contributing to the preservation of genetic diversity (Suwardi et al., 2020).

The current study found that five fruit plant species, previously not used for firewood, are now being utilized for this purpose. This shift may be due to the decline in enforcement of tribal conservation practices and the modernized youth's lack of knowledge or disregard for tribal rules. Elderly participants in the Niger State study lamented that trees not used for firewood three decades ago are now being exploited due to some community members' careless attitudes (Abdullahi et al., 2013). Similarly, the use of 29 edible fruit plants as firewood (Maroyi & Cheikhyoussef, 2017) poses a significant extinction threat. Mwamba (2006), Ngemakwe et al. (2017), and Ngadze et al. (2017b) also noted that wild edible fruit plants face extinction risks due to unsustainable harvesting and firewood collection, which contribute to rapid climate change.

To address these issues, it is suggested that tribal rules and regulations be enforced, supported by scientific research as a remedial strategy to prevent plant extinction. Vanderbroek et al. (2011) argued that local knowledge systems should complement, rather than replace, scientific research.

During the research, it was noted that plants like *Sclerocarya birrea* are considered the Chief's plant, as community members are required to deliver Marula beer to the Chief's kraal for special ceremonies. This practice promotes the conservation of *Sclerocarya birrea*, which has attributes beneficial to community health (Mokganya et al., 2018; Gouwakinnou et al., 2011). This highlights that plant species can be protected from extinction when used for cultural and traditional purposes rather than solely for practical uses (Shackleton et al., 2007). Gadgil et al. (1993) described tree species of the genus Ficus as keystone resources essential for ecosystem conservation. Participants

emphasized the importance of conserving wild fruit plants for future generations to benefit from these resources and acquire knowledge about their uses. Gadgil et al. (1993) also stressed the importance of plant conservation for knowledge transfer across generations.

A significant finding from 123 respondents indicated that the enforcement of traditional laws or taboos in the study area effectively prevents the harvesting of indigenous plants, such as marula, for firewood (Sinthumule & Mashau, 2019). However, 37 respondents indicated that there are no conservation laws from tribal authorities, underscoring the urgent need to enforce royal rules and regulations to promote wild edible fruit plant conservation. Full cooperation from community members is essential for the successful implementation of these rules. Albuquerque et al. (2011) recommended involving community members in designing and implementing management plans for conserving and monitoring culturally valuable and vulnerable plant species. *Strychnos pungens* Soler, a species indispensable to local communities, was mentioned for the first time as being used for firewood in this study. Using a plant for firewood leads to its degradation. Mareng (2022) highlighted the valuable uses of *Strychnos pungens* Soler in Botswana and suggested that tissue culture methods could control its extinction for later domestication. Besides domestication, these plant species can be preserved by maintaining their endangered status in protected areas, promoting accessibility through permits.

CONCLUSION

There is no doubt that wild edible fruit plants are invaluable due to their numerous beneficial uses. The findings of this research will help preserve Indigenous knowledge related to the protection of wild fruit plants, ensuring their sustainable availability. Additionally, the results will support the responsible use of plants like *Sclerocarya birrea*, which provide essential services to local and rural communities. Given the crucial role these plants play in the lives of rural populations, it is recommended to develop appropriate cultivation and harvesting strategies. The involvement of local communities, conservers, educators, and other stakeholders in applying Indigenous knowledge for the conservation of wild edible fruit plants should be strengthened. Some respondents indicated that conservation laws from tribal authorities are lacking, highlighting the need to reinforce these regulations.

AUTHOR CONTRIBUTION

Conceptualization, Methodology, Data collection, Data Analysis, Writing----Original drafting, Writing----Review and Editing by author.

FUNDING

This research was funded by The University of Venda's Capacity Development Grant- D058.

DATA AVAILABILITY

The datasets collected during this study are available from the corresponding author on request.

INFORMED CONSENT

Informed consent was obtained from participating members of the Vhembe District Municipality.

CONFLICT OF INTEREST

The author declares no conflict of interest.

REFERENCES

1. Abdullahi, J., Usman, I., Samaila, G. & Zuni, A. (2013). Importance of indigenous knowledge in biodiversity conservation: A case study of communities surrounding Kpashimi Forest Reserve, Niger State, Nigeria. *Journal of Environmental Science, Toxicology and Food Technology*, *5*(6), 10-17.
2. Albuquerque, U.P., Andrade, L.H.C. & de Silva, A.C.O. (2005). Use of plant resources in a seasonal dry forest (Northeastern Brazil). *Acta Botanica Brasilica, 19*, 27-38.
3. Amente, D. A. (2017). Ethnobotanical survey of wild edible plants and their contribution for food security used by Gumuz People in Kamash Woreda, Benishangul Gumuz Regional State, Ethiopia. *Journal of Food Nutrition Science, 5*(6), 217-224.
4. Balemie, K. & Kebebew, F. (2000). Ethnobotanical study of wild edible plants in Dereshe and Kucha Districts, South Ethiopia. *Journal of Ethnobiology and Ethnomedicine, 2*, 53.
5. Bhattarai, S., Chaudhary, R. P. &Taylor, R. S. L. (2009). Wild edible plants used by the people of Manang District, Central Nepal. *Ecology of Food and Nutrition, 48*(1), 1-20, DOI: 10.1080/03670240802034996.m
6. Ebert, A.W. (2014). Potential of underutilized traditional vegetables and legume crops to contribute to food and nutritional security, income and more sustainable production systems. Sustainability, 6(1), pp.319-335.
7. Flaber, C.H., Wilson, K.R., and Shriner, S.A. (2009). Geographic approaches to biodiversity conservation: Implications of scale and error to landscape planning. In: J.J. Millspaugh and F.R. Thompson, eds. Models for Planning Wildlife Conservation in Large Landscapes. Academic Press, pp. 85-121. ISBN 9780123736314. Available at: https://doi.org/10.1016/B978-0-12-373631-4.00004-6.

8. Gadgil, M., Berkes, F. & Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *AMBIO 22*(2-3), 151-156.
9. Gouwakinnou, G.N., Lykke, A.M., Assogbadjo, A.E. & Sinsin, B. (2011). Local knowledge, pattern and diversity of the use of *Sclerocarya birrea*. *Journal of Ethnobiology and Ethnomedicine, 7*(8).
10. Harris, F.M. & Mohammed, S. (2003). Relying on nature: wild foods in northern Nigeria. *AMBIO, A Journal of the Human Environment, 32*(1), 24-29.
11. Limpopo State of the Environment Report (LSOER), 2004. State of the environment report, viewed from http://www.environment.gov.za/soer/reports/limpopo.html.
12. Legwaila GM, Mojeremane W, Madisa ME, Mmolotsi RM and Rampart M. 2011. Potential of traditional food plants in rural household food security in Botswana. Journal of Horticulture and Forestry 3(6): 171-177.
13. Lombard, Z., Dalton, D.L., Venter, P.A., Williams, R.C. & Bornman, L. (2006). Association of HLA-DR, -DQ and Vitamin D receptor alleles and haplotypes with tuberculosis in the Venda of South Africa. *Human Immunology, 67*, 643-654. https://doi.org/10.1016/j.humimm.2006.04.008.
14. Magwede, K., van Wyk, B,-E. & van Wyk, A.E. (2019). An inventory of Vhavenda useful plants. *South African Journal of Botany*, *122*,57-89. https://doi.org/10.1016/j.sajb.2017.12.013.
15. Mareng W. 2022. Diversity, Distribution, Tissue Culture, and Value Addition of *Strychnos* species in the Central and North-East Districts of Botswana. MSc. Dissertation. Botswana International University of Science and Technology.
16. Maroyi A and Cheikhyoussef A. 2017. Traditional knowledge of wild edible fruits in Southern Africa: A comparative use patterns in Namibia and Zimbabwe. Indian Journal of Traditional Knowledge 16(3): 385-392.
17. Mashile, S.P., Tshisikhawe M.P., Masevhe, N.A. (2019). Indigenous fruit plants species of the Mapulana of Ehlanzeni district in Mpumalanga province, South Africa. *South African Journal of Botany*, *122*, 180-183. https://doi.org/10.1016/j.sajb.2018.09.031.
18. Mbambala, S. G., Tshisikhawe, M. P., & Masevhe, N. A. (2017). Invasive alien plants used in the treatment of HIV/AIDS-related symptoms by traditional healers of Vhembe municipality, Limpopo Province, South Africa. *African Journal of Traditional, Complementary and Alternative Medicines*, *14*(5), 80-88. https://doi.org/10.21010/ajtcam.v14i5.11.
19. Mokganya, M.G., Tshisikhawe, M.P., Selwankomo, N., Tshivhandekano, T.R., Ramovha, L.I., Masevhe, N.A, Ligavha-Mbelengwa, M.H. & Mocheki,T.A. (2018). An evaluation of additional uses of some wild edible fruit plants of the Vhembe District Municipality in the Limpopo Province, South Africa. *Indian Journal of Traditional Knowledge, 17*(2), 276-281. https://doi.org/0000-0001-7233-9183
20. Motlhanka, D.M.T., Motlhanka, P. & Selebatso, T. (2008). Edible Indigenous Wild Fruit Plants of Eastern Botswana. *International Journal of Poultry Science,7*(5), 457-460.
21. Mwamba, C.K., 2006. Monkey orange: Strychnos cocculoides. Crops for the Future.
22. Neupane, R.P., Shaarma, K.R. & Thapa, G.B. (2002). Adoption of agroforestry in the hills of Nepal: a logistic regression analysis. *Agricultural Systems, 72*, 177 -196. https://doi.org/10.1016/s0308-521x(01)00066-x
23. Ngadze, R.T., Verkerk, R., Nyanga, L.K., Fogliano, V., Linnemann, A.R., 2017b. Improvement of traditional processing of local monkey orange (Strychnos spp.) fruits to enhance nutrition security in Zimbabwe. Food Security 9, 621-633.
24. Ngemakwe, P.N., Remize, F., Thaoge, M., Sivakumar, D., 2017. Phytochemical and nutritional properties of underutilised fruits in the southern African region. South African Journal of Botany 113, 137-149.
25. Nguanchoo, V., Wangpakapattanawong, P., Balsley, H., &Inta, A. (2022). Hmong Medicinal Plant Knowledge Transmission and Retention in Social Modernity. *Human Ecology*, 1-15. https://doi.org/10.1007/s10745-022-00326-4
26. Rampedi, I.T. and Olivier, J. (2013). Traditional Beverages Derived from Wild Food Plant Species in the Vhembe District, Limpopo Province in South Africa. *Ecology of Food and Nutrition, 52*, 203-222. https://doi.org/10.1080/03670244.2012.706131
27. Reddy S, and D´avalos LM. 2003. Geographical sampling bias and its implications for conservation priorities in Africa: sampling bias and conservation in Africa. Journal of Biogeography 30:1719–1727.
28. Sahoo, G., Wani, A.M., Dash, A.C., Rout, S., Tripathy, B., Prusty, A.K. and Dash, L., 2021. Impact of Rural Activities on Biodiversity and Ecosystem Services. Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/Journal of Tianjin University Science and Technology, 54, pp.373-393.
29. Schippmann, U., Cunningham, A.B. & Leaman, D.J. (2002). Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries, FAO, Rome. Impact of cultivation and gathering of medicinal plants on biodiversity: Global trends and issues. Rome, Italy.
30. Shackleton, M.C., Shackleton, S.E., Buiten, E. & Bird, N. (2007). The importance of dry woodlands and forest in rural livelihoods and poverty alleviation in South Africa. *Forest Policy and Economics, 9*, 558-557. https://doi:10.1016/j.forpol.2006.03.004.
31. Sinthumule, N.I. and Mashau, M.L., 2019. Attitudes of local communities towards Marula tree (Sclerocarya birrea subsp. Caffra) conservation at the villages of ha-Mashau and ha-Mashamba in Limpopo Province, South Africa. Resources, 8(1), p.22.

32. Suwardi, A.B., Navia, Z. I., Harmawan, T., Syamsuardi & Mukhtar, E. (2020). Ethnobotany and conservation of indigenous edible fruit plants in South Aceh, Indonesia', *Biodiversitas, 21*(5), 1850-1860. https://doi:10.13057/biodiv/d210511
33. Vanderbroek, I., Reyes-Garcia, V., de Albuquerque, U., Bussmann, R. & Pieroni, A. (2011). Local knowledge: Who cares? *Journal of Ethnobiology and Ethnomedicine 7*(35). http://www.ethnobiomed.com/content/7/1/35
34. Venter, S.M. & Witkowski, E.T.F. (2011). Baobab (*Adansonia digitata* L.) Fruit production in communal and conservation land-use types in southern Africa. *Forest Ecology and Management, 261*, 630-639.
35. Welcome, A. K., & Van Wyk, B. E. (2019). An inventory and analysis of the food plants of southern Africa. *South African Journal of Botany, 122,* 136-179. https://doi.org/10.1016/j.sajb.2018.11.003