

Vegetable Dinosaurs

Daniel Stiles looks at the curious world of cycads and the arguments about how best to conserve them.

A WHILE BACK I WENT ON A private safari through Tanzania and northern Zambia. A couple of people on the trip were cycad enthusiasts and they were lucky to find a few specimens of rare species, which they proceeded to collect. I questioned the wisdom of this practice in terms of conservation and received a spirited defense: "We are promoting the conservation of cycads," said one. "We don't want to see them become extinct," said another. "We love cycads," they both attested.

These enthusiasts claimed that what they collected would lead to the propagation of many more plants in cultivation than would ever be produced in the wild. They thought that putting wild seed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was foolish, and putting threatened species on the Appendix was dooming them to certain extinction.

Cycad conservation is not a simple question. Cycads are found today in the tropical, subtropical and warm temperate regions of Africa, Central and South America, the Caribbean, Australia, various Pacific islands, and many parts of Asia. There are 11 genera and over 185 described species. Several species remain undescribed or unnamed; who knows how many remain undiscovered?

People often confuse cycads with palms or ferns because of their superficially similar leaves and trunks. In fact cycads are unique, unrelated to any group of living plants. They originated over two hundred million years ago and flourished during the period of the dinosaurs. They should have been a dominant part of the flora of *Jurassic Park*, but their current sparse distribution and their listing on Appendices I and II of CITES must have presented too formidable a set of obstacles for

explained to me that no species listed on Appendix I can be traded internationally unless the individuals are propagated artificially or are to be used for legitimate scientific study. Those listed on Appendix II can be traded only if the country of origin specifies that trade will not endanger the species' survival. She also pointed out that it is often very difficult to satisfy CITES trade criteria.

Unfortunately, some cycad species have already become extinct in the

wild because of overcollecting. The Threatened Plant Unit of IUCN—the World Conservation Union has placed approximately half of the world's cycads on the threatened species list. According to David L. Jones, author of *Cycads of the World*, cycads are like the rhinoceros in terms of conservation: both are "heading

"In modern times, by far the greatest menace to the wild populations of *Encephalartos* is man. From all over the world has arisen an insatiable demand for sizable Cycads to place in cultivation.... The cultivator usually consoles himself as having protectionist motivation. He fails to appreciate the fact that the thinning out of natural populations reduces proportionately the number of cones and consequently the chances of fertilization of the female cones that are produced in the wild."

R.A. Dyer and Inez Verdoon, *Kirkia*, 1969


Spielberg's production designers.

Cycads have become extremely popular with collectors because of their rarity, primitiveness and attractiveness. Some adult specimens of rare species can attract US \$50,000 or more each. Because of demand, all species of four of the genera—including *Encephalartos* which is found only in Africa—have been put on Appendix I of CITES. The rest are on Appendix II.

Nina Marshall of the East African Regional Office of TRAFFIC, which monitors trade in and utilisation of wild plants and animals listed under CITES,

down the same path to total obliteration; and all because of human stupidity and greed."


In Kenya there are six species of cycads in two different genera: *Encephalartos hildebrandtii* is found in numerous places along the coast; *E. kisambo* is located mainly in the Maungu and Sagala Hills in Taita-Taveta district; *E. tegulaneus*, a highland species, grows in the Mathews and Ndoto mountains of northern Kenya; *E. bubalinus* is seen in the Nguruman-Loita Hills area; *E. powysorum*, a recently discovered species, has so far only been seen on one



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hill in the Meru-Embu area; and *Cycas thouarsii*, a very palm-like cycad that originated in Madagascar which is found mainly in parks and gardens and is thought to have been introduced by early Swahili and Arab traders.

None of these Kenyan species is currently in danger of extinction, though three—*E. kisambo*, *bubalinus* and *powysorum*—are rated as 'vulnerable' by Hank Beentje in his book *Kenya Trees, Shrubs and Lianas*, meaning that they could become endangered by overcollecting or by bush clearance for agriculture if they are not protected. *E. hildebrandtii*, on the other hand, is very common even though it is on Appendix I. Other African cycads, however, as well as cycads in other parts of the world, are threatened with extinction. The East African Herbarium, recognising a growing threat to the region's cycads, has recently appointed an officer to deal specifically with their conservation.


Tanzanian cycads include *E. bubalinus* and *E. hildebrandtii*, mentioned above, which appear around Lake Natron and the northern coast respectively. Then there are *E. scalvoi*, found in the eastern Usambara Mountains, *E. marunguensis*, found near the eastern shores of Lake Tanganyika (and previously only known in the southeast of the Democratic Republic of Congo), and *E. delucaneus*, located south of Tabora. These latter three are quite rare.

What is the best course of action to ensure that no more species of these beautiful plants become extinct? There is a growing debate about the wisdom of the CITES regulations concerning the international trade in wild cycads, which necessarily involves the collection of cycads or their parts from the wild. Many agree with the view expressed by Dyer and Verdoon in the quote above, but others, including my safari companions, feel that in some circumstances strict adherence to CITES will spell doom for many cycad species. I shall attempt to present both sides of the argument as objectively as I can, but first I must explain a little cycad biology.


Cycads are gymnosperms, which means that they produce seeds but not flowers. The seeds develop in cones which grow out of the crown of the stem in the female plants, and are pollinated from pollen produced in the cones of male plants. Coning is notoriously unpredictable in cycads; some species only cone once every few years. Most cycads are insect-pollinated, with each species being pollinated by one or two specific types of insect, often a weevil or beetle.

Encephalartos can produce seeds even without pollination—though they will be infertile—but most cycads will not produce seed in the absence of pollination. Depending on the species, seed ripening can take from six to eighteen months, and time to germination another six to eighteen months. They are not speedy reproducers.

Seeds, which break out of the cones at maturity, are dispersed by gravity, water or wildlife. Most cycad seeds are toxic, but the sarcotesta, a colorful outside layer, is edible and results in their being eaten and transported by a wide variety of animals and birds. Elephants have been known to eat large numbers of them; the bare seeds reemerge in a fertile covering of manure. The Aweer, former hunter-gatherers of Lamu District in Kenya (see *Swara* 20:5), not only eat the sarcotesta, but they have learned how to leach the toxins out of the seeds of *E. hildebrandtii* to make a




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flour which is eaten as porridge or flat bread.

The probability of germination and the subsequent survival of a cycad plant from seed in the wild has been estimated at one in ten thousand. Several fortuitous circumstances must occur: male and female plants must cone at the same time, and relatively close together, and the proper insect to enact pollination must be present. Then, if the seed is not destroyed by fire, insects or animals, and it eventually finds itself in a conducive habitat, it may germinate. Nevertheless, many of the few seeds that do manage to germinate in the wild die off from competition because they end up too close to the parent plant.

Cycads can be propagated artificially by digging up and transplanting the bulb of young plants, or the whole stem of older trees. Very young bulbs, having germinated from seed, with only one or a few leaves growing out of them are called suckers. These are prized by collectors because they are small and easily transportable. Bulbs and suckers of most species can have their leaves and dangling roots cut off them and still survive for weeks or months before transplanting if kept under proper conditions.

Today, because of overcollecting or habitat destruction, many cycads are too far away from a plant of the opposite sex to allow seed production. In some cases the pollen vector has disappeared, in others the males and few females do not cone simultaneously.

The case in favour of international trade in cycads is that, since so many species are narrowly endemic and dangerously isolated, if they are not collected and distributed to government and private botanical gardens they will eventually become extinct. With some species already so threatened that they cannot reproduce in the wild, prohibiting their collection just means that they will die off.

A further point made in favour of freer trade is that prohibition is not enforceable; the ban is not working. As with drugs, where there is a market the product will be traded one way or another. Cycad plant parts are currently being shipped around the world under various labels and guises. The trade ban enhances their value, further encouraging illegal trade.

If limited trade were allowed, trade proponents argue, currently rare

The genus *Encephalartos* is restricted to Africa, but it contains more species—over fifty—than any other genus. *E. schmidtsii* (right) is a valuable cycad found in northern Zambia; the rare *E. delucaneus* (below right) is found in southwest Tanzania.

Cycads are popular ornamentals in private and botanical gardens and are propagated in commercial nurseries (below). When they eventually cone, the seeds can be distributed to collectors worldwide, removing commercial pressures on wild cycads.

All photos © Daniel Stiles



species would become plentiful and there would be no pressure to collect in the wild. Cycads are often located in hard-to-get-to, dangerous localities. Cycad enthusiasts would be very happy to obtain their plants and seeds from easier sources. Once all species are distributed and the plants become easily available, prices would drop so low as to make wild collecting economically unviable. The only threat to cycads then would be habitat destruction. (On this point, TRAFFIC's Nina Marshall disagrees. She notes that *E. kisambo* has been traded illegally for some time now, but collectors are still going to the Taita-Taveta area to collect it. This surprises me, as collectors I have talked to, even those in Kenya, are no longer interested in going into the field for it.)

The argument against international trade is fairly straightforward: the collection of wild plants and seeds reduces the numbers of existing *in situ* specimens, further reducing reproduction. Collectors concentrate on female plants to produce seed under cultiva-

tion, and there are now wild colonies where males outnumber females ten to one. For example, collecting in South Africa has reduced wild populations of *E. middleburgensis* and *E. dolomiticus* to such small numbers, and with sex ratios so skewed, that seed production no longer takes place. There are documented cases of various cycad species in South Africa, Mozambique and Mexico becoming virtually extinct in the wild because of overcollecting.

International trade ban proponents also point out that CITES does not prohibit collecting and propagating cycads within the country of origin; in fact they encourage this course. In theory, artificially propagated second generation seed can be traded under Appendix I, though in practice this is rarely permitted. South Africa, for example, prohibits any seed from being exported because it is too difficult to differentiate cultivated seed from wild seed. To promote the artificial propagation of Appendix I species CITES has adopted a resolution for the registration

of approved nurseries by a country's CITES management authority. These nurseries, having demonstrated that the plants and plant parts are artificially propagated, can more easily export Appendix I species. (On the other hand, supporters of international trade in wild cycads point out that in areas like the Congo and southern Sudan, political instability rules out any national cycad propagation facility.)

Another argument used by pro-traders is that seed collecting only cannot harm regeneration numbers since so many wild seeds fail to germinate and grow successfully. In a nursery, on the other hand, fertile seed can be raised to a successful plant in over 90 percent of cases. The counter-arguments to this are basically two. First, when seeds are collected in large numbers, they are put on the market. Sometimes a lot of the seeds are not sold (because of greedy collectors overpricing them, as argued by one anti-trade proponent), and they become too old to germinate. Second, very little is known about the consequences of seed removal to the population dynamics and successful propagation of wild cycads. Perhaps a certain density of seed or seed dispersal numbers are needed to successfully maintain a population. In the absence of knowledge it is better to err on the conservative side. The Conservation Biology Unit of the National Botanical Institute in South Africa is currently studying the population dynamics of cycads to resolve this question.

To make some of these arguments less abstract, I would like to present some actual stories recounted to me. Growing on the western shore of Lake Albert in the Congo there is a little-known colony of cycads. They are taxonomically problematical because they are not well enough known. When collectors reached the locality in the summer of 1994 they found only one small remnant colony after an extensive two-day search. A few plants were growing in a narrow strip about fifty metres wide either side of a stream; the surrounding hills had been cleared for grazing, killing whatever cycads had grown there. Farmers were now busy clearing the last remaining forest in the lower areas for maize farming. There were many felled cycads lying around rotting in the grass. One was easily five hundred years old; the stem measured over six metres tall and one metre in

diameter. The collectors took away some germinated seeds which were sent to the USA, Australia and Thailand and the species has been widely propagated for future seed production; there is no longer a reason for collectors to go there. This species has never been described and is probably by now extinct in the wild.

Another undescribed species was collected from southern Sudan in 1995. No one knew previously that it even existed. The plants are widely distributed and are not endangered in any way. Many plant parts were collected and made freely available so that cycad enthusiasts all over the world now have it, taking any pressure off future collecting. It is now being described by a botanist.

Taking cycads from the wild can deplete a habitat. Yet banning trade may make some species extinct. What should we do?

In western Uganda there is a huge colony of *E. whitelockii*—a species described and named only in 1995—numbering between five and ten thousand individuals. They are reproducing vigorously, and many are located on inaccessible cliffs. Some collecting would not endanger this species. Seeds have been collected and the species is now widely available, so probably no collector will bother going there again to look for it.

There are many similar examples. Cycads are not, after all, as David Jones wrote, like rhinos. Rhinos are killed for their horns, and the carcasses left to rot; people don't capture live rhinos to propagate their horns. Trade irrevocably depletes the stock. Cycads, on the other hand, are traded alive. When they reach their final destinations they are nurtured and encouraged to propagate; they are exploited for nothing more than their beauty. In some cases it is true that taking cycads from the wild will harm some species' chances of remaining a part of the biodiversity of a local habitat. But it is equally true that a trade ban, if strictly enforced, would result in the extinction of some cycad species.

So what is the answer? I would suggest we do the same thing that has

been done with mammals. Each species should be evaluated separately based on its own particular conservation situation. Not all mammals have been put onto Appendix I because certain species are threatened. *E. hildebrandtii*, for example, ranges from southern Somalia to northern Tanzania and numbers in the thousands in the wild. It is commonly sold in Kenyan nurseries and as a result is seen in many gardens, including the Nairobi Arboretum. It is also found in botanical gardens around the world. It is no longer collected in the wild because there is no need to make the effort. Why should it be on Appendix I?

E. powysorum, on the other hand, should be protected from overcollecting because of its rarity. But rather than prohibit any collecting, it would be much more sensible for the Kenyan authorities to permit managed collecting of at least some seeds to allow propagation under controlled conditions in government-approved nurseries. Plants and seeds from these nurseries could be exported to benefit the economy of the country. Some seed could also be distributed to foreign cultivators. This would go far towards reducing the current pressure to collect this species. As long as only a few people have specimens of the *powysorum* variety, there will be a risk of illegal overcollection.

There are many people knowledgeable about the locations and status of the world's cycad species. Amongst the foremost of these are certain cycad collectors. If conservationists and governments are serious about wanting to prevent the imminent extinction of several cycad species they should organise a joint review under CITES sponsorship of each species involving both conservationists and collectors (who, incidentally, are not mutually exclusive).

Those species found to be under most serious threat, from either overcollecting or habitat destruction, and which are also rare or unknown in cultivation, should be immediately collected. If overcollection is the source of the threat, then controlled collection followed by wide distribution of viable seed will remove the cause. If habitat destruction is the problem there is probably little that can be done, other than to save the germ plasm in the form of cultivated specimens.

I believe this to be a better solution to the cycad problem than a blind trade ban. #