Journal of the Cycad Society of South Africa

ENCEPHALARTOS

Tydskrif van die Broodboom Vereniging van Suid-Afrika

No. 107 March 2012 ISSN 1012-9987

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BROODBOOM VERENIGING VAN SUID-AFRIKA

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On the cover:

Cycad debaoensis in habitat. Photo by Willie Tang.

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VAN DIE PRESIDENT / FROM THE PRESIDENT

The year 2012 is already in full swing and the Society faces a number of challenges. Amongst them are:

1. The composition of the Board for the next term of two years.

2. The way forward with the proposed new constitution.

3. The payment of certain services such as the hosting and maintenance of our website; the editing and distribution of ENCEPHALARTOS etc.

4. The ban on the export of our indigenous cycads.

In order to address these issues and other matters, I have scheduled a Board meeting for Saturday, 17th March in Pretoria.

All the Regional Branches' new committees for the next term of office have been elected. Good luck to all and I believe that you will accept your responsibilities with dilligence and sincerity. Most Regional Branches have compiled their annual programs; some were published in the previous edition of ENCEPHALARTOS and hopefully the rest will appear in this issue. I encourage all members to take part in their Region's activities.

In the December issue of ENCEPHALARTOS I encouraged local members to consider signing up for the Debit Order facility which the Society has put in place at considerable cost and effort. However, I was somewhat disappointed to learn that less than 20 members have signed up. Hopefully some of the more than 230 members who, at the time of writing this article, have not yet renewed their 2012 membership, will follow the Debit Order route.

The winner of the book prize for 2011 is Roy Osborne. Not only does he provide an article for each issue of our journal, but they are of very high quality and I find them most interesting. Congratulations Roy and please continue with your good work. Roy's prize, a limited edition of "The Bushman Candles" written by Charles Craib and John Lavarnos was donated by Wynand van Eeden. It contains numerous photographs as well as watercolour and pencil drawings by wellknown artists. The book prize for 2012 will be "Cycads with specific reference to the Southern African Species", or the Afrikaans version, by Prof Nat Grobbelaar.

I must once again appeal to our members to please support the Society by providing the Editor with articles for publication. I know that there is a lot of 'knowledge' out there and am sure that many of you have interesting stories about your cycads to share with the rest of us.

Lastly, please enjoy your cycads during 2012. While most of the plants have already flushed their leaves, there are still cones to be pollenated and seeds to be harvested. Share your knowledge of cycads with others and please consider donating a seedling to someone!

Dirk van der Walt

Die jaar 2012 is alreeds in volle gang met vele uitdagings wat ons in die gesig staar. Vir die Vereniging is daar:

1. Die samestelling van die raad vir die volgende ampstermyn van twee jaar.

2. Die pad vorentoe met die voorgestelde nuwe grondwet.

3. Die betaling vir sekere dienste soos bv. die instandhouding van die webblad, die redigering en verspreiding van die ENCEPHALARTOS joernaal ens.

4. Die verbod op die uitvoer van ons inheemse broodbome.

Ek het 'n Raadsvergadering geskeduleer vir Saterdag 17 Maart 2012 wat sal plaasvind in Pretoria om bogenoemde te bespreek en aksies te aktiveer.

Al die Streekstakke se nuwe kommitees vir die volgende ampstermyn is verkies, baie geluk aan elkeen wat verkies is, ek glo en vertrou dat julle die verantwoordelikheid wat daarmee gepaard gaan met ywer sal nakom. Die meeste streekstakke se jaar programme is saamgestel, van dit is alreeds in die vorige uitgawe gepubliseer en die res is in hierdie uitgawe geplaas, ek moedig al ons lede aan om te begin om aktief deel te neem aan die aktiwiteite.

Ek het in die vorige uitgawe lede aangemoedig om van die Debiet order fasiliteit wat met baie moeite beskikbaar gestel is te gebruik om julle jaarlikse lidmaatskap fooie te betaal, met skok en teleurstelling het ek verneem dat minder as 20 lede daarvan gebruik wil maak. Dit is egter nog nie te laat om daarvoor aansoek te doen nie. Hopenlik sal van die meer as 230 lede wie nog nie hul 2012 ledegelde betaal nie, hierdie roete volg.

Die wenner van die boekprys, "The Bushman Candles" van Charles Craib en John Lavranos wat geskenk is deur Wynand van Eeden vir die beste artikel of bydrae vir ENCEPHALARTOS 2011, gaan aan Roy Osborne. Behalwe dat hy 'n artikel in elke uitgawe gehad het, is die artikels van hoogstaande gehalte en baie interesant. Baie geluk Roy, gaan voort met die goeie werk. Die boekprys vir 2012 is "Broodbome met spesiale verwysing na die Suider Afrikaanse Soorte" van Prof. Nat Grobbelaar.

Ek wil weereens 'n beroep doen op ons lede, ondersteun ons asseblief met artikels vir ENCEPHALARTOS, ek weet daar is baie kennis en interesanthede daar buite, al wat u moet doen is om dit aan Wynand van Eeden, die redakteur, te stuur sodat hy dit kan publiseer.

Ten laaste, geniet julle broodbome in 2012, alhoewel die plante alreeds klaar blare gestoot het is daar nog die bestuiwing van keëls wat moet gebeur, die oes van die saad asook die ontkieming van die vorige seisoen se saad. Deel die vreugde en kennis daarvan met ander en skenk gerus vir iemand 'n saailing.

Dirk van der Walt

BROODBOOM NUUS VANUIT DIE LAEVELD STREEK

Encephalartos dolomiticus en die sogenaamde *Encephalartos ?dolomiticus* [outeur noem dit 'n sogenaamde "dolomitica". Red.]

Met ons onlangse vergadering het een van die lede verskeie blaarvorms gebring sodat dit deur die lede ondersoek kan word, en is daar dan ook n paar vrae gevra.

Figuur 1.—*Encephalartos ?dolomiticus* en *E. dolomiticus*.

Figuur 2.— Manlike keël van *Encephalartos ?dolomiticus*.

Meeste mense ken die eienskappe van *E. dolomiticus*, naamlik:

1. Die bekende piesang vorm van die pinnas.
2. Die blou groen kleur van die plant.
3. Die onnet voorkoms van die plant as gevolg van die gedraaide ragis.

Maar wat van *Encephalartos ?dolomiticus*?

Die meeste kenmerke is dieselfde as *E. dolomiticus*, maar daar is tog 'n verskil.

Sien die verksillende blare op Figuur 1, *Encephalartos ?dolomiticus* en *E. dolomiticus*.

Kenners meen *Encephalartos ?dolomiticus* is aan *E. nubimontanus* verwant.

Figuur 2 is van 'n manlike keël van *Encephalartos ?dolomiticus*. Is dit *E. dolomiticus* of *E. nubimontanus*? (Die foto is baie blou, ek het ongelukkig nie die foto self geneem nie.)

Min of meer dieselfde geld met *Encephalartos spesie* (Levubu), as daar so iets is, en *E. dyerianus*. Is die Luvubu plant 'n beskryfde plant en 'n nuwe spesie of is dit net 'n ander vorm van *E. dyerianus*? Figuur 3 wys die verskille tussen *Encephalartos spesie* (Levubu) en *E. dyerianus*.

Ek sal baie bly wees as van ons lesers kommentaar kan lewer in die verband.

Ina Vermaak

Figuur 3.— *Encephalartos spesie* (Levubu) en *E. dyerianus*.

LOWVELD BRANCH YEAR PLAN 2012

LOWVELD BRANCH - S.A. CYCAD SOCIETY
♦
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Dalene Ludick
Sel: 082 327 9215

JAAR BEPLANNER - 2012 **18-Jan-2012**

Datum	Aktiwiteit	Koördineerder	Plek
5 Feb 2012	1st Kwartaallikse vergaderging	Edward Berry / Jan Joubert	Edward Berry
20 Mei 2012	2de Kwartaallikse vergadering	Jan Joubert	Roelie van Rooyen
22 Jul 2012	Umbeluziensis & Lebomboensis Uitstappie	Edward Berry / Jan Joubert	Swaziland
19 Aug 2012	3de Kwartaallikse vergadering	Jan Joubert	Malelane
31 Aug 2012 & 1 & 2 Sep 2012	Laeveld Broodboom verkope	Fanie Vermaak	Hall's Gate Way
14 Okt 2012	Laevifolius & Humilis Uitstappie	Hugo Schreuder	Kaapsehoop & Sudwala
11 Nov 2012	4de Kwartaallikse vergadering & Afsluiting	Fanie Vermaak	Nelspruit

NEWS FROM KWAZULU-NATAL REGIONAL BRANCH OF THE CYCAD SOCIETY OF SOUTH AFRICA.

A new committee was chosen and the following people will be responsible for the KZN regional branch activities the next two years:

Chairman:	Hein Hoft, 0824068756 hein.hoft@bcx.co.za
Treasurer:	Danie Nel 0829254540 cycadcenter@mweb.co.za
Secretary:	Avis Nel 0829246969 cycadcenter@mweb.co.za
Co-opted member:	Geoff Isack isacksg@telkomsa.net
Co-opted member:	Graham Isack misacks@telkomsa.net

Program - 2012

The KZN regional branch of the Cycad Society had a very good meeting on the 15th April 2012. This was held at the Cato Ridge Electical premises and it is one of the best gardens in KZN. The plants are stunning.

Over 100 people attended this meeting and listened to MARK CROOKES telling them that contrary to popular belief the Cycad Society has been working behind the scenes, negotiating with the government on the future of cycads and the TOPS regulations. Many questions were fielded by Mark and I must say that he has instilled much interest again, a lot of people went away wanting to get on with their plants again.

A raffle was held and donations were from all members who brought a plant along and it was amazing the amount of plants that turned up. There were well over 100 plants. Thank you to all our KZN branch members as well as to the following people who made donations - Prof Nat Grobler, Ernie Bouwer, Susan Myburgh, University of Pretoria and Attie Stander. These donations certainly put us in the black again as there were no funds available to do anything for the members.

A full selection of memorabillia, books posters etc were available thanks to Danie Nel, who really put up a good show for the members. A lot of people were not aware that there is such a collection of books on cycads.

After the meeting a braai was available for people to participate in and the meeting lingered on till 5pm. Everyone meeting folk they hadn't seen in years and also networkiung for the future. There was cake, tea, coffee and other beverages available and this was enjoyed by all present.

The next meeting is on 17th June 2012 at Cato Ridge Electrical, then 3rd September we are going to visit the habitat of one or more plants. Information will be available by email to whomever is interested. This is a

wonderful opportunity for other areas to join us. Accommodation will be arranged and perhaps Gauteng, Mpumalanga and Eastern Cape members can make a break and visit us. This is an invitation to join the KZN regional branch for this visit.

The last meeting for the year will be 3 November 2012, which will be our year end meeting and once again it will be held at Cato Ridge Electrical.

Avis Nel.

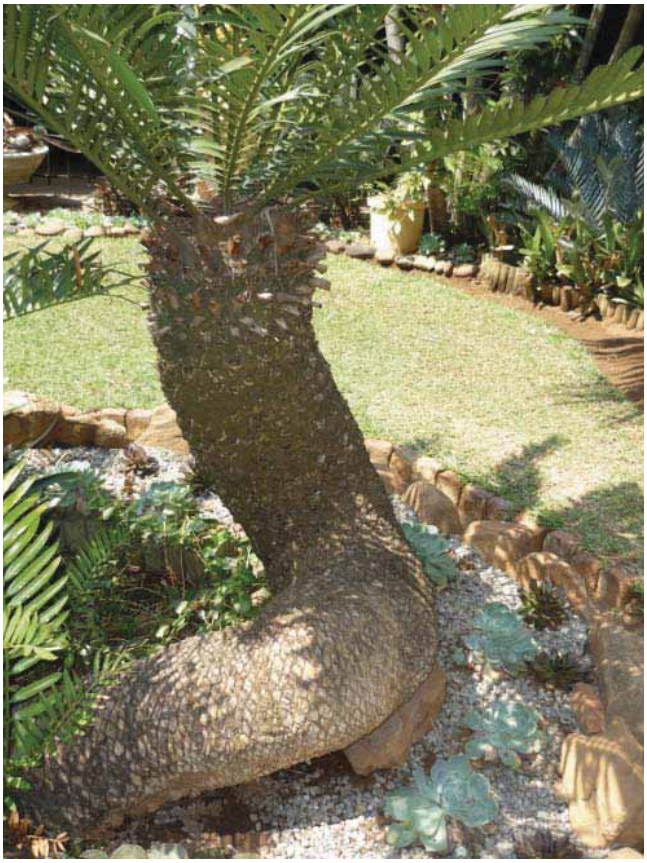
GAUTENG TAK BESOEK MOOINOOI

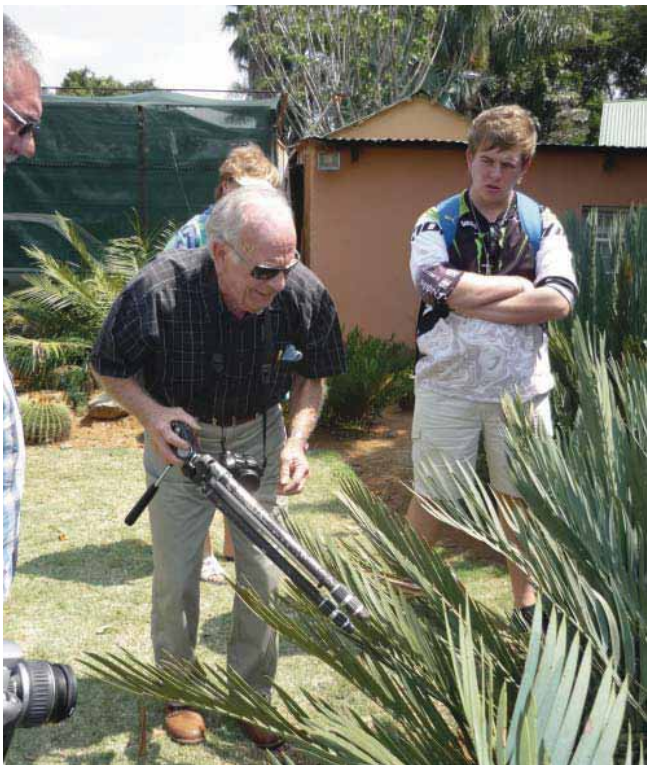
Met 'n paar rand in die sak,
sluit die finansiële jaar vir die Gauteng se tak.

Die Oos Kaapse toer,
lê opwindend en loer.

Maar eers kuier ons op Mooinooi,
by 'n Palala in 3 keëls getooi.

Oom Roelof maan dat ons nie moet begeer,
maar eerder by mekaar iets leer en net met jouself kompeteer.





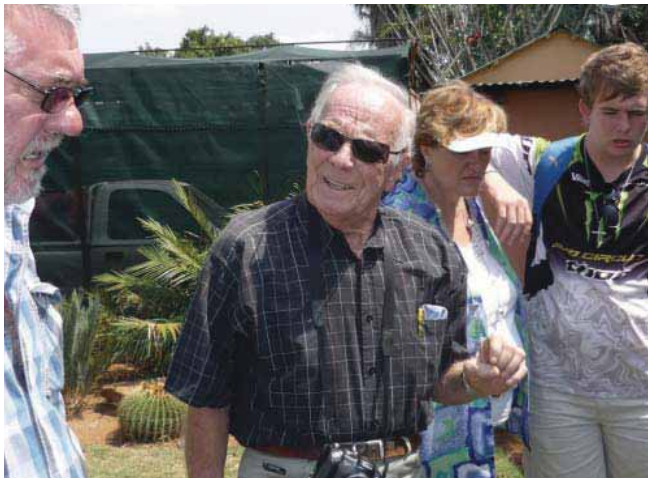
Oom Pine wil net leer,
hoe om ‘n spesie te registreer.
Hy soek ‘n taksonoom
vir Roelof se Venda Dollieboom.

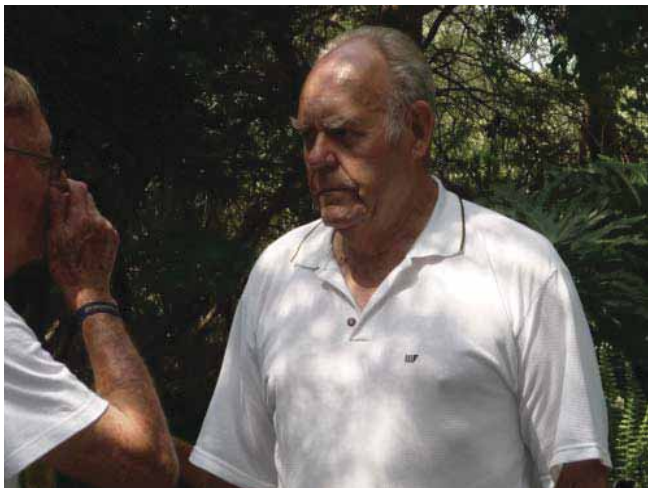
Diep in die bos, is die debatte eers gelos
en kuiers ons by Dr Deon, om ‘n bordjie kos.

Dis ‘n voorreg om ‘n liefde te deel,
al wil die regulasies ons regte steel.

Want agter al die regulasie smart,
lê in elke plantliefhebber se hart,

die volgende bos blare wat stoot,
want die lewe en die genade is nog groot!

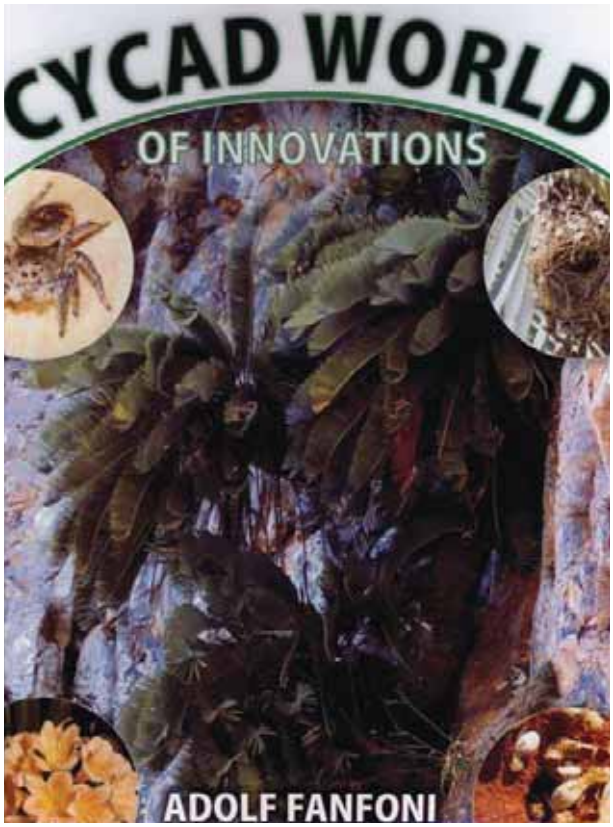




BOOK PRIZE FOR 2012

Our next book prize will be a copy of Cycad World of Innovation by Adolf Fanfoni. He kindly donated a copy. For more information on this publication please contact him at P.O. Box 58804, Karen Park, 0118 or telephone 082 568 9498 or look up his website www.cycadwofi.com.

Wynand van Eeden



FUTURE CONFERENCES ON CYCAD BIOLOGY

Before CYCAD 2011 our Board asked me to extend an invitation to the CYCAD 2011 attendees for the next conference, in 2014, to be held in South Africa.

On discussing our plans for the next conference, should our invitation be accepted, it became clear that we haven't really planned anything, so that it would be very difficult to answer any questions about our proposal. For this reason it was decided that our invitation won't be for the next conference, but for the one after that. However, in case no-one else offered to host the next conference, we would be prepared to do so.

Once at the conference, it transpired indeed that no-one else was interested in hosting the next conference. Because continuity is of the utmost importance, I prepared to offer our hospitality for the next conference.

Shortly before the slot allotted to the next conference, someone asked Cristina Lopez-Gallega from Columbia whether she would be prepared to organise the next conference, and she said "yes". Enthusiasm spread like a wildfire, because Colombia is not an easy place to visit and see plants in the field due to the drug wars. When it came to vote for the next conference, the outcome was 24 votes for Colombia and 21 for South Africa.

The reason why attendees voted for Colombia rather than South Africa probably is that Colombia is so difficult to visit on one's own, and its cycads are so poorly known to most of us, compared to South Africa.

Be as it may, the conference after that, in the winter of 2018 will be in South Africa, and we will soon start planning for that.

Piet Vorster

NUUS UIT DIE WES-KAAP

'n Nuwe kommittee is verkies op 25 Februarie 2012 vir die volgende termyn van twee jaar. Die volgende persone is verkies:

Voorsitter:	Johan Kotze
Ondervoorsitter:	Andy Naude
Sekretaris:	Michael Koopman
Tesourier:	Frikkie Conradie

Jaarbeplanning van die Wes-Kaap Streekstak

Mei	Verkope by Kirstenbosch Plantverkoping
Junie	Datum en onderwerp sal aangekondig word.
Julie	Informele spreker by Charl Gouws, datum sal per e-pos aangekondig word.
18 Augustus	Houtbaai Tuinbesoek
17 September	Vergadering en besoek aan Kirstenbosch
13 Oktober	Strand - Tuinbesoek by Leslie Hobson.
November	Algemene jaar vergadering en jaareindfunksie by Johan Kotze.

Vir enige navrae of inligting rondom ons aktiwiteite, kontak my gerus per e-pos.

Johan Kotze

NEW MEMBERS

The Society welcomes the undermentioned new members who joined between November, 2011 and March, 2012

3900 W	IMPSON, Mr N D	HELDERVIEW, 7130
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3903 M	VORSTER, Mnr P	Posbus 295, KOMATIPOORT, 1340
3904 M	BOSHOFF, Mnr B J	Posbus 1560, PIET RETIEF, 2380
3905 G	KORKIE, Mr C G	P O Box 3018, SYMRIDGE, 1420
3906 N	LOTTERING, Mnr M	Posbus 479, BRITS, 0250
3907 W	PETZER, Mnr D J	Posbus 10289, DANABAAI, 6510
3908 M	TOPHAM, Mr L L	P O Box 6332, LYDENBURG, 1120
3909 M	SMIT, Mnr J K R	Posbus 22, HENDRINA, 1095
3910 N	SCHROLL, Mr T H	STILFONTEIN, 2550
3911 G	HOWELL, Mr S M	P O Box 313, BOB ACCORD, 0009
3912 G	LEE, Mr J	Postnet Suite 231, P/Bag x4, MENLO PARK, 0102
3913 G	SNYMAN, Mev J C	Posbus 18120, SUNWARD PARK, 1470

ZAMIA FURFURACEA L.F.

Roy Osborne[1] & Andrew P. Vovides[2]

Introduction

For more than 30 years *Zamia furfuracea*, the "cardboard plant" (sometimes "cardboard palm"), has deservedly been one of the most popular cycads used in horticulture, second only to the ubiquitous *Cycas revoluta* from Japan (Osborne 1986). And because the zamia is relatively unaffected by the Cycad Aulacaspis Scale (CAS) which is presently causing such damage to wild and cultivated *Cycas* plants globally (Haynes 2005), it is possible that *Z. furfuracea* may yet become the dominant cycad in the industry.

Zamia furfuracea was the first Mexican cycad to be cultivated in Europe and the first Mexican cycad to be named, being described by Carl Linnaeus (the son) in the journal Hortus Kewensis in 1789. The specific epithet is derived from the Latin *furfuraceus*, referring to the persistent yellowish-brown pubescence on the foliage of this species. This article is adapted from the authors' earlier review of the species (Osborne & Vovides 2007).

The trivial name "cardboard palm" was first used in the 1960s by nurseryman Luciano Guerra of Mission, Texas, who had a supplying nursery near Tamazunchale, San Luis Potosí, Mexico. Guerra grew large numbers of cycads from seed and also imported considerable numbers of wild-collected Mexican cycads. Garrie Landry (pers. comm.) recalls seeing "absolutely gigantic multistemmed" mature *Zamia furfuracea* plants for sale for about US$7.50 each in Houston, Texas flea markets in the early 1970s, the plants being labelled as "cardboard palms".

Discovery

Full details of the discovery of *Zamia furfuracea* are unknown, but it appears that British plant collector William Houston (sometimes Houstoun) had gathered seeds of this species from plants "near the seaport of Veracruz" in Mexico. These were subsequently cultivated at the Chelsea Physic Garden in London. A specimen was displayed at the Royal Garden at Hampton Court in 1691 (Sims 1818).

As with many very early cycad descriptions, there are several synonyms that may refer to this taxon. Schuster (1932) lists *Zamia crassifolia*, *Z. fusca* var. *latifolia* and *Z. furfuracea* var. *obovata*, but each of these was unaccompanied by any formal description. The Berlin herbarium specimens, if they were ever prepared, were destroyed during WW II. Furthermore, a specimen described in 1868 by Alphonse de Candolle as *Z. furfura-*

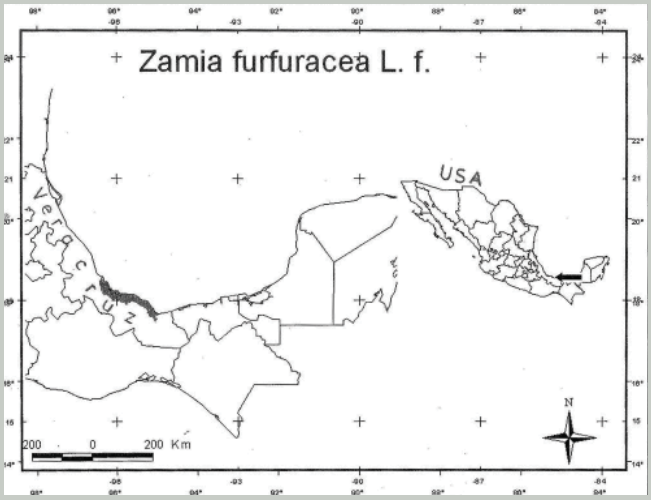

Figure 1.—The distribution of *Zamia furfuracea* in coastal Veracruz, Mexico. Populations in some of the areas marked on this map have become sparse or have been eliminated.

Figure 2.—Christopher Trew's 1752 illustration of what A. de Candolle described in 1868 as *Zamia furfuracea* var. *trewii*, now regarded as a synonym for *Z. furfuracea*. Image kindly provided by Dennis Stevenson.

[1]19 Calhoun Street, McDowall, Queensland 4053, Australia
[2]Instituto de Ecología A.C., Xapala, Veracruz, Mexico

Figure 3.—The plate in Paul Hermann's 1698 text which Stevenson & Sabato have nominated the lectotype for *Zamia furfuracea.* Image kindly provided by Dennis Stevenson.

Figure 4.—Close-up detail of the "furfuraceous" tomentum, for which the species is named, on the surface of a young leaflet. Scale bar = 1 mm. Image by Andrew Vovides.

cea var. *trewii* was based on an illustration at the Geneva Herbarium under the name *Palmifolia fructu clavato polypireno* (*polyspermo*). This illustration had been made by physician and amateur botanist Christopher Trew in 1752 from a specimen in the British Museum that had been prepared in 1694 from a plant at Hampton Court—which we believe probably originated from Houston's seed collections.

In their typification of names for the genus *Zamia*, Stevenson & Sabato (1986) nominated the illustration (plate 210) in Paul Hermann's Paradisus Batavus (1698), under the title *Palma americana crassis rigidisque foliis*, as the lectotype for *Z. furfuracea*.

Figure 5.—Dr Piet Vorster photographing *Z. furfuracea* just south of Alvarado, Veracruz. Note the *Opuntia* in the foreground. Photo: Lou Randall.

Distribution, habitat and ecology

Zamia furfuracea is distributed along a narrow coastal belt in southern Veracruz, extending from south of Alvarado to south of Playa de Montepio of the Sierra de Los Tuxtlas, a distance of about 150 km. It grows at altitudes from sea level to 50 m, mainly on stabilised sand dunes but sometimes on basalt cliffs. Soils are sandy, basaltic or calcareous with sparse organic matter and plants are often exposed to salt spray. Temperatures range from 20–30°C in summer and 10–20°C in winter. Rainfall in the area averages in excess of 2000 mm annually, falling mostly in summer, but periods of drought are not uncommon.

The primary vegetation is low coastal scrub (*vegetación costera*) on stabilised sand dunes, and this is where most *Zamia furfuracea* plants were originally found, at times forming large colonies. The vegetation comprises diverse tropical trees and shrubs such as *Acacia cornigera*, *Bursera simaruba*, *Coccoloba barbadensis*, *Eugenia capuli*, *Chiococca alba*, *Karwinskia humboldtiana*, *Psychotria erythrocarpa*, *Celtis iguanaea*, *Randia aculeata* and *R. laetevirens*—the two *Randia* species being very thorny and the second species often closely associated with cycads. The coyol palm, *Acrocomia mexicana*, is also common in the coastal scrub.

Much of the land is now used for cattle farming and urban developments and the habitat has become highly disturbed or destroyed. Even the assignment of right-of-way for an oil pipeline has impacted on the habitat. Vegetation on the dune slacks, especially along the borders with pastureland, is secondary and many of the cycads that were previously understorey to coastal scrub are now in fully exposed sites in palm savannas, where common components include the fan palm *Sabal mexicana*, the prickly pear *Opuntia stricta* var. *dillenii* (= *O. dillenii*) and the terrestrial bromeliad, *Bromelia pinguin*.

Zamia furfuracea varies somewhat in its morphology with locality and several ecotypes can be recognized. The population near Alvarado, has longer and narrower leaflets than the coastal forms to the southeast, and may represent a some genetic mixing with *Z. loddigesii* (Vovides et al. 1983) that is widespread throughout the gulf plains of eastern Mexico. At the CYCAD 99 conference in Miami, Bart Schutzman presented a proposal to name the coastal ecotype of *Z. furfuracea* separately as *Z. mar-*

Figure 6.—*Zamia furfuracea* on the margin between coastal scrub and grassland just south of Alvarado, Veracruz. Photo: Piet Vorster

Figure 7.—Leaf of *Zamia furfuracea* showing the characteristic leaflet shape and colour, and angle of insertion onto the rachis. Photo: Roy Osborne

itima; but this has never been formally published. Schutzman (2004) also believes that it is this coastal ecotype that corresponds best to the Stevenson & Sabato (1986) lectotypification. Further molecular work and population genetics studies on these populations will be necessary to resolve these matters.

Pollen and ovulate cones typically emerge in the wild population in June; the ovulate cones are pollen receptive through July, and cones shed their mature seeds around November each year. Vovides (1991) indicates two species of insect may be implicated in the pollination of *Zamia furfuracea*: the snout weevil, *Rholapotria mollis* (Curculionoidea: Belidae), in what has become one of the best studied examples of cycad-insect symbiotic interactions (Norstog et al. 1986, Norstog 1987, Norstog & Fawcett 1989), and a *Pharaxonotha* (Coleoptera: Erotylidae) beetle.

Dispersal agents for *Zamia furfuracea* have not been reported in Mexico although Eckenwalder (1980) believes that the Northern Mockingbird (*Mimus polyglottos*) may be implicated in seed distribution of zamias generally. This bird has been seen in Florida taking dehiscing *Z. furfuracea* seed to remote perches in trees where it consumes the fleshy seed coats and drops the cleaned seeds to the ground (Tom Broome pers. comm.) Interestingly, the red land crab (*Gecarcinus lateralis*) is known to gather *Z. furfuracea* seeds and cache them away in underground lairs in the sand dunes (Mario Vázquez Torres pers. comm.).

Larvae of the lycaenid butterfly *Eumaeus toxea* are known herbivores of *Zamia furfuracea* and appear to sequester cycad toxins from their host plant as an anti-predator tool.

Description, vegetative structures

Zamia furfuracea is a robust, medium-sized cycad with **stems** much branched, tuberous, subterranean or shortly arborescent, up to 60 cm long and 15–20 cm in diameter, becoming decumbent in unstable substrates. Older plants can form substantial and impenetrable clumps, sometimes exceeding 300 cm in diameter. Each stem bears cohorts of 3–8 **leaves** that are 45–190 cm long, 10–30 cm wide, yellowish brown pubescent at emergence, maturing to olive green or brownish green above and paler and somewhat silvery pubescent below, obliquely erect to erect in profile, the rachis curved and sometimes twisted. Mature stems can hold several cohorts of leaves giving the plant a densely-foliated appearance. The **petiole** is 17–50 cm long, 8–10 mm in diameter, flattened above and rounded below, brownish yellow in young leaves, copiously covered with stout spines up to 3 mm long, swollen and densely tomentose at the base. The **rachis** in similarly covered with stout spines and bears 8–18 pairs of leaflets in a keeled arrangement (pinna-to-pinna angle varying from about 80 to 160°). **Leaflets** are lanceolate to oblanceolate or obovate, stiffly coriaceous, obtuse or irregular at the apex, the distal third with numerous small blunt teeth. Leaflets are variable in the degree of overlapping and have slight-

Figure 8.—Each stem on this male *Zamia furfuracea* bears several cones. Photo: Piet Vorster

ly revolute margins. Apical leaflets reduce only slightly in size. **Median leaflets** are 14–20 cm long by 5–8 cm wide. **Cataphylls** are coriaceous, persistent, triangular at the base and aristate at the apex, up to 10 cm long, 3–5 cm wide basally, and yellowish brown tomentose. Narrower cataphylls are associated with leaves and broader ones subtend cones. **Eophylls** have 2–4 leaflets.

Description, reproductive structures

Zamia furfuracea bears 1–4 **pollen cones** per crown, 7–17 cm long excluding the peduncle, 1–2 cm in diameter, erect but decumbent when spent, cylindrical to ovoid-cylindrical, densely covered with short yellowish to brown hairs, with a densely pale brown tomentose peduncle 2–12 cm long by 8–11 mm in diameter. **Microsporophylls** are arranged in 8–13 rows each of 18–20 cuneiform structures, each with the apex hexagonal, truncate, 2–3 mm high by 5–7 mm wide, with a central hexagonal facet, and with sporangia abaxially in two zones separated by a sterile central band 2–5 mm wide.

Female *Zamia furfuracea* stems usually bear solitary **ovulate cones**, 10–25 cm long excluding the peduncle, 5–11 cm in diameter, densely pale brown tomentose, erect, cylindrical to barrel-shaped, with a mucronate sterile apex about 2 cm long, on a yellowish brown tomentose peduncle 8–20 cm long by 13–25 mm in diameter. **Megasporophylls** are arranged in 8–10 rows each of 14–15, peltate, the apex 9–13 mm high by 13–18 mm wide with a slightly depressed central hexagonal facet. **Seeds** are ovoid, 16–22 mm long by 10–12 mm wide, variably angled by compression, with a sarcotesta that changes from yellowish green initially, through pink to red later, to brown at the time of dehiscence, with a sclerotesta more or less three sided, 11–15 mm long, 8–10 mm in diameter, smooth and pale brown.

The diploid chromosome number for *Zamia furfuracea* is 2n = 18.

Distinguishing features

Distinguishing characters of *Zamia furfuracea* are the generally ball-shaped stems of juvenile plants, the multi-stemmed profile of mature plants, the extremely coriaceous, imbricate and furfuraceous leaflets, and the curved rachis (when grown in full sun). Its leaf and leaflet shape and texture make *Z. furfuracea* one of the most easily recognized of all cycads. The nearest species, both botanically and geographically, is *Zamia loddigesii*, but that species does not have the broad, furfuraceous and extremely coriaceous leaflets.

Ethnobotany

We have no record of any ethnic usage for *Zamia furfuracea*. Locally in Veracruz, it is sometimes called the *palma bola* (ball palm) in reference either to the spherical caudex or possibly the shape of the ovulate cone. The interpretation of *palma bola* as “drunk palm” (Bonta & Osborne 2007) appears to be incorrect. In some Spanish

Figure 9.—*Zamia furfuracea* ovulate cone 24 weeks after the time of pollination and at the cone dehiscence stage. Photo: Roy Osborne

Figure 10.—*Zamia furfuracea* used horticulturally at the Kennedy Space Centre, Florida, USA. Photo: Jonathan Kotas.

speaking countries, the landscape industry calls this cycad *palma cartón*, a literal translation of cardboard palm, and testimony to its horticultural value.

Conservation status

Once abundant in coastal Veracruz, the horticultural popularity and the relatively easy access to these plants has resulted in almost a century of systematic exploitation. For example, Vovides (1993, citing Gilbert 1984) reported that more than 130 000 cycads were exported from Mexico, mainly to the USA, under questionable permits issued over the period 1977–1982, and that most of these plants were *Zamia furfuracea*. This cycad also occurred previously on islands off the coast of Montepío and Balzapote, but these islands no longer exist after being mined to extinction for road gravel in the late 1980s and early 90s.

Fortunately, *Zamia furfuracea* grows easily and rapidly from seed. Under an initiative from the University of Veracruz, a number of nurseries in the Los Tuxtlas region have collaborated in the forming of the "Unidad de Productores de Zamia" to coordinate production and marketing of *Z. furfuracea* (Vovides et al. 2002). In a campesino family nursery established at Ciénega del Sur in 1992 (but no longer operating) plants reached maturity after only three to four years and numbers produced were sufficient to satisfy local demand. In addition, because there are now so many plants in cultivation globally, many nurseries outside Mexico now produce large numbers of plants from artificially-pollinated seed crops. As a consequence of these various initiatives, the collector demand on the remaining wild plants has become greatly reduced. However, demand for wild-collected seed continues to inhibit natural regeneration in the wild populations (Doña Felipa pers comm.)

The total number of *Zamia furfuracea* plants remaining in the wild was estimated at 10 000 (Stevenson et al. 2003). Unfortunately, none of the plant localities falls within a protected area and nearly all are potentially subject to further threats of habitat reduction. This species protected by Mexican Law NOM-059-ECOL and its conservation status has recently been upgraded from **vulnerable** to **endangered** on the IUCN Red List of Threatened Species (2011).

Cultivation

Enormously successful in horticulture, *Zamia furfuracea* is renowned for its ease and speed of growth under a wide variety of conditions, its pleasing appearance as a container specimen, landscape feature or grouped planting, and its relative freedom from pest and disease damage. In the USA nursery trade, this species has been appropriately described as "bulletproof" (Jody Haynes pers. comm.).

Hardy and adaptable, *Zamia furfuracea* grows well in sunny situations in tropical, subtropical and temperate zones. This plant's ability to grow in almost pure beach sand, and to withstand salt spray (or even immersion in sea water), makes it very useful in beachfront properties. Greg Holzman (pers. comm.) says: "Cardboard palms are in great demand in Hawaii because they are one of the few plants that thrive at the ocean's edge—which helps with beach erosion and property boundary issues. Since all beaches in Hawaii are open to the public, rich home-

Figure 11.—Commercial production of *Zamia furfuracea* (with *Dioon spinulosum* in the rear) in a nursery near Brisbane, Queensland, Australia. Photo: Stan Walkley.

owners like to have plants that can keep the public as far away as possible from their beach homes. These cycads do very well in encroachment issues. Also they would be good as a barrier from storm surges when they get big. Not many plants thrive on the beach in pure sand". *Zamia furfuracea* also has a high degree of cold tolerance; having been said to survive temperatures as low as –9°C. *Zamia furfuracea* is one of the few cycads that is relatively successfully used in bonsai (Michael Buckner pers. comm.) and the occasional odd variegated or crested leaf forms have become items of interest to specialist collectors (Dhar & Osborne 2004, Dhar 2006).

Like all cycads, this plant responds to a good quality, well-drained soil. Overcrowded foliage can sometimes lead to mealybug infestations that can be controlled by soapy water treatment or a mild commercial insecticide. Some growers cut away all leaves every second year to achieve healthy new foliage flushes. While this process reduces insect infestation, plants should be adequately fertilised to compensate for the loss of photosynthesising foliage. Australian growers should note that this cycad is prone to attack by the trunk-boring weevil, *Melotranes internatus* (Kennedy 2011).

As mentioned above, the "cardboard plant" is easily grown from seed, and artificial pollination of female cones at the time of receptivity almost always leads to viable seed production. Interestingly, the inadvertent importation of the native pollinating beetle *Rhopalotria mollis* into southern Florida, probably with one or more of the early wild-collected plant consignments, means that many grouped plantings now produce viable seed without intervention (Norstog & Fawcett 1989).

Acknowledgments

We thank Michael Buckner, Jeremy Kotas, Tom Mac McCalmon, Lou Randall, Dennis Stevenson, Stan Walkley and Piet Vorster for their assistance during the preparation of this article.

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Figure 12.—*Zamia furfuracea* can be used to effect as a bonsai subject. This splendid specimen has been carefully tended in a garden in San Diego, California, for the last 40 years. Photo: Michael Buckner.

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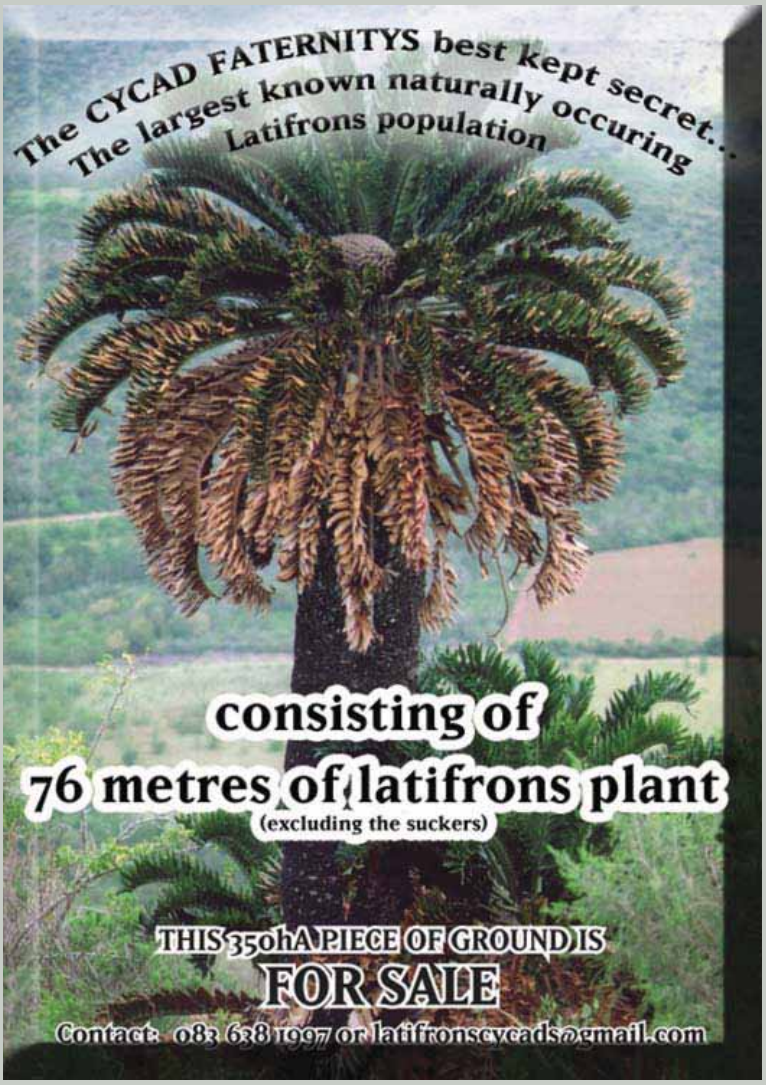

A CYCAD HUNTING EXPEDITION TO THE GUANGXI PROVINCE OF CHINA, 7 to 13 December 2011

Piet Vorster[1] and Jan-Louis Bezuidenhout[2]

Figure 1.—The picturesque karst mountains which cover much of the Guangxi Province, with sugarcane in the foreground

After the CYCAD 2011 conference (see pages 26–38 of this issue) some 20 of us went on a post-conference trip to the Guangxi Province of China to see cycads in habitat. Again the South Africans demonstrated their love for exploration and adventure, and our group included Steve Trollip, Karen & Diekie de Klerk, Stephen Cousins, John Donaldson, De Wet Bösenberg, Phakamani Xaba, Amanda Botha, Bessie van der Walt, Jan-Louis Bezuidenhout, Philip Rousseau, and myself. Ian Waters from Zimbabwe did not attend the conference, but joined us for the trip and Willie and Limei Tang joined us later to show us the *Cycas debaoensis* conservation scheme (see pages 44–49 of this issue).

The Guangxi Province lies in the south of China, due west of Hong Kong and Shenzhen, bordering on the Yellow Sea in the south. It is renowned for its spectacular Karst limestone landscapes and subtropical vegetation.

During our visit it was winter, and to our surprise it was almost uncomfortably cool at night. It is one of the wilder parts of China, and although it is split by several multi-lane highways, much of the province has only narrow roads which are not always paved. Together with the very broken topography this means that travelling is difficult and time-consuming.

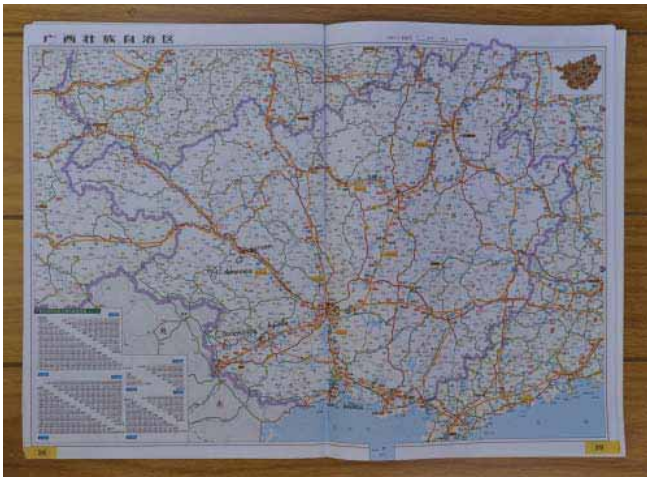

Figure 2.—The Guangxi Province of China. The lack of an understandable map made it difficult to know where we traveled. In desperation we bought this map at a road centre.

Although the province is quite densely populated, much of the natural vegetation seems to be un-affected. This is because the numerous karst outcrops are too steep to be cultivated, and farming is with plant products rather than with animals.

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[2]11 Ireland Place, Springbok Street, Eldoraigne, 0157.

Figure 3.—The *Guangxi Medicinal Herb Botanical Garden* in Nanning.

Figure 4.—In the *Provincial Monkey Reserve* beyond Taiping.

Figure 5.—On the muddy track to *Cycas bifida*.

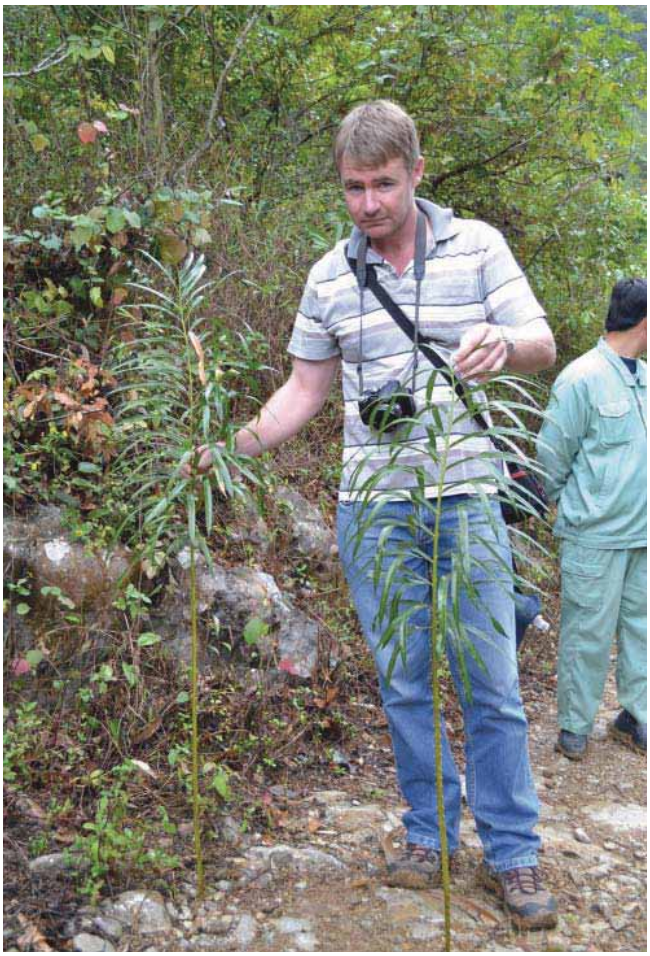

Figure 6.—The co-author with juvenile leaves of *Cycas bifida*.

We travelled by air from Shenzhen to Nanning, a flight of just more than an hour. In a pattern which would be repeated in the following days, there was no time on our arrival in mid-morning to visit any wild cycads, so we visited the *Guangxi Medicinal Herb Botanical Garden*, "the most famous medicinal botanical garden in China". This proved to be an unusually well-designed and – maintained garden, and even if one had no interest in folk-medicinal plants it was a splendid education on how to make a garden if one has a poetic bend.

On the second day we set off in persuit of *Cycas bifida*. After travelling for several hours through indescribably beautiful landscapes punctuated by rural settlements of varying sophistication nestling between sheer limestone towers festooned in lush vegetation, we reached

Figure 7.—*Cycas bifida,* all of 3 m tall.

Figure 8.—*Cycas bifida*: leaf detail, showing the split (bifid) leaflets.

the *Provincial Monkey Reserve* beyond Taiping, for that is where *Cycad bifida* is to be seen. We stopped at a tiny cluster of houses such as must have been used for thousands of years, and hiked some distance on an incredibly muddy track.

Along the track we found half a dozen juvenile cycads, and finally saw a lone mature plant at the edge of a fallow land. This plant had leaves about 3 meters long, a small and barely emergent stem, but no cones. When we asked where the other cycads were, the answer was that this is it. Yet the surrounding country looked exactly similar to where the cycads grew, so there must be more of them.

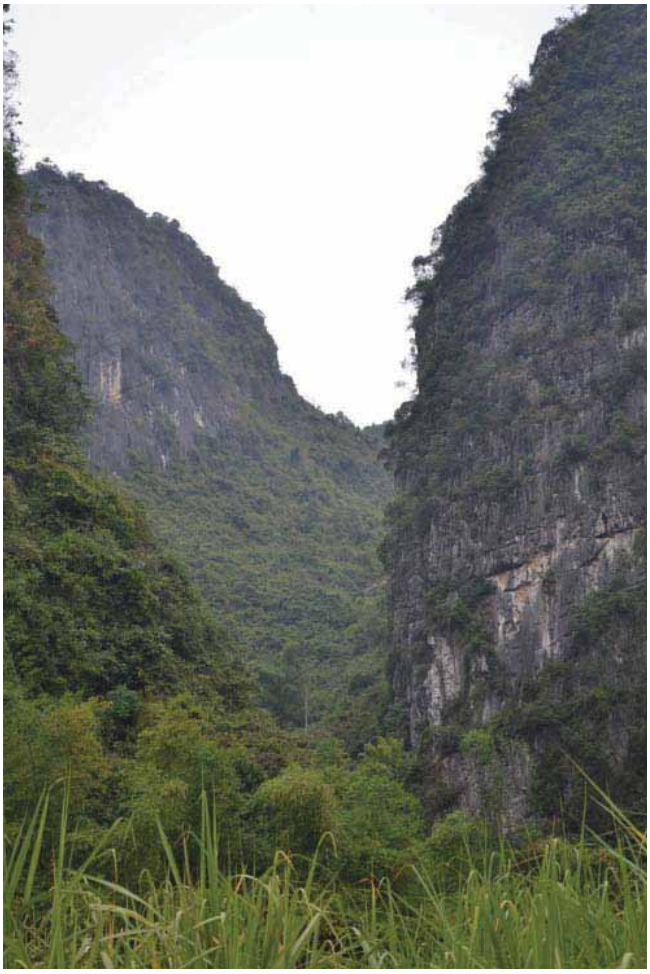

Figure 9.—The habitat of *Cycas sexseminifera* in the *Nonggang National Reserve*. The plants grow on the sheer cliffs lining the ravine.

An Ancient Plant "Living Fossil"

***Cycas fairylakea* Wild Population in Shenzhen Meilin Reservoir**

Cycas fairylakea is a national grade-I key protection wild plant, known as a "living fossil". Its wild population is currently found only in one place in the entire world -- Shenzhen city and Qujiang county of Guangdong province, There are fewer than 2,000 total individuals. There are 1500 plants of *Cycas fairylakea* surviving in the grade-1 water source protection zone of Shenzhen Meilin Reservoir -- accounting for over 75% of the world's known individuals. This is the world's biggest wild *Cycas fairylakea* population ever found.

[*Cycas fairylakea* and its endangered situation]

The total number of wild *Cycas fairylakea* is less than 2000. According to the *New Standards of Grades for International Endangered Species* (1994) issued by IUCN, *Cycas fairylakea* was "Endangered" and was classified as a national grade-I key protection wild plant in *National Key Protection Wild Plants List*.

[Brief Introduction to Meilin Reservoir]

Meilin reservoir is located in Xiameilin Village, Futian District, Shenzhen City, with a rain collection area of 5.1 square kilometers and a total capacity of 13.09 million cubic meters, and is a medium-sized drinking water reservoir in urban central area of Shenzhen.

Rare south tropical lowland monsoon forest vegetation occurs in the gully area of the Meilin reservoir. Native vegetation has almost disappeared because of development and construction, but the natural monsoon forest in Meilin reservoir survives completely due to the strict protection of Grade-1 drinking water supply.

[Discovery and living conditions of *Cycas fairylakea* in Meilin reservoir]

At both sides of a few valley streams at the end of Meilin reservoir, about 1500 plants of *Cycas fairylakea* spreads there. as many as five populations occur near the water at the altitude of 70-300m.

When the rare plants were discovered, because of chamomile and surrounding plants' strangling and disease and insect damage, *Cycas fairylakea* was in dire need of help. The plants were not healthy, and many were near death. The survival of *Cycas fairylakea* faces a huge threat.

Figure 11.—The famous gigantic *Cycas sexseminifera* in the *Nonggang National Reserve*, clinging to the cliff face. It was already too dark to take a photograph, but this one is from the Reserve's information guide.

Figure 10.—*Cycas sexseminifera*: a young plant at the foot of the cliffs.

Figure 12.—*Cycas sexseminifera*: stem of the young plant.

Figure 13.—*Cycas sexseminifera*: leaf detail.

Figure 14.—*Cycas sexseminifera:* a female plant with ripe seeds high on a cliff. Note the glass-like limestone.

Figure 15.—*Cycas* sexseminifera: a double-stemmed plant high on a cliff.

Figure 16.—*Cycas dolichophylla cultivated* in Debao city.

Figure 17.—*Cycas* dolichophylla: leaf detail. This example hardly shows the wavy leaflet margins which are so characteristic for this species.

Figure 18.—The grandiose and educational entrance to the *Hungliashan Provincial Nature Reserve*'s nursery where *Cycas debaoensis* is propagated for re-introduction into its habitat.

Figure 19.—*Cycas debaoensis*: a 10-year old seedling in the re-introduction nursery, with Bessie van der Walt.

Figure 20.—*Cycas debaoensis*: the commercial nursery at the village below the habitat.

Figure 21.—*Cycas debaoensis*: plant in habitat, with fallow rice fields in background.

After lunch and vain attempts to rid our shoes of the fine-grained clinging mud, we set off for the *Nonggang National Reserve* to see what initially was called *Cycas miquellii*, but subsequently decided to be *C. sexseminifera*. This is a medium-sized species with narrow leaflets which are somewhat wider and longer than in *C. revoluta*, and small seeds about 15 mm across. We travelled for the rest of the afternoon, and just before sunset arrived at the base of an impressive ravine between two outcrops (limestone, of course).

Up we went (up the ravine, not up the sheer cliffs lining it), and eventually found a single smallish plant which must have grown from a seed which dropped off the cliffs, because that was where they otherwise grow.

These plants were so high on the cliffs that with the naked eye one could not even see them. These cliffs were smooth like walls, and goodness knows how they could cling to the rocks. Surely every seed must fall down, so the only explanation for their continuing presence must be that some or other animal collects and caches the seeds in crevices, where some eventually germinate and establish themselves. This particular locality is said to harbour the mother of all *C. sexseminifera*, but it was so far away and the light was so poor that we could not get a photo. The accompanying one was taken from a brochure handed out.

The third day was devoted to seeing more, but smaller, plants of *C. sexseminifera* in the Debao County. Again all the plants we saw grew on sheer glass-like limestone cliffs. On this day we were lucky to see a female plant with ripe seeds; but though we sifted the ground underneath with our eyes, not a single seed was found.

Figure 22.—*Cycas debaoensis* in habitat.

Figure 23.—*Cycas debaoensis*: the leaves.

Figure 24.—*Cycas debaoensis*: a seedling in habitat.

Figure 25.—The tortuous road traversed to get to the habitat of *Cycas ferruginea*.

The fourth day offered the prize for which we really came to China: *Cycas debaoensis*. On the way, when passing through Debao city, we spotted a potted cycad which turned out to be *C. dolichophylla*, a rather pretty cycad with wavy leaflet margins previously photographed by Piet Vorster in Vietnam, (see ENCEPHALARTOS **73**: 20 & 23).

C. dolichophylla is a Vietnamese species, and attests to the long-distance trade in cycads in that part of the world.

C. debaoensis, discovered only a few years ago, must count amongst the three or four most beautiful cycads in the world. The good news is that it grows fast when cultivated, and seems to be hassle-free under a wide range of conditions. Our first stop was the nursery in the *Huangliashan Provincial Nature Reserve* where *C. debaoensis* is grown from seed to be re-introduced into the natural habitat.

After 10 years these plants have attained an impressive size, though none has coned so far. Interestingly, a seedling of the same age grown in Stellenbosch and transferred to Pretoria coned last year: see page 50 in this issue [Morné's plant]. It was pure delight to wander amongst these plants, and only the prospect of seeing plants in habitat enabled our host to "get on the bus".

Cycas debaoensis is now known from several populations, but the habitat which we visited was the place from where the species was first described, on a low limestone hill above a village. In 2002, 2000 plants were counted, but these had dwindled to 700 by 2008 due to collectors' demands. Clearly something had to be done to protect

Figure 26.—A village of the Yao people near the habitat of *Cycas ferruginea*.

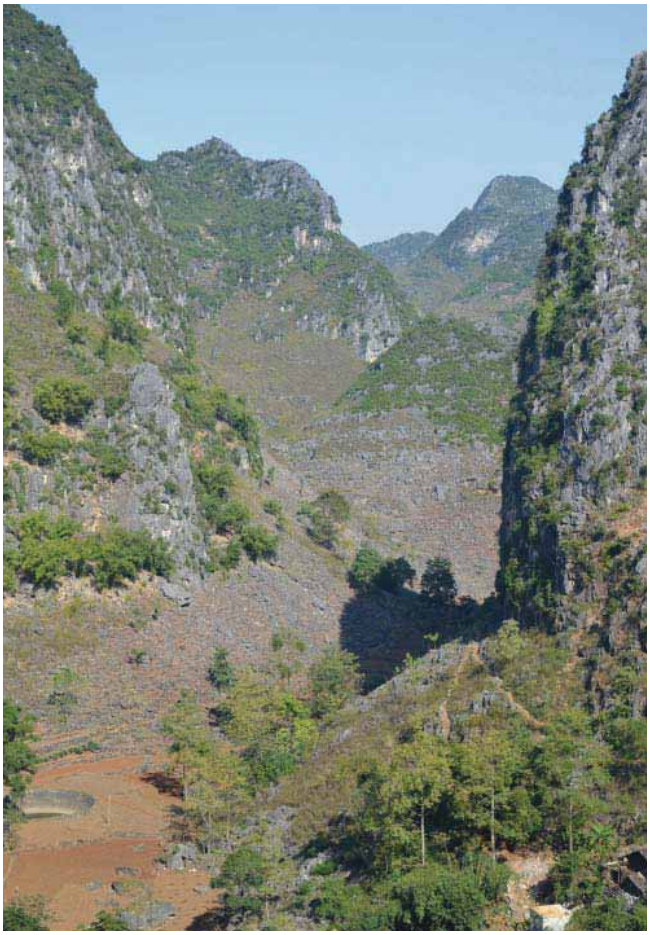

Figure 27.—The habitat of *Cycas ferruginea*. The plants occur on the shrubby slopes.

Figure 29.—*Cycas ferruginea*: a not very satisfactory photograph of a female cone.

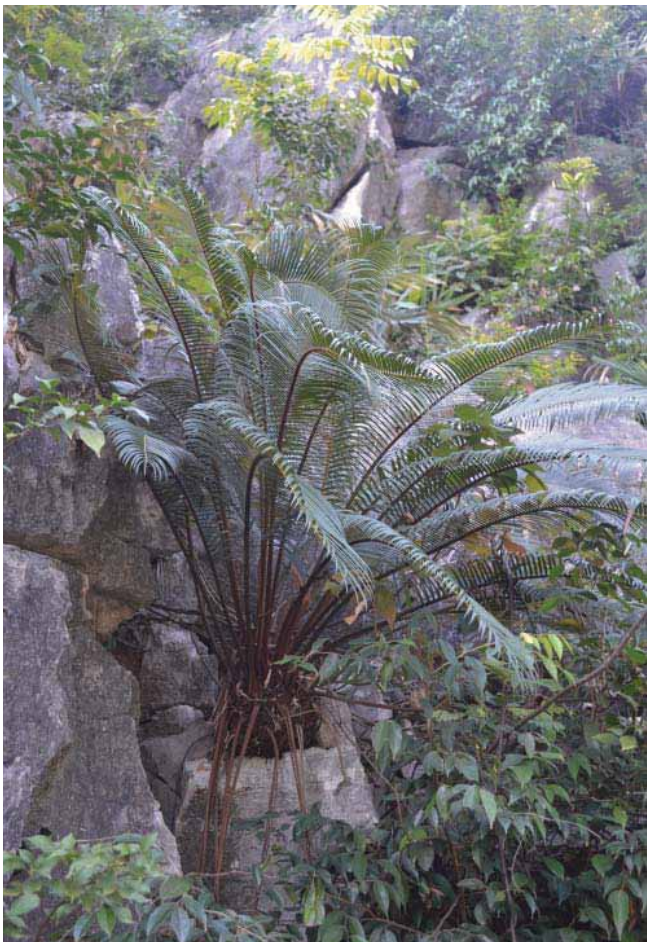

Figure 28.—*Cycas ferruginea*: a plant in habitat.

Figure 30.—*Cycas ferruginea*: leaf detail.

Figure 31.—On our way to the habitat of *Cycas sexseminifera*.

Figure 32.—*Cycas shiwandashanica*: a plant in habitat.

the remaining plants, and our Willie Tang took the lead. Firstly he impressed upon the inhabitants of the village the uniqueness of the plants, then he helped them to start a nursery where they could grow plants from seed to sell, and lastly he promised to build a school for them in exchange for protecting the plants. Our society is also involved, having donated funds to the project which Willie used for paying the school fees of the villiage children. The full story appears on page 50 of this issue.

The plants grow in low scrubland in partial shade, but do equally well in direct sunlight in adjacent grassland. They are magnificent. The stems are short, apparently not exceeding 60 cm, and John Donaldson thought that they are probably relatively short-lived. They carry an ample crown of leaves, each more than 2 meters long. The crowning glory is the leaflets which are each divided several times. As with all the other cycad species which we saw on this trip, it was the wrong time of the year for cones.

The fifth day took us to a village of the Yao people, whose picturesque houses cling to the steep slopes high in the mountains, and reached via a tortuous and hair-raising road.

This is where *C. ferruginea* hides. This species also occurs in Vietnam, where it clings to sheer limestone faces reminiscent of the habitat of *C. sexseminifera*. Here, however, they occur on moderate slopes amongst boulders and shrubs. It is a smallish species, at first glance not unlike *C. sexseminifera*, and it also has very small 15 mm diameter seeds.

Figure 33.—*Cycas shiwandashanica*: leaf detail. The leaflets are up to 50 mm long and 10–20 mm wide.

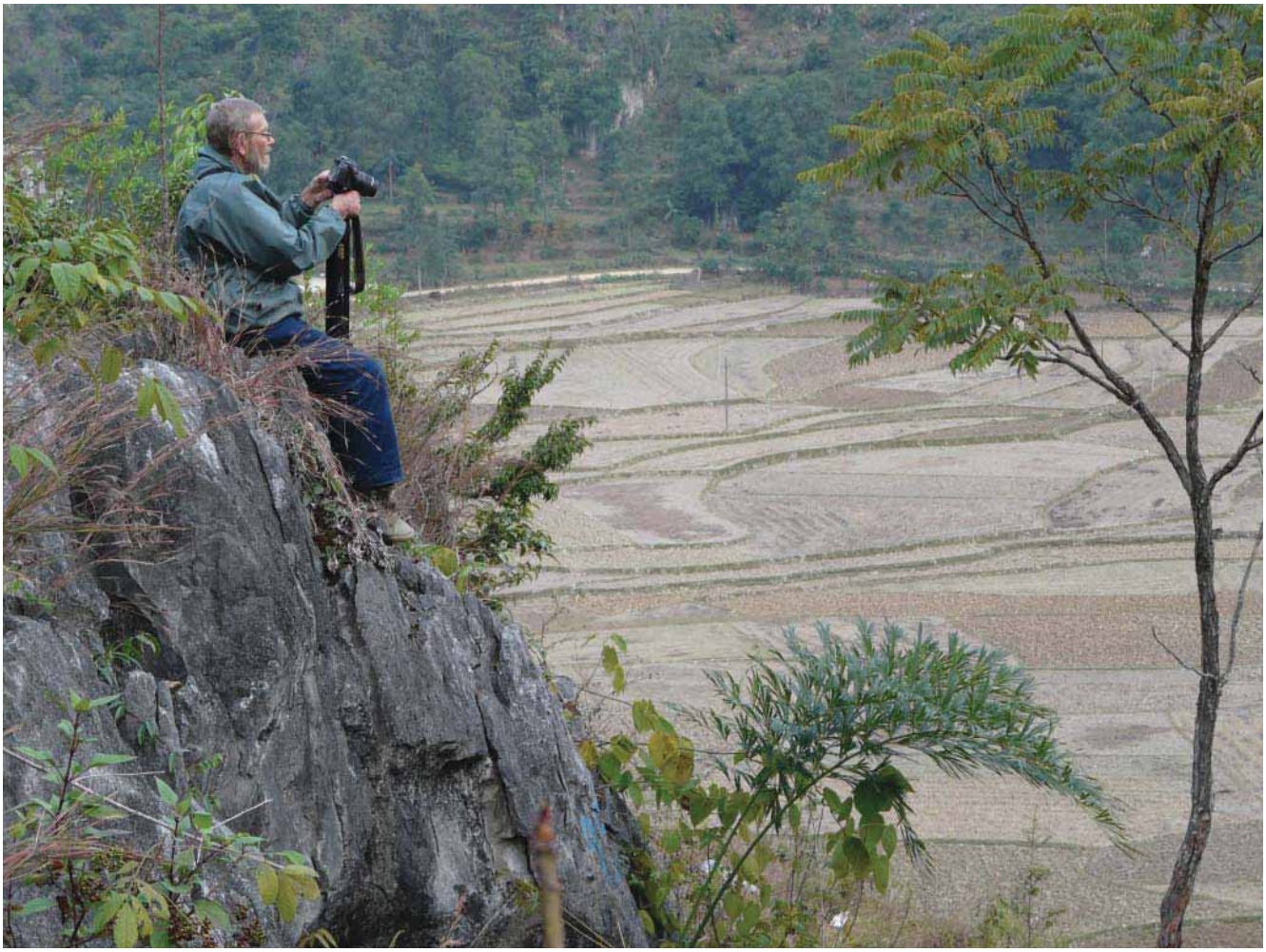

Figure 34.—Piet Vorster photographing *Cycas debaoensis* growing in between large rocks. Photo: Jan-Louis Bezuidenhout.

The sixth and last day brought a very different cycad, *C. shiwandashanica*, which grows in the *National Reserve of the Golden Camelia*.

It grows in what appears to be a semi-deciduous low forest reminiscent of South African Bankenveld ravine bush. Even in midwinter it grew in the shade, and with their underground stems and relatively few leaves the plants not only look like *Encephalartos villosus*, but the habitat as well resembled that of *E. villosus*.

There cannot be many shade-growing *Cycas* species, but this is definitely one. According to the literature its stem can be up to 1 meter tall, but the plants we saw all had barely emerging stems, The leaves are 1.5 to 2.5 m long with median leaflets up to 50 cm long and 10–20 mm wide. If well-grown in cultivation it should be a very showy plant, especially in those shady sites where other cycad species won't be at their best.

And so our field trip ended. Though of a mere six days' duration, it felt more like six weeks, with the incredible landscapes through which we travelled and the strange cycads which we saw. All of us who participated shall forever be grateful for the opportunity, and for our host Li Nan for making it all possible.

CYCAD 2011

Philip Rousseau[1], with photographs by Piet Vorster[2]

Figure 1.—Shenzhen: the conference venue.

Every year since 1987 a conference on cycad biology has been held. The first, in 1987, was in Nice in France, the next in Townsville, Australia, then in South Africa (1993), Panzhihua (China) in 1996, Miami (Florida) in 1999, Pattaya (Thailand) in 2002, Xalapa (Mexico) in 2005), Panama City (Panama) in 2008, and lately in Shenzhen (China) in December 2011. These conferences have been excellent occasions for bringing together cycad enthusiasts from many different backgrounds and interests from all over the world, making known new research results, forging links, and stimulating further research. One example of the stimulating effect of these conferences is that, at the time of the 1987 conference, about 130 living cycad species were known, while at present the number stands at 330.

The 2011 conference was well attended by 13 South Africans; Jan-Louis Bezuidenhout, Steve Trollip,. Karen & Diekie de Klerk, Stephen Cousins, John Donaldson, DeWet Bösenberg, Phakamani Xaba, Terrence Suinyuy, Amanda Botha, Bessie van der Walt, Piet Vorster, and myself. Foreign members of our Society included Jeff Chemnick, Willie Tang and his wife LiMei, Anders Lindstrom, Doris Francis, and Virginia Hayes.

We were particularly taken with the conference host, the Fairy Lake Botanical Garden in Shenzhen. Already in 1996 when Piet Vorster visited Shenzhen (see *ENCEPHALARTOS* 48: 24 (1996)) the garden had impressive laboratories at which important and revealing research was done. The topography of the garden, in a high-rimmed basin surrounding a lake, was visually arresting, and the excellent living collection was already very extensive en well maintained, containing some of the most beautiful cycad specimens which one could imagine.

However, the conference as well as our accommodation was several kilometers away in the middle of the ultramodern 30-year old city of Shenzhen. Shenzhen is in the far south of China, 40 minutes by train north of Hong Kong. The climate is subtropical as can be judged from the abundance of tropical palms throughout the city, but it was winter during our stay and uncomfortably cool, especially at night.

The conference centre was conveniently close to where we stayed, well-equiped, and small enough not to be intimidating.

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[2]34 Brandwag Street, 7600 Stellenbosch.

Figure 2.—Shenzhen: the intimate lecture hall where the papers were read.

Figure 3.—Prof. Li Nan in a relaxed mood during the post-conference tour.

Our host was Prof. Li Nan, assisted by staff from the Fairy Lake laboratories. We were particularly honoured by the presence of Prof. Chia-Rui Chen, who founded cycadology in China, and who organised the CYCAD '96 conference in Panzhihua.

The conference was held over five days, from the 2nd to the 6th of December 2011. Over 50 talks and 20 poster presentations were presented by attendees from all over the world, on a wide range of cycad-related topics. While this report is concluded with a list of presentations, a number of these are of profound interest to all of us:

L. LU, L. WANG, H. WU, & S.-Z. ZHANG: The complete chloroplast genome of *Zamia furfuracea* L.f. and *Stangeria eriopus* (Kunze) Baillon.

These data will be of great help when investigating variation within *Stangeria*: are there more than one species?

Q.-Q. ZHAN & X GONG: Genetic population structure of *Cycas micholitzii* complex inferred from chloroplast nuclear DNA.

The *Cycas micholitzii* complex comprises species with divided leaflets, and contains some of the most arresting plants of all cycads. However, it is by no means always easy to identify plants of this complex, and to be sure where one species ends and another begins. These data should help solving this conundrum.

C.-J. CHEN, Y. YANG, & N. LI: A taxonomic revision of *Cycas* L. in China.

K.D. HILL & L.C. STANBERG: Review of the genus *Cycas* in China.

In the last 16 years a great deal of exploration and taxonomical research has been done on the *Cycas* of China. While the task is not yet finished, and it is still not entirely clear how many species should be recognised, it is clear that China is a very important centre of diversity for *Cycas*.

P. XABA & J. DONALDSON: Structured analysis of factors affecting low seed germination in *Encephalartos latifrons*.

A.W. MEEROW, J. FRANCISCO-ORTEGA, D. SALAS-LEIVA, P. GRIFFITH, M. CALONJE, D.W. STEVENSON, & K. NAKAMURA: Phylogeography and conservation genetics of the Caribbean *Zamia* clade: an integrated systematic approach with SSRs and single copy nuclear genes.

M. CALONJE, A.W. MEEROW, L. KNOWLES, D. KNOWLES, P. GRIFFITH, & J. FRANCISCO-ORTEGA: Genetics-based conservation action plan for *Zamia lucayana*, the only cycad species endemic to the Bahamian archipelago.

A.W. MEEROW, J. FRANCISCO-ORTEGA, M. CALONJE, F. JIMÉNEZ, A. VELOZ, D.W. STEVENSON, & P. GRIFFITH: Comparative patterns of genetic variation among populations of the *Zamia pumila* complex across three islands of the Greater Antilles.

Figure 4.—Prof. Chia-Rui Chen giving an impromptu talk on the taxonomical relationships of *Cycas fairylakea* in Shenzhen.

Figure 5.—*Cycas fairylakea*: plants in habitat at Shenzhen.

The taxonomy of the Caribbean *Zamia* species is comparable to that of the variable *Encephalartos natalensis* and the confusing *E. manikensis* complex. It probably reflects recent and continuing evolution, but this does not make the field botanist's life any easier. Molecular research now offers the potential to define different geographical populations and elucidate how they are related. It also makes it possible to spot uniqueness in small or isolated populations so that these can timely be conserved.

S.R. COUSINS, V.L. WILLIAMS, & T.F. WITKOWSKI: Uncovering the cycad taxa (*Encephalartos* species) traded for traditional medicine in Johannesburg and Durban.

We know that cycad fragments are commonly traded on traditional medicine markets, but which species are involved?

D.A. MADULID & E.M. AGOO: Recent studies on Philippine cycads.

T. MARLER & A. LINDSTROM: Scouting Philippines for cycads.

The Philippine islands have hitherto been a closed book as far as cycads are concerned. The authors conducted a physical survey of the cycads throughout the archipelago, revealing 11 published species but probably several more undescribed ones. Like in so many other parts of the world, time is running out in the Philippines because of degradation and loss of habitat.

T. MAGELLAN, P. GRIFFITH, C. HUSBY, & S. CUESTAS: Coffee grounds: assessing a potential control for cycad *Aulacaspis* scale, *Aulacaspis yasumatsui*.

The Asian *Aulacaspis* scale insect which recently spread to the Americas and Guam is a frightening pest, almost impossible to eradicate, and capable of killing *Cycas* plants within three years. It has now been found that infections can apparently be eradicated by mulching plants with used coffee grounds. The active principle is surmised to be the alkaloid caffein in the grounds.

This is nevertheless no reason to stop drinking coffee.

My own papers were:

- DNA Barcoding of Africa's endemic cycads.
- A molecular phylogeny of *Encephalartos*.

The research of which these presentations were based, aimed to refine our understanding of the evolutionary relationships between *Encephalartos* species. The concept of barcoding aims to produce a method by which a sample of a plant's DNA could be placed in an analytical apparatus which would then identify the species involved.

Of the remaining presentations, many are of a specialised nature and possibly of less interest to the majority of our readers. Nevertheless, for the readers' interest, here is a complete listing. It should be noted that all or most of these will be published in the conference proceedings. These proceedings are a mine of useful information, and should grace the libraries of every cycad enthusiast.

The proceedings were opened by a first plenary session in which our host LI NAN of the Fairy Lake Botanical Garden, spoke on the Taxonomy of *Cycas* in China. This is the result of a very thorough and ongoing investigation

into the species of *Cycas*. This resulted in numerous new species having been described, and close monitoring of populations have ensured accurate threat estimations allowing proper Red List categorisation and advice to the relevant conservation authorities. A similar long-running project would be most welcome on *Encephalartos* as most of the issues in the genus will most certainly benefit from this type of attention.

Session 1 addressed Taxonomy and Phylogeny, as well as information management:

DENNIS STEVENSON of the New York Botanical Garden in the U.S.A. discussed branching patterns in the cycads, and its evolutionary implications. Mature trunks were sectioned (much to the dismay of the horticulturists, Dennis reported), and branching was found to be dichotomous, a pattern conspicuous in lower plants such as mosses. Once more the importance of cycad for interpreting all other plants was highlighted.

YU-YAN HUANG of the Zhongkai University in China reported on a comparative study of the tracheids of gymnosperms and angiosperms. It was a wonderfully illustrated talk with outstanding electron microscope photographs, where several differences could be seen between the gymnosperms analysed. It remains to be seen if these data are taxonomically applicable on the species level, but it may be worth investigating in *Encephalartos.*

BOGLÁRKA ERDEI of the Hungarian Natural History Museum presented results of paleobotanical work on cycads, primarily of the Paleocene and Eocene. Beautiful full-colour sections of extant cycads were compared to leaf anatomical characters of fossils. Based on these results, many fossils previously attributed to extant genera are reclassified into the extinct genus *Dioonopsis.* Thus the "*Encephalartos*" from Greece can no longer with confidence be considered as such, which has enormous implications for the dating and erstwhile distribution of *Encephalartos*.

DE WET BÖSENBERG of SANBI, South Africa presented the new IUCN species information database and its various improvements and functions. Importantly information fed into the user friendly database can automatically provide a Red List categorisation based on the information enclosed. This system is however only as strong as the information it receives and it is up to members such as ourselves to provide the relevant people with accurate field data of each *Encephalartos* species.

Session 2 dealt with Ecology and Toxicology:

LOURDES GEORGINA IGLESIAS-ANDRIEU of the Universidad Veracruzana in Mexico and her collaborators worked on the effect of disturbance on cycad populations in Mexico. Notably there seems to be no discernible difference between the responses of *Dioon* and *Ceratozamia*, two genera that are very different ecologically in terms of habitat and life history. Also the cycad populations seem to be quite resilient to the disturbances which are mostly anthropological in nature. Very little is known about the response of *Encephalartos* species to disturbance and a study such as this should be conducted to assist in management practice planning.

IGLESIAS-ANDRIEU's team also investigated the composition of two *Ceratozamia mexicana* populations

Figure 6.—*Cycas fairylakea*, growing typically almost in water.

under different conditions. As in their previous presentation, the results once again proved surprising as there seemed to be little appreciable difference between the disturbed and undisturbed populations. Once more studies of this nature on *Encephalartos* are lacking and long term population based monitoring programs are essential for projection and conservation planning work.

IRENE TERRY of the University of Utah in the U.S.A. presented research results of her team's study of the pollination ecology of *Macrozamia maclaeyi* and *M. lucida.* These corroborate their previous theory on the push-pull system where lower amounts of the volatiles attract the pollinators but high amounts are used to disperse pollinators from male cones. This is also correlated with temperature increases and interestingly light (i.e. time of day) has an influence on how these ques are interpreted by the pollinators. Work on *Encephalartos* is progressing to this stage and it would be interesting to see how the two phylogenetically linked groups may differ or agree in terms of pollinator ecology.

WILLIE TANG of the United States Department of Agriculture in Miami presented a genetic phylogeny of the weevils found on two clades of *Cycas.* These are compared to the evolutionary and phylogenetic relationships of their cycad hosts with very interesting implications for colonisation and migration. Such comparative works are essential to understanding the evolutionary history of larger groupings such as genera. With the conspicuous distribution patterns and geomorphological history of the African continent this is guaranteed to be very enlightening if done in *Encephalartos*.

Figure 7.—Patrick Griffith, Director of the Montgomery Botanical Center, with a fine specimen of *Cycas fairylakea*.

PAUL YAROWSKY of the University of Maryland in the U.S.A., discussed the effects of *Cycas micronesia* seed ingestion in rats. Video footage along with other very compelling evidence clearly showed hallmark traits of Parkinson's Disease along with sleep pattern disturbance. Shockingly a small dosage can result in symptoms after a significant time lapse. The lack of detection of BMMA or MAM glycosides lead the researchers to pin the symptoms on other chemicals, many of which are still undescribed. These undescribed and seemingly very complex compounds may well serve as taxonomically delimiting data and, who knows, some may be exclusive to *Encephalartos* or species groups within it.

Session 3 dealt with Conservation matters:

QING-QING ZHAN of the Academy of Sciences in China talked about the genetic variation found *Cycas micholitzii* and associated species *C. bifida, C. longipetiolula*, *C. deboensis*, and *C. multipinnata.* Results were contrary to the current species delimitation with several haplotypes grouping with other species. Various reasons for this were proposed, including incomplete lineage sorting as well as introgression resulting in hybridisation. As *Encephalartos* suffers from all of these phenomena which are extremely difficult to pinpoint and handle with current analytical software, the advances made here will most certainly pave the way to a clearer understanding in *Encephalartos.*

SHOU-ZHOU ZHANG of the Fairy Lake Botanical Garden brought results of his team's mammoth effort to sequence the entire chloroplast genome of *Zamia furfuracea* and *Stangeria eriopus*, which they compared to the previously completed one of *Cycas taitungensis.* Various

Figure 8.—Scene below stand of *Cycas fairylakea*, with city reservour in foreground and city in the background.

Figure 9.—Fairy Lake Botanical Garden: entrance to Cycad Conservatiion Centre and cycad collection, with fine examples of *Macrozamia moorei*.

regions were identified as possible DNA barcodes, though even with the entire chloroplast sequenced *Zamia* and *Stangeria* still have 86% identical bases. The barcoding regions must be tested as an ongoing effort to build on the dataset already produced in *Encephalartos*, and hopefully an *Encephalartos* species will be the next to be completely sequenced which would allow for the identification of regions specific to the genus that might have played an important role in their evolution.

SANEESH SOMASDEKHARAN of the Keystone foundation in India reported on challenges faced by a population of *Cycas circinalis*, and the steps taken to preserve the cycad in its natural habitat. The cycad is heavily used for numerous purposes by the local people who depend on their natural environment to sustain them. Cycad conservation centres have been set up to raise nurseries and promote sustainable use of the populations with the village conservation centres thoroughly embraced by the participants. Although culturally different from South Africa, this approach must be seriously considered if *Encephalartos* species, especially in South Africa, are to survive in their natural habitat.

YU-CHUNG CHIANG of the National Sun Yat-sen University in China brought results of his team's work on *Cycas taitungensis* looking at genetic diversity with an eye on *ex situ* conservation. The only two natural populations known are under threat from the scale insect *Aulacaspis yasumatsui*, and programs have been instituted to protect the species *ex situ*. For this to be successful the genetic diversity found should be represented, and was found to be the case when *ex situ* plants were compared to the range of sub-populations found naturally. This is also applicable to *Encephalartos* and has been the focus of the Lowveld Botanical Garden.

Figure 10.—Fairy Lake Botanical Garden: Steve Trollip and Diekie De Klerk with a venerable example of *Cycas elongata*.

An Ancient Plant "Living Fossil"

***Cycas fairylakea* Wild Population in Shenzhen Meilin Reservoir**

Cycas fairylakea is a national grade-I key protection wild plant, known as a "living fossil". Its wild population is currently found only in one place in the entire world -- Shenzhen city and Qujiang county of Guangdong province, There are fewer than 2,000 total individuals. There are 1500 plants of *Cycas fairylakea* surviving in the grade-1 water source protection zone of Shenzhen Meilin Reservoir -- accounting for over 75% of the world's known individuals. This is the world's biggest wild *Cycas fairylakea* population ever found.

[*Cycas fairylakea* and its endangered situation]

The total number of wild *Cycas fairylakea* is less than 2000. According to the *New Standards of Grades for International Endangered Species* (1994) issued by IUCN, *Cycas fairylakea* was "Endangered" and was classified as a national grade-I key protection wild plant in *National Key Protection Wild Plants List*.

[Brief Introduction to Meilin Reservoir]

Meilin reservoir is located in Xiameilin Village, Futian District, Shenzhen City, with a rain collection area of 5.1 square kilometers and a total capacity of 13.09 million cubic meters, and is a medium-sized drinking water reservoir in urban central area of Shenzhen.

Rare south tropical lowland monsoon forest vegetation occurs in the gully area of the Meilin reservoir. Native vegetation has almost disappeared because of development and construction, but the natural monsoon forest in Meilin reservoir survives completely due to the strict protection of Grade-1 drinking water supply.

[Discovery and living conditions of *Cycas fairylakea* in Meilin reservoir]

At both sides of a few valley streams at the end of Meilin reservoir, about 1500 plants of *Cycas fairylakea* spreads there. as many as five populations occur near the water at the altitude of 70-300m.

When the rare plants were discovered, because of chamomile and surrounding plants' strangling and disease and insect damage, *Cycas fairylakea* was in dire need of help. The plants were not healthy, and many were near death. The survival of *Cycas fairylakea* faces a huge threat.

[Social Attention]

As the only national grade-I key protection plant in Shenzhen, the *Cycas fairylakea* of Meilin reservoir has aroused broad social attention since it was first discovered.

[The protection of *Cycas fairylakea* in Meilin reservoir achieves significant breakthrough]

In October 2008, the "Protection Plans for Cycas fairylakea in Meilin reservoir" passed expert review.

Then Shenzhen Meilin Reservoir Management Office quickly engaged in rescue protection work, including tending to the plants (increase illumination, prevent and cure diseases and insect pests, apply fertilizer, etc), documenting and numbering each plant, and establishing a database.

After a year of rescue tending, the protection achieved remarkable results. All plants were rescued from serious ill vegetative growth, of which 99 percent plants thrive with new leaves.

After careful maintenance individuals of the populations grow vigorous with reproductive growth completely recovered in 2011. 85 male and 21 female plants flowered in April and May. The seed setting rate was over 99 percent with artificial pollination. 6200 seeds were collected in September and October. The largest plant bore more than 500 seeds.

[Scientific Research and Exchange]

Cycas fairylakea rescue and protection efforts brought extensive interest from the botanical community at home and abroad.

[Prospect]

Ancient *Cycas fairylakea* is now thriving in a modern urban central area. This living treasure is not only the valuable wealth of Shenzhen people, but also the spiritual wealth of mankind.

Cycas fairylakea is mainly found near the stream at the end of Meilin reservoir. *Cycas fairylakea* loves water and a damp environment. A closed protection area will be constructed to combine the protection of both *Cycas fairylakea* and the grade-1 drinking water source protection zone in the Meilin reservoir. This will implement the strictest water resource management system while also better protecting the forest ecological system and *Cycas fairylakea*.

PRADEEP SRIVASTAVA of the University of Allahabad in India investigated the threats to natural populations of *Cycas beddomei* in a long term study. The cycad is plagued by many of the human threats highlighted in Saneesh Somasekharan talk on *Cycas circinalis*, along with habitat loss due to development. The effects of some insect herbivores are multiplied through the harvesting by locals. The cultural aspects of *Encephalartos* in tropical Africa are somewhat similar to the situation in India and should be dealt with before it becomes problematic. The culturally rich association of *Encephalartos* and people in these areas also needs documentation.

HUGH PRITCHARD of the Royal Botanical Garden, Kew, in England spoke about their struggles in storing cycad seeds under sub-zero temperatures. However, cycad seeds do not handle desiccation well and although various very innovative techniques (such as embryo removal) have been applied, the necessary thresholds can still not be achieved without death. *Encephalartos* is a prime subject for long term storage to circumvent extinction and aid in reintroduction, and the project should be supported in whatever capacity possible with their progress closely monitored.

The second plenary session was devoted to a talk by DENNIS STEVENSON of the New York Botanical Garden in the U.S.A., on features of cycads that are conserved throughout their evolutionary history and are unique to the group. This helps us to decipher the fossil record which is very incomplete and difficult to interpret due to poorly preserved material, with a few unrelated extinct groups that have cycad-like attributes. As the living cycads are very similar to extinct species, these features can be used to date and understand the evolution of especially the families and genera we have today. Also phenomena such as insects herbivory found on fossils allows us an unprecedented window into past events.

Session 4 dealt with Taxonomy and Economic Botany:

CJIA-RUI CHEN of the Chinese Academy of Sciences expanded on the various species and species groups currently recognised in the genus *Cycas* in China. Of the over 50 published species names only 23 are currently recognised, representing four of the five sections in *Cycas*. Special reference was made to distribution, and detailed full colour photographs shown of all species. Unfortunately the talk could not be completed due to time constraints. Importantly three principles were outlined for species delimitation which are applicable to *Encepha-*

Figure 11.—Fairy Lke Botanical Garden: a female cone of *Cycas elongata*.

Figure 12.—Fairy Lke Botanical Garden: part of the *Cycas* department.

lartos: (1) At least a pair of relative morphologically distinct characters, (2) Existence of wild populations, not only individual specimens in cultivation, and (3) A distinct geographical distribution.

PHILIP ROUSSEAU of the University of Johannesburg talked about his efforts to DNA barcode Africa's endemic cycads. Both the CBOL proposed region as well as several other promising regions were found wanting due to either/or technical difficulty or lack of ability to resolve species. The highest number of species that could be resolved in preliminary analysis was 20%. The search for a barcode region in *Encephalartos* continues however, with close monitoring of research on other cycad genera.

PEI-CHUNG LIAO of the National Pingtun University of Science and Technology in China discussed evolutionary and distributional history and genetic associations of *Cycas revoluta* and *C. taitungensis* which form the section *Asiorientales*. Findings corroborate research results on other *Cycas* species and other genera which suggested recent divergence and prevalent introgression.

MICHAEL CALONJE of the Montgomery Botanical Center in the U.S.A. presented a phylogeny based on single copy nuclear genes as part of his collaborators' larger work on *Zamia.* Over 80% of the recognised species were included with multiple accessions per species to incorporate population based variation and negate bias based on the uncertain taxonomy. Various clades were discussed based on the distribution, and the genus was shown to have large amounts of convergence in traits often considered to be taxonomically important (e.g. leaf colour on emergence). The molecular phylogeny of *Encephalartos* should be interpreted in terms of these considerations.

PHILIP ROUSSEAU of the University of Johannesburg also presented a molecular phylogeny of *Encephalartos.* Significant improvements on the only previous molecular phylogeny of the genus had been achieved and allowed for comparison with the species groups currently hypothetised. Several departures were noted and new species groupings were defined. The tree is however far from satisfactory in terms of resolution and genetic regions, and analyses employed in other genera presented during the conference should be the next step.

STEPHEN COUSINS of the University of the Witwatersrand quantified the amount of trade in *Encephalartos* at medicinal markets in Durban and Johannesburg. Two markets were sampled where the amount of trade was found to be substantial (9 tonnes per year at Durban), also the type of trade showed the use of whole stems in smaller species or juveniles, a very unsustainable practice. Innovative methods were developed to determine actual stem size from traded fragments. This study provides the scientific evidence for the speculated and anecdotal effects of the medicinal trade in *Encephalartos* and should be used to advise authorities in implementing conservation strategies.

Session 5 encompassed Ecology and Ethnobotany:

IRENE TERRY of the University of Utah in the U.S.A. presented her continuing research on reproduction of cycads, in this case on the thermogenesis of cones in *Cycas*. Species in the *Cycas rumphii* complex were investigated *in situ* and *ex situ*.

YONG-JIANG ZHANG of the Chinese Academy of Sciences elaborated on physiological and nutritional aspects in cycad leaves. Specifically his team investigated traits correlated with photosynthetic capacity which were found to be leaf mass per surface area as well as the elements nitrogen, sulphur, zink and iron. Plants were also found to become iron deficient very rapidly once all other traits were optimised. This holds great importance for the cul-

Figure 13.—Fairy Lke Botanical Garden: part of the American department, with *Dioon* and *Ceratozamia*.

tivation of all other cycads including *Encephalartos*, as the application of iron supplements may well increase photosynthetic and thus growth rates.

TERRENCE SUINYUY of the University of Cape Town presented an overview of the pollination volatiles of South African *Encephalartos* species. Almost all species native to South Africa had been studied, with extensive sampling of *E. villosus* along its extended distribution range. The various compounds of the complex scents were also experimentally shown to attract pollinating insects. Most importantly a very interesting pattern became apparent when all species' volatiles were compared and associations made. Geographic groups as well as phylogenetic groups occur while *E. villosus* showed a change in the major composites along its range, with KwaZulu Natal populations grouping with other species from this geographic region, and the same is true for Eastern Cape populations. This was probably the most important talk on *Encephalartos* at the conference, as the results are somewhat contrary to expectations, with the data extremely meaningful because reproduction is the main driving force behind evolution.

VANDANA KRISHNAMURTHY of the Univeristy of Hawaii presented her team's ethnobotanical research results on *Cycas circinalis* and *C. indica.* The trade in these two species was reported to be both ancient and extensive, becoming threatening of late. Unaffected populations were contrasted with populations subjected to harvesting, with results indicating a marked negative effect of the current harvesting practice. An *in situ* study such as this is surely the next step following on Cousins' work showing that trade in *Encephalartos* is extensive.

MARK BONTA of the Delta State University in the U.S.A. delivered a very insightful talk on the possible role of cycads in stimulating ancient Americans to domesticate maize. Ancient maize being mostly a poor food crop has troubled scientists as to why Mesoamericans would invest so much to finally derive a sufficiently beneficial food. The author presented very strong circumstantial and some direct evidence for the simultaneous use of cycad seed and maize, while mythology may also have played a role with maize cobs selected to mimic cycad cones. The use and reverence of *Encephalartos* by indigenous people may also hold surprising and rich data.

Session 6 comprised Conservation and Horticulture:

YI-QING GONG of the Fairy Lake Botanical Garden presented results of preliminary research on the few extant individuals of *Cycas szechuanensis*, which is the extinct in the wild. These specimens have been recorded as cultivated for over one hundred years and contrary to *Encephalartos* plants extinct in the wild, these are all female. They plan to employ various molecular techiniques to determine the relationships between the speculated clones and possibly their evolutionary origin.

ESPERANZA AGOO of the De La Salle University in the Philippines discussed a new species of *Cycas*, *C. sancti-lasallei*, with comparisons to related taxa. It is distinguished by longer leaves, undulated pinnae, and megasporophyll laminas differing in shape and spinescence. The species was described as Critically Endangered due to low population density and few mature individuals, limited distribution range, and threats of landslides and erosion.

KHURAIJAM SINGH of the GGS Indraprastha University in India spoke on the conservation status of *Cycas pectinata* based on population surveys. Sex ratio and viability were assessed, suggesting a change in its conservation status.

PHAKAMANI XABA of SANBI at Kirstenbosch discussed possible reasons for the low germination percentage of *Encephalartos latifrons* seed at Kirstenbosch. Pollen viability was found not to be the culprit, which led to the investigation of the exact time of excretion of the pollination droplet with *E. altensteinii* as comparative species.

PATRICK GRIFFITH of the Montgomery Botanical Center in the U.S.A. presented an historical account of *Microcycas calocoma* in *ex situ* cultivation in America, and its pollination and market release. The importance and effect of such an effort is highlighted as a correlated drop in price is seen with the increase in availability. This is a clear indication on how market control can be implemented on *Encephalartos* species through mass release of seedlings of extremely rare species.

In Plenary Talk no. 3

ALAN MEEROW of the United States Department of Agriculture in Miami presented an overview of a holistic investigation into the genus *Zamia*, specifically focusing in this talk on the phylogeography and conservation genetics of Caribbean members. The extremely complex gene exchange and historical evolution of populations were highlighted, revealing a clear need for specialised analytic tools to deal with the genetic data. Numerous chromosome regions and primers have been designed and tested.

These will be highly applicable to *Encephalartos* with a clear need to use non-mainstream programs to make sense of the observed patterns.

Session 7 comprised contributions on Taxonomy, Phylogeny, Economic Botany, and Information Management:

STEPHEN COUSINS of the University of the Witwatersrand reported on the taxonomic identification of fragments of *Encephalartos* that are traded medicinally in South Africa. Techniques include leaf base size, colour, adornment (e.g. hairiness) and fire damage; all correlated with probable site of harvesting. Commonly recorded species include: *E. natalensis, E. villosus, E. ghellinckii* and probably *E. senticosus* and *E. ferox.* These identifications are very important to determine the effect of harvesting on populations, and need to be strengthened through other techniques such as DNA barcoding.

PATRICK GRIFFITH of theMontgomery Botanical Center presented initial results of the anatomical study of all living cycad genera focusing on leaf traits that could be compared to fossil taxa. This will aid in identifying ancestral states of these traits which would allow the evolutionary history to be reconstructed with greater accuracy and detail. This study will generate untold amounts of very informative data. It would allow the placement of *Encephalartos* in the cycad evolutionary picture and should be conducted within the genus to place the subclades and species groups of *Encephalartos* in relation to each other.

CRISTINA LOPEZ-GALLEGO of the Universidad de Antioquia in Colombia demonstrated results of extensive field surveys and *ex situ* collections of *Zamia* species, looking at ecological traits such as frequency of reproduction, resource allocation to reproduction, and seedling survival. There seems to be clear and very understandable differences between species with differing habitats. This type of data must be collected for *Encephalartos* too as it has enormous influence on the conservation management of species and will undoubtedly provide additional information on species delimitation and relationships.

Figure 14.—The CYCAD 2011 farewell banquert was a barbeque, Chinese style.

DOMINGO MADULID of the Philippine National Museum reported on his team's field work on the cycads of the Philippine Islands. Work over the last decade had seen the number of species surpass 10 with possibly more to be described. Identification of taxonomic pitfalls and standardisation of techniques were suggested. The revision of the taxonomy of *Encephalartos* must keep in consideration the lessons learnt in these other genera to effect a successful reassessment of the current diversity.

JAMES CLUGSTON of the Royal Botanic Garden Edinburgh in Scotland presented results of a phenological study based on herbarium collections, focusing on *Zamia*. Challenges in working with herbarium material to determine cone presence and state of maturity were the main concerns raised. Tesults were compared with coning data from the Montgomery Botanical Center, with a slight time shift in some cases most probably attributable to the climatic difference. Finally the data were overlayed on the molecular phylogeny, revealing evolutionary shifts. This method as well as other measurements from herbarium specimens are a wealth of untapped data in *Encephalartos* and will most definitely be pursued.

Session 8 encompassed (again) Conservation and Horticulture:

THOMAS MARLER of the University of Guam developed a practical method to find cycad populations on the numerous Philippine islands. Many new populations and possibly new species were discovered across a large area. His dynamic approach to discovering cycads in an unconventional area holds much promise for cycad hunting in tropical Africa as well as the discovery of new populations in southern Africa.

MICHAEL CALONJE of the Montgomery Botanical Center discussed the conservation status and population dynamics of *Zamia lucayana*, a species endemic to the Bahamas. This is an interesting species found in a small area threatened by development. All known populations were thoroughly sampled and genetically analysed. Once again the population genetic patterns are complex with distinct populations and intermingling evident. Of note is the conservation action taken, including the printing of informative postcards and community based education, and sampling of all populations for *ex situ* conservation. All of these conservation strategies are well suited to the situation in many species of *Encephalartos*. Also, the need for thorough sampling of species across their distribution range is evident and should be a must in genetic analysis of *Encephalartos.*

CHAD HUSBY of the Montgomery Botanical Center presented comparative results on containers and growing media used in cultivation at the Montgomery Botanical Center, including a wide range of cycad species and ecological needs. Three rare *Zamia* species were used for testing of various substrates including silica sand, turface, perlite, pumice, and shale; with plants being supplied with liquid nutrients. For species prone to disease it was concluded that coarse sterilised silica sand performs best. This hold great promise for cultivation of *Encephalartos* species, especially unrooted suckers and notoriously disease prone species.

Our own STEVE TROLLIP gave an anecdotal account of historical translocation and reintroduction programs of wild *Encephalartos* populations covering *E. humilis, E. inopinus, E. cupidus, E dyerianus,* and *E. laevifolius* by Nature Conservation, and as reported in *ENCEPHALARTOS* no 104, a private effort on *E. middelburgensis.* Most projects have been less than satisfactory in terms of the end results, and *in situ* propagation was abandoned in all but the latter case. Hopefully the costly lessons learnt will be implemented in future endeavours which should be implimented in especially the case of *in situ* propagation, and only in extreme circumstances for translocation.

PATRICK GRIFFITH of the Montgomery Botanical Center demonstrated their Plant Search Database as part of the Global Botanic Garden Congress outputs. Custodians of *ex situ* collections were asked to join in an effort which allows for the sourcing of material from gardens in a way that is safe. This removes pressure from wild populations and improves the effectiveness of funding. It also allows for the use value of such collections and enables their associated expertise to be realised. This is very applicable to South African gardens and it is good to see the Lowveld Botanical Garden as one of the partners in this endeavour.

In Plenary Talk no. 4

JOHN DONALDSON of SANBI at Kirstenbosch gave an overview of the global cycad assessment completed in 2010, a continuation of the 2003 project. The cycads were compared to other groups such as Conifers and Amphibians that had been assessed so far, and found to be the clear standout as highly endangered. However, assessments of more comparable groups such as succulents are yet to be completed. All cycads were found to have declined since the last assessment in 2003 and over 62% are now included in the IUCN Red Data List. Africa is shown as the region with the highest threat and decline over the period. This must serve as a call for drastic action on the African continent, especially in its center of endemism which is South Africa.

Session 9 and 10 were again devoted to Genetics:

ALAN MEEROW of the United States Department of Agriculture in Miami here presented results of yet another part of his research team's umbrella project on the genetic variation found amongst the taxonomically uncertain species grouping known as *Zamia pumila* and associated species. Very sensitive molecular techniques were applied in this case to resolve relationships between populations and species of which the sampling is very thorough. Mean genetic variation between and within populations was compared. The results indicated high geneflow in populations of some species, compared to genetic isolation in others. The distribution patterns prompt interesting speculation on human aided dispersal based on the known developmental history of the islands. The human influence on distribution of *Encephalartos* has not been investigated and may well be worth looking at.

MARIA BALDO-ROMERO of the Univerdad Veracruzana in Mexico spoke on sex identification of sterile *Zamia furfuracea* plants, and morphological traits within plants of specific sexes. Numerous *in situ* measurements were made, with the only linked morphological traits to sex being rachis width. These results are however not very robust, as the statistical correlation is low and numerous ecological factors are known to influence such traits. The

Figure 15.—Closing ceremony of CYCAD 2011 in the Fairy Lake Botanical Garden, with Patrick Griffith and Li Nan.

study aims to continue investigating the link of DNA methylation, which influences the expression of genes, and its link to sex determination. This will hold great promise for *Encephalartos* species such as *E. woodii, E. relictus* and *E. brevifoliolatus* of which only males are known.

ZHI-RONG ZHONG of the Fairy Lake Botanical Garden reported on the inheritance pattern in *Cycas.* Though most flowering plants have their chloroplast and mitochondrial genes and alleles inherited from the female parent, in several gymnosperms it is paternally inherited. Their research however clearly demonstrates that in cycads the female parent donates the genetic material in both these organels. This is corroborated by work done previously on *Encephalartos*.

SANCHEZ-COELLO of the Universidad Veracruzana in Mexico reported on his team's efforts to use various gene expression markers to determine sex specific ones in *Ceratozamia mexicana.*

STEVE TROLLIP discussed the current status of all known populations of *Encephalartos laevifolius*, based on site visits by third parties, and highlighted factors that have contributed to their marked decline in so many cases. Habitat loss and illegal poaching seem to be the main culprits along with failed rescue attempts. Many locations are now devoid of plants with others perilously close to empty. No mention was made of the reproductive capability of remaining populations but one might assume it is severely reduced if not absent.

LEONIE STANBERG of the Royal Botanic Gardens in Sydney, Australia, gave a tribute to the life and work of her late colleague and world expert on *Cycas*, Ken Hill.

A number of informative posters were presented:

LEONIE STANBERG of the National Herbarium of New South Wales in Sydney, Autralia presented a review of the genus *Cycas* in China.

NAN LI of the Fairy Lake Botanical Garden in China) exposed a new fossil cycad from China.

JIN ZHENG of the Qingxiushan Scenic Spot in China explained the *ex situ* conservation of cycads at the Qingxiushan Scenic Spot.

ZHI-XIANG YU of the Panzhihua Cycad National Nature Reserve in China reported on the effect of fire on *Cycas panzhihuaensis.*

STELLA CUESTAS of the Montgomery Botanical Center compared horticultural practices through trail and error at the Montgomery Botanical Center.

WILLIE TANG of the United States Department of Agriculture in Miami related the story of the conservation efforts on *Cycas debaoensis* in China (see page 44 in this issue).

THOMAS MARLER of the University of Guam presented research results on the population status of *Cycas nongnoochiae.*

YODYING SONSUPAB of the Department of Agriculture in Thailand reported on the state of the *Cycas chamoensis* populations.

KHURAIJAM SINGH of the GGS Indraprastha University in India had a poster on the illegal trade in *Cycas* cones in north-east India.

TANG-LING WEI of the Forestry Bureau of Wangmo County in China showed the effects of *Liloceris* sp. on *Cycas guizhouensis.*

WILLIE TANG of the United States Department of Agriculture in Miami announcded a new beetle genus of the Pharaxonothinae (Erotlidae) from Asia.

XING-RONG WANG of the South China Agricultural University explained the risks posed by various cycad pathogens.

TRACY MAGELLAN of the Montgomery Botanical Center related amazing results with the application of used coffee grounds as a mulch for treating cycad plants against for cycad scale *Aulacaspis yasumatsui.*

SHOU-ZHOU ZHANG of the South China Agricultural University reported on the sex differential transcribed products in *Cycas elongata.*

HONG WO of the South China Agricultural University explained the sporogenesis patterns in *Cycas* species.

MARIA SANCHEZ-TINOCO of the Universidad Veracruzana in Mexico demonstrated the cytoplasmic connections between central and transfer cells in both *Ceratozamia mexicana* and *Zamia furfuracea.*

MARIA SANCHEZ-TINOCO also explained the developmental cycle of the ovules to seeds in *Zamia furfuracea.*

ZHAO-YU HUANG of the Yulin Normal University in China reported on their investigation into the reproductive traits of *Cycas revoluta.*

CLAUDIA CALONJE of theMontgomery Botanical Center presented a poster on the sex ratios of cycads at the Montgomery Botanical Center.

NIRMALA DONGOL of the University of Guam reported on the amount and frequency of reproductive and vegetative growth events.

WILLIE TANG of the United States Department of Agriculture in Miami discussed the heat production in cones of *Cycas* species.

On the 5th December there were no presentations. Instead we were taken to a reservoir within the city limits, above which the only known population of *Cycas fairylakea* grows. Obviously this species had narrow escape from extinction. The plants occur along a perennial stream, quite close to the water. Our visit was during the dry season, but it seems probable that during heavy rains some plants are partially inundated. It may well be one of the few species of *Cycas* which really need a lot of water. It is an attractive species with stems up to 1.5 tall, and 3 m long leaves. Unfortunately no cones were seen, and neither any seedlings.

Finally the last day of the conference dawned, and that afternoon we were taken to the Fairy Lake Botanical Garden. It had changed unrecognisably since the photos in ENCEPHALARTOS **48**: 22–25 (December 1996) were taken, with the cycads much bigger and the surrounding trees having sprung up. There are separate departments for cycads from different parts of the world.

The day, and the conference, ended with a Chinese-style barbeque in the garden.

The 9th International Conference on Cycad Biology was my first attendance of these conferences and did not disappoint. The talks were of a high standard and although English was troublesome at times, it was thoroughly enjoyable. I look forward to 2014 in Colombia where the expected wide use of Spanish is likely to test my comprehension.

THE TRADE IN SOUTH AFRICAN ENCEPHALARTOS SPECIES FOR TRADITIONAL MEDICINE: ADDED PRESSURE TO THE CYCAD EXTINCTION CRISIS

Stephen Cousins[1]

South Africa's cycad extinction crisis

The 2010 Global Cycad Assessment indicates that of all the taxa that were comprehensively assessed for the IUCN Red List Assessments in 2009, cycads hit top of the charts as the most highly threatened group globally. Analyses of the trends emerging from successive Red List Assessments between 1997 and 2009 has shown that Africa has consistently been the region with the greatest threats to wild cycad populations. Over half of Africa's cycad species are found in a critical centre of cycad diversity in South Africa (37 *Encephalartos* species and *Stangeria eriopus*). Twenty-nine of South Africa's 38 taxa are local endemics, and a startling 32 are classified as threatened on the IUCN Red List. Three species *(Encephalartos brevifoliolatus, E. nubimontanus* and *E. woodii)* are already Extinct in the Wild (EW) and several other Critically Endangered (CR) species are rapidly facing the same fate. The ongoing dramatic declines observed across numerous wild populations of South African cycads are largely as a result of intensive illegal collection of wild plants by unscrupulous cycad collectors. These illegally-acquired wild cycads then enter the poorly-regulated cycad trade where they often fetch exorbitant prices depending on the species traded.

To the average gardener cycads are a "nice-to-have", unusual addition to the garden. Modest cycad enthusiasts often have comprehensive, but mostly legal collections of South African species. However, to other more serious collectors they are often seen as highly desirable status symbols or the objects of an insatiable obsession. Rarity-fuelled demand for these uniquely beautiful plants frequently drives serious collectors to exceptional lengths to obtain the rarest and most valuable cycads. Not only are they removed from the wild, but there have also been several cycad thefts from local botanical gardens. Restrictive legislation, law enforcement and concerted efforts to carry out effective *in situ* and *ex situ* cycad conservation have met with mixed success in the past. Unfortunately, the very measures put in place to protect wild cycads in South Africa have sometimes inadvertently had the undesirable effect of actually threatening wild populations further.

Illegal collection for the horticultural trade is not the only driver behind the South African cycad quandary. Other contributing factors include habitat destruction, alien plant species encroachment, natural death, and exploitation of wild plants for traditional medicine ('*muthi*'). The continuously worsening situation has recently been termed the 'South African cycad extinction crisis' and therefore calls for an urgent, comprehensive and integrated conservation strategy with substantial emphasis on effective management of trade. In response to this situation, the SANBI Scientific Authority has recently engaged with cycad researchers, conservationists and law enforcement officers to develop a strategy to solve this problem by means of new legislation involving the use of Non-Detriment Findings (NDFs). It is hoped that this new approach will be a 'win-win' situation for both cycad conservation and the cycad trade.

The traditional medicine trade in South Africa

While the illegal collection of South African cycads is by far the greatest threat to their survival in the wild, many species are also adversely affected by harvesting for traditional medicine. South Africa's traditional medicine trade is a large, rapidly growing industry worth an estimated R2.9 billion per year. Supplying approximately 27 million consumers, the trade employs over 130 000 people and is fuelled by escalating population growth, high unemployment rates, and the high cultural value of traditional medicines. More than 770 indigenous plant species are traded, many of them in staggering quantities. The plant parts sold include bark, roots, stems, leaves, fruits, seeds, bulbs and whole plants. In recent years, increased commercialization of the trade has negatively impacted many popular plant species, and intensive harvesting of wild indigenous flora for traditional medicine is considered a serious threat to biodiversity.

Figure 1.—A consignment of illegally-collected wild *E. ghellinckii* individuals confiscated by nature conservation officials in the Eastern Cape. Photograph courtesy of Dean Ricketts.

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Figure 2.—One of several buildings that house the traders at the Faraday traditional medicine market in Johannesburg. Photographer: Stephen Cousins.

The use of South African Encephalartos species for traditional medicine

People have been using cycads across the world for centuries, and in South Africa the Afrikaans name "broodboom" refers to the historical use of starch-rich *Encephalartos* stems by indigenous people for making rudimentary bread, usually in times of famine. This practise seems to have disappeared in South Africa and in recent times has only been observed in Mozambique. Traditional use of *Encephalartos* species in South Africa primarily involves the harvesting of stem material for medico-magical purposes (Figure 3). Wild-harvested stem material is sold in local traditional medicine markets by the Zulu name '*isiGqikisomkovu'* (or occasionally *isiDwabasomkhovu*), roughly translated as "Seat of the Familiar" or "Zombie's Pillow". The genus is traditionally given to subjects as an antidote to the mischievous activities of evil spirits or 'zombies'. In this context, *Encephalartos* plants are grown near houses as charms to protect the residents against the *imikhovu* (witches' familiars or 'hairy dwarfs'.) When the little rogues arrive to wreak havoc, their plans are thwarted as they find themselves stuck in the leaves of the prickly cycad outside. Sometimes young plants were sold at markets to be grown for this purpose, and the practise possibly still continues today. The use of stem material (bark strips and stem fragments) for magic rituals is, however, much more common. In recent years, an increase in the harvesting of *Encephalartos* species for *muthi* has been observed at several localities across South Africa. Exploitation of wild cycads for *muthi* has led to the demise of numerous cycad populations. Two of the hardest hit species are *E. frederici-gulielmi* in the Eastern Cape and *E. natalensis* in KwaZulu-Natal.

Until recently, the threat posed by the use of South African *Encephalartos* species for *muthi* was largely understudied. Information on the quantities and actual species traded in local *muthi* markets was scant and mostly speculative. This lack of knowledge combined with con-

Figure 3.— (a) A single clump of *E. paucidentatus* (Vulnerable, VU) showing signs of severe damage due to *muthi* harvesting. The plants were totally destroyed subsequent to the photo being taken. (b) The stem of a mature *E. laevifolius* (Critically Endangered, CR) individual almost completely severed by *muthi* harvesters. (c) An *E. dolomiticus* (CR) individual stripped of a substantial amount of bark and inner stem tissue. Photographs courtesy of (a) Coenraad van Zyl and Xander de Kock, (b) John Donaldson, (c) Xander de Kock.

cerns about the impacts of the *muthi* trade on wild cycad populations provided the basis for an honours project on the topic.

Introducing the study

In early 2009, a study was launched to investigate the trade in South African *Encephalartos* species for traditional medicine. The study was undertaken at the University of the Witwatersrand, Johannesburg with funding from the South African National Biodiversity Institute (SANBI) and the NRF. The project was given the title "An ethno-ecological assessment of the *Encephalartos* species in the traditional medicine trade on the eastern seaboard of South Africa." The primary aims were to:

a) Quantify the trade in South African *Encephalartos* species for traditional medicine, and

b) Identify the actual *Encephalartos* species commonly traded.

To carry out these aims, surveys were conducted in South Africa's two largest traditional medicine markets, namely the Faraday market in Johannesburg and the Warwick market in Durban. Surveys involved conducting interviews with traders selling cycads, and purchasing *Encephalartos* stem samples for identification and further analyses (Figure 4). The quantity of cycads sold by each vendor was estimated, and the stem fragments purchased were allocated to stem diameter size classes to estimate the sizes of the plants harvested. Photographs and descriptions of the species identified were then used to develop an identification guide to the species commonly traded in Faraday and Warwick.

What we found

Results showed that *Encephalartos* species were sold by 26% of the traders at Faraday and 13% at Warwick, with an estimated 9.0 metric tonnes of *Encephalartos* traded at Warwick in 2009. *Encephalartos* species were thought to be traded as bark strips only (live leaf bases attached to some inner cortex tissue), but the study revealed that both bark strips and slices of entire stems are sold. Due to the fact that the cycad material is sold as stem sections and not whole stems, it was difficult to estimate the actual number of individual cycads affected by harvesting. However, the estimated mass of cycads traded at Warwick revealed that the trade is more extensive than previously thought, which raises questions about its sustainability. Size class analyses suggested that *muthi* gatherers target mostly sub-adult and adult cycads.

A comprehensive literature search revealed that cycads are harvested for *muthi* in all the provinces in which they naturally occur in South Africa. Astoundingly, not only are common species targeted, but there is evidence of Critically Endangered (CR) species such as *E. hirsutus* and *E. dolomiticus* being utilized as well (see figure 3c). Twenty-three South African *Encephalartos* species are cited in the literature as being used for traditional medicine, and the findings of this study resulted in the addition of two new species to the list, which brings the total to 25. Records of the harvesting localities cited by the vendors at Faraday and Warwick indicated that for some species there are harvesting hotspots where there are probably large and reasonably accessible populations that are easy targets for *muthi* gatherers (see Cousins et al., 2012). These populations therefore require careful monitoring and implementation of conservation interventions to secure their survival.

The absence of leaves and cones, which are commonly used to identify cycads, presented a major challenge to the identification of the species traded in the markets. During the interviews traders were asked if they knew where the cycads were harvested, and almost all the plants traded were reported to have originated from KwaZulu-Natal (KZN). Therefore, identification was undertaken by comparing trader citations of harvesting areas with the geographical distributions of the *Encephalartos* species in KZN. The morphological features of the stem samples with their associated harvesting localities were then compared with other samples to further verify the identifications. (Stem characters included leaf base size, shape and colour, stem diameter size, presence or absence of wool, etc. (see Figure 5)).

Figure 4.— (a) A selection of plants and plant parts at a typical stall in the Faraday market, downtown Johannesburg. A small heap of fresh *Encephalartos* stem slices is visible on the right hand side of the photo. (b) A packet of *Encephalartos* stem pieces purchased from a trader at Faraday for ZAR10. Photographer: Stephen Cousins.

Figure 5.—Selection of leaf bases excised from 19 different *Encephalartos* stem fragments purchased at the Faraday market (three leaf bases per stem fragment). Note the differences in shape, size and colour. All the leaf bases in this photograph have their woolly undersides facing upwards. Their upper surfaces are smooth and somewhat glossy across all the species, and generally show more colour variation among species than the undersides. These morphological characters were measured, described and then compared between specimens to distinguish between species.

The most commonly traded species in Faraday and Warwick were identified as *E. natalensis* (Natal Giant Cycad), *E. villosus* (Poor Man's Cycad) and *E. ghellinckii* (Drakensberg Cycad). These are the three most widely distributed cycad species in KZN and therefore considered reasonably accessible to plant gatherers. *Encephalartos ngoyanus* (Ngoye Dwarf Cycad) and what appeared to be *E. senticosus* (Jozini Cycad), as well as *E. ferox* (Zululand Cycad) were also encountered in smaller quantities. Large arborescent (tree-like) cycads such as *E. natalensis* appear to be harvested primarily by removing bark strips from adult individuals, while subterranean and dwarf species such as *E. villosus* and the lowland form of *E. ghellinckii* are harvested by removing the entire plant or large parts thereof. Descriptions of stem morphological features, plus photographs and measurements of the stem sections and leaf bases of six *Encephalartos* species traded in Faraday and Warwick have been compiled in the form of an identification guide for ethnobotanists and conservation officials working on South African cycads. The six species included in the guide are *E. natalensis, E. ghellinckii, E. ferox, E. villosus*, *E. senticosus* and *E. ngoyanus.* The guide is intended as a tool to help identify the leafless cycad stems and stem sections encountered not only in the *muthi* markets, but also in confiscated consignments of illegally collected plants bound for the horticultural trade. Publication of the guide is envisaged for the end of 2012 (see Cousins et al., in prep).

In terms of the physiological and ecological impacts of the exploitation of wild cycads for traditional medicine, it has been shown that intensive bark stripping has highly detrimental effects on the health of wild populations. Wounded parts of the stems are exposed to fungal and insect attack, and the vascular tissues (xylem and phloem) may be damaged, thus impeding the flow of water and nutrients through the plant. Removal of whole plants has an even more devastating impact, since entire reproductively mature individuals are lost from the population, thus resulting in a sharp decrease in reproductive output and seedling recruitment. Since cycads are such slow-growing plants, it can take many decades for the population to recover from such a catastrophic event.

It is quite possible that prior to the rapid commercialization and expansion of the *muthi* trade, harvesting of *Encephalartos* species was done more sustainably in the form of bark strip removal only, and *not* whole stem removal. Now that there are more and more untrained gatherers collecting plants to satisfy an ever-increasing demand, customary harvesting practises are being lost, and wild plant populations are becoming severely over-exploited. This trend has been observed in several indigenous tree species that used to be harvested sustainably, but are now being ring-barked from top to bottom, resulting in the death of the tree. Good examples of South African cycad populations that have been severely affected by *muthi* harvesting are the *E. friderici-guilielmi* population at Tsolo in the Eastern Cape and the type locality of *E. natalensis* in KZN (see matched photographs of *E. friderici-guilielmi* in Donaldson and Bösenberg, (1999)). In some cases undocumented populations of known species (and possibly new and undescribed species) are wiped out by *muthi* gatherers before herbarium specimens have been formally collected and described. Clearly there is a pressing need for effective conservation action to abate species extinctions resulting from the horticultural and medicinal trades in South African cycads.

Conclusions

- The trade in South African *Encephalartos* species for traditional medicine appears to be unsustainable due to the large quantities traded and the manner in which the cycads are harvested (i.e. whole stems in addition to bark strips).
- The species most prevalent in the Johannesburg and Durban traditional medicine markets are *E. natalensis, E. villosus* and *E. ghellinckii.*
- Large arborescent species such as *E. natalensis* appear to be harvested primarily by the removal of bark strips, since cutting down their entire stems would involve considerable time and effort. In the case of smaller arborescent species (e.g. the lowland form of *E. ghellinckii*) and subterranean species (e.g. *E. villosus* and *E. ngoyanus*) their entire stems are cut down or dug up and then sliced before being sold at the markets.
- Impact assessments and monitoring of the wild cycad populations most affected by *muthi* harvesting would be highly beneficial for informing conservation and management decisions.
- Members of the public are requested to send the author any photographs and information (including locality data) on *Encephalartos* species affected by *muthi* harvesting. This information will then be passed onto the relevant conservation authorities for inclusion in their conservation action plans.

Acknowledgements

I would like to express my gratitude to my honours supervisors Prof. Ed Witkowski and Dr. Vivienne Williams for their guidance, encouragement and foresight. Without their time and expertise this project would not have been possible. I thank Dr. John Donaldson for securing funding through SANBI and for providing valuable correspondence and some of the photographs. The NRF is also

thanked for providing additional financial support. De Wet Bösenberg is thanked for his assistance with the ArcView species distribution maps. I thank my colleague Ewa Fourie for her help and support throughout the project, and Dean Ricketts and Xander de Kock are thanked for providing photographs for inclusion in the article. Lastly, I sincerely thank the Cycad Society of South Africa and the organizers of the 9th International Conference on Cycad Biology (CYCAD 2011) for funding my attendance at the conference to present this work.

Further reading

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CYCAD SOCIETY OF SOUTH AFRICA JOINS THE *CYCAS DEBAOENSIS* PROJECT

William Tang*

Figure 1.—Wild plant of *Cycas debaoensis* overlooks one of the villages in Fuping valley.

Introduction

Cycads are threatened with extinction in many parts of the world. Solutions to this crisis will likely differ from country to country depending on local customs, as well as prevailing economic and political conditions. Studying conservation projects in various countries, however, provides new inspiration and models that may be adapted for conservation issues in our own region. This was my personal view when I started a cycad conservation project in China in 1999.

Project history

In 1997, a beautiful member of the bamboo *Cycas* species group was discovered in a remote mountainous area of Guangxi Province, China. It was named *Cycas debaoensis*. Like other members of its group it had divided leaflets and resembled bamboo in appearance (Figures 1–4). Unlike other members of its group, however, this species grew in full sun and was capable of producing a luxuriant crown of leaves. Within a year of its scientific discovery the type population of this species had been plundered and reduced from approximately 2000 to 500 individuals by local villagers seeking to make a quick profit from this plant (Ma et al. 2003). It appeared to authorities that nothing could be done to stop the demise of the wild population. I had been intrigued by village nursery projects started by Andrew Vovides in Mexico (see Vovides et al. 2010) and decided that this might be a solution to this particular crisis. In this conservation model, the villagers living next to a threatened population of cycads are encouraged to start a nursery using seeds from the wild population. The cycad is grown as a cash crop and the villagers, through an education initiative, learn to view their cycad population as a renewable resource to be protected for their children and grandchildren. A similar project had been started for *Encephalartos transvenosus* and enjoyed some measure of success for a time. I felt that this model could be adapted to China.

I found two partners for the *Cycas debaoensis* project, Prof. Liu Nian, then at South China Botanical Garden, and Anders Lindström, of Nong Nooch Tropical Garden in Thailand. In our initial visit we held a village meet-

*Miami Springs, Florida, U.S.A.

Figure 2.—Plant usually grow on limestone outcrops.

Figure 3.—Male cone of the Debao Cycad.

ing and told the villagers of our concept of the plant as a "goose that lays the golden egg" and explained that if they nurtured this special plant as a resource it would continue to produce a profit for them for generations. In many ways this cycad and village were ideal for a nursery project. The villagers were poor, with few resources, and would be more receptive to our advances. The plant and village were also isolated in mountainous terrain and could only be reached after many hours along bumpy dirt roads, thus the number of competing influences would be limited. No one in the village recalled a foreigner ever visiting the area. Even Chinese from other provinces rarely visited.

Our initial attempt to map the cycads on their mountain brought great excitement to the village over three days, as children and adults alike assisted us with GPS readings and spray painting numbers on rocks next to plants (Figure 5). One village family volunteered a plot of land to establish a cycad nursery. Seedlings were subsequently planted and the first plant coned in the nursery after five years and now some 11 years later most of the plants in the nursery are mature and are producing seeds (Figure 6). In the meantime we needed to develop an education initiative. The locals are a minority people who speak a version of the Thai language. Anders, fluent in Thai, was able to speak directly to the villagers, who expressed a concern about their young children walking 2 km each day to school at the end of the valley. The villagers proposed the idea of building a schoolhouse in the village – an idea that both the project managers and villagers embraced.

Figure 4.—Female cone of the Debao Cycad.

For the next 7 years, first with US$6000 from Nong Nooch Tropical Garden and then several thousand more from Cycad Gardens and Jurassic Garden in southern California as well as funds from The Cycad Society and the Central Florida Palm and Cycad Society our group provided bricks and concrete and the villagers provided labor to build the school. This building stands nearly complete today (Figure 7) and is a physical monument of the conservation effort. During construction, however, provincial education officials declared that only one elementary school, located 2 km away, was allowed to serve the valley where this cycad lived, so this building, a "cycad education center" so to speak, is now used by villagers for office space, crop storage and other purposes.

Over the years it became more and more apparent that education of kids was the most effective way to spread the conservation ethic. From the children the idea spreads to parents and other adults. I originally approached this project as a scientist, but learned to appreciate that conservation work is about education and dealing with people in a fair and respectful way. In 2008 the Palm and Cycad Societies of Australia (PACSOA) joined the project with a US$900 grant. With this seed money Prof. Liu, now at Zhongkai University in Guangzhou, organized a meeting for the IUCN Cycad Specialist Group (CSG) to visit the project site. My wife Limei (who served as interpreter and cultural advisor during the entire project) led the group on a two week visit to conduct surveys on the bird, reptile and insect fauna of the area, experiments on pollination biology and a resurvey of the population. Chinese are fascinated by foreign visitors and the presence of European and Indian faces brought a lot of excitement to the valley. We found that our activities had inspired teachers from the nearby Guangxi Normal University, who contributed to the education initiative and helped to rename the local elementary school the "Debao Cycad School", the only school in China, and perhaps the world, named after a cycad. Our group added to the teachers' education initiative by donating two computers as well as books and other educational materials to the Debao Cycad School (Figure 8).

The level of success that our activities achieved was possible, in large part, because of the excellent cooperation of the local department of forestry. Three successive Heads of the Debao County Forestry Department provided transportation and logistical support for our visits and were

Figure 5.—Each plant in the wild population was mapped and numbered to track the progress of the conservation project.

Figure 6.—Village cycad nursery in 2011 with mature plants; L to R: L. Tang, W. Tang, C. Lopez-Gallego, Lu Yan Zhao (Debao Forestry Dept.), C. Calonje, M. Calonje.

very helpful in integrating our project into the fabric of the local culture. Similarly the education establishment, from local school teachers to professors at the Guangxi Normal University, embraced the project and its conservation message. Education is prized in Chinese culture and is almost universally recognized as a route to success in life. This tenet of Chinese society no doubt played a large role in why this conservation approach worked.

Cycad Society of South Africa joins project

In December 2011 the international cycad conference, CYCAD 2011, was held in Shenzhen, China and presented another opportunity to advance the *Cycas debaoensis* project. Before the conference Piet Vorster, Past President of the Cycad Society of South Africa, helped to secure a US$600 grant from the Society for the project. China, like many cycad areas of the world, is a rapidly developing country. In the 12 years that the project managers have been visiting Debao County, where this cycad and the villagers live, dramatic changes have come to the region. Vast deposits of aluminum ore were discovered, a processing plant was built, and roads were paved. Income for villagers from farming soared as demand for food and cash crops grew with a local population that was doubled in size by migrant labor. In the year 2011 we found that the central government had demolished the old Debao Cycad School building and begun construction of a new school building to accommodate a growing number of students. Where once our project attracted coverage by local and national newspapers and TV, it was

Figure 7.—Village school building built as a result of the project as it stands in 2011.

now a relatively smaller concern in a rapidly changing society. As project managers, Prof. Liu, Anders, my wife and me have been challenged throughout this project by how to make a conservation project succeed with a minimal budget and in the face of rapid change. On this trip, Michael and Claudia Calonje, of the Montgomery Botanical Center in Florida, and Cristina Lopez-Gallego, from the Universidad de Antioquia in Colombia, accompanied us to the project site (Figure 6). Michael and Cristina, as well as other members of the Cycad Specialist Group donated more than US$200 to add to our total budget. We

Figure 8.—Members of the IUCN Cycad Specialist Group present computers and educational materials to the Debao Cycad School in 2008.

Figure 9.—Project participants Prof. Huang Yu Yuan and Limei Tang hand out scholarships to elementary school students at the village next to the population of *Cycas debaoensis*.

Figure 10.—Elementary school students hold certificates and their 100 yuan scholarship money (worth approximately US$16).

decided the best use of the Cycad Society of South Africa and CSG grants was to make conservation scholarships available to the elementary school kids in the village next to the cycad population. This appeared to be the most effective option at this juncture of the project. We consulted the headmaster of the Debao Cycad School at his temporary facility and it was decided that in addition to a small donation for sporting equipment to the elementary school (balls and ping pong nets) we should disperse a scholarship to the 38 students in the village that attend the school. We designed scholarship certificates on my laptop computer, printed them at a local shop and with the help of teachers wrote the name of each student on each certificate. Then I traveled, with assistance from the Debao County Forestry Department, to meet Piet Vorster and John Donaldson (Head of the IUCN Cycad Specialist Group) on their post–conference tour to sign the certificates. News travels quickly in a village. When we arrived later that afternoon the kids were waiting for us and ran to join the group as we headed out to see the cycad nursery and wild plants. The distribution of scholarships was an exciting event for everyone (Figures 9–11).

Future of the Project

It has been over a dozen years since the scientific discovery and description of *Cycas debaoensis*. This year the Head of the Forestry Department in Debao County, Mr. Nong Bao Quan (Figure 12), explained to me that the wild population had finally been designated a provincial preserve under the management and protection of the

Figure 11.—Some CYCAD 2011 tour group members pose with school kids in front of the "cycad education center" built during the project; back row left to right: L. Stanberg, P. Vorster, P. Xaba, J. Donaldson, W. Tang, B. Q. Nong.

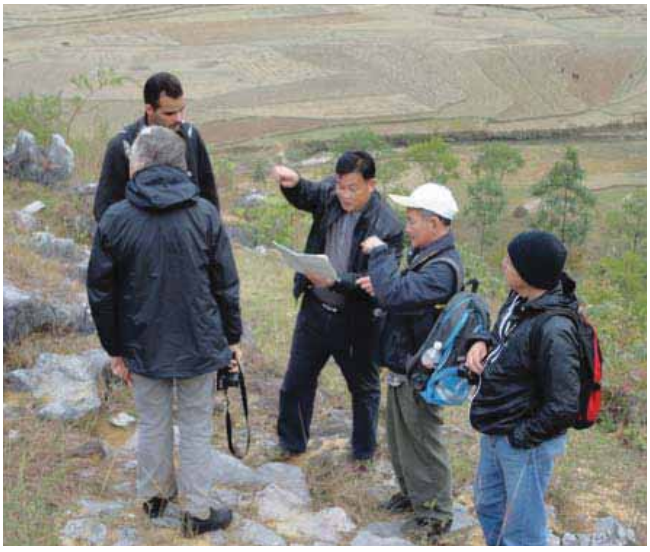

Figure 12.—The Head of the Debao County Forestry Department, Mr. Nong Bao Quan (left), examines a map of the wild population with the author.

Forestry Department, and this designation included the hiring of two rangers from local villages. Our challenge now is to work with the Forestry people and ensure that progress in conservation continues.

Looking back at my experience I would say that perseverance and a willingness to adapt to changing situations has been the key to running this project. The managers have striven to make it a grass-roots project, attracting funds and involvement from cycad societies, botanical gardens, commercial nurseries and private individuals. Compared with other projects the total amount of money spent has been small, but great effort was made to reach out to villagers and governing authorities. I suppose conservation is akin to the process of raising a child – something that parents of all backgrounds can appreciate. It is a long term process and worthwhile results come only with commitment and effort.

For more information on the *Cycas debaoensis* Project see Tang et al. 2004, Tang 2008 or visit the website: www.debaocycad.info

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LETTERS TO THE EDITOR / BRIEWE AAN DIE REDAKTEUR

CONING *CYCAS DEBAOENSIS.*

Dear Editor,

To my knowledge this is the first recorded coning of *C. debaoensis* in South Africa in a garden. The plant is in my garden in Pretoria and around 8 years old. It is a male. Leaves of the plant are around 2m long.

Morné Ferreira

Coning of *C. debaoensis*

MATERIAL OF *ENCEPHALARTOS TEGULANEUS* SUBSP. *POWYSII*

Dear Cycad Society Members,

I am doing research on the genus *Encephalartos*. The only taxon missing out of the entire genus is *E. tegulaneus* subsp. *powysii* and I would dearly like to have a complete collection for the upcoming article we wish to publish. I would of course like to have material of known origin, but will settle for any material at this stage.

Thanks in advance

Philip Rousseau
pr.philiprousseau@gmail.com

[If anybody can help Philip with material, please contact him directly. Ed.]

Hallo Wynand

Ek het 'n tydjie gelede hierdie besie afgeneem op my *E. eugene-maraisii*. Kan jy dalk hom identifiseer? Jy kan dit in die volgende uitgawe van ENCEPHALARTOS publiseer indien jou sou wou.

Vriendelike Groete
Steven Jordaan
072 909 2635

[Steven reported this bug on his *Encephalartos eugene-maraisii*. Can anybody identify it perhaps? Ed.]

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GROW CYCADS BY DONALDSON & WINTER

The Society has obtained a stock of the booklet 'Grow Cycads', written by Dr. John Donaldson and John Winter, and published by the South African National Biodiversity Institute (SANBI) under their Kirstenbosch Gardening series. Dr. Donaldson is well-known amongst cycadologists, either as the author of articles appearing in *ENCEPHALARTOS* or as a source of reference used by other authors.

The booklet is A5 in size, consists of 36 pages, is printed in colour and addresses various matters under the following headings:
Propagation from seed • Vegetative propagation • Cultivation
• Container plants • Pests and diseases • Landscaping with cycads
• Cycads and the law

What is of interest is the table listing the distribution, availability, features, and growing conditions for South African cycads, setting out their water and sunlight preferences, whether they are frost-hardy, their overall leaf colour and availability/scarcity. The booklet is written in layman terms and is ideal for the novice/beginner.

It sells for R60.00, excluding postage, from the SANBI bookshops. However, due to a discount passed on to the Society, we are able to provide it to members at the cost of **R60.00** inclusive of postage to South African addresses. It is available from the secretary/treasurer whose contact details appear elsewhere in this issue.

CYCAD-O-METER

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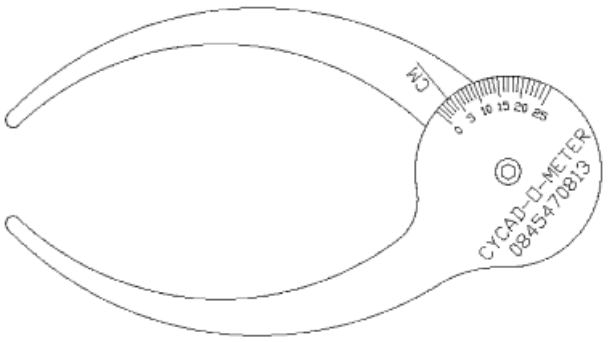

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SAAD

Piet Vorster (Stellenbosch) het interessante saad.
E-pos: pjvors@gmail.com

GROW CLIVIAS BY GRAHAM DUNCAN

The Society has obtained the latest edition of Grow Clivias, also published by SANBI, under their Kirstenbosch Gardening Series, written by Graham Duncan.

This edition is a vast improvement over the previous one in that it has been expanded from 47 pages to 192 pages. It is also A5 in size, printed in colour and addresses, amongst others, the following:

A brief history • General information • Taxonomy • Hybrid, variegated & novelty clivias • Cultivation • Propagation • Pests and diseases

Apart from being a co-ordinator of the Kirstenbosch Gardening Series, Graham Duncan is a specialist horticulturist at Kirstenbosch Botanical Garden where he curates the collection of indigenous South African bulbs, and the displays inside the Kay Bergh Bulb House of the Botanical society Conservatory.

He has co-authored two major publications on indigenous bulbs, Spring and Winter Flowering Bulbs of the Cape with Barbara Jeppe, and Bulbous Plants of Southern Africa with Prof. Niel du Plessis.

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The Cycad Society (website: www.cycad.org; email: membership@cycad.org) is a nonprofit organization based in the United States. It is dedicated to the conservation of cycads through education and scientific research. The full color Cycad Newsletter is published 4 times per year. Membership is for the calendar year.

For more information, please contact:
Dr. Craig Nazor
Membership Director, The Cycad Society, 11701 Barchetta Drive, Austin, Texas 78758, USA

UITHEEMSE SAAILINGE TE KOOP

Bowenia spectabilis, Cycas. nongnoochiae, C. armstrongii, C. spp."silver", C. panzhihuaensis, C. siamensis, C. guizhouensis, C. tangingii, C. debaoensis, C. micholitzii, C. multipinnata, C. cairnsiana, C. platyphylla, C. seemannii, C. elephantipes, D. holmgrenni, D. merolae, D. califanoi, Lepidozamia peroffskyana, L. hopei, Macrozamia communis, M. mountperriensis, Zamia pseudoparasitica

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CYCAD SOCIETY OF SOUTH AFRICA

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Membership number of exisiting member for membership renewal

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1. *To encourage the cultivation and propagation of cycads.*
2. *To disseminate information on cycads by various means, inter alia through the regular publication of a magazine.*
3. *To arrange the legal exchange of plants, seedlings, seed, and pollen of different cycad species between members.*
4. *To encourage scientific research on cycads.*
5. *To promote all aspects of cycad conservation.*
6. *To foster and maintain links with organizations having similar aims on an international basis.*

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In addition to the membership fee I/We would like to make the following donations

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YES	NO

By ticking YES I/We hereby give permission to the Society to publish my/our contact and address details in the member list of the society to other members.

Signature _____ **Date** _____

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The appropriate addresses are:

- **Ian Bassingthwaighte:** P.O. Box 176, 0159 Montana Park (Pretoria), South Africa.
- **Paul Kennedy:** 21 Sierra Road, Engadine, NSW 2233, Australia.
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_____ Poskode _____

E-pos _____ Tel _____ Fax _____

doen hiermee aansoek om lidmaatskap van die **Broodboom Vereniging van Suid-Afrika** en verklaar dat ek/ons die doelstellings van die Vereniging soos dit hieronder gelys is, heelhartig onderskryf:

1. *Om die kweek en vermeerdering van broodbome aan te moedig.*
2. *Om inligting oor broodbome op verskillende wyses te versprei, onder andere deur die gereëlde publisering van 'n tydskrif.*
3. *Om die wettige uitruil van plante, saailinge, saad en stuifmeel van broodbome tussen lede te reël.*
4. *Om wetenskaplike navorsing oor broodbome aan te moedig.*
5. *Om alle aspekte van die bewaring van broodbome te bevorder.*
6. *Om bande met organisasies wat soortgelyke doelstellings het op 'n internasionale basis te smee en te handhaaf.*

- Ledegeld vir **2012***

  Addisioneel tot die ledegeld wil ek/ons ook graag die volgende bydraes maak:

  - Broodboomvereniging Navorsingsfonds
  - Algemene donasie

  Totaal (Ledegeld en donasies ingesluit)

JA	NEE

Deur JA te selekteer, gee ek/ons toestemming aan die Vereniging om my/ons kontak en adres besonderhede op die Vereniging se ledelys aan ander lede te publiseer.

Handtekening _____ **Datum** _____

*LEDEGELD VIR 2012

Plaaslike lede (inwoners van Suid-Afrika)	**R 200**						
Suider-Afrika lede (Namibië, Swaziland, Zimbabwe, ens) ***Lugposaflewering***	**R 320**	Suider-Afrika lede (Namibië, Swaziland, Zimbabwe, ens) ***Landposversending***	**R 280**	Oorsese lede ***Lugposaflewering***	**R 340** **US$ 52** **AU$ 52** **€ 36** **£ 32**	Oorsese lede ***Landposversending***	**R 300** **US$ 46** **AU$ 46** **€ 34** **£ 28**

Lede ontvang 'n kwartaalikse kopie van die vereniging se tydskrif *ENCEPHALARTOS*. Plaaslike lede moet hulle ledegeld en die voltooide vorm stuur aan Ian Bassingthwaighte en alle tjeks of poswissels moet uitgemaak word aan die "Broodboomvereniging van Suid-Afrika".

Ian Bassingthwaighte, Posbus 176, 0159 Montanapark, Pretoria, Suid-Afrika.

Betaling in Suid-Afrikaanse Rand kan ook gemaak word by:

Bank	Standard Bank	**Tak**	Hatfield	**Takkode**	01-15-45	**Rekeningnommer**	011943300
SWIFT	SBZAZAJJ						

Betalingverwysing: Lidnaam en lidnommer.
Bewys van betaling asook aansoekvorms moet gestuur word aan: Faks: +27 086678 9807 (faks na e-pos)
e-pos: cycad@cycadsociety.org

Nuwe lede ontvang 'n eksemplaar van al die uitgawes van *ENCEPHALARTOS* vir die jaar waarin hulle aansluit op die veronderstelling dat daar voorraad is.

CYCAD SOCIETY OF SOUTH AFRICA

www.cycadsociety.org

Posbus 176
0159 Montanapark
Pretoria, Suid Afrika

Tel/Faks: +27 12 548 1152
E-pos: cycad@cycadsociety.org

P.O.Box 176
0159 Montana Park
Pretoria, South Africa

Tel/Fax: +27 12 548 1152
Email: cycad@cycadsociety.org

DEBIT ORDER FORM

PERSONAL DETAILS OF CLIENT						
Surname / Company Name:						
Full names / Trading Name:						
ID number / Registration Number:						
Physical Address:						
Postal Address:						
Contact details:	HOME	WORK	MOBILE	e-MAIL	FAX	
Client reference number:						

BANK DETAILS OF CLIENT				
Name of Account Holder:				
Account Type:	CHEQUE	TRANSMISSION	SAVINGS	OTHER
Name of Bank:				
Account Number:				
Branch Name:				
Branch Code:				
Credit Card type:	MASTER	VISA		
Last 3 digits of credit card:				

COLLECTION INSTRUCTION - please tick the applicable										
R	Annual Deductions	X	Complete only date of 1st deduction	d	d	m	m	y	y
Annual escalation thereof	**See no. 7 below**									

I/We, the client or the duly authorised representative thereof ("the CLIENT"), hereby authorise the entity mentioned below ("**Cycad Society of SA** "), STRATCOL LTD and/or its agents, to collect by means of electronic debit from the above account in the name of the CLIENT at the same or any other bank, all or any monies due by the CLIENT to **Cycad Society of SA** , as principal debtor or for any other reason, and to pay same to **Cycad Society of SA** . The authority so given is restricted to the amount mentioned above and may be deducted on any mentioned 7 working days hereafter.
I accept the following to be applicable hereto:

1. This authorisation may only be withdrawn with 30 (thirty) days written notice to **Cycad Society of SA** at its physical address.
2. I and/or the CLIENT, individually and collectivity hold harmless **Cycad Society of SA** , STRATCOL LTD and/or its agents against any claim of any nature arising from the electronic debit or transfer or from any other cause following this authorisation and irrespective whether such authorisation had been withdrawn or not;
3. In the event of the relevant account not having sufficient cleared funds to meet any debit, I am aware that a unpaid fee will be debited against the CLIENTS account by its bank and an additional unpaid fee of **R50** will be charged by **Cycad Society of SA** relating to the return of the debit. I accept the responsibility to ensure sufficient cleared and available funds to the minimum of the limit above (or as amended from time to time).
4. Any reference to the entities above includes a reference to any successor in title or in appointment;
5. This authorisation is not an amendment to any specific arrangement regarding payment of accounts and serves merely as an arrangement as the method of payment, in part or in full and any account with **Cycad Society of SA** will only to be credited once actual payment is received by the **Cycad Society of SA** , and
6. Should any dispute arise about **Cycad Society of SA** 's right to collect any amount in terms hereof, the CLIENT shall have the onus to instruct his bank to refuse or return any debit as unpaid.
7. Annual fee to be advised in *Encephalartos* prior to the annual collection date.

DATE: _____ SIGNATURE: _____

STRATCOL REF: 0 0 0 0

CYCAD SOCIETY OF SOUTH AFRICA

www.cycadsociety.org

Posbus 176
0159 Montanapark
Pretoria, Suid Afrika

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0159 Montana Park
Pretoria, South Africa

Tel/Fax: +27 12 548 1152
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DEBIETORDERVORM

PERSOONLIKE BESONDERHEDE VAN KLIëNT															
Van / Besigheid naam:															
Volle name / Trading Name:															
ID nommer / Registrasie nommer:															
Fisiese Adres:															
Pos Adres:															
Kontak nommers:	HUIS	WERK		SELFOON		e-POS		FAKS							
Kliëntverwysings nommer:															
BANKBESONDERHEDE VAN KLIëNT															
Naam van rekeninghouer:															
Rekening tipe:	TJEK	TRANSAKSIE		SPAAR		ANDER									
Naam van Bank:															
Rekening Nommer:															
Taknaam:															
Takkode:															
Kredietkaart:	MASTER	VISA													
Laaste 3 syfers van Kredietkaart:															

TREKKINGS INSTRUKSIE - merk as van toepassing											
R	Jaarlikse aftrekkings	X	Voltooi alleenlik datum van 1ste aftrekking	d	d	m	m	j	j		
Verhoogings	Sien nr. 7 onderaan										

Ek/Ons, die kliënt of behoorlike gemagtigde verteenwoordiger daarvan ("die kliënt"), gee hiermee goedkeuring aan die entiteit hieronder genoem **Broodboom Vereniging van SA** , STRATCOL BPK en/of sy agente, om d.m.v. 'n Elektroniese Debietorder van die bogenoemde rekening te vorder, en om genoemde gelde oor te betaal aan **Broodboom Vereniging van SA** . Die goedkeuring gegee is beperk tot enige maksimum bedrag en trekkingsdatum gestel of binne 7 dae daarna.

Ek aanvaar die volgende om van toepassing te wees hiertoe:

1. Hierdie goedkeuring mag net teruggetrek word met 30 (dertig) dae skriftelike kennis aan die gebruiker by sy/haar fisiese adres;
2. Ek en/of die KLIëNT, afsonderlik en/of gesamentlik, vrywaar **Broodboom Vereniging van SA** en STRATCOL BPK en/of sy agente teen enige eise van enige aard wat kan ontstaan a.g.v. die elektroniese debiet of oordragte d.m.v. hierdie goedkeuring hetsy reeds teruggetrek of nie;
3. In die geval waar die relevante rekening nie genoegsame beskikbare fondse het om enige debiet te dek nie, is ek bewus dat 'n addisionele fooi van **R50** gehef sal word teen die KLIëNT se rekening deur **Broodboom Vereniging van SA** vir hierdie terugsending, asook 'n onbetaalde fooi deur die KLIENT se eie bank. Ek aanvaar die verantwoordelikheid om genoegsame en beskikbare fondse gelykstaande aan die minimum bedrag soos hierbo genoem, te verseker (of soos aangepas van tyd tot tyd)
4. Enige verwysing na die entiteite soos hierbo genoem sluit in 'n verwysing na enige opvolger in titel of in aanstelling;
5. Hierdie goedkeuring is nie 'n verwysing van 'n spesifieke betalingsooreenkoms van rekeninge nie en dit dien slegs as 'n ooreenkoms vir die manier van betaling, gedeeltelik of ten volle en enige rekening met die gebruiker sal net gekrediteer word wanneer die werklike betaling deur **Broodboom Vereniging van SA** ontvang is;
6. Sou enige dispuut ontstaan insake **Broodboom Vereniging van SA** se regte om gelde te vorder in terme hiervan, is die onnus op die KLIëNT om sy bank die instruksie te gee om enige debiete terug te stuur as onbetaald.
7. Jaarlikse fooi sal aangekondig word in *Encephalartos* alvorens die jaarlikse kolleksie datum.

DATUM: _____ HANDTEKENING: _____

STRATCOL VERW. 0 0 0 0

Encephalartos

INSTRUCTIONS TO AUTHORS

Contributions may be written in English or Afrikaans. Manuscripts must be typed. Short communications and letters to the editor may either be typed or in legible handwriting. All pages of a manuscript must be numbered consecutively. Photographs should be of excellent quality with clear details and adequate contrast. Authors are welcome to send illustrations in electronic format with the following requirements:

- Scan at 300 dpi.
- Save as jpeg, using maximum file size (i.e. minimum compression).
- Send by e-mail to **wynand@ananzi.co.za** and mark 'For Encephalartos'.

The tables and figures/photographs of a manuscript should be numbered and all tables should have a heading. All figures and photographs should have a legend. All figures/photographs should bear written on the reverse the name of the author, figure number and the top of the figure or photograph.

Formal descriptions of new cycad taxa and new name combinations may be published in *ENCEPHALARTOS*. Authors are however, advised to rather publish such articles in the journal *Novon* which has been established especially for such articles. Articles on potential new cycad taxa, without formally describing them as new taxa, may also be published in *ENCEPHALARTOS*. To avoid any possible confusion of names of such taxa in future, they should be designated for example by terms such as Species A or Species 99. Do not ascribe provisional names to potential new cycad taxa.

Contributions should reach the editor not later than:

March issue	: First week of January
June issue	: First week of April
September issue	: First week of July
December issue	: Last week of September

One copy of the *ENCEPHALARTOS* issue in which a contribution appears, will be supplied gratis to all non-member authors.

Note: If applicable, all figures and photographs will be reduced or enlarged to fit over either one, two or three columns when printed.

Tariffs for advertising in Encephalartos:

Page size	Black and white	Colour
Quarter page	R175	R250
Half page	R350	R500
Full page	R700	R1000

Members: up to quarter page free of charge—black and white only.

To advertise in *ENCEPHALARTOS*, contact the Secretary Treasurer and/or Editor.

VOORSKRIFTE AAN OUTEURS

Bydraes kan in Afrikaans of Engels geskryf word. Manuskripte moet getik wees. Kort mededelings en briewe aan die redakteur mag getik of in duidelik leesbare handskrif wees. Nommer alle bladsye van 'n manuskrip opeenvolgend. Foto's moet van goeie gehalte wees, voldoende kontras besit en besonderhede duidelik toon. Skrywers is welkom om illustrasies in elektroniese formaat te stuur, met die volgende vereistes:

- Skandeer teen 300 dpi.
- Stoor as jpeg, maksimum lêergrootte (d.w.s. minimum kompressie).
- Stuur per e-pos na **wynand@ananzi.co.za** en merk 'Vir Encephalartos'.

Die tabelle en figure/foto's van 'n manuskrip moet genommer wees en elke tabel moet 'n opskrif hê. Alle figure en foto's moet 'n onderskrif hê. Agter op elke figuur/foto moet die naam van die outeur en die nommer van die figuur/foto geskryf word en die bopunt van die figuur of foto moet aangedui word.

Alhoewel die formele beskrywing van nuwe broodboom taksons en nuwe naamkombinasies in *ENCEPHALARTOS* opgeneem kan word, word daar aanbeveel dat sodanige artikels eerder in die tydskrif *Novon*, wat spesiaal vir sodanige artikels in die lewe geroep is, gepubliseer word. Artikels oor potensiële nuwe broodboomtaksons kan ook opgeneem word in *ENCEPHALARTOS* sonder dat die artikels die nuwe takson formeel beskryf. Om latere moontlike naamsverwarring van sodanige taksons tot die minimum te beperk, moet die potensiële nuwe takson in die artikel deur terme soos byvoorbeeld Spesie A of Spesie 99 aangedui word.

Bydraes moet die redakteur voor of op die volgende datums bereik:

Maart-uitgawe	: Eerste week van Januarie
Junie-uitgawe	: Eerste week van April
September-uitgawe	: Eerste week van Julie
Desember-uitgawe	: Eerste week van September

Een eksemplaar van die *ENCEPHALARTOS* uitgawe waarin 'n bydrae verskyn, sal gratis aan alle nie-lid outeurs voorsien word.

Nota: Waar van toepassing, sal alle finaal gedrukte figure en foto's verklein of vergroot word om oor óf een, twee óf drie kolomme te pas.

Tariewe om in Encephalartos te adverteer:

Bladsy grootte	Swart en wit	Kleur
Kwart blad	R175	R250
Half blad	R350	R500
Vol blad	R700	R1000

Lede: tot 'n maksimum van 'n kwartblad gratis—slegs swart en wit.

Om in *ENCEPHALARTOS* te adverteer, kontak die Sekretaris-tesourier en/of Redakteur.