

Journal of the Cycad Society of South Africa

ENCEPHALARTOS

Tydskrif van die Broodboom Vereniging van Suid-Afrika

No. 129

September 2017

ISSN 1012-9987



STATUS OF *ENCEPHALARTOS MACROSTROBILUS* (SCOTT JONES & WYNANTS JEFF) IN AGORO AGU CENTRAL FOREST RESERVE, UGANDA

Samuel Ojelel^{1*} and Desmond Anywar²

ABSTRACT

Encephalartos macrostrobilus is an Endangered cycad in Agoro-Agu Central Forest Reserve in Lamwo district, Northern Uganda with a population estimate between 200-300 individuals. However, the entire area where it occurred was not adequately botanized due to insecurity. This study was therefore aimed at (i) estimating the population size (ii) establishing the threats and (iv) inventorying the local uses of *E. macrostrobilus*. In order to collect the data, belt transects of 5x200m wide were established along environmental gradients and all the individuals enumerated. In addition, a semi-structured questionnaire was administered to sixty household heads in two villages within an enclave in the forest reserve. These were selected using systematic simple random sampling. The population size of *E. macrostrobilus* was estimated to be 665 individuals. The majority of respondents (82%) did not report any use of the cycad, 18% reported its use for ornamental purposes while 15% did not know the cycad. Illegal collection was reported by all respondents as a major threat while other threats were indiscriminate cutting, agricultural encroachment and settlement and wild fires. This population remains greatly in danger because of the illegal collection and the continuous habitat quality decline. There is therefore need for the National Forestry Authority (NFA) to relocate the forest encroachers, sensitize the masses about the conservation value of *E. macrostrobilus*, regulate bush burning and raise seedlings for planters and ornamentalists to ease pressure on the wild population.

Key words: Cycads, Endangered, *Encephalartos macrostrobilus*, Agoro Agu, Uganda

1. INTRODUCTION

Cycads are the world's most threatened organisms whereby 62% of the known species are threatened with extinction (Hoffmann *et al.*, 2010). Notwithstanding their representation of only a small fraction of the world's plant diversity, they are a group of global conservation significance (Donaldson, 2003). The greatest threat posed to Africa's cycads is the illegal acquisition of wild plants by unscrupulous collectors for the horticultural

trade (Donaldson & Bösenberg, 1999; Okubamichael *et al.*, 2016). The 2003 IUCN Red List assessment for African cycads indicates that all 18 Critically Endangered (CR) *Encephalartos* species had population sizes of <950 plants, and six had estimates of less than 100 plants remaining in the wild (Donaldson, 2003).

Several African cycad species already have very restricted distributions and occur in small numbers even before the advent of intensive cycad collecting (Cousins & Witkowski, 2017). This is true for the *E. macrostrobilus* in Uganda whose population was estimated to be 100 individuals in 1997 by Jones & Wynants and between 200-300 individuals by Donaldson in 2010. All these studies reported inaccessibility of the areas where this cycad occur due to the insecurity caused by the Lord's Resistance Army (LRA) rebels, declining quality of habitat and continued illegal collections. Given the relative peace in Northern Uganda, it become prudent to ascertain the present population size, utilization and threats to the species in order to generate information needed to shape its conservation agenda.

2. MATERIALS AND METHODS

1.1. Study area

Agoro-Agu Central Forest Reserve (CFR) is located along the border between Uganda and Southern Sudan (Figure 1) at 3°40'–3°53'N and 32°42'–33°4'E, and an altitude ranging between 110-2700M (Gorsevsk *et al.* 2012). The forest reserve covers a total of 26,508 hectares (IUCN 2015). It was gazetted in 1937, as a natural forest for biodiversity conservation. The Agoro-Agu CFR lies in the sub counties of Agoro and Lokungu, in Lamwo district. Agoro sub-county hosts the largest part of the forest reserve accounting for about 90% (IUCN 2015). Rocky hills and a mountainous relief characterize the Agoro-Agu landscape in the North and Northwest and in the East and South are undulating plains with some valleys and swamps (IUCN 2015).

Agoro Agu is a catchment for two streams, the Okura, in the East of the sub-county and Aringo stream in the West. The Okura flows down Southwards to the low lying plain across Agoro trading center, while the Aringo stream runs South wards (IUCN 2015). The vegetation of the landscape majorly includes Afromontane undifferentiated forest, dry Combretum wooded grassland, *Butyrospermum* wooded grassland, low land Bamboo, and Upland Acacia wooded grassland and has endemic species of the Eastern Afro Montane hot spot (IUCN 2015).

¹Makerere University, College of Natural Sciences, Department of plant sciences, Microbiology & Biotechnology; P.O. Box 7062 Kampala, Uganda

²Lamwo District Local Government, Department of Natural Resources

*Corresponding author: sojelel@cns.mak.ac.ug

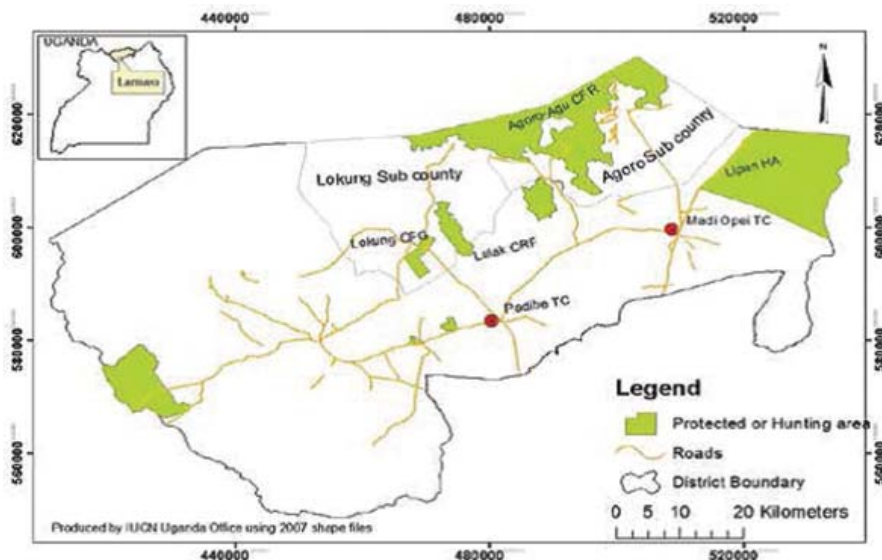


Figure 1. Location of Agoro-Agu Central Forest Reserve (adapted from IUCN 2015)

The temperature averages at a minimum of 12°C and a maximum of 27°C in the lowlands (Lamwo District, 2015). It is also indicated to have a fairly distributed rainfall pattern received twice a year March–June and August to November. There is a dry spell in the months of June–July and Nov–March.

2.2. Sampling design and data collection

Belt-transect sampling was used to estimate the population size of *E. macrostrobilus*. In this method, three transects of 5 m wide and 200 m long were established following environmental gradient in Agoro-Agu Central Forest Reserve where the cycad occurs. Within these transects, the individuals of *E. macrostrobilus* that were encountered were enumerated. In addition, a semi-structured questionnaire was administered to sixty residents in the two villages of Lotuturu A and B within an enclave in Agoro-Agu Central Forest Reserve to elicit information on utilization of *E. macrostrobilus*. These respondents were selected using a systematic simple random sampling technique. In this method, the first household was chosen randomly in each village and thereafter one household was skipped along a walkable path until all the thirty households are reached. The household heads were targeted in this study because of the greater experience they have had with the surrounding environment. In the survey, 38 females and 22 males were interviewed.

3.3. Data analysis

The population density and size of *Encephalartos macrostrobilus* in each transect and the entire area surveyed was determined. In addition, the uses of *Encephalartos macrostrobilus* were collated into frequencies and illustrated using graphs.

3. RESULTS AND DISCUSSION

A total of 665 individuals were enumerated within the three belt transects sampled. Figure 2 shows a female cone. This number is higher than that recorded Jones & Wynants, (1997) and Donaldson (2010)

because of the larger area surveyed. This has been aided by the prevailing security conditions in the area. Scot & Wynants (1997) cited security as a major hindrance of their study hence an estimate of only 200 individuals of *Encephalartos macrostrobilus*. It is plausible that natural rejuvenation has allowed the population to increase since the area has been accessible due to insecurity.



Figure 2. *E. macrostrobilus* female cone.

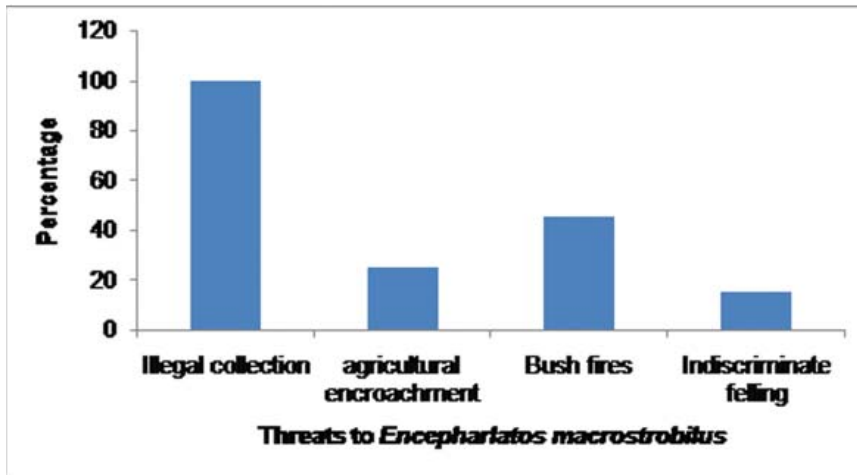


Figure 3. Threats to the survival of *Encephalartos macrostrobilus*

The majority of respondents (82%) we interviewed did not mention any use of the cycad while 18% cited its usage for ornamental purposes. In addition, some of the respondents 15% did not even know the plant partly because it is found in remote and rugged terrains. Similarly, Jones & Wynants (1997) did not record any human consumption of this cycad except collection of seeds for “chasing demons”. This scenario can be attributed to a possible loss of Indigenous Knowledge due to the armed conflicts which either led to the death of old people in the society who had this knowledge or confined them in the Internally Displaced Peoples (IDP) camps. This situation seems to have been exacerbated by the lack of proper mechanisms of systematically documenting Indigenous Knowledge. Another noteworthy explanation for this trend is the limited interaction of the community with the *E. macrostrobilus* since it is located in hard to reach, rugged and remote areas. This study therefore affirms Cousins & Witkowski (2017) assertion that the traditional use of cycads in African countries other than South Africa is poorly known, particularly which species are used, the quantity harvested (and traded), and the actual uses of the taxa concerned. However, this is a sharp contrast with the existing literature on the utilization cycads for food in other parts of the world (Whitelock, 2002; Ravele & Makhado, 2008), medico-magical practices, production of gum and fibre, and decoration during special occasions (Thieret, 1958).

In terms of threats to the survival of this cycad, Figure 3 offers the summary. Our interactions with the community show that there is an emerging market for cycads from outside the local community and this is fuelling illegal collection. In the previous studies by Jones & Wynants (1997) and Donaldson (2010), illegal collection had been mentioned as a threat. It is worth noting that these illegal collectors work in collusion with some local community members who are vastly unaware of the conservation status of the species. This illegal act has been largely perpetuated by growing levels globalization and the weak implementation of the existing laws on governance of central forest reserves as contained in National Forestry and Tree Planting Act (2003), CITES regulations on trade in Endangered species.

Annual wild fires are equally a major threat to the survival of *Encephalartos macrostrobilus*. Our observation was in tandem with Jones & Wynants (1997) that the trees showed evidence of fire resistance as witnessed by stem charring (Figure 4). However, the biggest concern is that, these regular fires may significantly hamper recruitment (Donaldson 2010). In Africa, very few scientific studies have investigated fire ecology of cycads (e.g. Donaldson 1995) although it is widely accepted that many *Encephalartos* species are fire-tolerant and some are fire-stimulated (Cousins & Witkowski, 2017). According to Cousins & Witkowski, (2017), it is therefore pertinent to generate information on the most appropriate burn frequency and season would also be useful for providing ecologically sound fire management guidelines for cycads in fire-prone habitats.

These threats also stem from the lack of clear cut individual, community or cultural benefit that is derived from the cycad. This is arguably explained by the curiosity to fell mature trees (Figure 5). This does not however mean that the species does not have any value as it is just a matter of lack of awareness. It should also be pointed out that the National Forestry Authority (NFA) that is mandated to manage central forest reserves in Uganda has limited capacity in terms of personnel to enforce the existing laws. A classical example in Agoro Agu is the illegal settlement and cultivation in the forest reserve with minimal or no intervention of NFA. The illegal settlement has culminated into increased opening of subsistence farms thereby contributing to decline in the quality of habitat. There is even a contract farming agreement between the local farmers and a beer producing company in the country to produce barley. If this trend is untamed, it is likely to jeopardize the quality of the habitat as farmers as farmers seek to produce more barley to meet the demand.

4. CONCLUSION

The population of *E. macrostrobilus* recorded in this study is higher than the previous records. However, the risk to this population has escalated with the return of security in the area which has facilitated human penetration into remote and hard to reach areas and opening of global markets.



Figure 4. Evidence of stem charring on mature cycad trees.



Figure 4. Indiscriminate felling of cycad trees.

5. WAY FORWARD

The NFA and the local government authorities need to sensitize the community on forest reserve management laws and open boundaries in a conflict sensitive approach. The sensitization programs can use flagship species such as *Encephalartos macrostrobilus* and their potential for tourist attraction and ecosystem functions such as Nitrogen fixation, habitat for other organisms among others. Thereafter, illegal settlers within the forest reserve need to be evicted. Efforts to raise the seedlings to meet the need of ornamentalists would go a long way in reducing the pressure on the wild population. Future research endeavours can focus fire ecology of cycads, population sex-ratios and genetic variability of this isolated population.

ACKNOWLEDGMENTS

The authors sincerely extend our gratitude to the Rufford Foundation for providing financial support to conduct this work under the project 19943-1. We also thank Owali Joseph the forest ranger for helping us navigate the forest reserve and the community members of Lotuturu who shared their invaluable knowledge with us.

AUTHOR CONTRIBUTIONS

SO designed the project, participated in data collection and drafted the manuscript while DA participated in data collection.

CONFLICT OF INTEREST

There is no conflict of interest between the authors

REFERENCES CITED

- Cousins, S. R., & E. T. F. Witkowski. (2017). African Cycad Ecology, Ethnobotany and Conservation: A Synthesis. *Bot. Rev.* 83:152–194
- Donaldson, J. S. & J. D. Bösenberg. (1999). Changes in the abundance of south African cycads during the twentieth century: Preliminary data from the study of matched photographs. *Biology and conservation of cycad*. In: C. J. Chen (Ed.) *Proceedings of the Fourth international Conference on cycad biology*, 240–247. Beijing: International Academic Publishers.
- Donaldson, J. S. (1995). The Winterberg cycad: Surviving against the odds. *Veld & Flora* 81(2): 36–39.
- Donaldson, J. S. (2003). *Cycads: A status survey and conservation action plan*. IUCN/SSC Cycad Specialist Group, Gland.
- Donaldson, J. S. (2010). *Encephalartos macrostrobilus*. The IUCN Red List of Threatened Species 2010: e.T41918A10595573. <http://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T41918A10595573.en>.
- Gorsevski V, E. Kasischke, J. Dempewolf, T. Loboda, F. Grossmann (2012): Analysis of the Impacts of armed conflict on the Eastern Afromontane forest region on the South Sudan-Uganda border using multi-temporal Landsat imagery. *Remote Sensing of the Environment* 118 (2012) 10–20.
- Hoffman, M., C. Hilton-Taylor, A. Angulo, M. Bohm, T.M. Brooks, S. H. M. Butchart, ..., S.N. Stuart. (2010). The impact of conservation on the status of the world's vertebrates. *Science* 330: 1503–1509.
- Okubamichael, D. Y., S. L. Jack, J. D. Bösenberg, M. T. Hoffman & J. S. Donaldson. (2016). Repeat photography confirms alarming

- decline in south African cycads. *Biodiversity Conservation* 25(11): 2153–2170.
- Ravele, A. M. & R. A. Makhado. (2008). The value of cycads to human wellbeing – An overview. *Encephalartos* 93: 23–26.
- Thieret, J. W. (1958). Economic botany of the cycads. *Economic Botany* 12(1): 3–41.
- Whitelock, L. M. (2002). *The Cycads*. Timber Press Inc. Portland, Oregon.
- Jones, S. & Wynants, J. (1997). *Encephalartos macrostrobilus* (Zamiaceae), a new cycad species from Northern Uganda.
- Lamwo District, (2015): Agoro Subcounty draft Development Plans 2015–2020.
- IUCN (2015). Socio economic baseline report for Agoro Agu forest landscape: Available options for REDD+ implementation in Uganda. International Union for Nature Conservation (IUCN), Kampala, Uganda.

CYCAD-O-METER

New 50 cm Model now Available

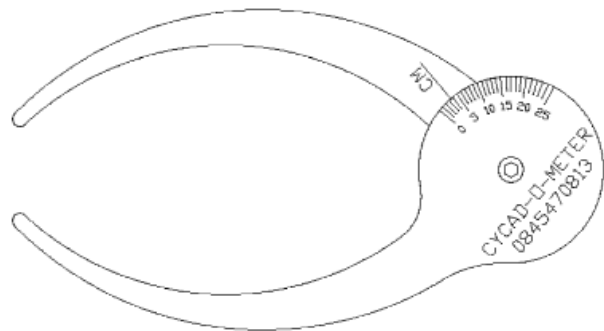
With the new legislation you will be required to list the diameter of all your plants; the new 50 cm Cycad-O-Meter makes this an easy task. With this instrument you will be able to measure the diameter of your cycads from 0 cm to 50 cm in 1 cm increments. The instruments are made from 2.5mm durable, laser cut, stainless steel.

Selling price of the 50 cm Large Plant Owners Cycad-O-Meter: R625 (add R50.00 for postage and packaging)

Selling price of the standard 25 cm Nurseryman's Cycad-O-Meter: R275.00 (add R25.00 for postage and Packaging)

Contact Russell: 074 134 2149 or Andy 082 900 8624

Or lasertecstreetluge@gmail.com



CYCAD COLLECTORS PRODUCTS

“With Quality comes Trust”



- **Cycadfeed** – The complete nutritional product for your established cycads, including N, P and K in the correct ratios for cycads as well as all the required micro-elements. R450/20kg.
- **Cycad Sucker Stim** – A unique combination of auxins and cytokinins (derived from Kelp), along with a complete nutrient range, including all macro- and micro-elements and fulvic acid to feed newly established cycads and suckers and stimulate root development. R1500 for 25 liters.
- **Cycad-N** – 46% controlled release granular nitrogen. R350/20 kg
- **Cycad seed germination box** – The best way to germinate your cycad seeds, winter and summer. Heating and moisture retention. R500.

Contact Andre Cilliers at 082 4996515 or acilliers@nulandis.com



JOIN THE CYCAD SOCIETY

TCS Membership information

The annual membership fees for TCS are listed below. For your convenience, you may join or renew your membership online using PayPal (see www.cycad.org/members/membership-info.htm), and you may pay your dues up to three years in advance, except for student memberships, which can only be paid one year at a time.

Two of the most important benefits of TCS membership are the Cycad Newsletter and the Cycad Society Seedbank.

- | | |
|-------------------------------|------------------|
| • Student Memberships: | \$25.00 per year |
| • Non-US Student Memberships: | \$35.00 per year |
| • US Memberships: | \$35.00 per year |
| • Non-US Memberships: | \$45.00 per year |