CBI

An Overview of the South African Cycad Biodiversity Institute

The only Encephalartos dedekindii ever found on the Kwa-Munye mountain near the Tugela Ferry settlement.

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EXECUTIVE SUMMARY

The **Cycad Biodiversity Institute "CBI"** is founded on a vision for the research and conservation of threatened and protected plant species. The CBI creates awareness and shares information through education programs, on social media or in-person. The practical hands-on demonstrations include many regular topics like pollination, shoot removal and treatment for pests, relocation, and recovery. To that extend, the CBI keeps a large and diverse collection of excellent specie examples at the campus sanctuary area. The CBI is located where the growing conditions such as climate, altitude and rainfall closely matches that of the natural habitat of the plants to ensure that the plants appear and behave as close as possible to those in their natural habitat.

The CBI strives to ensure the survival and prosperity of Cycad species in the wild for future generations, according to internationally approved conservation strategies and research programs. These programs include organized field expeditions for the collection of information and specimen samples, to multiply in an ideal controlled environment, and reintroduce strong growth in its original natural habitat. For this purpose, the CBI keeps an isolated germination area to establish cuttings and germinate seed to be re-introduced in habitat.

The CBI applied to join the Scientific Authority of South Africa, established by DFFE, to build strong academic and conservation relations, and involve key organizations to accelerate the overall national conservation and research strategies. To that extent, the CBI has adopted its own generic Biodiversity Management Plan with assistance of the DFFE. The CBI plan to become a satellite campus for universities and other research authorities. These organizations may introduce research programs and conservation strategies which the CBI would provide facilities and sanctuaries for and participate in the programmes. The goal is to join data bases and processing protocol strategically, to avoid the duplication of decades of work.

The CBI welcomes the establishment of a dedicated plant DNA test facility, established in collaboration with various conservation and academic stakeholders, at the SANBI campus in Pretoria botanical garden. The facility shall rapidly profile cycad material in terms of species and sex, and possibly verify pollen for pureness and viability, and so assist nature conservation and collectors with certainty of the origin and integrity of plant material. For this unique service, a herbarium and library has been established on the CBI campus, to develop, keep and maintain the databases and tissue samples organized and handy. The CBI will also establish a cryogenic pollen storage facility as part of the pollen and seed bank, to keep very special and rare pollen viable for long times.

The CBI take part in worldwide networking through various social media platforms, and other formal international affiliations. International collaboration commenced some years ago with the university of Berkeley in California, USA. The research team visited the CBI regularly, collecting samples from the CBI mother stock for DNA testing. For this reason, the CBI provide for overnight facilities and offices at campus, where students, researchers, delegates, and other visitors find themselves amid a one-stop environment for the research and conservation of endangered and protected plant species. The program followed the leading professor to Montgomery Botanical Centre at Miami, USA. The CBI was invited and applied for affiliation to the Montgomery Botanical Institute's international initiative, the Botanical Garden Conservation International. The CBI affiliates with the Global Cycad Consortium for Cycads. The affiliation offered access to the large DNA database for Encephalartos species, which has relocated to Montgomery Botanical Institute. The CBI hope to soon list as a global steward for Encephalartos species for research and conservation.

The CBI is central and in close approximation to the South African National Biodiversity Institute (SANBI), the Cycad Society of South Africa (CSSA), the University of Pretoria, and the Council for Scientific and Industrial Research (CSIR).

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1 BACKGROUND

By the turn of the century, dr Derik Minnaar, well known as Derik, as either deputy chairman or chairman of the of the Central branch Cycad Society of South Africa (CSSA), became deeply involvement in the organization and participation in many spectacular field and garden tours, visiting plants in their natural habitat and wrote many articles for the Encephalartos Cycad journal and on the internet. Since then, Derik became well connected with Nature Conservation, the Cycad researchers, conservists, collectors and cultivators.

Derik noted that collectors of rare and endangered plant species, have to give up the collections as they retire and move smaller, or passes away and the plants find homes where they are not appreciated and preserved as it should be. The unique history of the individual plants gets lost over time, and as plants move around too often, they risk being relocated incorrectly, and so many plants dies over time or their locations become unknown and so lost for research and protection. Appart from the loss of valuable species through casual collecting, plants populations in nature also vanishes over time as pouching from the veld has become increasingly a big problem. The overall effect is that rare and protected plant species become even more rare to the point of extinction.

Through his interests in plants, the first plants that Derik collected since 1980, as he inherited his parents collection, bought his in-laws collection, and his uncles collection. From that time, Derik periodically acquired Cycads to join the collection. The plants were relocated to the Kliptuin Estate in 1998, and so became the first development on the Kliptuin Estate. The entire Kliptuin Estate together with fixtures such as the garden, the buildings and the infrastructure, was owned by the Kliptuin Trust since 2000. Since 2000 all Cycads that were acquired, was bought into the ownership of the Kliptuin Trust.

Coming from a career of scientific research, Derik founded the idea to develop a unique organisation to fill the void in South Africa for the preservation of plants or plant collections for research and conservation, while retaining participation in the research programmes. Derik therefore established the Kliptuin Trust t.a. CBI, as an entity for that purpose. Any member of the public, or official from Nature Conservation, or similar organization who want to book plant in for research and conservation, may approach the CBI, to take up the plant(s) under the CBI nursery permit system, to join in the pool of plants for the sake of research and conservation. Duplicate genetic specimen or materials are sold or exchanged with the public, or research ortganizations, or sold in order for the CBI to afford the CBI running costs and salaries. Since 2000, the CBI has grown the Cycad motherstock with periodic acquisitions from Derik, and with about thirty different plant collections under individual contracts with the previous owners.

The CBI has affiliated with Nature Conservation as well as an international organization of academic institutions and botanical gardens, who freely shares academic information and participates in rersearch and conservation activities on a global scale. The CBI has applied

for CITES export trading permits to that extent. The CBI also applied to become a member of the South African Scientific Authority, to help protect plant populations in nature, replant populations back in nature and to assist in the maintenance of national legislation and regulations for the Department of Agriculture and Rural Development to enforce.

The Gauteng Department of Agriculture and Rural Development (GDARD) listed the plant collection to permit the permit holder for restricted activities in respect of endangered and protected plant species. Attached to the permits is the list of all the endangered and protected plants on the Kliptuin Estate.

The CBI officially launced at the end of June 2022, when GDARD registered the CBI nursery for restricted activities through the CBI Nursery under the CBI Nursery Standing Permit. The GDARD also issued the CBI nursery with a CBI Sales Permit book, bearing the CBI business logo, for the CBI to issue permits for any CBI plants traded with researchers and collectors.

To that extent, the ownership (posession) and transaction rights of the plants listed and annext to the Posession and Sales permits, was transferred to Nursery Stock on 12 October 2022 and since then falls under the CBI Nursery Standing Permit.

2 FOUNDING

The Gauteng Department of Agriculture and Rural Development (GDARD) listed the plant collection and issued a Posession Permit no 003545 and a Sales Permit no 003550 dated 1 October 2022, to permit the permit holder for restricted activities in respect of endangered and protected plant species. Attached to the permits is the list of all the endangered and protected plants on the Kliptuin Estate.

The GDARD also issued Certificate no 07787 dated 30 June 2022 to register the CBI nursery. At the same time, GDARD issued the CBI Nursery with a Standing Trading Permit no 24548 in order to allow for the transfer of plants listed on the Posesion/Sales Permits, to the CBI Nursery at any time and as the case may be, for restricted activities through the CBI Nursery under the CBI Nursery Standing Permit. The GDARD also issued the CBI nursery with a CBI Sales Permit book, bearing the CBI business logo, for the CBI to issue permits for any CBI plants traded with researchers and collectors.

The Ordinary Posession and Sales permits usually involve once-off transactions or transactions for a short period. To that extent, the ownership (posession) and transaction rights of the plants listed and annext to the Posession and Sales permits, was transferred to Nursery Stock on 12 October 2022 and since then falls under the CBI Nursery Standing Permit.

At that time, Deriks wife Lynette, and daughter Michelle, and Lukies wife Carina, took positions for CBI administration. When Lukie, Lynette, Michelle and Carina resigned in June 2023, Kgomotso Mphafudi took the admin job as part of her PRO responsibilities. Christie

Botha assumed nursery management. Christie resigned in August 2024 and was replaced by Refilwe Mlotshwa.

CBI FOUNDING TIMELINE : UP TO AND INCLUDING THE FIRST YEAR OF TRADING				
No	Date			Milestone
1	4	August	1997	Purchasing the investment properties, holdings 641&642
2	16	September	2011	Holdings 641&642 sold “voetstoots” to the Kliptuin Estate Trust
3	2	March	2012	Consolidation of holdings 641&642 into single Holding 849 Estate
4	March 2012 – June 2022			Continued investment into the KT/KTE garden and infrastructure
5	18	June	2022	Resolution : Trustee D. Minnaar to bank and trade OBO KTT ta CBI
6	23	June	2022	CBI Official opening day
7	23	June	2022	L. Steenkamp start as nursery manager
8	23	June	2022	D. Minnaar assumes the contract for the position of CBI Dean
9	30	June	2022	Nursery Registration, Standing Trading Permit for CBI to trade
10	11	October	2022	L. Minnaar & M. Minnaar assume CBI admin assistance positions
11	11	October	2022	Possession and Sales Permits for the CBI Mother Stock
12	12	October	2022	Transfer of CBI Mother Stock to the Nursery Stock
13	8	November	2022	L. Minnaar and M. Minnaar submit a BP for the CBI
14	6	December	2022	D. Minnaar become sole Trustee of KTT
15	3	January	2023	K. Mphafudi start PRO on a 6 month probationary contract
16	19	January	2023	D. Minnaar publishes the CBI Overview, updated with the BP
17	24	January	2023	D. Minnaar become sole Trustee of KTE
18	25	January	2023	Business Agreement : Nursery stock txfer from KTT to KTE Trust
19	23	February	2023	L. Steenkamp on family duty long leave
20	5	May	2023	L. Minnaar and M. Minnaar resigns CBI admin assistance positions
21	1	June	2023	K. Mphafudi permanent PRO contract
22	10	June	2023	L. Steenkamp resigns as Nursery Manager
23	1	July	2023	C. Botha assumes position of nursery manager

Dr Minnaar has decided on this date 25 January 2023, to transfer the ownership of the CBI Nursery together with its plant collection, to the Kliptuin Estate Trust, in accordance with its function to hold the Kliptuin Estate property with all its immovable and movable assets for the sole benefit of the CBI, in exchange for life long position of “Dean of the Kliptuin Trust t.a. CBI business”. The key duties and benefits of the Dean are listed herein.

3 VISION

The CBI raises awareness and compassion for Cycads, through focussed education programmes such as media publications, lectures, and practical workshops. We collaborate with conservation authorities to ensure the survival and prosperity of *in situ* threatened and protected plant species for future generations, according to approved research and conservation strategies. We provide for genetic testing, profiling, and fingerprinting to assist with effective law enforcement and determine the origin and integrity of plants.

4 MISSION

The CBI affiliates and networks locally and globally, to share and conduct focussed education programmes through social media publications, lectures, and practical workshops. The CBI built strong relations and collaborates with key organizations to join data bases, protocols and strategies, to avoid the duplication of decades of work.

The CBI collaborates with Conservation Authorities, to ensure the survival and prosperity of *in situ* threatened and protected plant species for future generations, according to approved research and conservation strategies.

As an aspirant member of the Scientific Authority, the CBI serves as a satellite campus for other scientific research stakeholders. An herbarium and library keep and maintain genetic databases and tissue samples organized and handy, to provide for quick genetic testing, profiling, and fingerprinting to assist with effective law enforcement and determine the origin and integrity of plants.

5 OVERALL OBJECTIVES

• **Communication, Awareness, Education** : To develop and implement effective com-munication and collaboration with all cycad stakeholders such as landowners, collectors, managers and authorities.

• **Sustainable use** : To increase public awareness of the cycad conservation crisis, the value of cycads to society, and of the role that the public can play in reducing the impact of wild cycad harvesting.

• **Research** : To ensure that decisions pertaining to cycad conservation are supported by robust scientific research and knowledge generation in terms of focus areas, strategic objectives and actions.

• **Security**. To reduce and ultimately prevent the illegal disturbance and collection of cycads in the wild to a level that does not have detrimental impacts on their natural habitat.

• **Habitat management** : To secure, protect and effectively manage critical habitat for wild cycads.

• **Population management** : To develop and implement reintroduction/reinforcement programmes for protected and endangered species in nature.

• **Purpose driven** : To achieve overall conservation targets through co-ordination and integration allowing adaptive responses to meet the aim of the strategy.

6 HUMAN CAPITAL

DEAN : Dr Derik Minnaar has a record of thirty year's involvement in the organization and participation in many spectacular field and garden tours, visiting plants in their natural habitat and wrote many articles for the Encephalartos journal and on the internet. He recently described the new E.dedekindii species and await publication in the Bothalia. Derik has been a member of the Cycad Society of South Africa (CSSA) for three decades. At the turn of the century, he was deputy chairman of the Central branch for two years, and chairman for seven years. Derik has been re-elected as deputy chairman of the Central Cycad branch, and Vice President of the South African National Cycad Society for the year 2022/23. Derik is well connected with the Cycad researchers, conservists, collectors and cultivators.

PUBLIC RELATIONS : Miss Kgomotso Mphafudi is a maticulous detail oriented person. She proved to be goal driven, greatly motivated and equipped with leadership skills, communication skills, critical thinking skills as well as people's management skills. She obtained an Advanced Diploma in Business Administration and a National Diploma in Retail Business Management at Tshwane University of Technology. Her experience as PRO at the CBI has sharpened her skills towards the objectives of conservation and research, and she proved to work well with different types of people, organizations and in the workforce. She is the heart and soul of our interaction with external parties and people both nationally and internationally. She is also an excellent acting administrator and financial manager for the CBI.

PLANTCARE : Miss Refilwe Mlotshwa grew up in Botswana and graduated at the Gaborone University College of Law and Professional Studies, majoring an A+ in Psychology and Early childhood education. She joined the restaurant industry in South Africa where she rose to become a restaurant manager and an excelllent cook in just three years time. Since December 2023 she proved to be also a good plant care manager for the CBI, managing the CBI Nursery with three gardeners. She also takes care of the CBI motherplant collection, and manages the seed and polen banks for the CBI.

As a young startup, the CBI has great opportunities for many other positions, which will become available as the CBI grows into its full potential. Some of the positions will be filled by persons and organizations already identified but not placed yet.

As the CBI sprung from a well established endangered and protected species collection as a hobby, the campus with its infrastructure such as the Research Labs and lecture facilities, along with the Inventory, has been established initially to service the Cycad Society and fill the voids which it experienced.

The DNA test facilities proved to be a challenge, but since SANBI has established it for the dedicated testing of endangered plant species, the CBI plan to utilize the facility in collaboration with the various stakeholders. The Library and Art Gallery will be the first to open soon in the Information Centre.

DERIK MINNAAR
DEAN

KGOMOTSO MPHAFUDI
PUBLIC RELATIONS

JEANNET RAGIMANA
HOSPITALITY

ARTHUR LERWILL
INFRASTRUCTURE

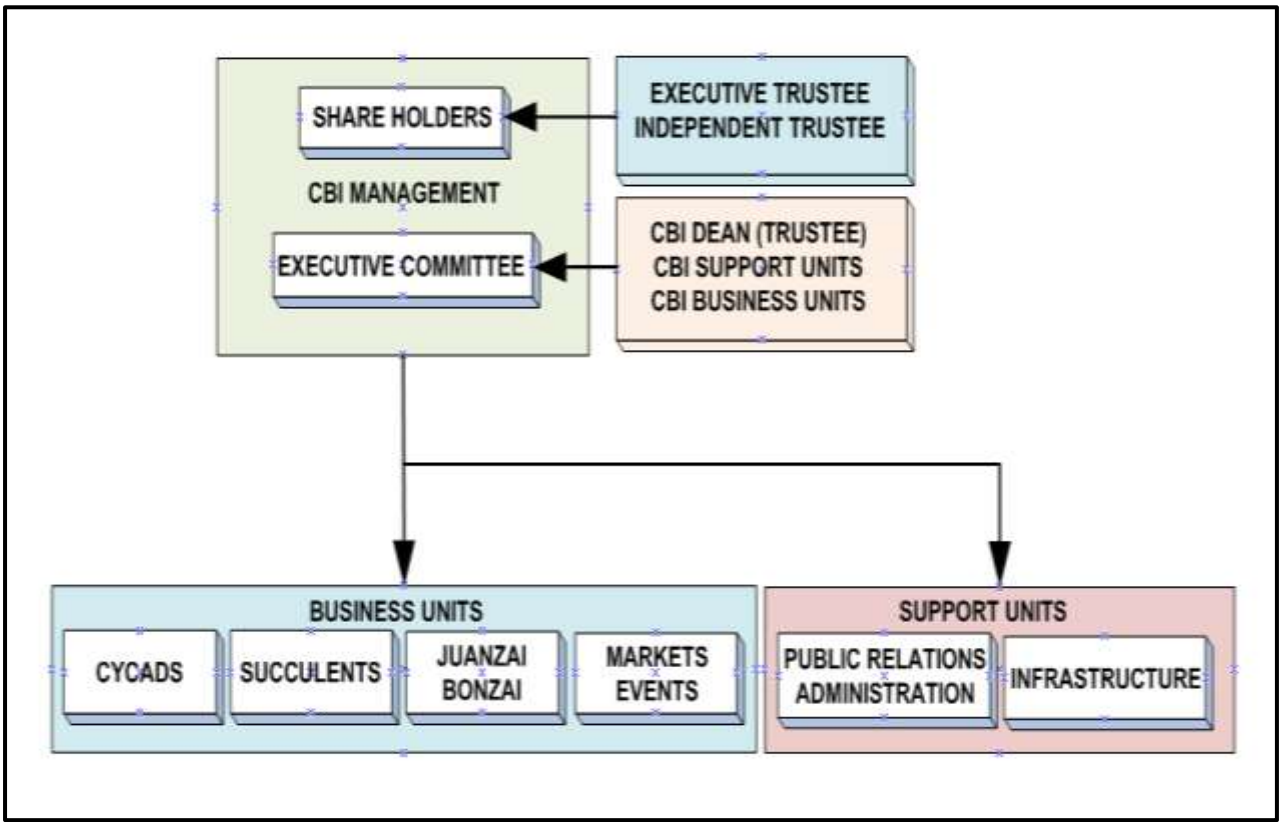
JOSEPH SIMANGO
INFRASTRUCTURE

OSBORNE MAKWIRAMITI
GARDEN CARE

CHRISTIE BOTHA
GARDENS ADMIN

JOSHUA MHAKAYAKORA
GARDEN CARE

The Cycad Biodiversity Institute Human Capital.



The Cycad Biodiversity Institute Human Capital Organogram.

7 CAMPUS LOCATION

The CBI campus comprises a small holding of 3 hectares situated at Holding 849, Doornkloof East, next to the R21 Highway between Pretoria and Johannesburg, and 15 minutes drive from the Johannesburg International O.R Tambo airport. The property borders the well known four star Pheasant Hill boutique hotel, the Ala Turka castle restaurant, the Saint Georges Hotel and conference venue, and as well as the Rietvlei Nature Reserve, hosting Rhino, cheetah, buffalo and much more. The Property is only about 20 minutes drive from the Pretoria Botanical gardens, the South African National Biodiversity Institute (SANBI), the University of Pretoria and the Council for Scientific and Industrial Research (CSIR). Irene Village Mall is only three kilometers away, with large veriety of stores, restaurants and chemists.

The Estate is also merely few hours drive to the well known Bezhoek farm where the natural habitat of *E. middelburgensis* and *E. lanatus* is, and the owners welcomes research activities there *in-situ*. The Blauwkrantz farm in the Eastern Cape has also accommodated regular tours to the area, where *E. horridus*, *E. trispinosus* and *E. longifolius* naturally grows. The CBI has been invited to do research there and all of these sites has accommodation facilities to enable short and medium term visiting groups or tours. The Entabeni reserve is a mere two hour drive from the campus, where *E. eugene-maraisii* grows, and they are also very forth coming.

Other localities such as Presedentsrus (*E. lanatus*), Kaapsehoop (*E. aevifolius*) and even Hoedspruit (Mariepskop laevifolius) to name just a few, are just a few hours drive away and ideal for a few days visit, utilizing guest houses and other overnight facilities in the vacinity.

8 CAMPUS PARTICULARS

The CBI Property is currently three hectare large, shown in the photo below. It includes two residential homes, an overnight unit with own bathroom, and two laboratories. The property is 90% self sufficient having a solar electrical system, a sustainable pristine bore hole, and a dam.

The real value of the property lies in its large and valuable collection of endangered plant species. The property was carefully selected from geographical records. It is steeply sloped with natural terraces facing exactly towards the North, ensuring optimum sunlight and mild climate throughout the year, making it the most ideal location in South Africa for cultivation and keeping of cycad plants for focussed research.

The property has not experienced destructive winds, hailstorms or frost during the last 25 years of record. The soil is shale with conglomerate with lots of rock, which is replaced by optimized growth medium where plants are grown.

The eight hectare property on the eastern border is also available for expansion should it be needed, as welll as the two hectare vacant property on the Western side, and the 11.6 hectare farm bordering the Southern side of the Estate.

9 CBI FACILITIES

The CBI may be developed to provide for the following important facilities and functions on the property. Other facilities may be developed as the need arises. This section explains the founder's vision for the CBI organization. The main facilities which can be further developed, and the capabilities which it provides for, are discussed. The operational model with responsibilities is suggested.

9.1 Security and Entrance

The CBI campus is located inside a farm portion estate with access controlled gate. The CBI Campus has its own fence around the perimeter, and a main access gate, with remote control access and audio/visual communication to visitors at the gate.

The CBI has contracted ADT for the full time maintenance and reaction to security systems such as video cameras, alarms and electric fencing guards the campus and assets. Together with the internet service provider, they support for all IT and security related issues.

9.2 Public Hospitality Facilities

9.2.1] Parking lot and staff parking. Lots of parking available central to all the CBI facilities, space for trucks and other long vehicles to turn and vast open spaces for *ad-hoc* use.

9.2.2] Public ablution and a kitchen. These facilities provide for public family support.

9.2.3] Public reception area and tea room. These facilities welcomes the public to the CBI.

9.2.4] Offices for sales, permit issuing, r&d programmes, finances, human resources, site management, site maintenance, security and medical.

9.2.5] Training centre with meeting, with workshop training and lecture space. These are often used as AGM purposes for the Cycad society, the Succulent society and the CBI.

9.2.6] On Campus Residence

9.2.6.1] Visitors such as Trustees, Researchers and Auditors, overnight quarters for short and medium term accommodation.

9.2.6.2] Residence for executive management, such as the Dean and the PRO, trustees and researchers.

9.3 Administrative Facilities

9.3.1] Archive for storing project reports, communication, planning, media, and journal back copies of publications.

9.3.2] Library with paper publications, books and journals. This is the main office of the Dean who plans the research projects and communicate with researchers, authorities and the public.

9.3.3] Herbarium-collection of dried plant leaf detail, seed and cone features. This is a special archive for dried plant genetic material, typically mounted on information palets. When a doubtful species are researched, genetic material is collected and registered in the herbarium. The material can be preserved for comparison and genetic testing for various reasons.

9.4 Research Facilities

The main building comprises a laboratory for seed germination, pollen keeping and facilities to treat plant material and prepare offshoots/suckers for rooting.

The labs have a large veranda in front to enable working even during rainy times.
The solar panels and solar geisers are clearly visible on the roof.
The premises enjoys free WiFi as can be seen on the castle top.

The sensitive plants grows under 40% shade netting, as shown above,
to provide for filtered wind and sunlight.

9.4.1] A large garden where the **mother plants** are planted and cared for in one large collection. These plants are known in terms of location, sex and they are registered with integrity. The plants are planted in the same growth medium, the same watering conditions, feeding, climate and such. This enables research where the plants features can be compared side by side and leaves no room for uncertainty.

The motherstock collection includes many rare species of Cycads, Cactii, Agave, Euphorbia and much more. Motherstock plants provide the same growth conditions for all plants, including soil, feeding, watering, climate, and when planted in “families” of three close together, the micro-climate is also the same. This enables a researcher to compare leaf colour, growth patterns and such, amongst different plants and species with no confusion as to differences due to habitat etc.

Motherstock plants planted in families of three where practical, in areas lifted for better drainage and protection. Plants are raised by ring-lining the holes with stones so that the stones can be removed as the plants settled to lower levels until level with the landscape.

Some areas in the garden hosts more sensitive motherplant stock such as *E. woodii* under 40% shade netting to protect them against strong wind and cold, and direct sunlight.

9.4.2] Polen Bank. The personell are trained to polinate and to collect polen from male plants when the male coned mature. The ripe cones are collected, the polen reaped and stored in a dry and cold environment. A cryogenic pollen bank is planned to store valuable pollen for many years at -80 deg C.

9.4.3] The Seed Bank is environmentically controlled to a constant ideal 26° Celsius and a high humidity, to germinize seed with a high yield. Polinated and ripe female cones are reaped, the sarcotesta removed and the seed cleaned, and separated from infertile seed, and germinated in the seed bank.

9.4.4] Cultivation tunnels for seedlings and recovery of suckers and mature plants.

9.4.5] A DNA research and test lab, where doubtfull species can be tested, profiled and compared to other species in order to establish identity integrity.

9.4.6] Cultivation – callus formation, meristem growth and shoot rooting. The cultivation lab is a future plan. We still cultivate the old school way, applying the “luxury bath” to stem cuttings and suckers, which stimulates vigorous growth through the feeding and Auxins and Cytokinins growth hormones in the bath. The wounds are thereafter sealed with Steriseal or such, and planted. The CBI has a very good yield with this method.

9.4.7] Nursery and tea garden

The inventory serves as a vehicle to connect with collector enthusiasts and share the off-spring of the valuable collection, which the CBI can firstly exploit to dispose of excessive duplicate genetics, and secondly secure funding for the upkeep of the CBI.

In order for a researcher/collector to raise funds for his work, the excess plants and offspring must be sold to other enthusiasts. It also creates friendships and collaboration which is invaluable for research. South African endangered species concervation authorities enforces a permit system for registered nurseries to control such activities.


Many of the larger settled plants which are available for sale, are kept in the open spaces and between motherstock and trees for filtered sun.
Preference is given to exchange
of species to benefit the program and the customer.


Seedlings and rooting shoots are kept in 20% shade netted tunnels, to provide for filtered air-flow and sunlight until they are strong to become mother stock or be sold. Overhead sprinkling lines and regular feeding is regarded as vital for a plant's optimum growth.

These pictures shows the prepared plant inventory. The trees on the property provide for a more natural environment for the inventory. The permits to sell excessive stock, have been allocated by the department of Nature Conservation, but many other exotic species such as Euphorbia, Agave, Cactii, and tree Aloes are also cultivated.

10 CBI HIGHLIGHTS

10.1 Workshops, lectures and demonstrations

The CBI avails its campus facilities and infrastructure to provide for lectures and demonstrations for the Cycad Society. Below are photos of a Saturday lecture–and–demonstration series where dr Andre Cilliers lectured on plant poisons and feeding, and dr Derik Minnaar lectured about the different forms and localities of *Encephalartos laevifolius*.

Saturday lectures and demonstrations, attended by officials from Nature Conservation and various academics.

10.2 Shows

The CBI hosted the grand opening show of the Pretoria branch of the Succulent Society.

Grand opening Pretoria Cactus and Succulent Siciety weekend open show at the CBI Nov 2024

10.3 Donations Received

The CBI frequently receives donations of unwanted Cycads, typically rescued from dumping at garden refuse sites or just dumped in pieces along the road. We received a dumped E.trans-venosus in February 2025.

Some owners also request the CBI to clean up the Cycads by removing suckers so that the collection presents better. Often the suckers are donated to the CBI to establish and find a new home for the young plants. Here is a donation of C. revolutas which cluttered a restaurant entrance.

We also receive unwanted collections, typically from collectors who has passed away, or relocated. These cycads were donated in March 2025.

10.4 Donations Given

The CBI donate plants to cultural institutions. The CBI donated two colonies of mature E.eugene marais cycads on two occasions, to the Voortrekker Monument.

The CBI attended the opening event at the conservation entity Cycad Trust, an event 30 October 2022, where the CBI donated a group of Encephalartos eugene marais cycads, which were planted at the Voortrekker Monument as a legacy for future generations.

The Trustee of the Cycad Trust, responsible for the Cycad garden at the Voortrekker Monument, takes posession of the Cycads on behalf of the Cycad Trust.

The CBI also donated a veriety of Cycads to the CR Swart school garden project in October 2024.





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10.5 Field Work

Mr Alan Tait ias a seasoned botanist, and he offers his services to various organizations. Mr Tait is employed by the Voortrekker Monument garden department. Mr Tait also do a lot of field work in the Eastern Cape and also Bezhoek in Mpumalanga, where he polinates E.middelburgensis.

Mr Tait also assisted in the conservation effort by polinating *E. middelburgensis* in their Bezhoek habitat. The programme plans to germinate the seed at the CBI and re-introduce the seedlings in the habitat at a later stage.


Onthe left pictures are shown of a recent visit by the Cycad Society to Bezhoek. We still witness some excellent examples of very old *E. middelburg* cycads. Many colonies of *E. lanatus* can also be found at Bezhoek.

Onthe left pictures are shown of a field project to polinate the female *E. middelburgensis* plants in nature, using pollen only from close by male plant(s). The cones exposed seed are covered with stones to protect the pollen and exposed seed.

Lots of fertile seed can be seen in nature around female plants.

The fertilization of *E. lanatus* is excellent.

The CBI is privileged to have mr Allan Tait as the library/art gallery and tour manager. Mr Tait is well connected with various farms where Cycads can be visited *in situ*.

The Allan Tait garden maintenance at the Voortrekker Monument, November 2024

10.6 The Exotic Garden

The CBI has decided to open a exotic garden, a collection of all non-South African Cycad species. The idea found lift-off as mr Morne Ferreira, an exotic Cycad collector and legendary specialist, moved from Pretoria to the Cape province. Many of the exotic Cycads will not grow there, so the CBI donated duplicate Dioon species to mr Ferreira while he left many exotic species for the exotic garden.

January 2025, CBI establishes the Morne Ferreira Exotic Cycad Garden, at the CBI Campus. For alien and forren Cycad genusses not found in South Africa. The initiative aims to create awareness and interest in the unknown Cycad species.

10.7 International Field Work

Mr Christo Schutte is a South African botanist who also resides in Uganda. He is well connected with the nature conservation authorities in Uganda. It came to light that the E.whitelockii cycads are being chopped up to make space for gardens. Mr Schutte has embarked on a rescue mission for whitelockii. The CBI offered to establish a small whitelockii sanctuary at the CBI. The first E.whitelockii suckers has arrived at the CBI on 9 May 2025.

11 NATIONAL AFFILIATION

Several Biodiversity Management Plans for endangered and critically endangered cycads species are at different levels of development and implementation and are aimed at protecting and managing the species. The CBI adopts the National Strategy and Action Plan as well as the generic Biodiversity Management Plan (BMP) as drafted by National Authorities. It has been well thought through with all stakeholders concerned and statistics to guide the strategies, which the CBI as a young start-up Institution will not be able to improve on. The best BMP and conservation Strategy has been summarized from the publication Notice 315 of 2017 by the Department of Environmental Affairs (DEA), “The Biodiversity Management Plan for eleven Critically Endangered and four Endangered Encephalartos Species.”, in terms of the **National Environmental Management Bio-diversity Act** no 10 of 2004.

11.1 Conservation Background

Encephalartos species are collectively the most threatened plant group in South Africa today. The rapid rate at which these species are declining in South Africa is mainly due to illegal collection or harvesting from the wild. Twelve of the 37 (32%) Encephalartos species that occur in South Africa are regarded as Critically Endangered, while an additional three are already considered Extinct in the Wild.

Hence the DEA developed a **National Strategy and Action Plan** in close consultation with the Scientific Authority and relevant stakeholders who are involved in either collection or management of this valuable resource, to provide the platform for effective conservation measures. This includes awareness raising campaigns, restrictive legislation, monitoring programmes and enforcement, to protect and conserve our wild cycads species. With this National Strategy and Action Plan, the Department is taking a practical and holistic approach to the conservation of cycads by providing a platform for all spheres of government and civil society to participate towards a coherent and common goal. The actions will focus on issues such as illegal collection, habitat management, re-introduction programmes and species conservation research amongst others involving a wide range of stakeholders.

The DEA oversees the implementation of this Strategy and Action Plan and will consider adopting exciting structures, such as the Cycad Working Group coordinated by the South African National Biodiversity Institute (SANBI), for monitoring, evaluation and reporting to the Minister regarding the implementation of this Strategy and Action Plan.

11.2 Legislative Framework

The following three legislation acts are applicable to activities in respect of research and conservation of endangered and protected plant species and are briefly summarized here.

National Environmental Management: Biodiversity Act (Act 10 of 2004)

NEM:BA Section 57(2) makes provision for the Minister to, by notice in the Government Gazette, prohibit the carrying out of a restricted activity if such activity may have a negative impact on the survival of a listed threatened or protected species. On 14 May 2012 the Minister published under section 57(2) the prohibition of certain restricted activities involving certain *Encephalartos* species in Government Gazette No. 35344 for immediate implementation. The notice stipulates that, unless required for conservation or enforcement purposes, the following restricted activities involving wild specimens of listed threatened or protected *Encephalartos* species are prohibited:

- Collect, pluck, uproot, destroy;
- Export from the South Africa, sell, trade, buy;
- Receive, give, donate, accept, acquire, dispose;
- Import into South Africa, convey, move, translocate; and
- Possess, exercise physical control (except where permits have been issued, prior to the publication of this notice, for plants that form part of legally obtained parental stock).

Section 43 of NEM:BA also makes provision for the development of Biodiversity Management Plans for Species (BMP-S) as a tool to manage species such as *Ence-phalartos*.

Threatened or Protected Species (TOPS) Regulations - 2007

In terms of Section 89 of NEM:BA and Regulation 11 of the TOPS regulations, a risk assessment in accordance with Regulation 15 may be required by the issuing authority before a restricted activity involving a wild population of a listed critically endangered species can be approved. Regulation 27 of the TOPS regulations also require the registration of a facility such as the CBI, where specimens of plant species that are listed as threatened or protected are grown and/or sold for commercial purposes.

National Environmental Management: Protected Areas Act (Act 57 of 2003)

Specially protected areas can be declared by the Minister in terms of the National Environmental Management: Protected Areas Act (NEM:PAA) (Act 57 of 2003). These specially protected areas, as may be the CBI, are declared to protect highly sensitive, outstanding ecosystems, species, geological or physical features. The focus of these areas is not on tourism or sustainable use but rather on scientific research or environmental monitoring. Special Nature Reserves have the highest level of protection and are even more important than a National Park, and therefore offences in these areas are dealt with more seriously than in other protected areas.

12 THE GENERIC BMP

The Department of Environmental Affairs (DEA) requested the South African National Biodiversity Institute (SANBI) to develop, by 15 January 2015, a ***generic Biodiversity Management Plan (BMP)*** for key Encephalartos species in accordance with Section 43 of the NEM:BA and the Norms and Standards for Biodiversity Management Plans for Species (BMP-S). The aim of the BMP-S is to ensure the long-term survival of 15 *Encephalartos* species in nature. Long-term survival is interpreted as halting the decline of the *in-situ* populations and thereafter attaining a population growth which will result in a down-listing of the species in terms of its conservation status in the IUCN Red List.

During the stakeholder identification process, the names and contact details of stakeholders were registered on a database of interested and affected parties. A total of 246 stakeholders were registered in the stakeholder database, and the CBI is to be added to the list of a National Private stakeholder for Conservation and Research.

Generic aspects of the BMP-S which are applicable to 15 *Encephalartos* species, include an increase in protection of wild cycads, essential research, and effective management of confiscated cycads and *ex situ* collections. Specific objectives, actions and recovery targets were established for the 15 *Encephalartos* species ranging from surveys to determine current population status, identification of secure sites for reintroduction, proclamation of areas as Specially Protected Areas in terms of the National Environmental Management: Protected Areas Act (NEM:PAA) (Act 57 of 2003) to recovery objectives such as reintroduction of seed and / or seedlings into secure localities.

12.1 Overarching Principles and Guidelines

The following principles have been identified and discussed with key role players and stakeholders and are relevant in providing an important framework for the successful implementation of the BMP for the identified *Encephalartos* species:

1) The focus of this BMP is the long-term **survival** of the *Encephalartos* species in the wild. It should however be noted that this process forms part of a holistic approach described in the draft “National Management Strategy and Action Plan for Cycads” (2014);

2) The only way to guarantee the long-term survival and evolution of plant species, and their associated ecological links, is to ensure plants are maintained in vigorous populations in the wild – or ***in situ* conservation**;

3) Although it is recognized that *in situ* (on-site) conservation is the best biological approach for the long term conservation of biological diversity, many *Encephalartos* species have declined to the point where an integrated approach, **including *in situ* and *ex situ*** actions is required to prevent extinction;

4) Information relating to known localities of *Encephalartos* populations in the wild will be handled as confidential to minimize the threat of illegal harvesting of these populations. Objectives and actions relating to **sensitive data** will be coordinated by the implementing agent (SANBI in consultation with provincial conservation agencies);

5) It is recommended that a *Encephalartos* species BMP Implementation Committee consisting of a collaborative partnership between DEA, SANBI and the private sector represented by the CSSA is established to **oversee the implementation** of the BMP;

6) It is recommended that **seed and seedlings** be utilized for species recovery. In specific instances, the use of mature plants can be considered.

7) The seed to be utilized for species recovery may be **sourced** from (order of preference):

a) Wild plants.
b) NBGs and other state-owned nurseries; or
c) Willing private growers or nurseries.

It should however be considered that there is a significant risk of introducing pathogens/pests into wild populations of *Encephalartos* species in South Africa (Prof Jolanda Roux, pers. comm. November 2014). The trade in plants has been shown to be one of the most important mechanisms of spread of **pests and pathogens** globally, with tree health experts considering the problem so important that the Montesclaros Declaration was drawn up to advocate for an end in the trade of live plants.

8) Risk of diseases. **Pathogens can spread** in many ways and through various pathways which include soil, plant material, equipment, shoes, water, and air. The use of seedlings and mature plants to establish new populations in the wild or to augment existing populations should therefore be undertaken with extreme care so as not to introduce non-native pathogens/pests into these areas. Pathogens can spread on plant associated soil/growth media, soil in vehicle tyres or on the shoes and planting equipment of people conducting the transplants. Great care should be taken by the teams that transplant the *Encephalartos* species to ensure that insects and pathogens are not hiding beneath plant bracts, on roots etc. In addition to this, the following measures are recommended (Prof Jolanda Roux, pers. comm. November 2014):

• Staff undertaking the augmentation of natural *Encephalartos* populations should be carefully trained in **pest and disease recognition** and all plants should be examined in detail before release for transplanting;

• Nurseries growing plants should be **inspected regularly**;

• Care should be taken in the **application of chemicals** in the nurseries, as these may mask infection/infestations, resulting in diseased/infected plants being sent to the field;

• Any observations of possible disease/pest occurrences on plants **should be reported** to plant health experts for further investigation.

9) Where the long-term goal for a species is to recreate a self-sustaining population, it must be ensured that required ecological processes such as **pollination and dispersal** are intact or can be **re-established** (Da Silva *et al*., 2011);

10) Where plants in the wild do not produce seed/ do not produce sufficient seed to meet recovery targets, **plants in *ex situ* collections can be used** provided that the purity of parental stock is confirmed through **DNA barcoding** (to be conducted by the University of Johannesburg). In instances where plants in *ex situ* collections are used to propagate seed for augmentation/reintroduction purposes, extensive measures should be taken to **prevent any hybridization** with other species and to ensure that the **seed is disease and pest free**;

11) Where an *Encephalartos* species is known from more than one locality, recovery will be affected with seed sourced from a **specific locality** as far as possible, in order to keep localities/ forms separate until further research has been undertaken regarding the evolutionary significance of the localities/ forms and the conservation genetics of the *Encephalartos* species;

12) Species recovery will only be conducted if areas into which recoveries are affected can be **secured against poaching**;

13) Recovery actions, including the establishment of *ex situ* collections from wild-sourced seed, would involve restricted activities stipulated in terms of Section 57 of NEM:BA. Therefore, **a TOPS permit must be obtained** before any such activities are conducted;

14) Although the intent is to save plants in the wild, it is recognized that *ex situ* collections can play an important role provided that these collections are managed to **ensure genetic purity** and health of specimens (disease and pest free). *Ex situ* collections at NBGs will only be expanded if current security systems can be upgraded to prevent theft of valuable specimens;

15) Harvesting of *Encephalartos species* for **medicinal purposes** is included under the definition of poaching or illegal removal;

16) Recovery plans must:

• Comply with all **legal requirements** for conducting a restricted activity in terms of Section 57 of NEM:BA;

• Identify **optimal sites** for recovery through a combination of desktop mapping, habitat modelling and field verifications;

• Include a **protocol of procedures** which should stipulate how plants/seeds will be collected, who will collect plants/seeds, artificial pollination etc.

• Include a protocol of procedures for preventing the introduction of **pathogens and pests** (refer to principle 8).

17) It is accepted that landowners may participate in breeding programmes that fit within the context of this management plan, and that subject to all legal requirements being met, seedlings can be produced from wild populations to meet the demand for plants in the trade and to provide **income to cover management and protection costs**.

12.2 Increased Protection from Poaching

Background
The provincial conservation agencies that are mandated to protect wild *Encephalartos* populations from poaching are experiencing severe capacity constraints such as shortages of human resources and budget. Thus, the enforcement of strict protection measures which have been developed for *Encephalartos* species in the wild is hampered. In addition to the challenges of securing wild populations, it is difficult to prove the origin of wild plants once present in the horticultural market. Although the use of microchips to mark wild plants is useful for monitoring of wild populations, microchips are less successful as a deterrent against poaching since they can be removed from poached plants.

Based on updated research and technology, improved unique microchips have been procured by the DEA to mark priority wild *Encephalartos* populations. At the same time, pilot studies will be conducted on marking wild plants with microdots. These data microdots are microscopic discs that contain unique information linked to *Encephalartos* species and locality and the laser-etched code can be stored on a national verification database (Xaba and Bosenberg, 2012). An additional method which is being investigated to secure plants in the wild is the use of transponders or tag devices which will immediately alert law enforcement authorities when marked plants are poached or when the tag devices are tampered with.

Research is also being conducted on the use of stable isotopes to determine the origin of *Encephalartos* species. Stable isotopes are chemical tracers that record the characteristics of the environment such as geology and rainfall and these tracers are fixed in the plant tissue. Two research phases have already been conducted and the results are promising. The growing histories of two specimens within the NBGs were successfully reconstructed using stable isotope ratios and radiocarbon dating (Retief *et al*., 2014). The use of stable isotopes and radiocarbon dating is already being piloted in an *Encephalartos* species investigation, while the required forensic procedures are being devised. The next phase of this research will involve the development of a forensic stable isotope reference database for wild *Encephalartos* populations that can be used in future investigations and prosecutions.

Objective 1
To incentivize the *in situ* protection of wild *Encephalartos* populations through increasing the economic value of wild *Encephalartos* species.

Action 1: Develop a protocol for the approval of wild seed harvest for seedling production programmes for trade purposes in accordance with the CITES1 Resolution Conf. 11.11 (Rev.CoP15).
Champions/ Responsibility: SANBI, DEA and provincial conservation agencies.
Funding: SANBI.
Timeline: Within one year of publication of this BMP.
Deliverable: Protocol for the approval of wild seed harvest for seedling production programmes for trade purposes.

Objective 2
To improve provincial capacity for implementation of protection measures for wild plants.
Action 1: Design and implement a security plan that deals with adequate anti-poaching personnel for priority plants, adequate equipment etc.
Champions/ Responsibility: DEA to co-ordinate in collaboration with provincial conservation agencies and relevant departments within the South African Polices Services.
Funding: Provincial conservation agency annual budgets.
Timeline: Within three years of publication of this BMP.
Deliverable: All essential anti-poaching posts filled and essential equipment available.

Objective 3
To mark priority wild *Encephalartos* populations with new super unique microchips.
Action 1: Mark all priority wild *Encephalartos* populations with new microchips.
Champions/ Responsibility: DEA to purchase microchips. Provincial conservation agencies to insert microchips. The SANBI to advise on selection of priority populations. DEA to co-ordinate.
Funding: Purchase: DEA.
Application: Provincial budgets.
Timeline Within one year of publication of BMP.
Deliverable All priority wild populations marked.

Objective 4
To pilot studies on the use of microdots for marking of wild *Encephalartos* populations.
Action 1: Identify one priority population per province and apply uniquely coded microdots in accordance with an agreed protocol.
Champions/ Responsibility SANBI/ Provincial conservation agencies.
Funding Purchase of microdots: SANBI (25% of Scientific Authority budget to be allocated to actions in this BMP).
Application: Provincial budgets.
Timeline Within one year of publication of BMP.
Deliverable At least one population per province marked according to agreed protocol.
Action 2: Monitor the presence of microdots on marked plants.
Champions/ Responsibility SANBI/ Provincial conservation agencies.
Funding: Provincial budgets.
Timeline: Annually.
Deliverable: Monitoring report.

Objective 5
To develop a forensic stable isotope reference database for wild *Encephalartos* populations for use in *Encephalartos* species investigations and prosecutions.
Action 1: Develop a forensic stable isotope reference database for wild *Encephalartos* populations.

Champions/ Responsibility: SANBI/ the University of Cape Town/ DEA/ SAPS
Funding SANBI to source (25% of Scientific Authority budget to be allocated to actions in this BMP).
Timeline: Five years.
Deliverable: A stable isotope reference database to provide forensic evidence in court for *Encephalartos* species investigations and prosecutions.

12.3 Conduct Essential Research

Background
Many of the essential research fields described below have been initiated with various universities such as the University of KwaZulu-Natal, the University of Pretoria, the University of Cape Town, the University of Johannesburg, Rhodes University and the Nelson Mandela Metropolitan University and collaborations should be formed with these universities to continue future efforts.

Objective 1
To formulate a research plan that prioritizes research documented below.
Action 1: Formulate a research plan.
Champions/ Responsibility: SANBI in collaboration with provincial conservation authorities.
Funding: None required.
Timeline: Within six months of publication of this BMP.
Deliverable: A research priority list.

12.3.1 Pollinators

Beetle species such as *Porthetes, Metacucujus* and *Xenoscelus* are important pollinators of *Encephalartos* species in South Africa. A lower diversity of insects has been observed on *Encephalartos* species in the northern parts of the country (Mpumalanga and Limpopo provinces) than on *Encephalartos* species in the south-eastern parts (Eastern Cape and KZN Provinces) (Donaldson, 1997; 1999). It is possible that insect pollinators are absent from small *Encephalartos* populations, with specialised weevils becoming locally extinct as these populations decline (Daly *et al*., 2006), although recent studies found that potential pollinators exist in male cones within small populations (Carin Swart, pers. comm., September 2014). The successful recovery of *Encephalartos* species as specified in this BMP will depend on the presence or reintroduction of pollinators.

Objective 1
To determine whether cucujid pollinators can be transferred between *Encephalartos* species.
Action 1: Conduct research to determine if cucujid pollinators can be transferred between *Encephalartos* species and can therefore be released into populations where they have become locally extinct.
Champions/ Responsibility: SANBI.
Funding: SANBI to source funding.
Timeline: Five years.
Deliverable: Published research papers on the speciesspecificity
of cucujid pollinators.

12.3.2 Sex Identification

Prakash and Van Staden from the University of KwaZulu-Natal (pers. comm. 2006) made use of RAPD markers to identify the sex in *Encephalartos* seedlings which assumed that there is a single genetic system across all *Encephalartos* species. It is thought that more sensitive methods such as AFLPs or next generation restriction-site-associated DNA (RAD) sequencing approaches are needed for sex determination in *Encephalartos* species (Prof Nigel Barker, Rhodes University, pers. comm. September 2014). The sex determination of *Encephalartos* species will have valuable applications for recovery efforts during which sex ratios can be reestablished in wild populations as well as determining the sex of adult non-coning plants in wild populations. This application could also prove to be useful for trade purposes, as female plants are considered more valuable than male plants.

Objective 1
To explore various molecular techniques to determine the sex of *Encephalartos* species.
Action 1: Continue research into molecular methods for determining the sex of *Encephalartos* species (adults and seedlings).
Champions/ Responsibility: Universities
Funding: To be determined.
Timeline: Five years
Deliverable: Published research papers on sex identification techniques for *Encephalartos* species

12.3.3 Species Recovery

Species recovery includes the manipulation, enhancing or restoration of *Encephalartos* species populations and for the purpose of this report also refers to restoration and reintroduction. Techniques used for recovery of *Encephalartos* species should be researched to ensure results are available for future recovery plans. Recovery techniques should be scientifically based and should address essential research questions such as survival rates of plants where the method of introduction involved seed, seedlings or adult plants, as well as comparisons between various replanting methods to determine the role of crowding and/or density dependant mortalities, nurse plants and land-use on germination and establishment. This research could also be conducted on more common *Encephalartos* species for which seed and seedlings are more readily available.

Objective 1
To conduct research into species recovery techniques.
Action 1: Initiate research projects in collaboration with recognized universities to increase knowledge on the restoration ecology of *Encephalartos* species.
Champions/ Responsibility: SANBI, Mpumalanga Tourism and Parks Agency (MTPA), the Tshwane University of Technology (TUT), other universities.
Funding: SANBI and/or universities to source funding.
Timeline: Five years.
Deliverable: Published research papers on the restoration ecology of *Encephalartos* species.

12.3.4 Essential Mutualisms

Encephalartos species are the only known gymnosperms that fix nitrogen symbiotically through an association with cyanobacteria which are located in the coralloid roots (dichotomously branched structures arising from the lateral roots) (Peters *et al.,* 1986 in Zheng *et al.,* 2002). Studies conducted by Zheng *et al.* (2002) demonstrated that individual coralloid roots as well as the developmental stages of the individual root clusters can host multiple cyanobacteria. The role of cyanobacteria in the survival and growth of South African *Encephalartos* species is not clearly understood and research into these and other essential mutualisms should be determined.

Objective 1
To determine the role of *Encephalartos* species mutualisms and the importance of maintaining and restoring these mutualisms.
Action 1: Explore the role and importance of mutualisms such as cyanobacteria in *Encephalartos* species.
Champions/ Responsibility: SANBI to coordinate.
Funding: SANBI to source funding.
Timeline: Five years.
Deliverable: Published research papers on essential *Encephalartos* specie mutualisms.

12.3.5 Diseases

According to Prof Jolanda Roux from the University of Pretoria (pers. comm. October 2014), virtually no scientific research into diseases of *Encephalartos* species has been conducted in Africa (including South Africa) to date. Research conducted by the DST/NRF Centre of Excellence in Tree Health Biotechnology (FABI) in 2013 confirmed the presence of a microbial disease on *E. transvenonsus* in the Modjadji Nature Reserve. In 2014 samples from the Durban Botanical Garden (DBG) were submitted to FABI for the identification of a white, scaly growth on the cones of *Cycas thouarsii* and *Encephalartos* species. The non-native *Aulacaspis yasumatsui* (Hemiptera: Coccoidea: Diaspididae) or commonly known as Cycad Aulacaspis Acale (CAS) was identified. Further investigations revealed that the scale (CAS) was killing *C. thouarsii* plants in gardens in Richards Bay and several gardens in Pretoria, with low level infestations also recorded on garden specimens of *Encephalartos* species. The presence of this non-native scale is of grave concern since CAS is not native to Africa and has been identified by the IUCN as one of the biggest threats to the survival of native *Encephalartos* species. Based on these preliminary studies it is considered essential that pest and disease studies are undertaken for all the *Encephalartos* species on the BMP. It is crucial that plant experts, conservation staff and cycad enthusiasts monitor, photograph and report to FABI all observations of possible disease and pest occurrences on *Encephalartos* in South Africa, both *in situ* and *ex situ*.

Objective 1
To increase research efforts into *Encephalartos* diseases in wild populations and *ex situ* collections.
Action 1: Document the occurrence of the non-native Cycad Aulacaspis Scale (CAS) in South Africa.

Champions/ Responsibility: The University of Pretoria, NBGs, CSSA, provincial conservation agencies.
Funding: UP and SANBI to source.
Timeline Five years.
Deliverable: Atlas on the occurrence of CAS in South Africa.
Action 2: Document the occurrence of pests and diseases affecting *Encephalartos* species in South Africa, with special reference to the 15 *Encephalartos* species in the BMP.
Champions/ Responsibility: The University of Pretoria, NBGs, CSSA, provincial conservation agencies.
Funding: UP and SANBI to source.
Timeline: Five years.
Deliverable: Atlas on the occurrence of pests and diseases affecting *Encephalartos* species in South Africa.

Objective 2
To communicate research findings on cycad pests and diseases on a continuous basis to collectors and nurseries.
Action 1: Communicate research findings on cycad pests and diseases to all nurseries and collectors through the BMP Implementation Committee and CSSA.
Champions/ Responsibility: BMP Implementation Committee, CSSA, SANBI and the University of Pretoria.
Funding: No funding required.
Timeline: Five years.
Deliverable: Articles and other communication materials on cycad pests and diseases.

12.3.6 Genetic Species Identification

The use of nuclear ribosomal internal transcribed spacer regions 1 and 2 (ITS 1&2), the chloroplast encoded *rbcl* gene, ISSR genomic fingerprinting, allozyme and random amplified polymorphic DNA (RAPD) techniques have been used to try and resolve the molecular history and the relationship within the genus *Encephalartos* with limited success in the past (Treutlein *et al.,* 2005; Chaiprasongsuk *et al.,* 2007), however new advancements in these DNA techniques are developing rapidly. At the University of Johannesburg DNA barcoding was initially performed by using two gene regions *rbcLa & matK* which was able to discriminate only around 50% of South Africa's *Encephalartos* species. However, researchers have now completed a sequencing matrix for *Encephalartos* species using three additional genes, *trnH-psbA,* ITS and Needly, and all of Africa's *Encephalartos* species can now be identified using DNA barcoding techniques (Prof Michelle van der Bank, pers. comm., November 2014). In 2015 the University of Johannesburg will also start to build a genetic profile of *Encephalartos* species using microsatellites and AFLPs which will allow researchers to trace the origin of the *Encephalartos* species and thereby distinguish between very closely related *Encephalartos* species (Prof Michelle van der Bank, pers. comm., November 2014).

Objective 1
To use DNA barcoding techniques to identify closely related *Encephalartos* species and to resolve their taxonomy (e.g. *E. heenanii* and *E. paucidentatus*).
Action 1: Identify closely related *Encephalartos* species using DNA barcoding techniques and resolve their taxonomy.
Champions/ Responsibility: University of Johannesburg and SANBI Biosystematics.

Funding: University of Johannesburg.
Timeline: Five years.
Deliverable: Taxonomic publication.

12.3.7 Genetic Variation in Localities

Encephalartos species such as *E. laevifolius, E. hirsutus* and to some extent *E. middelburgensis* and *E. arenarius* were historically recorded from more than one subpopulation or locality which were often widely separated. Most of these subpopulations/localities no longer contain a functional population and in many cases the *Encephalartos* species is considered extinct from the locality. Although plants from these localities are considered to be more valuable in trade, there is still uncertainty if the subpopulations are genetically distinct. Species recovery as described in this BMP-S will take the cautious approach and only recover *Encephalartos* species in various subpopulations/localities using parental stock from the same subpopulation/locality. However this could result in inbreeding and a loss of genetic fitness. It is, therefore, important to determine if there is genetic variation and assess its role in the genetic fitness and adaptability of the *Encephalartos* species. Although the reasons for variations could be complex, the aim should be to determine principles for recovery when dealing with subpopulations or different localities.

Objective 1
To conduct conservation genetics research on different subpopulations / localities of *E. laevifolius* and *E. hirsutus* in order to inform species recovery.
Action 1: Determine if there is genetic variation between subpopulations / localities of *E. laevifolius* and *E. hirsutus.*
Champions/ Responsibility: To be determined.
Funding: To be determined.
Timeline: Five years.
Deliverable: Recommendations for species recovery at different localities / subpopulations based on genetic considerations.

12.3.8 Genetic Integrity

Ex situ conservation is considered to be a tool to ensure the survival of a wild population and should preferably be established within the distribution range or region of the taxa. However the option of locating an *ex situ* collection outside the taxa's natural range can be considered if the taxa is threatened by natural catastrophes, political and social disruptions, or if further research, isolation or germplasm banking is required. Irrespective of the locality of the *ex situ* collection it should be managed in ways that minimize the loss of capacity for expression of natural behaviours and loss of ability to later again thrive in natural habitats (IUCN SSC, 2002). The management of *ex situ* populations must minimize any deleterious effects associated with *ex situ* conservation such as loss of genetic diversity, artificial selection, pathogen transfer and hybridization. There are various *ex situ* conservation methods (Laliberte, 1997), some of these are already in use for some of the *Encephalartos* species in this BMP-S:

• **Field genebanks:** Field genebanks (also known as living collections) are usually established for long-lived, recalcitrant species. The disadvantage of field genebanks is that they usually require a great deal of space and are susceptible to natural disasters, the spread of diseases and may suffer from neglect. Hybridization between *Encephalartos* species is an important aspect which needs to be managed through strict controlled pollination

programmes. In South Africa, field genebanks have been established as various NBGs and further research is needed to ensure that these collections are managed to maintain genetic integrity;

• **In vitro storage methods:** Is the storage of germplasm in laboratory conditions and is also suited for long-term conservation of recalcitrant *Encephalartos* species or *Encephalartos* species which are vegetatively propagated. The germplasm is stored at low temperatures under slow growth conditions or cryopreserved in liquid nitrogen at -196°C. The main limitation of cryopreservation is the need for special equipment, techniques and trained staff. More research is needed to define the mechanisms of desiccation and chilling injury (Eberhart *et al.,* 1991 in Laliberte, 1997). Preliminary studies conducted by the Kew Millennium Seed Bank Project on *E. middelburgensis, E. altensteinii* and *E. latifrons* showed recovery of 85% germination rate on Murashige and Skoog (MS) basal culture media supplemented with activated charcoal (Jayanthi Nadarajan, pers. comm.); and

• **Pollen Banks:** Pollen preservation requires little space but some cytoplasmic genes might be lost during the storage process. Information about the storage characteristics of pollen from the wild is limited and further research is required.

Objective 1
To continue research into the use of in vitro storage techniques to establish *ex situ* conservation collections.
Action 1: Investigate the possibility of using in vitro storage for *ex situ* conservation.
Champions/ Responsibility: SANBI/Kew Millennium Seed Bank Project.
Funding: To be determined.
Timeline: Five years.
Deliverable: Documented methods for in vitro storage of *Encephalartos* species.

12.3.9 Climate Change

The uptake of carbon dioxide (CO2), which is one of the principal greenhouse gases, during photosynthesis make plants major regulators of global climate change (Hawkins *et al.,* 2008). Over the past 30 years, climate change has produced numerous shifts in the distributions and abundances of *Encephalartos* species (Prof Nigel Barker, Rhodes University, pers. comm. September 2014). Physiological responses of plants to climate change include responses to rising CO2 levels, temperature changes, available water, light levels, and levels of methane, while there could also be a significant change in plant community interactions such as competition, plant/pollinator and plant/pathogen interactions (Hawkins *et al.,* 2008). There is a concern that if biome shifts occur and the climate envelope of *Encephalartos* species is no longer compatible with their geographic position, then extinction is unavoidable (Prof Nigel Barker, Rhodes University, pers. comm. September 2014). Research into climate modelling for *Encephalartos* species could be based on available distribution data but warrants further research.

Objective 1
To investigate the potential impact of climate change on South African *Encephalartos* species.
Action 1: Conduct climate modelling to assess the potential impact of climate change on South African *Encephalartos* species.
Champions/ Responsibility: Rhodes University.
Funding: To be determined.

Timeline: Five years.
Deliverable: Publications on the predicted impact of climate change on South African *Encephalartos* species.

12.4 Management of Confiscated Species

Background
Confiscated *Encephalartos* species are illegally harvested wild plants which have been seized during law enforcement operations. Large numbers of confiscated *Encephalartos* species are now present in local and national government-controlled facilities and nurseries, some of which may have the potential to be used as parental stock for species recovery. There is no national database that records the confiscated *Encephalartos* species present in government nurseries and facilities and in private custodianship. *Encephalartos* species are usually damaged when they are removed from the wild. When these damaged plants are confiscated, law enforcement officials often do not have the knowledge, experience and/ or resources to effectively treat and manage the damaged plants, resulting in high mortalities of the confiscated plants. Many private growers and collectors have extensive knowledge and experience in *Encephalartos* specie maintenance and have access to the resources required to ensure the survival of the plants. The private sector has expressed their willingness to develop guidelines for the management of confiscated *Encephalartos* species, with important steps and methods to deal with confiscated plants described.

Objective 1
To develop guidelines for law enforcement officials for the care of confiscated and damaged *Encephalartos* species.
Action 1: Develop a guideline describing the recommended methods for the caring of confiscated and damaged *Encephalartos* species, inclusive of a list of relevant experts to contact.
Champions/ Responsibility: CSSA – Xander de Kock.
Funding: Not required.
Timeline: Within one year of publication of this BMP.
Deliverable: Recommended steps for the caring of confiscated and damaged *Encephalartos* species.

Objective 2
To identify key growers and horticulturists in all provinces who will assist law enforcement officials when damaged *Encephalartos* species need to be treated.
Action 1: Identify key growers and horticulturists who will care for confiscated plants
Champions/ Responsibility: CSSA in collaboration with NBGs and provincial conservation agencies.
Funding: Not required.
Timeline: Within one year of publication of this BMP.
Deliverable: List of relevant experts to contact for advice on the caring of confiscated and treatment of damaged *Encephalartos* species.

Objective 3
To formalize private custodianships of confiscated plants.
Action 1: Formalize custodianship of confiscated plants in private collections and nurseries.
Champions/ Responsibility: Provincial conservation agencies in collaboration with SANBI.
Funding: Not required.
Timeline: Within one year of publication of this BMP.

Deliverable: Custodianship agreements formalized.

12.5 Genebank Collections

Background
As a signatory to the Convention on Biological Diversity (CBD), South Africa is required to develop a National Strategy for Plant Conservation (NSPC) which is aligned to the Global Strategy for Plant Conservation (GSPC) 2011-2020. The GSPC consists of 16 targets and is applied through the International Agenda for Botanical Gardens (BGCI, 2012). Further, Section 11(1)(h) of NEM:BA requires the SANBI to establish, maintain, protect, and preserve collections of plants in NBGs and in herbaria. The SANBI through its Garden Conservation Strategy (GCS) is currently developing a strategy for *Encephalartos* specie collections in National Botanical Gardens, to be aligned with this BMP. With the increased demand within the trade for various rare *Encephalartos* species, the collections at NBGs have been the target of theft in the past 10 years.

Upgrades to the current security systems are urgently needed to ensure the safe keeping of these *ex-situ* collections. In instances where individual plants which are of conservation value as defined in this BMP are currently in private or state-owned custodianship, it is recommended that these plants remain at the current locality provided such a locality is secure. This will decrease the risk of losing valuable *Encephalartos* species through relocation or a single theft event in NBGs. In this regard, it is strongly recommended that the BMP Implementation Committee support the “Cycad Saviours” initiative of the Cycad Society of South Africa to facilitate collaborative participation between private collectors and conservation departments.

Ex situ collections which have been established for conservation purposes should furthermore aim to maintain the genetic integrity of the collection and maintain the insect assemblages associated with conservation collections. To maintain the insect assemblages associated with *Encephalartos* collections, the use of pesticides should be limited especially on indigenous *Encephalartos* species.

Objective 1
To compile a confidential database for *ex situ Encephalartos* species of potential conservation value.
Action 1: Establish a database for *ex situ Encephalartos* species of potential conservation value located within private collections through the Cycad Saviours initiative.
Champions/ Responsibility: CSSA (CSSA) – Japie Steenkamp.
Funding: CSSA.
Timeline: Within one year of the publication of this BMP.
Deliverable: Database for *Encephalartos* species of potential conservation value located within private collections.
Action 2: Confirm conservation value of *ex situ Encephalartos* species on database through DNA barcoding and stable isotope analysis.
Champions/ Responsibility: SANBI.
Funding: SANBI (25% of Scientific Authority budget to be allocated to actions in this BMP).
Timeline: Within one year of the publication of this BMP.
Deliverable: Validated database for *Encephalartos* species of conservation value located within private collections.
Action 3: Establish a database for *ex situ Encephalartos* species of potential conservation value located within national and international government facilities.

Champions/ Responsibility: SANBI.
Funding: SANBI (25% of Scientific Authority budget to be allocated to actions in this BMP).
Timeline: Within one year of the publication of this BMP.
Deliverable: Database for *Encephalartos* species of potential conservation value located within national and international government facilities.

Objective 2
To establish, maintain and secure *ex situ* genebank collections of all the CR and EN *Encephalartos* species in NBGs.
Action 1: Upgrade security of valuable *Encephalartos* species collections at NBGs to prevent theft of *Encephalartos* species.
Champions/ Responsibility: SANBI through its NBGs
Funding: SANBI (NBGs).
Timeline: Within one year of publication of this BMP.
Deliverable: Secure *Encephalartos* collections at NBGs.
Action 2: Following agreement with owners of private collections, mark confirmed *ex situ Encephalartos* species of conservation value located within private collections with microdots.
Champions/ Responsibility: SANBI.
Funding: SANBI.
Timeline: Within one year of publication of this BMP.
Deliverable: Confirmed *Encephalartos* species of conservation value located within private collections marked with microdots.
Action 3: Manage and coordinate *ex situ* conservation collections (including private collections where possible) for all the *Encephalartos* species in this BMP.
Champions/ Responsibility: SANBI (NBGs) in collaboration with private growers and collectors.
Funding: SANBI (NBGs).
Timeline: Within one year of publication of this BMP.
Deliverable: Strategy for *Encephalartos* collections in National Botanical Gardens.
Action 4: Develop a protocol for duplicate collections and material exchange between NBG *Encephalartos* gene banks.
Champions/ Responsibility SANBI (NBGs).
Funding: Not required.
Timeline: Protocol developed within one year of publication of this BMP and implemented within the 5-year timeframe of this BMP.
Deliverable: Protocol for duplicate collections and material exchange developed and implemented.
Action 5: Pilot the RFID *Encephalartos* species theft detection system at Lowveld NBG.
Champions/ Responsibility: SANBI.
Funding: SANBI and the University of Kent to source funding.
Timeline: Pilot project to commence within one year of publication of this BMP.
Deliverable: Analysis of the effectiveness of the RFID *Encephalartos* species theft detection system.
Action 6: Train key personnel in the maintenance of *ex situ* conservation collections for *Encephalartos* species to ensure genetic purity (by preventing hybridization) and retention of important insect assemblages.
Champions/ Responsibility: SANBI through NBGs.
Funding: SANBI (NBGs).
Timeline: Within one year of publication of the BMP.

Deliverable: Key personnel managing the conservation collections for *Encephalartos* species trained to prevent hybridization of important collections and to maintain important insect assemblages.

12.6 Species-Specific Action Plans

The CBI has close relations with owners of the farms/reserves where the following four species habitat: Encephalartos eugene-marais, horridus, laevifolius and middelburgensis. The re-introduction of seedlings or small plants back *in situ*, can be greatly improved by utilizing the Cycad Dome, to protect the settling and vulnerable specimen against excessive weather, pests, animals, and provide for drip-irrigation and feeding at the same time.

The Cycad Dome. Protection and Nourishing the Vulnerable Reintroduction

12.6.1 Encephalartos eugene-maraisii

Background
Encephalartos eugene-maraisii occurs on rocky hills and steep slopes in grassland and savanna in small scattered sub-populations in the Waterberg and adjacent areas (Grobbelaar, 2004). There has been significant poaching of this *Encephalartos* species over the past 30 years and it is estimated that the population has declined by more than 50% over this period, with between 900 and 1000 plants remaining in the wild. Most of the remaining sub-populations are located on private Nature Reserves and in formally protected areas managed by SANParks. *Encephalartos eugene-maraisii* is currently listed as EN under the Red List criteria A2d; C1 (IUCN version 3.1).

Plants in formally protected areas are monitored regularly with individual plants marked, measured and GPS referenced and although complete population surveys are not conducted on the private Nature Reserves, monitoring is conducted on portions of the subpopulation. This *Encephalartos* species is not currently represented in a viable *ex situ* collection at the NBGs.

Objective 1
To establish an *ex-situ* genebank for *E. eugene-maraisii* at the Lowveld NBG.
Action 1: Source seed from stable wild subpopulations of *E. eugene-maraisii*
Champions/ Responsibility: SANBI in collaboration with private Nature Reserves and landowners.
Resources/Funding: SANBI through NBGs.
Timeline: Within one year of publication of this BMP.
Deliverable: An *ex-situ* gene bank for *E. eugene-maraisii* comprised of at least 100 seedlings.

12.6.2 Encephalartos horridus

Background
Encephalartos horridus occurs in xeric thicket vegetation between Port Elizabeth and Uitenhage in the Eastern Cape. This *Encephalartos* species has declined by more than 50% due to habitat destruction (urban settlements) and collecting for horticultural purposes and is now considered extinct from some localities. *Encephalartos horridus* is currently listed as EN under the Red List criteria A2acd (IUCN version 3.1). According to Eastern Cape DEDEAT and SANParks, the exact extent of the species' distribution as well as subpopulation sizes are unknown since a complete population survey has never been conducted. Landowners who were consulted as part of the this BMP did not express any interest in economic incentives for the conservation of *E. horridus* and it is therefore recommended that BMAs are entered into with these landowners in accordance with Section 44 of NEM:BA. The option of tax incentives can subsequently be explored. It should however be noted that since the complete distribution of *E. horridus* is unknown, not all landowners could be consulted during this BMP. *Encephalartos horridus* is represented in *ex situ* collections at the NBGs, however, a recent increase in the theft of this *Encephalartos* species has resulted in a significant reduction in the number of plants within these collections. Therefore, it is crucial that these *ex-situ* collections are secured and restored (see 3.3.8 objective 1).

Objective 1
To determine the current distribution and size of *E. horridus* populations.
Action 1: Conduct a population survey for *E. horridus.*
Champions/ Responsibility: EC DEDEAT, SANBI, SANParks, the Nelson Mandela Metropolitan University, Rhodes University.
Resources/Funding SANBI (25% of Scientific Authority budget to be allocated to actions in this BMP).
Timeline: Within five years of the publication of this BMP.
Deliverable: Report on the current population status of *E. horridus.*

Objective 2
To enter into a BMA with landowners on whose properties *E. horridus* occurs.
Action 1: Initiate a BMA with landowners on whose properties *E. horridus* occurs
Champions/ Responsibility: EC DEDEAT (stewardship programme) in collaboration with the SANBI.
Resources/Funding: EC DEDEAT.
Timeline: Within five years of publication of this BMP.
Deliverable: BMAs between landowners and the Minister in accordance with section 44 of NEM:BA.

Recovery Targets
Due to a lack of current population information, it is not possible to set realistic recovery targets for this *Encephalartos* species. It is therefore recommended that recovery targets are only determined upon completion of the population survey.

Recovery Objective 1
To set recovery targets for *E. horridus* once objective 1 above has been achieved.
Action 1: Set recovery targets for *E. horridus*
Champions/ Responsibility: *Encephalartos* species BMP Implementation Committee.
Resources/Funding: To be determined.
Timeline: After five years or once necessary information has been obtained.
Deliverable: Recovery targets for *E. horridus.*
When implementing the actions above, full consideration must be given to the principles and operational guidelines outlined in 3.1 of this document.

12.6.3 Encephalartos laevifolius

Background
Historically, *Encephalartos laevifolius* used to occur in Mpumalanga, KZN, and the Eastern Cape as well as in Swaziland, but today it predominantly occurs in Mpumalanga within the Kaapsehoop mountain range with an isolated colony occurring further north. The population in the Kaapsehoop area initially numbered 1700 plants but severe poaching has resulted in less than five plants remaining. The subpopulations in Blyderivierspoort Nature Reserve in Mpumalanga as well as the subpopulations in KZN and the Eastern Cape are all extinct due to poaching. *Encephalartos laevifolius* is currently listed as CR under the Red List criteria A2acde (IUCN version 3.1). The Kaapsehoop subpopulation of *E. laevifolius* is represented in viable *ex situ* collections in NBGs, while three plants from the Blyderivierspoort Nature Reserve were recovered from poachers and planted at a secure site.

Objective 1
To identify an additional three secure sites within the species' historic distribution range where *E. laevifolius* can be reintroduced in Mpumalanga.
Action 1: Identify three secure sites within the historic distribution range of *E. laevifolius* for species recovery
Champions/ Responsibility: MTPA.
Resources/Funding: MTPA annual *Encephalartos* species budget of R147 912.00 (not for procurement of land).
Timeline: Within one year of the publication of this BMP.
Deliverable: Map indicating three suitable sites for species recovery.

Objective 2
To establish a viable gene bank for *E. laevifolius* in a secure locality using the Blyderivierspoort Nature Reserve plants recovered from poachers.
Action 1: Establish a viable genebank for *E. laevifolius* with seed sourced from the recovered Blyderivierspoort Nature Reserve plants.
Champions/ Responsibility: MTPA in collaboration with LEDET.
Resources/Funding: MTPA annual *Encephalartos* species budget of R147 912.00 / LEDET.
Timeline: Within five years of publication of this BMP.
Deliverable: Viable genebank for *E. laevifolius* at a secure location.

Recovery Targets
The recovery targets for *E. laevifolius* are based on recovery actions already underway. The availability of resources and seed for recovery actions were taken into consideration. Due to expanding human settlements, habitat destruction and free access to the area, the locality at Kaapsehoop where the five remaining adult plants grow is not considered suitable for species recovery. There is a viable *ex situ* collection of *E. laevifolius* within the NBGs which can be used to supply seed for species recovery for the subpopulation occurring in the Kaapsehoop Mountain Range.

Recovery Objective 1
To undertake species recovery for *E. laevifolius* within the three identified localities.
Action 1: Plant 2000 *E. laevifolius* seed within the three identified localities.
Champions/ Responsibility: MTPA.
Resources/Funding: MTPA annual *Encephalartos* species budget of R147 912.00.
Timeline: Within five years of publication of this BMP.
Deliverable: A report documenting the progress and success of species recovery for *E. laevifolius* in three localities when implementing the actions above, full consideration must be given to the principles and operational guidelines outlined in 3.1 of this document.

12.6.4 Encephalartos middelburgensis

Background
Encephalartos middelburgensis has a fragmented distribution and is confined to the Witbank, Middelburg and Bronkhorstspruit areas of Mpumalanga and Gauteng. It is estimated that the total population currently consists of less than 350 plants, most of these confined to a single Nature Reserve in Mpumalanga. Total population decline is currently estimated at approximately 60% with the threat of poaching still present. *Encephalartos middelburgensis* is currently listed as CR under the Red List criteria A2acd+4acd; C1 (IUCN version 3.1). Outside of the Nature Reserve, the high amount of poaching has resulted in a severely

fragmented population with many of the individuals now occurring in isolation. Mpumalanga Tourism and Parks Agency (MTPA) is currently involved with numerous restoration projects for this *Encephalartos* species, both inside and outside of protected areas. A small number of plants occur within a private Nature Reserve in Gauteng and an *Encephalartos* Species Management Plan has been submitted by the landowner to the GDARD. In this *Encephalartos* Species Management Plan, it is proposed that the population be artificially pollinated and seed and/ or seedlings used for restoration on the same property. Future goals of this management plan are to expand the project to neighbouring properties. *Encephalartos middelburgensis* is currently represented in one viable *ex situ* collection within the NBGs.

Objective 1
To investigate the ecology and restoration of *E. middelburgensis*, including restoration success with seed compared to seedlings.
Action 1: Register and undertake a research project on the ecology and restoration of *E. middelburgensis.*
Champions/ Responsibility: MTPA and the Tshwane University of Technology.
Resources/Funding: MTPA annual *Encephalartos* species budget of R147 912.00.
Timeline: Within five years of publication of this BMP.
Deliverable: Research report on the ecology and restoration of *E. middelburgensis.*

Recovery Targets
The recovery targets for *E. middelburgensis* are based on recovery actions already underway. The availability of resources and seed for recovery actions were also considered.

Recovery Objective 1
To augment *E. middelburgensis* subpopulations in Mpumalanga with an additional 140 seed or seedlings.
Action 1: Plant an additional 140 *E. middelburgensis* seed/ seedlings in secure wild locations, sourcing seed from:
a) Wild populations or
b) The NBG genebank.
Champions/ Responsibility: MTPA.
Resources/Funding: MTPA annual *Encephalartos* species budget of R147 912.00.
Timeline: Within five years of publication of this BMP.
Deliverable: Report documenting the germination / establishment success of at least 140 *E.middelburgensis* seed or seedlings planted in secure wild locations.

Recovery Objective 2
To augment the *E. middelburgensis* subpopulation growing in a private Nature Reserve in Gauteng with at least 400 seed or seedlings.
Action 1: Carry out artificial pollination and subpopulation recovery as per the *Encephalartos* Species Management Plan submitted to GDARD for plants on a private Nature Reserve in Gauteng
Champions/ Responsibility: Philip Rousseau.
Resources/Funding: Philip Rousseau.
Timeline: Within five years of publication of this BMP.
Deliverable Report documenting the germination / establishment success of at least 400 *E. middelburgensis* seed or seedlings planted on a
private Nature Reserve in Gauteng. When implementing the actions above, full consideration must be given to the principles and operational guidelines outlined in 3.1 of this document.

13 INTERNATIONAL AFFILIATION

International collaboration commenced some years ago with the university of Berkeley in California, USA. The US research team visited the CBI regularly, collecting samples from the CBI mother stock for DNA testing and profiling. The program followed the leading professor to Montgomery Botanical Centre at Miami, USA. The CBI was invited and applied for affiliation to the Montgomery Botanical Institute's international initiative, the Botanical Garden Conservation International. The CBI affiliates with the Global Cycad Consortium for Cycads. The affiliation offered access to the large DNA database for Encephalartos species, which has relocated to Montgomery Botanical Institute. The CBI hope to soon list as the world's steward for Encephalartos species for research and conservation.

Botanic Gardens Conservation International (BGCI) represent botanic gardens in more than 100 countries around the world. It is an independent UK charity established in 1987 to link the botanic gardens of the world in a global network for plant conservation. The BGCI's goal is to network botanical organisations to play a critical role in preventing plant species extinctions and create a more sustainable planet for everyone.

The BGCI network of botanic gardens includes globally significant living plant collections, covering approximately a third of known plant diversity; world class seed banks, glass houses and tissue culture infrastructures, and; technical knowledge networks covering all aspects of plant conservation policy, practice and education. BGCI is in a prime position to promote an efficient, cost-effective, and rational approach to plant conservation in botanic gardens.

The BGCI believes that through leadership, influence, and empowerment of their members and partners, plant diversity can be better conserved, people can be encouraged to live in an environmentally sustainable way, and benefits can be provided to indigenous people as well as the ecology of the planet. Specifically, BGCI's network of specialists will be mobilised to carry out plant conservation prioritisation, planning, action, and monitoring, thereby preventing plant species extinctions and promoting sustainability. The BGCI shall mobilise botanic gardens and engage partners in securing plant diversity for the wellbeing of people and the planet. The BGCI research and conservation programme is founded by the following principles:

1. Establish the Global Biodiversity Standard, the world's only international certification that recognises and promotes the protection, restoration, and enhancement of biodiversity.

2. Establish Global Conservation Consortia to lead and coordinate integrated conservation action for 10 priority taxonomic groups.

3. Support the Ecological Restoration Alliance of Botanic Gardens in providing data, plant material, expertise and mentorship to restoration programmes.

4. Quantify, co-ordinate and promote the role of botanic gardens in conserving socio-economically important species, reducing the threat of overexploitation to plants, and

sustainable management of plants for improved livelihoods in support of the Sustainable Development Goals.

5. Ensure that threatened plants are better protected in genetically diverse and duplicated seed bank and living plant collections.

6. Deploy the International Plant Sentinel Network to help ensure that the threat to plants from pests and diseases is reduced.

7. Ensure that all of BGCI's plant conservation programmes adhere to best practice, and impact can be monitored.

The Global Conservation Consortia mission (see point 2 above), is to accelerate effective conservation of global plant diversity.

Botanic Gardens Conservation International is coordinating a suite of Global Conservation Consortia, which catalyse groups of institutions and experts to collaboratively develop and implement comprehensive strategies to prevent extinction of priority threatened plant groups. Primary objectives include coordinated in situ and ex situ conservation efforts and dissemination of species recovery knowledge.

BGCI collectively coordinates the Global Conservation Consortia through network development and support of consortia leadership, promotion of scientifically informed best practices, facilitation of communication and data sharing, as well as provision of conservation prioritization support. BGCI also provides institutional recognition for consortia collaborators, advocates globally for consortia, and mobilizes conservation action through collaborative fundraising and provision of grant opportunities.

No one garden can conserve all the world's threatened cycad species, so a coordinated, global effort is needed. Led by the Montgomery Botanical Centre in collaboration with BGCI and dozens of other partners, the Global Conservation Consortium for Cycads was launched to prevent extinctions and ensure healthy cycad species and populations for the future.

The goal of the Global Conservation Consortium for Cycads is to mobilise a coordinated network of institutions and experts who work collaboratively to develop and implement a comprehensive conservation strategy to prevent the extinction of the world's cycad species. It brings together the world's cycad experts, conservationists, and the botanic garden community to ensure that no wild species of cycad becomes extinct.

Consortium Lead Institutions guide and catalyse efforts across regions within a single Consortium. Lead Institutions are responsible for Consortium coordination, communication, and reporting at the global scale. Steering Committee Members coordinate and support Consortium efforts within regional centres of diversity.

Consortium Affiliates make up the bulk of each Consortium and support *ex situ* and *in situ* species conservation action. Affiliates receive communications about Consortium activities, and may support, collaborate, or advise on any Consortium activities in coordination with the Consortium Steering Committee and/or Species Steward(s).

The CBI signed up as an Affiliate for the Consortium for Cycads. The CBI wishes to assume the role as Species Steward for Encephalartos and possibly become a Steering Committee Member. The CBI may even become a Lead Institution in its Consortium. Affiliates commit to the Statement of Intent, receive communications about consortium activities, and may support, collaborate, or advise on any Consortium activities in coordination with the Consortium Steering Committee and/or Species Steward(s), including but not limited to:

- Scouting or collecting trips;
- Population monitoring;
- Research;
- Taxonomic work;
- IUCN Red List assessment compilation or review;
- *Ex situ* conservation projects (e.g. metacollection management and development);
- *In situ* conservation projects (e.g. reintroduction, habitat management, invasive species removal);
- Fundraising, advocacy, and outreach.

14 CONCLUSIONS

This document serves as a compact introduction to the **Cycad Biodiversity Institute** in South Africa. The purpose of the CBI is to collect, keep, care, protect, educate and research for a large diverse reprehensive collection of Cycad plants of interest for current and future generations, at a place which is easily accessible for local and international visitors such as collectors, enthusiasts, and researchers.

The key objective is to provide for a one-stop networking station where plant enthusiasts can gather, meet, network, participate and learn about these amazing plants, without the need to disturb their natural habitat. It is imperative for research and comparison, to ensure that the CBI is located where the growing conditions such as climate, altitude and rainfall closely matches that of the natural habitat of the plants.

The CBI intend to involve key organizations and provide for offices at the CBI where their interests and capabilities can be exploited and enhanced for the benefit of the CBI and the organization’s missions. Such organizations include Nature Conservation, South African National Biodiversity Institute (SANBI), the Cycad Society of South Africa (CSSA), the Council for Scientific and Industrial Research (CSIR), and various universities. All of these institutions are in close range of the CBI. The university of Berkeley in California, USA, already conducts research using samples from the CBI mother stock, for DNA profiling on an

ongoing basis. The program followed the leading professor to Montgomery Botanical Centre at Miami, USA. The CBI was invited and applied for affiliation to the Montgomery Botanical Institute's international initiative, the Botanical Garden Conservation International. The CBI affiliates with the Global Cycad Consortium, and the CBI hope to list as the world's custodian for Encephalartos. The plan is to also involve researchers from the University of Pretoria and Wits University in Johannesburg. The CBI may consequently serve as a convienient satellite campus for large local and international research institutions.

Currently, the CBI has secured basic infrastructure on a 3 hectare small holding next to the Rietvlei Nature reserve. The property has a pristine and unlimited water supply from the Rietvlei dam, and its own solar electrical supply, rendering it reasonably self-sufficient. Established facilities include visitor overnight residence, a laboratory, library, art gallery, archive, cycad treatment area, germination tunnel and a nursery with a tea garden. The CBI has established a large collection of mother stock plants for research which has been collected over more than three decades. The CBI plans to soon expand the facilities to include a Training Centre where courses, lectures, demonstrations, and tours can be facilitated. The Douglas Goode Art Gallery will open soon with many original cycad art pieces and copies for sale. The CBI also plans to establish an on-site Herbarium as part of the Information Centre.

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