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Detecting threats to *Encephalartos transvenosus* (Limpopo cycad) in Limpopo province, South Africa through indigenous knowledge

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Indigenous knowledge contains valuable information which is often essential to biodiversity and species conservation. The traditional knowledge of people in local communities can enhance conservation policies and planning and also reveal local perspectives in relation to endangered species. Cycads as a vascular plant group contain the highest percentage of threatened plant species, at global, regional, national and community levels. In this study we focused on *Encephalartos transvenosus* Stapf & Burtt Davy, a cycad species endemic to Limpopo province in South Africa. Despite every effort to conserve this highly endangered species the threats keep increasing and the population keep decreasing. Through indigenous knowledge, we discovered a location of this species not yet conserved within Vhembe district on the Soutpansberg mountain range in Limpopo province, South Africa. Practices such as bark harvesting, and uprooting of young seedlings were discovered at this population. All these practices noticed at this location are detrimental to *in situ* conservation of the cycads. This study hereby revealed that indigenous knowledge has a great role in cycads' conservation. Through the local communities, factors that are threatening cycads existence can be determined and the local community can also be integrated in effective conservation plan that discourage illegal harvesting of cycads.

Keywords: Cycads, Conservation, *Encephalartos transvenosus,* Indigenous knowledge, Traditional knowledge, Endangered species, Threat

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Indigenous knowledge is defined as specific information from local communities based on culture, lifestyle and practices that are passed from one generation to another[1-3]. This knowledge is not only important to local indigenes but also useful for scientists and planners in the area of improving the environment, well being of people and also sustaining natural resource management[4,5]. The indigenes of certain local communities have an understanding of the ecosystem functioning of their localities from a number of perspectives. Through long term uses they possess vast knowledge of certain locations of endemic plant species. For instance certain plant species are identified in local communities through local names by reason of their uses for food and medicine[6,7]. This local knowledge can also be very useful in the area of plant conservation.

Cycads are amongst some of the oldest living representative of gymnosperms and they have existed for about 300 million years[8,9]. Davis & Schaefer[10] suggested a need for integration of the fossil records in a better way in order to improve our understanding of the rate and mode of diversification in the family tree of gymnosperm. They are also the most threatened plant taxa globally containing the highest percentage of threatened plant species[11,12]. Despite conservation efforts there have been steady increase of the threat status and decrease in the population trend in all continents where they occur[12]. These globally threatened species demands conservation attention to prevent their total extinction. Unlike some other nations of the world where habitat loss is a major cause of cycad extinction risk, South Africa cycads are facing extinction mainly due to bark harvest[13,14]. Three species of cycads are extinct in South Africa due to bark harvesting for medicinal purpose[15]. This threat is at global, national, regional and community levels[16].

Encephalartos transvenosus Stapf & Burtt Davy is a species of cycad endemic to Limpopo province in South Africa[17]. This species was once listed as a rare species by Hilton-Taylor[18] but currently some of them

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are abundant in places such as Modjadji nature reserve which contains about 15,000 individuals alongside some other subpopulations[19]. It's being listed as least concern by Raimondo *et al*.[20] with the population trend decreasing due to wild harvesting of individuals and habitat destruction[12]. This species is nominally protected under the National Environmental Management Biodiversity act of South Africa[21] and also under Limpopo Environmental Management act (LEMA) of South Africa[22]. In this study, we focused on determining threat to these species due to illegal harvest by local communities through indigenous knowledge.

Materials and methods

This study was conducted at Mahunguwi in Limpopo province, South Africa. Mahunguwi is a small rural village of 394 people which falls within Thulamela local municipality in Vhembe district[23]. According to Acocks[24] the study site is situated within a sourish mixed bushveld vegetation type of the savanna biome. The annual rainfall of the area as per Tshitavha Weather Station data is 698 mm[25]. It is an area geographically characterized by the Soutpansberg mountain range which geology is made up of Makgabeng Plateau, Blouberg Mountains, Pink erosion-resistant quartzite and sandstone with pebbles as the major dominating rocks[26]. A population of *Encephalartos transvenosus* was found on the east facing slope of the mountain in this location. *Encephalartos transvenosus* population was identified by one of the male traditional knowledge holder through the local Tshivenda name of *Tshifhanga*. Through the local name it was easier to communicate to informant on the plant species and the required information about it.

Ethnobotanical survey was conducted in order to determine the knowledge of the villagers about utilization of this species. Informants above 25 yrs of age who were willing to participate were randomly selected after prior consent regarding the use of their information for research purposes was sought with them. Twenty nine people were interviewed in Tshivenda which is their local language. We also ensure that the people interviewed are people who originated and reside in this village and they also get their livelihood in Mahunguwi village (Table 1).

Results and discussion

Informants profile and their harvesting perceptions

In the household survey conducted 55 % of the informants were males while 45 % were females. Convenient approach on selection of informants was adopted after obtaining prior consent from them. Amongst the informants youth made up 45 % while adults constituted 55 %. The survey also revealed that the majority of the informants (93.2 %) were aware that harvesting of *Encephalartos transvenosus* was illegal, whereas only 2 individuals (6.8 %) indicated that they were not aware of its conservation status. This might be probably driven by their needs of making a living out of its harvesting. This should, therefore, call for a community integrated conservation plan either through nursery propagation or re-introduction[27] which might take people away from the wild harvesting of these plants.

The informants indicated that seedlings from this population had been previously removed and sold resulting in the absence of juvenile individuals. Total removal of the species particularly seedlings for horticultural purposes was also not ruled out.

Encephalartos tranvenosus bark utilization

The population of *Encephalartos transvenosus* found in this location has been highly disturbed with bark harvesting on all individuals observed (Figs. 1 a-d). Harvest for medicinal use is one of the major factors threatening cycad existence in South Africa[14,15] and in particular bark harvest is the main factor contributing to cycad extinction in South Africa[13]. It was certainly the main threat to the individuals of *Encephalartos transvenosus* found in this population. Some individuals also showed sign of decay as a result of internal stem exposure from this practice (Fig. 1d).

The informants confirmed that the motive behind harvesting of cycads was mainly medicinal. According to them the reason why the upper part of the bark of *Encephalartos transvenosus* is always being harvested is due to the traditional belief that this part specifically works magic and drives evil spirits away (Fig. 1a). It was also reported that the rest of the bark parts (excluding the upper part) being harvested are for other medicinal purposes which include anticancer therapy in treatment of people with breast cancer. Poaching of cycads materials has been reported to be influenced by people who want to produce hard drugs prepared by international community. Individuals are, therefore, completely removed to satisfy the demand of international communities. The informants confirmed that the harvesting of these plants in the wild by the local communities has been unsustainable.

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Table 1—An inventory of responses on the utilization of *Encephalartos transvenosus*

Respondents	Age groups	Gender	Parts harvested	Purpose	Awareness on illegal harvesting
1	Elder	Male	Leaves	For roofing hut	Aware
2	Elder	Male	Bark	Medicine	Aware
3	Youth	Female	Bark	Hard drugs	Aware
4	Elder	Female	Bark	Hard drugs	Aware
5	Youth	Male	Bark	Hard drugs/Medicine	Aware
6	Youth	Male	Bark	Hard drugs	Aware
7	Youth	Male	Bark	Hard drugs	Aware
8	Middle age	Male	Leaves	Roofing hurt	Aware
9	Elder	Male	Bark	Hard drugs/medicine	Aware
10	Elder	Male	Bark	Hard drugs	Aware
11	Elder	Male	Leaves	Roofing hut	Aware
12	Elder	Female	Bark	Hard drugs	Aware
13	Elder	Female	Don't know	Don't know	Aware
14	Elder	Female	leaves	Roofing hut	Aware
15	Elder	Female	Leaves	Roofing hut	Aware
16	Elder	Female	Bark	Hard drugs	Aware
17	Elder	Male	Leaves	Medicine	Aware
18	Elder	Female	Bark	Hard drugs	Aware
19	Middle age	Male	Leaves	Roofing hut	Aware
20	Youth	Female	Bark	Hard drugs	Aware
21	Elder	Male	Bark	Hard drugs/medicine	Aware
22	Elder	Female	Leaves	Medicine	Aware
23	Elder	Female	Leaves	Roofing hut	Aware
24	Middle age	Male	Don't't know	Don't know	Not Aware
25	Elder	Female	Bark	Drugs	Aware
26	Elder	Male	Leaves	Roofing hut	Aware
27	Youth	Male	Don't't know	Don't know	Not aware
28	Middle age	Male	Root/Bark	Medicine	Aware
29	Middle age	Female	Don't know	Don't know	Aware

The household survey conducted confirmed that *Encephalartos transvenosus* bark was the most mentioned of all the part used followed by leaves (Fig. 2). This still support that bark harvest is the greatest threat to cycads in South Africa[13-15,28-30] (Figs. 1a,b,c,d) because 48 % of the people interviewed mentioned bark as the main part used (Fig. 2). In Fig. 3, the majority of the respondents (37.5 %) mentioned that the inner part of the bark (Fig. 1a) is taken as hard drugs either through sniffing or smoking. It is being ground into powder and mix with some other unknown substances to be taken as hard drugs. This is a major finding in our study as many studies have only supported that the bark are harvested for medicinal purpose[13-15,28-30]. This revealed another reason for which the bark of these plants are being harvested for, and further studies are recommended to determine the active chemical compound found in this plant that possibly support this use.

***Encephalartos tranvenosus* leaf utilization**

The leaf harvest (35 %) for roofing huts (25 %) and for medicinal use (25 %) was detected in this study (Fig. 2). A study by Krishnamurthy *et al.*[31] showed that a population of *Cycas circinalis* L. experienced reproductive decline due to leaf harvest. It can be the case for other cycads species. Which means leaf harvest might possibly be a threat to this species especially when the intensity of harvest is very high.

***Encephalartos tranvenosus* roots utilization**

The roots of *Encephalartos transvenosus* are also being harvested although at a minimal scale (3 %) (Fig. 2) and will have a negative effect on the recovery process of the plants. Harvesting of roots might lead to death of some of the individuals in the population. According to informants roots of *Encephalartos transvenosus* are only harvested for medicinal purposes. Roots harvest for medicinal purpose is a common practice in Limpopo with majority of the plants harvested for their roots being

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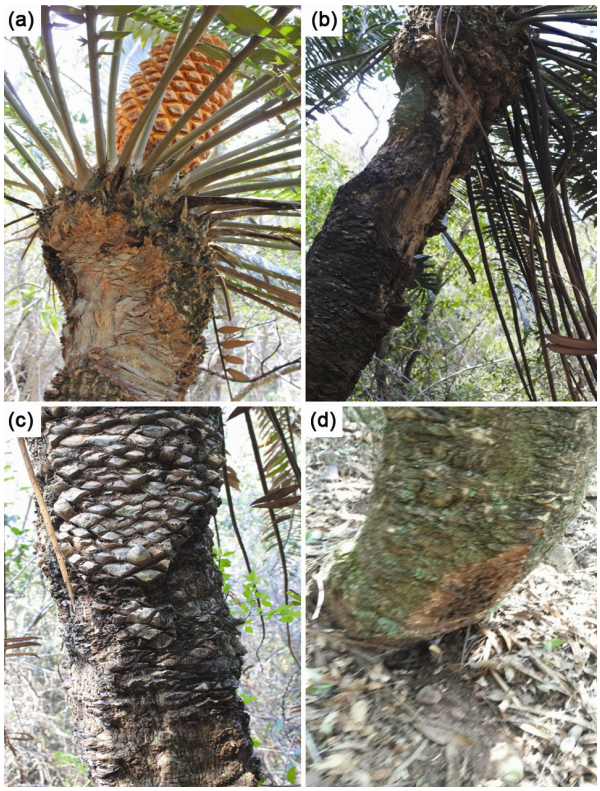

Fig. 1 — De-barking of *Encephalartos transvenosus* for medicinal purposes

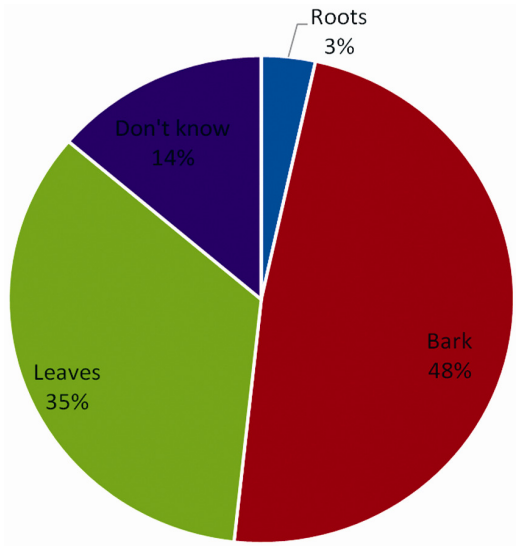

Fig. 2 — Informants responses on *Encephalartos transvenosus* parts utilization frequencies

threatened with extinction[32,33]. Root harvest is highly detrimental to plants growth and development, and a species of plants like cycads will experience serious decline due to the nature of its slow growing rate which can lead to the species being unable to recover from such practice.

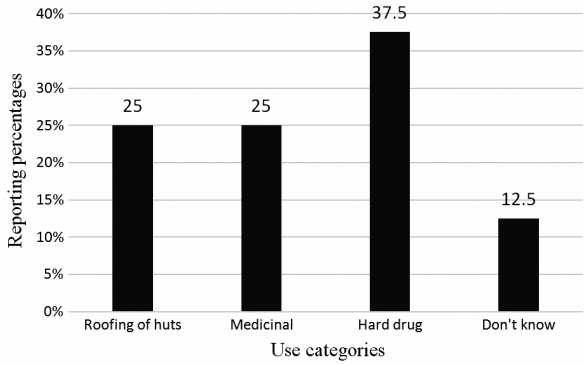

Fig. 3 — Informants responses on *Encephalartos transvenosus*use category frequencies

Conclusion

The present study supports that the practice of cycads harvesting is still ongoing in parts of South Africa. However, quantifying the sustainability of bark harvest of this species was not part of this study because the practice of harvesting cycads for any purpose is a practice not encouraged in South Africa at provincial and national level. The location discovered in this study coupled with the surveys from the village where this population is found revealed people are still practicing illegal harvesting of cycads in the wild and there appears to be little impact on reducing this activity from government initiatives aimed at conservation. The role of local indigenous knowledge in identifying locations of cycads and also unraveling the threat through local uses should be respectfully acknowledged and incorporated in designing effective conservation plans. According to Vovides *et al*., in their studies in Mexico they concluded that species conservation can be strengthened by looking at species with economic interests of local people and include them in rural nurseries. Rare species like cycads can be rescued, transplanted and reintroduced in natural areas with minimal anthropogenic impacts with community involvement. Such effective community participation in conservation plan could possibly reduce threat to cycads and limit wild harvest. We also recommend that such conservation plan with community involvement should be implemented in areas such as this in a unique way that it might take the community people away from illegal wild harvest of this species. The local community also needs to be sensitized on the need to restrict people from collecting these plants because of its implication of losing them in the future. This can be in the form of conservation education so as to enlighten the community people on the value

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that should be placed on these plants that they are privileged to have in their community.

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