

Cycads and their associated species in Queensland

Travel Scholarship Report



The author with *Lepidozamia hopei* at Cape Tribulation, Queensland

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Preface

The second year of the three-year diploma course at Kew offers the opportunity to apply for a travel scholarship. This is the chance for a student to study a chosen plant or group of plants in their natural habitat.

Since working in the Palm House at Kew as a member of staff, I have developed a passion for the order Cycadales.

Kew has an extensive collection of cycads; mainly the South African *Encephalartos*, which are well represented in the living collections of the Palm and Temperate House. I am especially interested in the genus *Cycas* and their insect pollinators, and am planning to study this relationship intensively throughout my future career.

Australia was chosen as the destination for my first trip to look at cycads in the wild. This continent has some of the most ancient relicts of flora and fauna to be found anywhere in the world. Australia is home of all three families within the Cycadales and also has a number of weevils involved in their pollination. This, therefore, is the perfect country to be starting my studies.

Additionally, the Australian species of cycads at Kew are not as well represented as the African species – the Australian cycads can be notoriously difficult to grow in cultivation and, of course, the import and export regulations from and into Australia are rather tight.

This trip provided a great opportunity to study the native flora of a country, combining this chance with a passion for insect-plant interactions, accumulating knowledge and experience for a possible future career and gathering horticultural understanding of an ancient group of plants which is in need of long-term conservation.

Over the following pages I would like to introduce the reader to the aims and objectives of my travel scholarship, provide a detailed itinerary written as diary and inform on the cycads of Queensland, their habitat and associated species, their evolution and biology. This report also includes aspects of horticulture and conservation measures that need to be taken in order to protect these plant dinosaurs as outlined in the recommendations.

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6. Introduction

Whilst working in the Palm House at the Royal Botanic Gardens in Kew from May 2006 until August 2007, I developed a passion for palms and cycads. Starting the Kew Diploma in September 2007, I had already set my mind on proposing a travel scholarship to a country to which cycads are native.

When, in October 2008, I received a letter from the School of Horticulture, a 'permission to travel', I was thrilled! And on 17th April 2009, I found myself on a plane heading for Brisbane, Australia. Here I would spend four weeks studying the native flora, collecting seeds and herbarium specimens with partners of the MSB at Kew, spend time meeting some of the world's experts on cycads and search the tropical rainforests of northern Queensland, hoping to find *Lepidozamia hopei*.

I spent ten days on a field trip with Jason Halford. He is employed by the Brisbane State Herbarium to research and collect the material contributing to the Seeds for Life project. With him, I drove almost 4,000km through Queensland, from Brisbane to Rockhampton, past Mt Archer, home of *Cycas ophiolitica*, up to Mackay and just beyond, to Cathu State Forest, holding impressive stands of *Cycas media*; inland through Eungella National Park, south through Clermont, Emerald and down to Springsure, visiting the impressive *Macrozamia moorei*. The trip concluded in the depths of the Carnarvon Range, a rugged but beautiful place, not far from the Darling Downs, where the (also German) explorer Ludwig Leichardt disappeared mysteriously on his expedition in 1848.

Along the way we found 11 species of cycads, various species of palms and many other fascinating plants. We made 33 collections of rare and endangered, as well as rather common plants. We worked well together as a team, exchanged much of our knowledge with each other and parted as friends.

Back in Brisbane, I hired a vehicle and drove to Caboolture where I met Louis and Tish Randall. Lou Randall was my main contact out in Australia during the planning stage of the trip, and his knowledge of the country and everything in it, but particularly his passion for plants, made this trip a fantastic experience. Tish and Lou made me feel very welcome for the two days I stayed with them.

Lou had organised for me to also meet Roy Osborne and Wes Field. Together they showed me a stand of *Lepidozamia peroffskyana*.

I was extremely excited to be going to meet Professor Roy Osborne, the man who has written hundreds of articles on cycads, contributed to many books and was the main author of the *Cycads of Australia* book. And indeed, to see *Lepidozamia peroffskyana* and *Macrozamia lucida* in habitat in the company of him, Lou and Wes made this a special event.

From Caboolture I drove north to Townsville where I met former Kew Diploma student Chris Cole and his family. Chris and his colleague Jason showed me the three gardens that together form the Townsville Botanic Gardens: Queens Gardens, Anderson Gardens and the Townsville Palmetum, which is rated as one of the ten best palm collections in the world.

From Townsville I headed even further north. Passing by Mission Beach and the Licuala State Forest (a dense forest of *Licuala ramsayi* with the forest floor covered in *Bowenia spectabilis*), also home to the giant Cassowary bird (dispersers of the seeds of many plants, including *Lepidozamia hopei*), I drove through the Atherton Tablelands towards Cairns. Here I spent a week around Cairns Botanic Gardens and the surrounding area of Cairns, travelling up north to Port Douglas, the Daintree and Cape Tribulation. Finally, on the very last two days of my scholarship, I found *Lepidozamia hopei*, the tallest cycad on Earth. It was awesome!

6.1. Map of Queensland, investigated cycads and travel Route



Table 1: Map of Queensland, the observed cycads and travel route (blue)

6.2. An introduction to Queensland

Queensland is the second largest state in Australia after Western Australia. It has a population of just over 4 million people, mostly concentrated in and around the cities of Brisbane, Rockhampton, Mackay and Cairns. The capital of Queensland is Brisbane.

Rockhampton lies on the Tropic of Capricorn. North of Rockhampton, towards Mackay the climate is tropical. The area around Townsville is classed as 'dry tropics', the area to the north is classed as 'wet tropics'.

6.3. Geology

The geology of Queensland is comprised of three main characteristics. The north-west and north has evolved on a Proterozoic shield, the east is characterised by the Palaeozoic-Mesozoic Tasman Orogenic zone and the interposing Mesozoic Great Australian Basin. The word Proterozoic is derived from the Greek meaning 'earlier life', it forms the most recent part of the Precambrian time (2500 million years ago to $542.0 \pm 1.0\text{Ma}$). One of the most important events of the Proterozoic aeon was the build-up of oxygen.

The maximum expansion of cycads occurred during the Cretaceous and Tertiary periods (Norstog and Nicholls 1997). Today, cycads are scattered throughout the tropical and subtropical regions of the world. It is interesting to note that in Queensland, south of the Tropic of Capricorn, no members of *Cycas* are found. The species occurring here are *Macrozamia spp.*, *Bowenia serrulata* and *Lepidozamia peroffskyana*. To the north of the Tropic of Capricorn, *Cycas spp.* becomes dominant, along with *Lepidozamia hopei* and *Bowenia spectabilis*.

6.4. Climate

Most of Queensland is classed as subtropical. The Tropic of Capricorn starts at Rockhampton, to its north the climate is tropical and is dominated by a monsoon season which lasts roughly from October to March, sometimes into April.

During my visit I experienced temperatures between 26 and 32 Celsius with sunshine in Brisbane.

Around Mackay the temperature was in the high twenties, but the humidity was much higher and there was cloud cover on most of the days.

In the tropical north near Cairns and in the Daintree, the temperatures were similar to Mackay but the cloud cover was much denser and it rained constantly. It was actually a beautiful sight to wake up in the morning, overlooking the river Daintree and the rainforest and seeing the hills in the distance completely covered in thick clouds. It was how one imagines the rainforest to look.

6.5. Flora

Much of Australia's flora are relicts of Gondwanaland. During the late Paleozoic and early Mesozoic eras, the Gondwana supercontinent underwent dramatic geographic and climatic changes. Geologic and biologic factors concurrently played an important role in modelling the vegetation of that time. The gymnospermic component of plant assemblages shows significant variations in composition and in the distribution of different taxa. Analysis of the assemblages shows that some plant groups dominated the scenario, such as the pteridosperms and, to a lesser degree, conifers. Cycads were less important in the Paleozoic era but their numbers increased in the Triassic. Today, Australia has representatives of all three families within the order Cycadales: The Cycadaceae, with *Cycas*, the Stangeriaceae with *Bowenia* and the Zamiaceae with *Lepidozamia*. All three families are found throughout Queensland.

Queensland as a state holds the highest number of native Australian plants (www.epa.qld.gov.au). Many of these are threatened by habitat loss through mining, farming and urban development. According to my observations, farming is probably the biggest threat in most areas, followed by mining. Due to the geological properties of the country, many raw materials such as coal are close to the surface and mined easily (Halford, pers com).

Other non-cycadaceous plants that were of interest to me included members of the Proteaceae such as *Banksia* and *Grevillea*, the Araucariaceae such as *Araucaria bidwillii*, *Araucaria cunninghamii* and *Agathis microstachya*, the grass trees *Xanthorrhoea* and the Palmae, mainly *Livistona* and *Licuala*.

During my four-week visit I also showed an interest in the huge numbers of *Eucalyptus* and *Corymbia*, however, I can only confidently identify about four or five out of the more than 700 species as the differences between species are often minute such as the size of fruit or the appearance of the bark.

6.6. Fauna

Queensland offers a variety of interesting animals, many of which are found nowhere else on the planet. Most mammals are marsupial, meaning they carry their offspring in a pouch. These include kangaroos and wallabies, opossums and bandicoots, koalas and gliders.

Other fascinating animals include the platypus and the echidna, two out of five extant species of monotremes, the only mammals that lay eggs.

The first Europeans to come across the platypus thought it was a fraud as it has a duck-like bill, a beaver-like tail and feet like an otter. The animal also has a spur on the hind foot which can deliver venom causing severe pain to any attackers including humans. Although it has been hunted for its fur it is not under threat so far. I saw two platypuses while walking along a stream in Eungella National Park, looking for a *Plectranthus* species to collect.

The echidna resembles a hedgehog and can sometimes be seen strolling through the undergrowth. It is also known as the Spiny Anteater but is not related to the true anteater species.

Australia is home to over 50 species of parrots, 40 of which are found nowhere else on Earth. Open grasslands in particular seem to house many species.

During my visit, I soon lost track of the different species of birds I saw, although I documented each positive identification with the help of a bird guide I bought.

I did, however, manage to see Wedge-Tailed Eagles, Emus and Cassowaries. I was especially pleased to see the latter as it is an impressive bird and important distributor of seeds in the tropical rainforest.

7. Investigation

7.1. Aims of the Travel Scholarship

The aims of the Travel Scholarship were:

- To observe cycads and their associated flora in their native environment.
- To assist on a field trip, collecting seeds and herbarium specimens, contributing to the ‘Seeds for Life’ project instigated by the Millennium Seed Bank at Kew.
- To establish and improve collaboration with other botanical institutions and help to provide a basis for future projects.
- To gather cultivation information for the cycads grown in the collections at Kew.

7.2. Objectives of the Travel Scholarship

The objectives of the Travel Scholarship were:

- To investigate cycads, their habitats and associated flora and to learn about different cultivation methods.
- To learn about field-trip methods and planning, techniques of seed collecting and taking herbarium specimens.
- To establish connections to other botanical institutions and private collectors for future research possibilities.
- To write a report on the findings that may assist in maintaining and improving Kew’s collection of cycads.

7.3. Travel Diary

Day 1: Friday, April 17th-Sunday, April 19th

21.35: departure from London Heathrow with Qantas Airlines. It is a 13-hour flight to Singapore. Singapore Airport is very nice; it has displays of orchids, palms, a cactus garden with large cacti and cycads. When leaving the terminal building I can feel the equatorial heat!

After another seven-hour flight, this time across the equator, I arrive in Sydney, where it is raining and the temperature is a cool 18C.

From Sydney it is a 90-minute flight to Brisbane (GMT+9hrs).

Upon arrival, I take a cab to Navarre Lodge in Toowong and check in. This motel was recommended to me by Lou Randall; it is within walking distance of the Brisbane Botanic Gardens.

Around lunchtime I take a walk to the gardens. Lou told me there was a bromeliad show organised by the Brisbane Bromeliad Society. Plants are exhibited and sold.

I spend a few hours walking through the botanic garden. Entry is free.

Cacti, bromeliads, orchids, palms and a variety of tropical trees such as *Gustavia sp*, *Spathodea*, *Schefflera* etc are growing outside. The garden has a large native section with *Melaleuca*, a range of cycads and conifers, *Brachychiton* and herbaceous plants.

The sun is shining and it is about 27 degrees Celsius.

Day 2 Monday, April 20th

I wake up at 5 in the morning. Take the bus into the city of Brisbane, have breakfast and then walk to Roma Street Parkland, a park that was recommended by Lou Randall. The park contains quite a few interesting palms and cycads and a section of native species including *Eucalyptus*, *Melaleuca* and some cycads such as *Macrozamia* and *Cycas*. An adjacent section of South African plants displays some rather large representatives of the African *Encephalartos*, some of them coning.

Around lunchtime I call Phil 'Red' Cameron to arrange the meeting. I take the bus to Mt Coot-tha in Toowong where I meet him and Jason Halford. I will be working with Jason for the next 10 days.

Red introduces me to Paul Forster, who informs me of various localities and useful contacts. Paul is a cycad authority who is based at the Brisbane State Herbarium. He has written many articles on the matter - investigating insect pollinators, for example. He is a very useful contact to have, and of interest to me as I wish to focus on the cycad-beetle interaction in my upcoming dissertation at Kew.

Paul passes on some other interesting contacts to me and makes recommendations as to where to go and see cycads in the wild. I ask him whether I will see any particular cycads in cone but he does not think so. Most of the species seem to cone in the wet season (November to April).

Day 3 Tuesday, April 21st

Jason and I meet at 6am at Mt Coot-tha. We set out for Rockhampton.

Jason has spent the last few months researching various native plants that might be in flower or fruiting to this time of the year. However, doing the research is only a small part of the actual collecting process. Often, the plants researched are not fruiting or flowering although they might have been in previous years. Or the area in which they grow might have been lost for development or cattle, or the population might simply have disappeared due to other ecological factors.

We set out in a 4x4, carrying herbarium presses, newspaper sheets to press the material in, paper bags for collecting on site, a fan to assist the drying process of the specimens and various tools such as a pole saw and secateurs.

Jason has also brought his laptop, on which he has data forms on the plants that have been collected on previous trips and on plants that still need to be collected.

We make one collection of a member of Rubiaceae along the way but it turns out to be a duplicate.

We spend the night in a motel near the Blackdown Tableland which lies north of Rockhampton.

Day 4 Wednesday, April 22nd



Figure 1: *Macrozamia platyrachis*

“Macrozamia platyrachis was described in 1898, based on specimens collected from Planet Downs station in central western Queensland. It is one of the rarest and most distinctive cycads of section Parazamia. The long, broad leaflets, leaves curved strongly backward and downward, and wide rachis, which is flat above and angular below, make this species easily recognizable. It is the northernmost member of this section.” (Whitelock, 2002)

We set out at 6am. Upon entering the Blackdown Tableland National Park, I see my first Swamp Wallabies and a Kookaburra, which is the world’s largest species of Kingfisher.

For this National Park, Jason has researched various plants to collect, and here I am hoping to find *Macrozamia platyrachis* (Fig. 1).

The park is dominated by a mountain range, which we drive up. On the way up we drive through Eucalypt forest and groves of palms that turn out to be *Livistona fulva* (Fig. 2), a palm classed as rare. It seems to grow preferably alongside gullies. Its leaf-underside is a beautiful gold-brown colour, almost tomentose. This makes it very distinctive in comparison with other species of *Livistona*. Seedlings of it are abundant.

On top of the range is the ranger station. Jason meets the ranger to let him know that we are in the area to collect. On a hiking trail we make a collection of an Asteraceae, but again, after checking the database on the computer, it turns out to be a duplicate.



Figure 2: *Livistona fulva* at the Blackdown Tablelands NP

We find a population of *Macrozamia platyrachis*. Only about six plants, but a couple have male cones that have already gone over. These are the only plants we see, no female cones or seedlings. The cycads grow in almost pure sand in Eucalyptus woodland (Fig. 3). Associated species are *Melaleuca leucadendra*, various *Eucalyptus* sp, *Banksia oblongifolia*, *Banksia spinulosa* var. *spinulosa* (Fig. 4), *Xanthorrhoea johnsonii* and different species of Graminae.

Livistona fulva seems to be widespread throughout this forest, reaching impressive heights when growing alongside a stream and in the open. The specimens that we saw on the drive up here were all growing in the forest and none of them were as tall.

On the way back to Rockhampton we make another collection, *Denhamia oleaster* in Celastraceae. Once we have found a motel in the city, we head out again to the caves at Mt Etna, which is only a very short drive. Here we want to check on further possible collections that can be made.



Figure 3: Habitat of *Macrozamia platyrachis*.



Figure 4: Associated species of *M. platyrachis*: *Banksia spinulosa* var. *spinulosa*

Day 5 Thursday, April 23rd



Figure 5: *Bowenia serrulata*

“Bowenia is named in honour of Sir George F. Bowen (1821-1899), the first governor of Queensland, Australia, serving at the time the genus was described.

*Bowenia, because of its bipinnate leaves, sometimes tripinnate in *B. serrulata*, is remarkable among the cycads. This feature easily separates it from all other Australian genera.”* (Whitelock, 2002)

We set out at 6am and drive towards Byfield. This is the home of *Bowenia serrulata*, the Byfield Fern (Fig.5).

On the way there we spot *Macrozamia miquelii* (Fig.6). As in the Blackdown Tablelands, the cycads grow in a very sandy soil. They are alongside the road next to pine plantations. We find one female plant bearing a cone, but the ovules were not fertilized and the seeds are hollow.

At Byfield NP we walk through a forest that contains a mixture of rainforest species such as *Freycinetia*, a climbing Pandan and *Archontophoenix alexandrae*. *Macrozamia miquelii* and *Bowenia serrulata* cover the forest floor.



Figure 6: *Macrozamia miquelii* with *B. serrulata* to its right

We make no further collections at Byfield. But on the way back we stop at Mt Jim Crowe where we manage to get two collections. We hike up the mountain (hill, rather) where we find *Araucaria cunninghamii*. The two collections are another Celastraceae, *Elaeodendron melanocarpum* and *Alectryon tomentosus* in Sapindaceae. We drive to Mt Archer and find *Macrozamia miquelii*, which is very abundant. Here we find the first female cones with fertilized ovules. The ripening seeds display a beautiful red colour as they break through the megasporophylls (Fig. 7).

Halfway up the mountain we also see stands of *Cycas ophiolitica* on steep hillsides in a Eucalyptus-woodland. Some *Cycas* are 4-5m tall and bear fruit. Most of the leaves are looking old and dry and some of the stems actually have burn marks on them. The area and the plants look desperate for a bush fire. A naturally occurring bush fire would also help reducing the *Lantana*, which is everywhere. This introduced species is suffocating whole hillsides and is possibly the most vigorous weed I have come across so far.

On top of Mt Archer we find a large colony of *Macrozamia miquelii*. There are quite a lot of ripe and shedding cones, so we can make a collection. However, it proves rather difficult to press the leaves of the plant as the leaflets are very sharp.

We spend another night in Rockhampton. I am impressed with the size of steaks in the ‘Cattle Capital’ of Australia. They are actually as big as the dinner plate with a token reminder of vegetables piled onto it. A nightmare for vegetarians!



Figure 7: Ripening seed cone of *Macrozamia miquelii*

Day 6 Friday, April 24th



Figure 8: *Cycas ophiolitica* at Mt Archer

“I consider Cycas ophiolitica threatened. Many plants have been killed or disfigured in attempts to remove them from land used for raising cattle. [...] C. ophiolitica is a handsome cycad well suited for landscaping; removal of plants from their habitat will no doubt continue to be a problem as long as it is cheaper and easier to remove large plants from the wild.” (Whitelock, 2002)

Early rise and back up Mt Archer. We make a small collection of *Cycas ophiolitica* (Fig. 8) seeds and herbarium specimens. Due to the lack of spines on the leaflets, *Cycas* leaves are a lot easier to press than the ones of *Macrozamia*. At about 7.30 in the morning, we set out for Mt Etna NP to make the following collections: *Pittosporum spinescens*, *Strychnos psilosperma* in Loganiaceae and *Cassia tomentella* in Leguminosae-Caesalpinioideae.

For lunch it is sand-crab sandwich and custard apples, then we head towards Mackay. On the way there we come across *Macrozamia serpentina* (Fig. 9) (or at least what P. Forster calls *M. serpentina* but what Lou says is a more stunted form of *M. miquelii*) and the northern population of *Cycas sp.* ‘Marlborough Blue’ (Fig. 10). This form of *C. ophiolitica* has a more glaucous young leaf which makes it more attractive to collectors and also more endangered as people dig them up (Forster, P. pers com) (Fig. 11). The plants we come across, however, do not look very attractive in a horticultural sense. The leaves are old and dry and it has been a while since the last flush. A lot of insect damage is visible. The *Macrozamia serpentina* are much greener and only appear a little smaller than *M. miquelii*. The soils are serpentinite, which is what the specific epithets *ophiolitica* and *serpentina* refer to.

Between Rockhampton and Mackay we drive through a dry belt for about four hours. There is virtually no civilisation with only farmland and some stands of stunted Eucalypt forest. Many acres of the forest have been cleared by farmers that spray the area with poison (often by plane!) so the cattle can graze the land. This technique is illegal according to Jason, but still is common practice.

The region around Mackay is of interest as here the pioneer rainforest species start to mix with the more dry scrub/Eucalypt-woodland species.



Figure 9: *Macrozamia serpentina*



Figure 10: *Cycas* sp. 'Marlborough Blue'



Figure 11: Dug-up plant of *Cycas ophiolitica* 'Marlborough Blue'

Day 7 Saturday, April 25th



Figure 12: *Cycas media* at Cathu State Forest

*“In the past, *Cycas media* served as food item for the Aborigines. They collected seeds, roasted them in a fire, and left them in the ashes until the next day. The shells were then removed and the kernel ground into flour. The flour was then put into a dilley bag, a cloth sack, and left to wash in a running stream for another day before being eaten. This procedure was very important since all parts of the cycad contain toxins that must be removed before they are safe to eat.” (Whitelock, 2002)*

We get up at 7am after spending the night in a motel in Mackay. We drive to Cathu State Forest, about 50 km north of Mackay. On the way we pass hundreds of hectares of sugar cane.

Cathu SF is a combination of rainforest plants and Eucalyptus woodland. During the dry season, the rainforest species are restricted to the creeks and gullies, but during the wet season, they advance farther into the Eucalyptus woodland. The dark green shades of the rainforest plants can be seen when looking across the mountain ranges.

Shortly after entering the SF, we see the first specimen of *Cycas media* (Fig. 12). We find male and female plants between 130 and 650m altitude, mostly growing on east-facing hillsides towards the sea. Here they get more moisture and rain. Some plants are of astonishing size; up to 4-6m tall, and many bear fruit.

We drive on top of the mount and go for a wander, making four collections: *Peperomia tetraphylla*, *Rhodomyrtus trineura* subsp. *trineura*, *Geniostema rupestre* and *Pollia macrophylla*.

We also see *Calamus* sp., Araceae, Orchids etc. which grow abundantly throughout this forest.

On the way back, we stop at a rocky outcrop (granite) with a beautiful population of *C. media*. There are hundreds of seeds on the ground, many germinating or already rooted. We make a small collection; it is hard to find seeds that have not yet germinated despite the mass of seeds present.

I find an old mature male plant, ca 5m tall, bearing a cone which is about to open up. The cone is swarming with weevils (Fig. 13)! For me, this is one of the highlights of this trip. After Paul Forster had doubted the presence of any cones at this time of the year, I was very excited to come across one!

We spend another night in Mackay.



Figure 13: *Cycas media* male cone with pollinators, a weevil

Day 8 Sunday, April 26th



Figure 14: *Calamus sp.*

Start 7am. We make a first collection on the Bruce Highway; *Nauclea orientalis* in Rubiaceae. Heading towards Eungella, which lies inland, we drive through Finchatton Gorge, where we collect *Boea hygroskopica* in Gesneriaceae and *Ficus virens* in Moraceae. Under this fig are lots of bat spitting that we collect. Apparently, once the fruits have passed through the digestive system of the fruit bats, they have a higher germination rate (Halford, J. pers com).

Eungella National Park is on top of the Clarke Range. On the way up, we pass through stretches of rainforest. Various species of *Calamus* (Fig. 14), *Ficus*, etc are found here. The actual town named Eungella is on the peak of the mountain. Here we put up base for the night.

This mountain range mainly consists of granite. The Oceanic plate once submerged under the Australian plate and pushed back up farther inland, which caused this range to rise.

We stay in a pub on the summit with stunning views over the valley below, all the way back to Mackay, (90km) surrounded by calling frogs in their thousands.

Day 9 Monday, April 27th



Figure 15: Platypus, *Ornithorhynchus anatinus*, at Eungella National Park

We get up at 5.30am and head out to collect a *Rubus probus* and a member of Ramnaceae near the motel.

At Eungella National Park, walking alongside a river looking for a *Plectranthus* to collect, we manage to spot a Platypus (Fig. 15). It dives to the ground to feed and a couple of minutes later it is on the surface again, chewing away. We are very lucky to have spotted one of these shy creatures in the wild!

On the drive towards the next town farther south, called Nebo, the scenery changes rapidly from wet rainforest to dry savannah – Eucalypt–woodland. We also come across some extremely nice specimens of *Brachychiton rupestris* (Fig.16) and

Brachychiton australis. Alongside the road, I find an inhabited Tarantula hole. I tickle out the spider with grass and I believe it is a *Selenocosmia sp.*
We spend the night in a motel at Nebo.



Figure 16: *Brachychiton rupestris*

Day 10 Tuesday, April 28th

From Nebo, we head to Homevale National Park, where we find another population of *Cycas media*. These plants thrive on acid-volcanic soils. We make six collections here. Two grasses, a *Plectranthus*, *Corymbia aureola* (Yellowbark), *Myoporum acuminatum* and a member of Compositae.

While making the collections, I notice quite a few different species of Praying Mantis. From Homevale NP, we drive to Clermont, where we spent the night. Clermont is another mining town, like Emerald and many others in the area. In the evenings, the

motels are occupied by mine workers, which can cause difficulties in finding somewhere to stay.

Day 11 Wednesday, April 29th



Figure 17: The author with *Macrozamia moorei*

“The most remarkable feature in the vegetation, however, was an arborescent Zamia, with a stem from seven to eight or ten feet high, and about nine inches in diameter, and with elongated cones not yet ripe. In consequence of the prevalence of this plant, I called the creek ‘Zamia Creek’ ” (Leichardt, 1847).

The plan for today is to drive from Clermont to Emerald and Springsure, which is where the impressive *Macrozamia moorei* dominate the landscape. We start driving at 5am and make four collections along the way. As we get closer to Springsure, a small mountain starts to appear in the distance - Mt Zamia. Getting closer, one can make out the *Macrozamia* - dark green round-shaped shadows on the slopes of the mountain. Arriving in Springsure, we drive up Mount Zamia and are surrounded *Macrozamia moorei* (Fig. 17) ca 8 metres tall! Many bear cones and we can make a collection. This is probably the most difficult cycad to collect. The leaflets are extremely sharp and the leaves can reach a length of 2-3 metres. This makes reaching the cones almost impossible and the seeds on the ground have to suffice. When pressing the leaves we divide them into sections and only take the base, the middle section and the leaf tip. The basal leaflets and the leaflets reduced to spines, the median leaflets and the tip-leaflets are the most important part of the leaf for correct identification.

We notice that some of the seeds, completely cleaned of the sarcotesta, are covering the entry holes to anthills as if the ants had carried the fruit there to feast on the pulp close to their burrow. I wonder if this is similar to some plants that have sweet appendices on their seeds which ants favour and take into their hills where the seeds have optimum conditions to germinate in the anthill's microclimate.

We spend the night at Zamia Motel. We change the paper of the presses as some of the plants attract mould, especially the more succulent species. Unfortunately, the fan we brought with us went up in flames the first time we plugged it in. So a regular changing of the newspaper is important to prevent the collections getting mouldy. I do the descriptions for the cycads we have collected so far. We also discuss the importance of fire in the cycad habitats we came across, as many of the plants we saw had burn marks on their trunks.

This gives me ideas for trials at Kew, such as regulating the watering regime more according to the seasonal droughts, and following bush fires in this region, replacing watering from the top with watering from below then stopping watering completely before lightly burning the leaves and stems.

The *Macrozamia moorei* we find have cones at the same stage. All male cones are dried and long gone, the female cones have ripe fruit and are either dehiscing or have already dehisced. This suggests that these plants all cone at a certain time of the year, a mass coning event as described in some literature.

Investigating the seeds of *Macrozamia*, I find that many have bite marks on them (Fig. 18). I am wondering what animal will go for the sarcotesta and possibly disperse the seeds. Bandicoots?



Figure 18: Seeds of *M. moorei* displaying bite marks

Day 12 Thursday, April 30th



Figure 19: The author amongst a grove of *Livistona nitida*

We get up at 6am, have breakfast and then head out to complete the *Macrozamia moorei* collection. We manage to get three bags of approximately 500 seeds. This makes a decent collection, leaving enough seeds to split between the Brisbane State Herbarium and the Millennium Seed Bank at Kew.

Then we drive towards Carnarvon Gorge National Park.

At Carnarvon Gorge we come across extensive populations of *Livistona nitida* (Fig. 19), the ‘Carnarvon Gorge Fan Palm’ and very fine specimen of *Macrozamia moorei*. We spend the day walking around in this beautiful national park. There are trails that describe traditional aboriginal uses of native plants, a walk that leads to a cave with symbols on the rocks, made simply with ochre about 10,000 years ago and they still exist!

From Carnarvon, we drive south to Theodore, where we spend the night.

Day 13 Friday, May 1st

We get up early, make two more collections at Isla Gorge National Park: *Corymbia hendersonii* and *Eucalyptus beaniana*. Then we start driving towards Brisbane and arrive 8 hours later.

Day 14 Saturday, May 2nd

I am visiting Queensland Museum and the city to buy some books. I get hold of a copy of the Field Guide to *Eucalyptus*, trying to familiarise myself with a few of the species in this genus. Today I also need to hire a car. Trying to find the cheapest car offer takes time as the companies charge me a lot of money per day because I am not yet 25 years of age. I am staying at the Navarre Lodge again.

Day 15 Sunday, May 3rd



Figure 20: From left to right: Roy Osborne, Lou Randall and Wes Field with *Lepidozamia peroffskyana* in the background

I get up and head out for Caboolture. Today, I am meeting Lou Randall and his wife, with whom I will be spending two nights. Lou has planned for me to meet Roy Osborne and Wes Field, and together they want to show me *Lepidozamia peroffskyana* (Fig. 20) in a natural stand near Mapleton.

I meet Lou and Tish Randall at 9am. They have a beautiful house and a two-acre garden full of cycads, cacti, bromeliads and many other plants.

Roy and Wes join us soon after and we drive to Mapleton.

On a little walk, we find *Macrozamia lucida* (Fig. 21) and finally the impressive stand of hundreds of *L. peroffskyana*.

They are growing densely as an understory plant, some quite a few metres tall (possibly 3-4 metres). It is a group of many hundred individuals but confined to a small space, a slope facing the sea. It seems to be a rather shady and moist environment. We don't find any cones, but seedlings are quite abundant, especially under some of the (obviously) female plants are large groups of seedlings where the seeds have just fallen on the ground through gravity.

In the afternoon, Lou shows me around his garden. He has a stunning specimen of *Encephalartos ferox* in cone, a female plant. The garden is home to many bromeliads, one of Lou's main interests, a lot of palms and a huge collection of cycads. Some *Encephalartos* have reached coning size such as, for example, *E. barteri* or *E. whitelockii*.



Figure 21: *Macrozamia lucida* at Mapleton

Day 16 Monday, May 4th

Today, the plan is to visit Plantation 2000 - a palm and cycad nursery. Wes Field, who is employed there, meets Lou and I at the gates and gives us an extensive tour through the nursery complex. Wes demonstrates the pollination of an *Encephalartos arenarius*. At Plantation 2000, the cycads are dry pollinated. Wes tells me that it has proven more successful than the wet pollination as practised at Kew. The reason for this is that in the process of wet pollination, (see appendix for pollination details) the soap sometimes causes the cone to rot prior to seed development.

Wes also introduces me to their seed-storage facility, shade house for rainforest species, and the compost mix used for all plants. The compost consists of composted pine bark, sand and chicken manure. This mix is used for all cycads in this nursery and also by many private collectors in Australia. According to my own observations, this seems a very good composition as nearly all visited habitats were very sandy and rather poor in nutrients (indicated by the presence of carnivorous plants such as *Drosera* and others with nutrient-poor soil-associated species).

After we leave Plantation 2000, Lou wants to make sure that I have seen enough kangaroos on my Australia visit. He takes me to a nearby town named Toorbul, where he claims the largest colonies of kangaroos live in the area of Caboolture. Kangaroos

like fresh grass shoots, and as the lawns are kept nice and short in this village, the animals gather in large groups to feed.

Toorbul is very close to the sea in a bay in an intertidal zone with brackish water. This is ideal mangrove habitat and indeed we come across some very nice specimen of *Avicennia marina*. (Fig. 22).



Figure 22: *Avicennia marina* at Turbull

Day 17 Tuesday, May 5th

I leave the Randall family at 7.30 in the morning. I am heading towards Rockhampton. Lou tells me that the Rockhampton Zoo houses Koalas and Cassowaries and I want to make sure I see those before I leave Australia. The chances of seeing these endangered species in the wild are slim so a zoo is the safer option.

From Rockhampton, I then set out for Mackay. Crossing the Tropic of Capricorn, I arrive in Mackay at 7.30 in the evening. The last few hours I drive through a tropical thunderstorm with rain, heavier than I ever experienced before. These two hours of driving are extremely exhausting! I am planning to drive to Townsville in the morning, passing by the Cathu State Forest once more to check on the *Cycas media* cone and its stage of development.

Day 18 Wednesday, May 6th

I take half a day's rest in Mackay before leaving for Cathu State Forest. I arrive there at 12 noon. The male *C. media* is easily found and I inspect the cone. It has completely opened up and pollen is shed, covering the cataphylls and the apex of the plant in a white-yellow layer. No beetles are to be seen. They are either nocturnal or have already done their deed. I would imagine that if they had left the cone to proceed to a female strobilus, there would still be some beetles present, so I assume they are nocturnal. Unfortunately, the cone is just out of reach, so I cannot open it up to have a look inside to see whether there are any of the insects inside the cone during the day.

I inspect the whole population again. I note that the main threats to the plants in this area (and also to most of the other populations I visited so far) are farming, invasive species such as *Lantana*, mining and urban development. Even though this is a State Forest, the whole of the area is heavily used to raise cattle. Farmers burn the forest and poison vast areas of tree cover to increase the ground for cattle.

I arrive in Townsville after a four-hour drive. I spend the night in a motel right next to Queens Gardens. The fruit bats give me a noisy welcome.

Day 19 Thursday, May 7th



Figure 23: *Lepidozamia hopei* in cone at Queens Garden in Townsville

I have an early fried breakfast on the strand before driving up Castle Hill, which is the highest point in Townsville - with a lookout on the top. I have arranged with Chris Cole to meet Jason Hore at 11 o'clock at the gates of Queens Gardens. He is the curator of the Townsville Botanic Garden complex. He gives me a tour around the three gardens, pointing out plants of special interest to me, mainly cacti, palms and cycads. It is interesting to see that species of *Melocactus* do really well in this climate - the humidity and the heat produce beautiful specimens of these South American species of cacti. The desert-cacti, however, do not fare nearly as well.

At Queens Garden is a planted specimen of *Lepidozamia hopei* with two impressive cones (Fig. 23).

The most interesting part to me is the Palmetum. Some of the palms have reached an impressive size such as the *Corypha umbraculifera* (Fig. 24) or the *Borassus flabellifer*. The layout of this rather modern garden is very good, too. It has open land containing the species adapted to more dry conditions such as *Hyphaene* and a large rainforest area containing the rainforest palms. There is also a swamp area with specimens of *Nypa fruticans* bearing fruit!

The Palmetum is also the only place where I get to see the ancient angiosperm *Idiospermum australiense*. I had wanted to see this plant in the wild on Hinchinbrook

Island but I will not have time to do the two-day walk on this island. And walking is the only way to get around there. One more reason for another visit!

It is a day of heavy rain, and Jason and I get absolutely soaked on our tour. Although the area around Townsville is classed as dry tropics, it seems I am here during a prolonged wet season.



Figure 24: *Corypha umbraculifera* at the Palmetum in Townsville

Day 20 Friday, May 8th

I spend the night at Chris Cole's place with him and his family. In the morning, he takes me to Denby Cycad Nursery. The owners, Lance and Avril, take time to show me their complex and the plants they sell. An interesting fact that I have heard from a few people during my visit is that the *Cycas revoluta* are badly affected by a lepidopteran larvae that eats the leaves. The problem is that *C. revoluta* only has one flush of leaves per year. The leaves usually get eaten when they emerge and are still fresh and soft. This means the plant is desecrated for the rest of the year and more importantly, not sellable. The only way to act upon this is to spray the plants early on. As most plants of *C. revoluta* are bought by commercial landscapers, the trend is not to buy them at all anymore. This is a problem that Plantation 2000 is also facing.

After the nursery tour, Chris takes me to Crystal Creek and Paluma, which is on top of a range, classed as wet tropics. There are road signs indicating the presence of Cassowaries! We also come past more populations of *Cycas media*.

Day 21 Saturday, May 9th



Figure 25: *Licuala ramsayi* at Licuala State Forest

Chris and I get up at 6 in the morning to go mountain biking. We go on a one-and-a-half-hour tour, but it takes us about three due to my lack of energy.

After the biking, I leave the Coles and head out for Mission Beach. Here, I want to see the Licuala State Forest - a whole forest of densely growing *Licuala ramsayi* palms (Fig. 25). This is also the home of *Bowenia spectabilis* (Fig. 26) and *Lepidozamia hopei*. Roy Osborne had told me that if I hoped to see a Southern Cassowary in the wild, Mission Beach would be the place. I arrive here at midday. It is a rainy and very cloudy day. I am hiking through the *Licuala* forest, a beautiful forest also containing *Calamus spp.* and in the understory, *Bowenia spectabilis*. I spend most of the day in

this forest but I cannot find any *Lepidozamia hopei* nor any Cassowaries. And the rain gets heavier and heavier. I have to take great care with my camera kit.



Figure 26: *Bowenia spectabilis* near Mission Beach

Just as I give up and am almost back at my car, a Southern Cassowary and its two chicks walk past me in the near distance (Fig. 27). This bird really reminds me of a dinosaur. It is the size of a small ostrich, flightless, black, has a huge red crop and a long blue neck. On its head it bears a great big horn and it is armed with a huge claw, just like a dinosaur. The male birds look after the chicks and anything or anyone posing a threat to them is likely to be chased after by the parent bird. Animals and sometimes people have known to be attacked by Cassowaries. In fact, they have the title of being the most dangerous birds in the world.

Cassowaries occur in the tropical forests of New Guinea and northern Australia. They are omnivorous but mainly feed on fruit. They are important dispersers of many rainforest plants. Due to habitat loss and increased traffic, these birds are now endangered. They are often killed crossing roads. Fossil records of this bird date back

to the Pliocene period, 5.3 to 2.8 million years ago. There are three species, the Southern Cassowary, (*Casuarius casuarius*) the Northern Cassowary, (*Casuarius unappendiculatus*) and the Dwarf Cassowary (*Casuarius benettii*). A fourth species, *Casuarius lydekki*, is already extinct.

As I leave the Licuala State Forest, another Southern Cassowary crosses the road right in front of the car, but disappears in the undergrowth before I can take a picture.



Figure 27: Southern Cassowary, *Casuarius casuarius* at Licuala SF

Mission Beach consists of a few small villages along a stretch of a beautiful rainforest beach, the rainforest coming right up to the seafront. I stop at various places where I can get access to the sea.

Besides many a tropical river or beach grows the biggest of all seed pods: the sea bean. This plant produces seeds that are some of the best plant-travellers of them all. The seeds that break out of the pod individually can float in the ocean currents for as long as a year and still remain alive. Even when the outer shell of the seed breaks away, the seed can float by itself. I am keen to find the seeds as they have beautiful markings on them.

From Mission Beach, I drive to Innisfail, where I spend the night.

Day 22 Sunday, May 10th



Figure 28: *Cyathea cooperi* in the Misty Mountains

I leave Innisfail early in the morning and drive towards Cairns. I take the route via Atherton to see the Cathedral Fig and the Curtain Fig that Jason from Townsville BG had recommended me to visit. The route takes me up a mountain range which is part of the Misty Mountains National Park.

In a small village, where I have breakfast, the landlady of the pub tells me about the beauty of the Misty Mountains. She encourages me to drive a short distance back and take a 20 km gravel road through the Misty Mountains National Park, which is what I do, still driven by the desire to maybe come across a *Lepidozamia hopei*.

The rainforest is very dense, containing many trees in Meliaceae, palms such as *Archonthisphoenix* and *Calamus*. There are the tallest tree ferns I have seen so far:

Cyathea cooperi, approximately 20 metres (Fig. 28)! The understory is dense with *Bowenia spectabilis*.

Another interesting plant I come across is a massive fern in the family Marattiaceae, probably *Angiopteris evecta*. This side of the forest is facing towards the sea and it is a very wet forest, dominated by ferns and palms.

It is in this area where the two impressive strangler figs are to be seen. The Cathedral Fig and the Curtain Fig, both *Ficus virens*, are only a few kilometres from each other. The massive trees have been made into tourist attractions but they were already considered sacred trees by the native Australians. Their size is absolutely enormous; the suffocated trees underneath the mass of aerial roots have long rotted away. The Curtain Fig has its name due to its shape, a solid wall of almost parallel roots reaching down to the ground, reminiscent of a curtain. The Cathedral Fig is of a more rounded shape and a wooden path has been built around it which makes it possible to walk right into the tree. They are true forest giants (Fig. 29).



Figure 29: Curtain Fig, *Ficus virens* in the Atherton Tablelands

As it is getting late and it is pouring with rain, I make my way towards Cairns. I put in one last stop at Lake Barrine to see *Agathis microstachya*, the Kauris that were also recommended to me by Jason Hore from Townsville. I am also hoping to find *Lepidozamia hopei* here, but again, no luck! However, the *Agathis* are remarkable trees. They are endemics, having a very narrow distribution range being almost limited to this area in Queensland. They can reach about 50m in height and have a very distinctive, almost flaky, bark.

On the way down from the Atherton Tablelands, heading east again towards the sea, the forest changes into a more sclerophytic woodland containing species such as *Eucalyptus* and *Cycas media subsp. banksii* which here actually turns into a dominant species. Some of the plants have reached enormous heights, 8 metres or taller! This species differs from *C. media subsp. media* in that its leaflets are broader and the cataphylls are relatively short in comparison.

I arrive in Cairns, where I stay in a backpacker's motel. This is to be my base for the last week.

Day 23 Monday, May 11th

Today I am having a rest day. I have a wander around Cairns, buy myself a nice hat (Akubra – it takes 15 rabbits to make one of these!) and write postcards. In the afternoon, I drive to the Barron Falls - a waterfall which is used to create energy for the city. It is surrounded by a beautiful rainforest. It rains all day but I don't mind the rain since it is nice and warm.

Two rather large *Ficus virens* on a public plaza are absolutely packed with fruit bats throughout the daytime. Even hanging in the trees, supposedly resting, they make a lot of noise and fight each other for a more prominent spot. They are fascinating to watch (Fig. 30).



Figure 30: Fruit bats on a *Ficus virens* in central Cairns

Day 24 Tuesday, May 12th

Today, I visit Flecker Botanic Gardens, where I meet David Warmington, the curator. He shows me the collections and introduces me to Peter Shanahan - a keen entomologist whose main interest is beetles.

The gardens house a large collection of palms and cycads. In 38 hectares, one can see large clumps of *Cyrtostachys renda*, the sealing wax palm, groves of *Zamia* and *Ceratozamia spp.* and a large section of Australian native plants.

The gardens are divided into the Flecker Gardens, Centenary Lakes, Mt Whitfield Conservation Park and the Tanks Arts Centre.

Dave is not sure about some labelling on the cycads and I can assist with some corrections.

I have a long conversation with Peter Shanahan, who is involved in the James Cook University. I am considering inquiring about a Masters Degree in botany and entomology at this university.

Day 25 Wednesday, May 13th

I have planned to drive to Port Douglas today and visit the Daintree. I leave Cairns early in the morning. Port Douglas seems rather touristy but there is a nice beach nearby where I find a few more sea beans. I have lunch and head on towards the Daintree. I stay in a motel in Daintree village; it has a balcony overlooking the rainforest and the Daintree River. For dinner I have a ‘road kill’ burger.

Day 26 Thursday, May 14th

I start the day by doing a boat cruise on the Daintree River. I see saltwater crocs (Fig. 31) and some rather rare birds called Tawny Frogmouth, (*Podargus strigoides*) a nocturnal bird related to the group that includes nightjars, oilbirds and the order Podargidae (Fig. 32). Podargidae have been around for about 56 million years, since the Eocene period.



Figure 31: Saltwater Crocodile, *Crocodylus porosus* in the Daintree



Figure 32: Tawny Frogmouth, *Podargus strigoides*

After the boat ride, I cross over the bridge and drive into the Cape Tribulation rainforest. I see masses of *Bowenia spectabilis*, which have the largest leaflets I have seen so far. The plants that I saw further south had leaflets just a few centimetres across, whereas these bear leaflets are almost half the size of my hand (Fig. 33). Also, the actual leaves are much taller, almost reaching two meters in height. I can place myself underneath a leaf quite easily and I am 1.8m tall!

“In its habitat, Bowenia spectabilis grows as scattered plants in rainforest or along the margins of rainforest. It does not form dense colonies, as does B. serrulata. The conservation status of B. spectabilis seems to be secure.” (Whitelock, 2002)

In the tropical rainforest of Cape Tribulation, I find only two specimens of *Bowenia spectabilis* bearing cones. The cones are hidden away under the leaf litter. They are dark green in colour and the developing seeds are almost white.

The development of the cones on the ground, often covered with rotting leaves, suggests pollination by beetles.

A quote from the botanist Pearson in 1906, observing *Encephalartos villosus* and its beetle pollinators in South Africa, is also suitable for *Bowenia spectabilis*:

“The bush is usually so dense that the air a few feet above ground can rarely move rapidly enough to carry even so light a substance as pollen.” (Pearson, 1906)



Figure 33: Leaflet of *Bowenia spectabilis*

It is in this oldest rainforest in the world that I finally find *Lepidozamia hopei* (Fig.34). The first plants I come across are about 3 metres tall. They are quite hard to spot as they are covered in lichens and mosses and blend in extremely well with the undergrowth. The second plant I spot is easily 6 metres tall, then I realise I am not looking up high enough: 10 metres or more are rather common. This is the tallest cycad on earth and reports say that 20 metre-tall plants have been found. The tallest one I come across is possibly around 12 metres.

Lepidozamia hopei which, alongside *Dioon spinulosum* in Mexico, also produces the largest cone of any living plant on earth. I come across a coning plant - the cone is too high up in the canopy for me to inspect it close-up, but I would suggest it is about 50 centimetres in length.

“Lepidozamia hopei has been referred to as the tallest cycad in the world with a trunk height sometimes in excess of 17 m. It is truly a remarkable plant when its white stem and crown of dark green leaves reach above the forest canopy. It is common but scattered within its range in the northern Queensland rainforest. Growing within the

same general area as *L. hopei* is a small, fernlike cycad, *Bowenia spectabilis*.”(Whitelock, 2002)

I drive further north through this amazing forest, some 80 kilometres south of Cooktown. Then I have to turn back as it is getting dark. I am leaving for England from Cairns the next morning.



Figure 34: *Lepidozamia hopei* at Cape Tribulation

8. Local areas of interest

After this four-week study trip of almost 7,000 kilometres through Queensland, I would like to recommend a few areas of interest to anyone visiting this Australian state. At this point, I will mention that a vehicle is a necessity to travel around Queensland, especially when visiting remote populations of plants. Vast distances are to be covered in this huge state (1,852,642 km²), and many roads are merely gravel roads. These can deteriorate rapidly during monsoon season and due to the heavy machinery travelling on it, especially in mining regions. A 4x4 comes in very handy.

Brisbane, the capital of Queensland, offers a diverse range of museums, parks and gardens and has a very good city life with numerous shops, bars and restaurants. It has also got a very sophisticated system of public transport which, once figured out, can be of great help when returning to the hotel after a visit to the pub.

The same can be said about Cairns, and here, one doesn't even need the public transport as most things are within walking distance. This place is densely populated with young people from all over the world and everybody is friendly and helpful when asked for any advice regarding sightseeing or days out.

Throughout the southern part of Queensland, one will repeatedly come across the Bottle Trees, *Brachychiton australis*, *B. rupestris*, *B. acerifolium* and others. These trees in Sterculiaceae remind of the impressive Baobab. Especially around the Darling Downs, *B. rupestris* is widely distributed.

Another beautiful but rugged place to visit is the Carnarvon, Range which holds impressive stands of *Macrozamia moorei*. Carnarvon Gorge National Park has a campsite on which one can pitch a tent amongst hundreds of huge specimens of this impressive cycad. In the surrounding forest are remains from early Aboriginal cultures, and walking trails have been established, along which visitors can inform themselves on the traditional use of plants.

One of the most fascinating places in Queensland is the tropical north and the Daintree and Cape Tribulation - a World Heritage Site and the oldest rainforest in the world. This area is rich in plant and animal life; ancient angiosperms such as *Idiospermum australiense* and rare birds such as the Southern Cassowary can be

found here. The Cape is well endorsed with tourist attractions and camp sites and is surrounded by beautiful beaches.

9. Conclusion

On my Travel Scholarship to Queensland, I achieved all my aims and objectives - and more. I was able to observe 11 species of cycads, various conifers, proteacious plants, palms and many other interesting species of plants and animals.

The information gathered by observing and socialising with experienced botanists and private plant enthusiasts greatly added to my knowledge and understanding of these Australian plants. I managed to create a base for future studies by forging these links. Parallel to this report, I am conducting a proposal to return to Queensland, specifically to look into soil analysis for the observed cycad species. This is of horticultural interest and will also assist in clarifying distributional patterns within the Cycadales. My then collaborator and now friend Jason Halford will be joining me for this quest.

To be able to experience any living organism in its natural environment was worth more to me than months of academic training, although this is the basis that directly enabled me to conduct such studies in the field.

Visiting the botanical institutions in Brisbane, Townsville and Cairns, as proposed prior to my trip, assisted greatly in my horticultural understanding of the investigated plants. The accumulated information on growing conditions, soil media, pollination, seed storage and other environmental factors will be of benefit to the keepers of the collections at Kew.

I became aware of the importance of *in situ* conservation and I lost my enthusiasm for collecting plants for pure horticultural merits. A westernised country such as Australia puts a lot of effort into conserving the natural habitat of its hugely diverse flora and fauna; however, so many species are still threatened by farming and mining. The only way this situation can be improved is by *in situ* conservation and by making people aware of what amazing beauty their nature has to offer and the importance their conservation has for future generations.

10. Recommendations

The opportunity to apply for a Travel Scholarship is one of the greatest things the Kew Diploma course has to offer its horticultural/botanical students. Anyone interested in plants should have the desire to see them in their natural habitat as this is where they evolved, adapted and survived for millions of years. A plant can only be grown in cultivation if its habit and habitat and all the interactions with any associated species are appreciated.

The 'Seeds for Life' initiative is a great project that should be continued past its original aim of collecting a certain number of species until 2010. Queensland has so many threatened species that are in need of conservation. The process of getting permits to collect outside national parks should be made easier as a lot of the endangered species are concentrated throughout farmland and mining areas. The Millennium Seed Bank will need to concentrate more on the endangered species and their preservation rather than study the storage and germination properties of plants. In my opinion, there is no point in germination tests if the plants are not reintroduced into the wild or even grown in botanical institutions (ideally in the country of origin).

The cycad collection at Kew is one of the most comprehensive in the northern hemisphere. These plants are slow growing and are extremely valuable. Any effort to improve the quality of these plants and further their cultivation needs to be done. The growers that I came across in Australia all seemed very keen on establishing a contact to Kew and they seemed interested in exchanging information and possibly plant material. A list of nurseries, private collectors and botanical institutions as well as the individuals that can contribute to our collections here at Kew is provided in the appendices.

One other point of interest for anyone planning to conduct a travel scholarship is the hiring of a satellite phone through the company used by Kew. This company, Adams Phones, is operating in a very time-consuming manner and if one has only limited funds available, an alternative should be sought as the renting costs of the satellite phone are exceedingly high. Also, the clarification process by the Herbarium could be more efficient.

Do not go to Mackay on Anzac Day as everything will be closed and the streets are packed with people. This makes driving around impossible!

For connoisseurs of the finer lagers in the world, stay away from XXXX-gold but always enjoy the XXXX-bitter!

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- Whitelock, L. 2002 *The Cycads*. Timber Press, Portland, Oregon
- Norstog, K.J., Nicholls, T.J. 1997 *The Biology of the Cycads*. Cornell University Press Ithaca, London.

Websites:

- <http://www.qld.gov.au/>
- www.cycad.org

13. Appendices

13.1. Appendix 1: List of identified native plants:

The following list includes native plants seen during my visit, identified down to *species*.

<u>Latin name</u>	<u>Family name</u>
<i>Agathis microstachya</i>	Araucariaceae
<i>Alectryon tomentosus</i>	Sapindaceae
<i>Alphitonia petriei</i>	Rhamnaceae
<i>Angiopteris evecta</i>	Marattiaceae
<i>Araucaria cunninghamii</i>	Araucariaceae
<i>Archontophoenix alexandrae</i>	Palmae
<i>Archontophoenix cunnighamiana</i>	Palmae
<i>Avicennia marina</i>	Avicenniaceae
<i>Banksia oblongifolia</i>	Proteaceae
<i>Banksia spinulosa</i> var. <i>spinulosa</i>	Proteaceae
<i>Boea hygroskopica</i>	Gesneriaceae
<i>Bowenia serrulata</i>	Stangeriaceae
<i>Bowenia spectabilis</i>	Stangeriaceae
<i>Brachychiton acerifolium</i>	Sterculiaceae
<i>Brachychiton australis</i>	Sterculiaceae
<i>Brachychiton bidwillii</i>	Sterculiaceae
<i>Brachychiton discolor</i>	Sterculiaceae
<i>Brachychiton rupestris</i>	Sterculiaceae
<i>Cassia tomentella</i>	Leguminosae-Caesalpinioideae
<i>Corymbia aureola</i>	Myrtaceae
<i>Corymbia clandestina</i>	Myrtaceae
<i>Corymbia hendersonii</i>	Myrtaceae
<i>Corymbia lamprophylla</i>	Myrtaceae
<i>Corymbia tessellaris</i>	Myrtaceae

<i>Crotalaria mitchellii</i>	Leguminosae-Papilionoideae
<i>Cyathea cooperi</i>	Cyatheaceae
<i>Cycas media subsp. media</i>	Cycadaceae
<i>Cycas media subsp. banksii</i>	Cycadaceae
<i>Cycas ophiolitica</i>	Cycadaceae
<i>Denhamia oleaster</i>	Celastraceae
<i>Dicksonia antarctica</i>	Dicksoniaceae
<i>Elaeodendron melanocarpum</i>	Sapindaceae
<i>Eucalyptus beaniana</i>	Myrtaceae
<i>Eucalyptus maculatus</i>	Myrtaceae
<i>Ficus virens</i>	Moraceae
<i>Freycinetia excelsa</i>	Pandanaceae
<i>Freycinetia scandens</i>	Pandanaceae
<i>Geniostoma rupestre var. australianum</i>	Loganiaceae
<i>Heteropogon triticeus</i>	Graminae
<i>Idiospermum australiense</i>	Calycanthaceae
<i>Keraudrenia hookeriana</i>	Malvaceae
<i>Lepidozamia hopei</i>	Zamiaceae
<i>Lepidozamia peroffskyana</i>	Zamiaceae
<i>Licuala ramsayi</i>	Palmae
<i>Livistona australis</i>	Palmae
<i>Livistona decora</i>	Palmae
<i>Livistona fulva</i>	Palmae
<i>Livistona nitida</i>	Palmae
<i>Macrozamia lucida</i>	Zamiaceae
<i>Macrozamia miquelii</i>	Zamiaceae
<i>Macrozamia moorei</i>	Zamiaceae
<i>Macrozamia platyrachis</i>	Zamiaceae
<i>Macrozamia serpentina</i>	Zamiaceae
<i>Melaleuca leucadendra</i>	Myrtaceae
<i>Mnesithea rottboellioides</i>	Graminae
<i>Myoporum acuminatum</i>	Myoporaceae
<i>Nauclea orientalis</i>	Rubiaceae

<i>Peperomia blanda</i> var. <i>floribunda</i>	Piperaceae
<i>Persicaria hydropiper</i>	Polygonaceae
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	Thymelaeaceae
<i>Pittosporum spinescens</i>	Pittosporaceae
<i>Plectranthus diversus</i>	Labiatae
<i>Plectranthus graniticola</i>	Labiatae
<i>Pollia macrophylla</i>	Commelinaceae
<i>Rhodomyrtus trineura</i> subsp. <i>trineura</i>	Myrtaceae
<i>Rubus probus</i>	Rosaceae
<i>Schefflera actinophylla</i>	Araliaceae
<i>Spathodea campanulata</i>	Bignoniaceae
<i>Strychnos psilosperma</i>	Loganiaceae
<i>Wedelia spilanthisoides</i>	Asteraceae
<i>Xanthorrhoea glauca</i>	Xanthorrhoeaceae
<i>Xanthorrhoea johnsonii</i>	Xanthorrhoeaceae

Table 2: List of identified native plants

13.2. Appendix 2: Costs and Expenditures

All costs have been rounded up to the next pound

Expenditures	£ GBP	\$ AUD
Flights	612.00	1224.00
Car Hire	732.00	1464.00
Accomodation	548.00	1096.00
Food	324.00	648.00
Extras: Fuel, Sat phone, gifts, entry fees, etc.	199.00	498.00
Total:	2415.00	4830.00 (currency converter: xe.com. accessed July 2009)
Costs proposed:	2247.25	5393.40 (currency converter: xe.com. accessed September 2008)

The car hire was a lot more expensive than originally thought as my age at the time was 24 years and I had to pay a daily rate of about \$ 60.00 AUD extra.

13.3. Appendix 3: Table of collections for SFL project:

Collection No.	Genus	Species	Rank	Infrasp. Epithet
BGQLD.0616	<i>Pimelea</i>	<i>linifolia</i>	subsp	<i>linifolia</i>
BGQLD.0617	<i>Denhamia</i>	<i>oleaster</i>		
BGQLD.0618	<i>Elaeodendron</i>	<i>melanocarpum</i>		
BGQLD.0619	<i>Alectryon</i>	<i>tomentosus</i>		
BGQLD.0620	<i>Macrozamia</i>	<i>miquelii</i>		
BGQLD.0621	<i>Cycas</i>	<i>ophiolitica</i>		
BGQLD.0622	<i>Cassia</i>	<i>tomentella</i>		
BGQLD.0623	<i>Strychnos</i>	<i>psilosperma</i>		
BGQLD.0624	<i>Pittosporum</i>	<i>spinescens</i>		
BGQLD.0625	<i>Peperomia</i>	<i>blanda</i>	var.	<i>floribunda</i>
BGQLD.0626	<i>Rhodomyrtus</i>	<i>trineura</i>	subsp	<i>trineura</i>
BGQLD.0627	<i>Geniostoma</i>	<i>rupestre</i>	var.	<i>australianum</i>
BGQLD.0628	<i>Pollia</i>	<i>macrophylla</i>		
BGQLD.0629	<i>Cycas</i>	<i>media</i>	subsp	<i>media</i>
BGQLD.0630	<i>Nauclea</i>	<i>orientalis</i>		
BGQLD.0631	<i>Boea</i>	<i>hygroscopica</i>		
BGQLD.0632	<i>Ficus</i>	<i>virens</i>	var.	<i>sublanceolata</i>
BGQLD.0633	<i>Rubus</i>	<i>probus</i>		
BGQLD.0634	<i>Alphitonia</i>	<i>petriei</i>		
BGQLD.0635	<i>Persicaria</i>	<i>hydropiper</i>		
BGQLD.0636	<i>Crotalaria</i>	<i>mitchellii</i>		
BGQLD.0637	<i>Plectranthus</i>	<i>diversus</i>		
BGQLD.0638	<i>Myoporum</i>	<i>acuminatum</i>		
BGQLD.0639	<i>Plectranthus</i>	<i>graniticola</i>		
BGQLD.0640	<i>Heteropogon</i>	<i>triticeus</i>		
BGQLD.0641	<i>Wedelia</i>	<i>spilanthoides</i>		
BGQLD.0642	<i>Mnesithea</i>	<i>rottboellioides</i>		
BGQLD.0643	<i>Corymbia</i>	<i>aureola</i>		
BGQLD.0644	<i>Keraudrenia</i>	<i>hookeriana</i>		
BGQLD.0645	<i>Corymbia</i>	<i>clandestina</i>		
BGQLD.0646	<i>Corymbia</i>	<i>lamprophylla</i>		
BGQLD.0647	<i>Macrozamia</i>	<i>moorei</i>		
BGQLD.0648	<i>Corymbia</i>	<i>hendersonii</i>		
BGQLD.0649	<i>Eucalyptus</i>	<i>beaniana</i>		

Table 3: Table of collections made for Seeds for Life Project

13.4. Appendix 4: SFL Collection Data Forms:

For Seeds for Life collection data form for *Cycas ophiolitica* see attached email from Lou Randall/Roy Osborne for correction of species.

13.5. Appendix 5: List of useful links and institutions

- Brisbane Botanic Gardens
Mt Coot-thaMt Coot-tha Road
TOOWONG QLD 4066
<http://www.brisbane.qld.gov.au>

- Flecker Botanic Gardens, Cairns
gardens@cairns.qld.gov.au

- Townsville Botanic Gardens
Townsville Botanic Gardens
Townsville City Council, PO Box 1268,
TOWNSVILLE
QLD 4810 Australia
cc1@townsville.qld.gov.au

- Palm and Cycad Society of Australia
enquiries@pacsoa.org.au

- The Cycad Society
<http://www.cycad.org/>

- The International Palm Society
<http://www.palms.org/>

- Denby Cycad Nursery
<http://www.denbycycads.com.au/>