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THE INTERNATIONAL PALM SOCIETY

A nonprofit corporation engaged in the study of palms and the dissemination of information about them. The society is international in scope with world-wide membership, and the formation of regional or local chapters affiliated with the international society is encouraged. Please address all inquiries regarding membership or information about the society to The International Palm Society, Inc., P.O. Box 1897, Lawrence, Kansas 66044, U.S.A.

PRINCIPES

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Contents for October

Cover Picture

Phoenix roebelenii, at the Golden Triangle overlooking the Mekong River in Northern Thailand. See pp. 177–181.

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Note from the President

I suppose that everyone has been enjoying the new and larger format adopted for *Principes* at the beginning of the year. You will also note a couple of other changes with this October issue. The amount of color content has been increased substantially, as approved by the Board of Directors in Venezuela in June. In addition, the masthead now provides contact information for the officers of the society. Although that information has always been available in the *Roster*, a number of members had commented that they really appreciated the ability to contact the officers should the need arise. Don't hesitate to contact me or one of the other officers directly if you think it appropriate.

Should you have any questions about palms, their culture or uses, please send this in written form to our main address. We have a team of horticultural correspondents ready to answer your questions. Please be patient, as it may take some time to get your inquiry to the proper correspondent. You will receive an individual answer. Please note that this offer is not intended to provide advice of a commercial nature.

Library subscriptions to *Principes* are currently at an all-time high, even more than when our membership reached its peak several years ago. This clearly indicates approval of the changes in *Principes*.

Our membership has continued to grow over the past two years in spite of economic pressures. It's now higher than all previous years except 1990 and 1991, when we reached a peak of just over 3,000 members. It is the intent of your current Executive Committee and Board of Directors to concentrate on increasing the usefulness of the International Palm Society to our members. This should also indirectly help the society's growth.

We would like again to welcome our two new affiliates: The Palm & Cycad Society of Western Australia and the Venezuelan Palm Association (Asociación Venezolana de Palmas or AVEPALMAS). We encourage all groups of palm enthusiasts worldwide to consider doing the same. Benefits include a free membership for the group in *Principes*, a large assortment of available *Principes* back issues for the group's library, and listing of local affiliates' contact information in our *Roster* (see the chapter section at the beginning of the enclosed *Roster*). There is no financial burden to the local group other than a requirement that the officers of the local affiliate group be members of the International Palm Society. For many groups, that's already the case. Should you have any questions on direct IPS affiliation, please contact either Edward Hall (FL) or myself.

The increased *Principes* color content, easier access to officers, enhanced horticultural correspondence team and introduction of this column are all intended to make our society more responsive to the needs of our membership. If you have any additional suggestions as to how we might further improve our services, please let me know. My home address is in the *Roster* you received with this issue of *Principes*.

JIM CAIN, PRESIDENT

Editorial

This is the first number of *Principes* to carry color plates within the cover, as approved by the Board of Directors at the Biennial in Caracas this last summer. We hope you like the result. Because of the complications involved in the new use of color, we are a little late in going to press but we hope that the next issue will be nearer to schedule.

This issue includes two papers relating to the Biennial in Venezuela, one by Phil Bergman, who describes the palms of the Caracas Botanic Garden as shown to him by the founder of the collection, August Braun; the other article by John Rees summarizes the Biennial activities. We also have a short paper by one of our hosts in Caracas, Sven Nehlin, on *Asterogyne spicata*, a palm that many of us saw and admired in Venezuela.

Two papers deal with the palms of Madagascar. Henk Beentje has recently completed a full revision of the genus *Ravenea* that was published in the latest issue of Kew Bulletin (49: 623–671. 1994). In order that the results of his work on this increasingly popular palm genus can be made widely available, he has condensed his monograph into a short popular article that lists all the currently accepted species in the genus and illustrates them. In a way, this also acts as a forerunner to the complete book on the Palms of Madagascar which is about to go to press. The other article is by A.J. Adany, C.R. Birkinshaw and J.R. Andrews, who have studied the illegal felling of palms in the famous Lokobe Reserve (of *Chrysalidocarpus madagascariensis* var. *lucubensis* fame). They have highlighted the extreme conservation pressures that threaten the survival of palms in Madagascar.

Sasha Barrow, who is at present monographing the genus *Phoenix*, has provided an article on the multi-stemmed form of *P. roebelenii*. an attractive palm which is currently being uprooted from the wild in southern China and Laos. We hope that her observations will provoke correspondence among growers on the distribution of clustering forms of this species in cultivation.

Everyone will enjoy Lester Pancoast and Ken Johnson's fine introduction to the New World Thrinacinae, an article aimed at the layman and full of useful hints on cultivation and landscaping.

We also have a detailed paper on the effects of a major hurricane on the palms within a rain forest on the Caribbean coast of Nicaragua. This paper describes the varied effects of the hurricane and considers the long term impact of violent storms on rain forest and its composition.

As usual we have interesting Chapter News. And, be sure also to read President Jim Cain's Note on the previous page. Finally since this issue is coming out in 1995, we take the opportunity to wish all IPS members a productive and Happy New Year.

JOHN DRANSFIELD
NATALIE UHL

CHAPTER NEWS AND EVENTS

News from New Zealand

On June 30, the temperature in the Auckland area dropped to −4 degrees Celsius (25 degrees F), lower than seen in more than 35 years. Much damage resulted, but few palms were killed.

The Palm & Cycad Society of New Zealand met on September 7 and Keith Boyer gave a presentation entitled "Venezuela", featuring slides of his recent trip there for the International Palm Society Biennial meeting. His presentation was not to be missed.

The group met again on October 5 when Alan Booth presented "New Caledonia, Vive la Difference"—a slide presentation of palms and other plants seen there on his trip to this interesting island earlier this year. An interesting discussion on palms with "fishtail" type leaves was also included.

On Sunday, October 16, the Palm & Cycad Society scheduled a field trip to see the Inner City Palms and Cycads. More about this in the next issue.

The Society had an exhibit at the Ellerslie Flower Show, November 17–20, 1994. Steve Dodds coordinated this display.

A Christmas function was planned for the first weekend in December and included a boat trip around the harbour with lunch. In addition, a field trip is being planned to the Whangarei area on Saturday, April 1, 1995. More details about these events in the next issue.

Southern California News

The Southern California Chapter of the International Palm Society met on September 17—the first time ever at the California State University–Fullerton Arboretum. This lovely 25 acre site opened in 1979 with plantings arranged in various climatic groupings. The palm collection contains many mature, well-maintained specimens of cold tolerant species. Among these are a lovely *Brahea brandegeei* and one of the larger *Livistona mar-*

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In Search of Phoenix roebelenii: The Xishuangbanna Palm

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This short paper is written in response to a growing interest among palm enthusiasts in an elegant, clustering form of *Phoenix roebelenii* O'Brien (Hoffman 1994). The solitary form of *P. roebelenii* (otherwise known as the Pygmy Date Palm) is well-known in cultivation and familiar to all palm growers, but the clustering, tall-stemmed form is never seen out of Indo-China. This account aims to give the reader an historical background to the species, and discusses various aspects of the palm's distribution, habit, ecology, and conservation status.

History of P. roebelenii

The name *Phoenix roebelenii* dates back to 1889, when James O'Brien described a dwarf palm from Indo-China. He published a brief description and illustration based on leaf material only, with no flowers or fruit, and named the palm after the German orchid collector, C. Roebelen, who had collected it from Laos. Only two months later, Mr. Roebelen himself published short notes on the habit of *P. roebelenii* in its native habitat on the banks of the Mekong River in Laos:

> It grows in great abundance along the rocky banks of the majestic river Mekong, as far north as 22° latitude, and where the temperature drops to 5°C in December and January. Although I looked eagerly for seeds and flowers I could discover none, but was told by the natives that monkeys and wild cats are very fond of the small berries, and carry them to their hiding-places where I really could find thousands of seedlings. The stems of this exceedingly graceful pygmy palm never attain more than 60 cm in height, and the plant generally grows in large clumps.

The lack of flowers and fruit with which to make a complete description of *P. roebelenii* led to confusion over the nature and classification of the palm, particularly concerning its relationship with *P. loureiri* Kunth. *P. loureiri* refers to a small palm with a thick stem to 60 cm high, briefly described by Loureiro (1790) from Hue in Vietnam. In the absence of flowers and fruit of *P. roebelenii*, O. Beccari, the Italian palm botanist, considered *P. roebelenii* to be synonymous with *P. loureiri* in his monograph of the genus (Beccari 1890). Furthermore, he made *P. loureiri* a variety of an Indian species—*P. humilis* var. *loureiri*.

Beccari later revised this decision and gave *P. roebelenii* species status, separate from *P. loureiri* (Beccari 1910). By this stage, *P. roebelenii* had flowered in Europe and the distinctly pointed petals and sepals of the species clearly indicated to Beccari that *P. roebelenii* was unique among the Asian species of *Phoenix*. In fact, only one other species of the genus shows such sharply pointed petals, *P. reclinata* Jacq. in sub-tropical Africa.

Further accounts of *P. roebelenii* in Indo-China added to Roebelen's description. In 1923, A. Chevalier published the observations of M. Miéville of *P. roebelenii* in the upper River Noire, near Lai-Chau in N.W. Vietnam. The palm was found on steep river banks at 200–400 m altitude, between 23–25° latitude, growing in the cracks of large limestone boulders, and sometimes on slaty shale. It was not found further than 25 m from the river bank and consequently was submerged by high water every year, presumably in the rainy season. In contrast to Roebelen's description of a dwarf palm only 60 cm tall, Miéville reports a palm of up to 3 m tall, often with a twisted stem.

M. Magalon (1930) published an account of the palms of Indo-China, including *P. roebelenii*, which he describes as an elegant, clumping palm with a slender stem often twisted and recurved, up to 2 m in height, and about 10 cm in diameter, and ringed with leaf-base scars. The center of each scar is marked by a short stump, which is the vascular remains of the interior face of the leaf sheath (see Fig. 3). Magalon reports *P. roebelenii* from regions of north Vietnam, Yenbay Province, and in the forests on the right bank of the Fleuve Rouge, near Lai-Chau, and from the valley of the Nam Ou, in the region of Pak Lay

1. A cluster of *Phoenix roebelenii* palms growing at the Golden Triangle, overlooking the Mekong River.

in Laos. This account was later supported by Gagnepain (1937) in "Flore Générale de l'Indo-Chine", leaving no doubt that *P. roebelenii* is a well-defined species of limited distribution in the northern regions of Laos and Vietnam, and areas of Yunnan in S.W. China (Shengji and Sanyang 1991).

P. roebelenii Habitat

All this information from the literature suggests that *P. roebelenii* is found closely associated with riverside or cliff habitats, its elegant, clustering habit enabling it to survive potentially damaging floods. Recent anonymous reports from Laos add to the observations of early plant hunters by noting that *P. roebelenii* is found actually growing in rivers. This rheophytic habit is rare within the palm family, as noted by Dransfield (1992). Rheophytes are defined by Van Steenis (1981) as plant species which are in nature confined to the beds of swift-running streams and rivers and grow there up to flood-level, but not beyond the reach of regularly occurring flash floods. Other rheophytic palms include *Ravenea musicalis* Beentje and *Vonitra crinita* Jumelle & Perrier from Madagascar, *Chamaedorea cataractarum* Mart., *Geonoma linearis* Burret, *G. schottiana* Mart. and *G. brevispatha* Barb.-Rodr. in South America, *Pinanga rivularis* Becc., *P. tenella* (H. A. Wendl.) Scheff. and *Areca rheophytica* J. Dransf. in Borneo, and a *Hydriastele* species in New Guinea.

Phoenix roebelenii in Cultivation

Since its introduction to Europe, *P. roebelenii* has become a popular and widely cultivated ornamental. The palm that we know as *P. roebelenii* in cultivation is rigidly upright, usually small and solitary, and without smooth, pale stems. The *P. roebelenii* described by Chevalier, Magalon and Gagnepain, is a much taller, clustering palm, with twisted and often pale stems. This raises a very interesting question. Are the cultivated and wild forms really the same species? A set of distinctive characteristics apply to both the cultivated and the wild forms and this suggests that they are both *P. roebelenii*. If this is so, then we have to ask

why the habit of the cultivated form is different from that of its wild relatives. Perhaps the change in habitat and local ecology of the palm, associated with its cultivation, is responsible for the habit differences. This was first reported by Miéville, who noted that cultivation gave the palm "une belle ampleur" (a beautiful fullness); the leaves hanging down in a gracious curve, the young leaves forming a light and slender bunch at the top. Alternatively, the cultivated palm, so common in tropical and sub-tropical gardens all over the world, could represent a single provenance of the species—that is, an original collection of just a few individuals of the shorter, solitary form provided the stock for all those plants brought into cultivation. However, if this is the case, then we would expect to find individuals of *P. roebelenii* in the wild that are similar to the cultivated form. No

2. Wild-collected *Phoenix roebelenii* palms on sale in Northern Thailand. 3. The pale, slender stems of wild *P. roebelenii*, showing the distinctive pattern of leaf-base scars, each marked by a central stump of remnant vascular tissue.

reports of such plants, to my knowledge, have been made. A third hypothesis must be considered. It is possible, considering the ease with which *Phoenix* species hybridize with each other (Uhl and Dransfield 1987), that the *P. roebelenii* that we know in cultivation is the product of a series of hybridization events with other cultivated *Phoenix* species, and somewhere along this series the clustering ability was lost.

Conservation Status of P. roebelenii

Earlier this year, I spent five weeks in Thailand studying and collecting specimens of various *Phoenix* species for the monograph of the genus on which I am working. A literature search at the library of the Royal Botanic Gardens, Kew, informed me that fieldwork in Thailand would yield specimens of *P. loureiri*, *P. acaulis* and *P. paludosa*, but *P. roebelenii* could not be found wild in that country, and this proved to be true. However, while wandering around the plant stalls of Bangkok's Sunday Market with John Dransfield, we came across several clustering, elegant *P. roebelenii* palms, up to 2 m tall, for sale. These had quite clearly been dug up from the wild and transported to the city, where they were being sold for large sums of money. Where had these plants come from? No one knew for sure, but it seemed that they could be bought at the Golden Triangle, by the Mekong River, which forms a natural border between Thailand, Laos and Myanmar (Burma).

Two weeks later I was there, standing on the bank of the Mekong looking across to Laos. I was accompanied by Rachan Phuma, of Huay Kaew Arboretum in Chiang Mai, who had kindly offered to join me on this *P. roebelenii* search. Among the stalls selling tourist souvenirs, *P. roebelenii* was for sale, but at a very high price. I could glean only limited information from the people selling the palms: namely, that they are known as Xishuangbanna Palms and that they are collected wild from up-river in Yunnan, S.W. China. Feeling rather frustrated at not discovering more about the palms, we drove further along the Mekong to Chiang Saen, where we could join the main road back south to Chiang Rai. On the road out of Chiang Saen we passed a field in which hundreds of *P. roebelenii* clumps stood bagged up in sacking. Up until then we had seen only small numbers of the palm for sale, the high price perhaps limiting the trade. But here at Chiang Saen, there was a veritable *P. roebelenii* forest on sale, consisting of wild collected individuals in a quantity which, considering the limited natural distribution of the species, raises serious questions about the survival of the palm in the wild. According to the woman selling the palms, the trade began five years ago, with *P. roebelenii* collected wild from northern Laos. As the trade increased, the natural populations of the palm in Laos diminished to such an extent that the traders had to venture further afield, into Xishuangbanna in Yunnan, in order to satisfy the demand.

In Xishuangbanna the palms are said to be found clustering on cliffs overlooking the Mekong, and perhaps even along the river's edge, thus further supporting the hypothesis of *P. roebelenii* as a rheophyte.

Each year a large shipment is transported down the Mekong from Xishuangbanna during the three-month rainy season. It is only then that the river is high enough to allow such shipments. From our discussion with the palm seller, it seemed that there will not be another shipment for several years. The reasons for this are three-fold. First, there is now a glut of *P. roebelenii* for sale in Chiang Saen, the high price severely limiting the size of the market. Second, the natural populations of the palm in Xishuangbanna are now so diminished that the traders cannot obtain enough tall, mature palms to make the long journey worth their while. Third, the plant sellers have collected large quantities of seed, which they are having no problems in growing. A successful trade in the resulting seedlings would lessen the need for gathering the palm from the wild.

The consequences of such trade on a palm of limited distribution such as *P. roebelenii* do not bode well for its status in the wild. If it is true that the trade is easing off, then populations in Laos and S.W. China might be offered temporary respite from attack, but the long-term conservation status of the species is still not clear. Further information relating to its distribution and frequency is needed and potential threats to its survival must be identified if this very beautiful, ornamental palm is to be ensured a safe future.

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CHAPTER NEWS AND EVENTS (*Continued from page 176*)

iae in Southern California. The meeting began at 11:30 a.m., with a tour led by Bill Dickenson of the dry palm area just past the Clark Victorian house, followed by a potluck picnic lunch. After lunch, Ralph Velez gave a slide presentation on Palms of Venezuela taken at the June IPS Biennial. This was followed by the raffle and auction. Louie and Carol Hooper invited members and guests to view their palm garden in La Habra after the Arboretum meeting.

On Saturday, September 24, there was a tour of the palms at Quail Botanical Gardens in Encinitas. Garden staff member and horticulturist Charlie Korns conducted the tour and gave a brief overview of palms and their economic importance.

A tour of Lotusland was held on the afternoon of October 15, arranged by Pauleen Sullivan. This tour followed a palm sale from 8:00 a.m. to noon at Ventura College, from which car pools to Lotusland originated.

The November meeting was held in San Diego, with tours of two private gardens not previously toured by the Chapter. The meeting started at 10:30 a.m. at the garden of Dennis Willoughby (4438 Pescadero, phone 224-2516) in the western Point Loma area of San Diego. Dennis's garden features the largest number of *Livistona* species planted out in Southern California as well as many other thriving genera. This was followed by a late morning tour of the nearby garden of Lee and Cindy Cooley (4408 Osprey, phone 223-8090), which features large *Roystonea regia*, *Gaussia maya*, *Prestoea montana*, several large *Pinanga* and many other mature palms. At 12:30, the group left for the Bahia Hotel, 998 West Mission Bay Drive, about 10 minutes away, where the lecture was held. The speaker was David Besst, well-known palm author and nurseryman from Florida, who talked about wild palm species seen on adventures into eastern Mexico.

The Southern California Chapter's Annual Banquet was scheduled for January 21, 1995.

News from the Broward County Chapter

On September 9 and 10, the Broward County Palm and Cycad Society (BCP&CS) held a field trip to McLean's Autumn Safari, 325 Farmington Drive, Plantation. Participants saw an extraordinary xeriscape and palm-filled yard, with plants available for sale.

The group met on September 22, 1994, in Davie. Tom Broome, the owner of B&B Landscape in Lakeland, gave a presentation on hands on experience with *Cycas* pollination. He has been growing cycads for six years and has 112 species in his collection.

On September 24 and 25, the Chapter held their "Beautify South Florida, Plant a Palm Sale" at Flamingo Gardens, Ft. Lauderdale. This was followed by the "Plant Affair West" there on October 8 and 9.

A "Plant Extravaganza" was scheduled for the Holiday Park, Ft. Lauderdale, on October 29 and 30.

In late November, the BCP&CS had their Society Picnic at Eric Beers's garden.

News from the South Florida Chapter

The South Florida Chapter met on October 19 to finalize plans for "The World's Largest Palm Sale". This activity has grown tremendously since its inception. Sales are over $80,000 per year and are forecast to exceed $100,000 soon. The sale not only raises funds for the Chapter and for the Fairchild Tropical Gardens, but also distributes over 1,000 species of palms to the community.

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Effects of Hurricane Joan on the Palms of the Caribbean Coast Rainforest of Nicaragua

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Hurricane Joan passed over the Caribbean coast city of Bluefields, Nicaragua, on October 22, 1988. In 1971 Hurricane Irene had struck the coast just south of Joan's landfall, indicating that hurricane hits are a relatively common occurrence in the region, at least from an ecological point of view, and it has been calculated that, on average, a hurricane strikes this coast about once per century (Boucher 1992). In the case of Hurricane Joan, approximately 500,000 hectares of tropical rainforest were severely affected, centered on a line between Bluefields and Rama, extending some 50 km inland.

Initial post-hurricane censuses of overstory trees revealed that the forest was as badly damaged as had been indicated in preliminary reports, as we have reported elsewhere (Yih et al. 1991, Vandermeer et al. 1990). In an intensively sampled area of 4,000 m^2, a total of 374 individual trees were encountered, representing 77 different species. Of all individuals encountered, 80.5% were either windthrown (27.3%) or snapped (53.2%), there was no forest canopy at all, and what had been canopy was on the ground as a deep and heterogeneously distributed and constituted layer. Very few individual trees were left standing (19.5%). Also evident was the fact that almost all species were represented by living individuals. Of 77 species of trees encountered in our intensively sampled area (4,000 m^2), all but two were represented by individuals that had already begun to resprout. A vast majority of trees (288 of the 374 individuals encountered) were resprouting.

The literature had suggested that the forest floor, four months after the hurricane, would be a garden of second-growth pioneers. It is well-documented that there are substantial quantities of seeds of pioneers in the seed bank under a tropical forest, and since four months with considerable rainfall had passed between the hurricane and our visit, we anticipated both normal dispersal mechanisms and germination of seed-bank seeds to have created an abundance of pioneers. We expected that the hurricane would have simply created a very large light gap and that the process of secondary succession would have begun, with gardens of seedlings of pioneer species such as *Ochroma, Cecropia, Croton, Heliconia, Heliocarpus, Calathea,* etc.

Our observations turned out to be dramatically at odds with such expectations. What had been forest understory was beneath or interspersed in a deep litter layer, not at all the imagined bare forest floor exposed to the sunlight. Light gaps caused by individual treefalls are characterized by an area in which the forest floor tends to be directly exposed to the incoming light with little debris covering it (the area of the bole), and a separate area with considerable debris covering the soil (the area on which the crown fell) (Orians 1982, Brokaw 1985). In contrast, for the most part the hurricane left almost all of the ground area covered in a deep layer of debris. In sampling seedlings, a total of 46 species were encountered in intensive subquadrats (40 2 × 2 m quadrats, 160 m^2 in total), almost all of which were species encountered as adults in the samples of the forest as a whole. Only one species (*Croton killipianus*) was new and a typical pioneer species; other expected large light gap colonizers, such as *Cecropia, Ochroma, Heliconia, Piper* or *Calathea,* were not encountered at all (although all were seen in surrounding agricultural and fallow fields).

In an attempt to characterize the forest understory, we also sampled the understory monocots, all of which were palms, at the two sites. A total of 13 species was encountered. Understory palms are notable for their ability to withstand physical damage (Rich 1986, Vandermeer et al. 1974, Bodley and Benson 1980), a reputation that was strongly reflected in our data. Of a total of 255 individual palms encountered, only 10 had been killed, despite the fact that many (181) had been severely damaged by falling debris. From our field

observations it was quite evident that the understory palm flora, while severely damaged, was certainly not altered permanently. It appeared obvious that the palm flora (and by implication the forest understory in general) was severely damaged, but the majority of individuals were still alive. While epicormic branching (buds borne on trunks) is obviously not a possible strategy for monocots, the palm species seem well-suited to withstand the considerable physical damage exerted by the hurricane, through a variety of their own structural features (e.g., Rich 1986, Bodley and Benson 1980, Chazdon 1986). Whether this initial response of the understory palm flora would persist in future years was the purpose of the present study.

Methods

The study was conducted in three sites distributed as representatively as possible within the area damaged by Hurricane Joan. Based on local features, the sites were referred to as Bodega, Fonseca, and Delicias. Site selection was very much hampered by the primitive means of travel available in the region, made especially difficult by the hurricane with thousands of trunks blocking most waterways, that provided access for automated transportation in the zone. Thus, while we attempted to choose three representative sites, our choices were quite limited to begin with. During the first expedition to the area (described above), only Bodega and Delicias were visited. Thus were established four plots (100 m × 10 m) in February of 1989, two each at Bodega and Delicias.

In February of 1990, all three sites were visited and additional plots established at each, such that a total of 10 plots (100 m × 10 m) were included in the study—three at Bodega, three at Fonseca, and four at Delicias. Subsequent to our initial expedition to the area, a logging road had been built at Delicias in such a way that one of the two original plots had been affected (approximately 20 meters at the origin of the plot was within 10 meters of the new logging road, thus not physically encountering the plot itself, but certainly having at least a small effect). This was the main reason for adding a fourth plot at Delicias. All adult trees in all ten plots were permanently marked and measured, understory palms censused, overstory shade estimated, and seedlings/saplings censused in subplots, all of which is described below.

In February of 1991 all ten plots were recensused, and in February of 1992 the second plot at Delicias was abandoned due to excessive vandalism. In February of 1993, plots 3 and 4 at Delicias had been completely slashed and burned and converted to a cassava/taro plantation, and thus had to be abandoned.

In each of the 10 permanent plots the left-hand side of the plot was censused yearly for understory palms (i.e., a plot 100 m × 5 m). All species of palms whose highest leaf apex was 1 m or more were recorded. While several species are clonal (i.e., *Geonoma congesta*, *G. longevaginata*, *Bactris* sp. 1., *Bactris* sp. 2, *Prestoea decurrens*, *Reinhardtia latisecta*), it is usually a simple matter to distinguish one clone from another, and only individual plants were recorded (i.e., all canes from a single cone were lumped as one individual). Frequently this gives rise to a "rare" species appearing to be much more abundant than it in fact does, as is obviously the case with *Bactris* sp. 1, and *Desmoncus* sp. (the latter because of its viny nature).

Censuses were done visually without marking individual plants for the purpose of recording any large-scale changes that might happen subsequent to the hurricane. Since the purpose was only to record large-scale effects, a variety of error sources enter this data set. A visual judgment was made as to whether each individual entered the >1 m height category. Thus the same individual could possibly be included in one year but not the next because of changes in judgment of the observer. Furthermore it was frequently visually estimated whether an individual was within 5 m of the center transect line, a method similarly affected by observer judgments. Neither of these two effects are likely to be very severe, but they are nevertheless inherent in the data collection technique. Finally, since individual plants were not marked, it is always possible that an individual encountered one year will not be encountered the next, simply because of the problems inherent in searching for plants in a severely damaged forest. Especially during the first two or three years, the understory was filled with dead and dying trees and fallen branches and debris, and some areas were extremely difficult to search. Undoubtedly this is a situation that could easily have contributed to inaccuracies in data collection. On the other hand, for the purposes at hand—to search for large-scale changes in the understory palm flora—I have no reason to doubt that the data collected are adequate to the task.

All individuals were identified by myself, with

Table 1. Number of individuals of each species encountered in all years sampled in each plot. D = Delicias, B = Bodega, and F = Fonseca.

Name	D1					D2			D3			D4			B1		
	89	90	91	92	93	89	90	91	90	91	92	90	91	92	89	90	91
Asterogyne martiana	0	13	12	14	14	1	0	0	0	0	0	0	7	2	0	0	0
Astrocaryum alatum	4	5	10	11	5	5	12	14	15	20	22	36	38	41	0	0	0
Bactris 1	6	5	6	7	2	6	10	12	4	7	11	2	2	2	2	2	3
Bactris 2	0	0	0	2	1	0	0	0	4	0	0	2	0	0	0	0	0
Bactris 3	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0
Bactris hondurensis	0	0	2	1	2	0	0	2	0	3	1	0	2	3	0	0	1
Calyptrogyne	0	7	2	1	0	0	2	0	0	0	0	0	2	0	26	27	31
Chamaedorea exorrhiza	3	2	3	3	0	0	4	4	0	0	0	0	0	0	0	1	0
Chamaedorea sp.	0	1	7	0	0	0	3	0	15	17	2	7	5	0	0	1	1
Cryosophila albida	8	16	24	23	15	3	2	2	0	2	3	20	27	29	0	1	1
Desmoncus sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
Geonoma congesta	46	41	59	76	51	39	30	26	37	44	63	40	50	61	27	11	12
Geonoma interrupta	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Geonoma longevaginata	2	2	9	13	11	0	0	1	10	7	42	0	0	11	2	2	1
Geonoma sp.	0	0	0	2	0	0	0	0	0	0	2	0	2	4	0	0	0
Prestoea decurrens	2	1	3	2	4	0	5	5	14	13	16	0	0	0	8	1	2
Reinhardtia latisecta	2	3	6	2	3	0	2	2	6	7	6	0	0	0	30	26	25
Reinhardtia simplex	1	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0
Socratea exorrhiza	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Welfia georgii	12	16	24	25	21	11	12	10	4	5	6	2	2	5	3	1	1

the aid of Mr. Nelson Zamora of the Universidad Nacional de Costa Rica, a noted Costa Rican plant taxonomist. All species were relatively easily identified with the exception of several species of *Bactris* and *Chamaedorea*. Because field identification in both of these cases was difficult, strategic lumping was employed. Thus, *Bactris* sp. 1, *Bactris* sp. 3, and *Bactris hondurensis* are quite distinctive and could be identified in the field. However, *Bactris* sp. 2 is a composite of a minimum of four species. *Chamaedorea exorrhiza*, with its distinctive aerial roots, was clearly identifiable, but at least two other species, virtually indistinguishable at small size, were also encountered, and lumped as *Chamaedorea* spp. Thus the list of 20 species presented below is actually a list of a minimum of 24 species. Furthermore, several other species were observed, but no individuals ever entered the >1 m category, including *Geonoma cuneata* and *Chamaedorea geonomiformis*.

Finally, it should be noted that, to my knowledge, this is the first time that the palm flora of this region has been examined at all. Several species seem to represent material that is genetically distinct from what I have seen elsewhere, and ultimately may prove to be distinct species, as could be the case in any newly examined area. For example, specimens of *Astrocaryum alatum* in this area have distinctly smaller seeds, smaller vegetative stature, and smaller and more finely divided leaves than the specimens I have seen in Costa Rica. Detailed systematic studies in this region are clearly warranted.

Results

The results of this five-year study are presented in Table 1. The major and most obvious conclusion to be drawn is that major changes in palm flora as a result of the hurricane did not seem to occur. The general pattern of relative abundance seems to have been maintained in all ten plots, despite significant floral differences among sites and plots. As discussed more fully below, all of these species seem particularly resistant to physical damage, possibly one of the reasons the lowland Central American Caribbean rainforests are so rich in palm species. Photographs of the area near Delicias are presented in Figure 1, illustrating the general aspect of the forest four months and four years after the hurricane.

Each of the three sites could be distinctly characterized with regard to its palm flora. Delicias is rich in *Astrocaryum alatum* and *Geonoma congesta*, with *Welfia georgii* frequently also a common part of the flora. At Bodega *G. congesta*

Table 1. Extended.

B1		B2					B3			F1				F2				F3			
92	93	89	90	91	92	93	90	91	92	90	91	92	93	90	91	92	93	90	91	92	93
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	68	65	87	87	73	55	78	115	42	40	59	38
5	4	2	4	5	4	4	3	1	1	1	3	6	2	7	3	5	4	0	1	0	1
0	0	2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
38	34	3	3	3	4	2	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	0	3	3	5	3	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	1	0
19	12	13	10	17	17	17	12	9	8	4	3	4	4	3	4	1	2	3	4	13	14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	2	3	0	0	1	11	9	14	23	19	28	29	12	8	15	22	57	40	43	49
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	4	2	1	1	1	5	5	4	0	0	0	0	0	1	0	0	8	6	8	7
35	32	4	5	3	5	2	19	19	24	0	0	1	1	21	10	15	16	30	23	41	28
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	4	3	2	4	3	2	1	1	0	0	0	0	0	0	1	0	1	0	3	0

dominates, but there is a notable absence of *A. alatum* (although the latter has been seen outside of the sampling plots—it is a rather rare species in the area), and typically with a relatively large abundance of *Reinhardtia latisecta*. Fonseca is characteristically dominated by *A. alatum* and *Geonoma longevaginata*, with *R. latisecta* sometimes abundant also. Occasionally a particular plot is characterized by a particular species, such as D-1 with *Asterogyne martiana*, B-1 with *Calyptrogyne* sp., and D-3 with *Prestoea decurrens*. Despite this arguable uniqueness of each site, and frequently each plot within each site, we see little evidence that there had been a dramatic shift in the nature of the understory palm flora during five post-hurricane years.

Of course subtle effects may exist. In Figure 2a, b and c, I have plotted genet abundances of the three commonest species over time. In all three cases there is a suggestion that populations are increasing in numbers. This suggestion is further enhanced with regressions—in 29 out of 36 cases the regression coefficients (population growth rates) are positive, although attaining statistical significance with such small numbers is difficult and only two examples are significant at the .05 level (see Table 2). On the other hand, looking at all the regression coefficients in Table 2, the probability of getting 29 or more positives out of a sample of 35 (if the real value were 0) by chance is less than .01, and a simple t-test shows a highly significant difference from zero ($t = 4.34$, $df = 34$, $p < .001$). These data may thus indicate that the population densities are generally increasing and a subtle effect of the hurricane was to provide at least a temporary advantage to understory palms. But it could also be a consequence of increasing ease of sampling the flora as the forest regenerates. Indeed, in 1989 it was impossible even to walk through the forest, the plots sampled by climbing through a forest canopy that effectively had been dropped to the ground. By 1993, there was enough of a new canopy and the debris deposited by the hurricane had decayed enough to make it far easier to maneuver through the forest. Thus, each year it may simply be that I see more of what was there in the first place. Such an interpretation is supported by the data on *Asterogyne martiana*. A single individual was encountered in 1989, yet by 1990 13 individuals were encountered in plot D-1. Many of these 13 individuals were already large and robust in 1990, as illustrated in Figure 3, suggesting that the 1989 census had simply overlooked the leafless trunks of these 13 individuals, which were probably buried in a mound of post-hurricane debris.

Discussion

The principal result of this study is that the understory palm flora was not greatly affected by the hurricane. If there was any effect at all it may have been slightly positive in that several species appear to be more common than before the hurricane, although this appearance could be due to sampling error, as discussed above. But even if the subtle increase in population densities is not a sampling artifact, the general result is striking. The hurricane did not have a significant effect on the understory palm flora.

Unfortunately no pre-hurricane data are available for these sites. In our initial surveys we were able to locate what seemed to be all of the understory palms, living or dead, that were underneath the large amount of dead vegetative material deposited by the hurricane. These densities generally correspond to other forests in Central America (e.g., Vandermeer 1993), and it is unlikely that the pre-hurricane forests were any different.

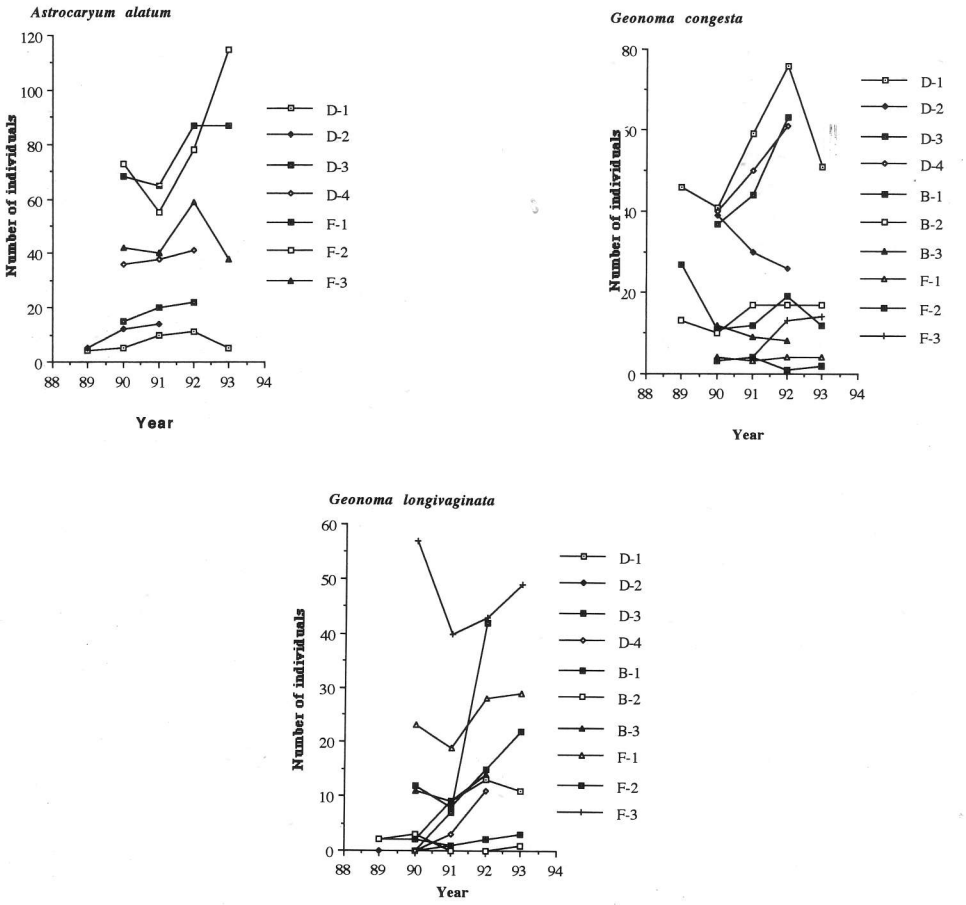
This result is not really surprising given the natural history of the species concerned. Almost all appear to be particularly resistant to physical damage. *Asterogyne martiana* has a single flexible trunk, and it is frequently seen in other forests with the trunk angled strongly or even bent, reflecting the effect of past damage. Several of the species have multiple and flexible canes (*Geonoma congesta, G. longevaginata, Bactris* spp. 1, 2, and 3) which can be virtually plastered to the ground, yet the meristem simply begins growing upward, resulting in the well-known bent canes of *Geonoma congesta* commonly encountered wherever the species occurs. Others of the species spend all of their life cycle with their meristems under the ground or at ground level (*Calyptrogyne* sp., *Bactris hondurensis*), and thus can withstand whatever physical damage that doesn't disturb the physical integrity of the ground. Others spend their juvenile years with their meristems under the ground (*Cryosophila albida, Geonoma interrupta, Prestoea decurrens, Reinhardtia latisecta, Welfia georgii*) such that their age distribution will be altered by the hurricane (since most of the adults will be killed), but all or almost all juveniles will survive. My studies of *W. georgii* in Costa Rica underscore that point (Vandermeer 1977, 1983; Vandermeer et al. 1979). In the case of *W. georgii*, for example, many felled

Table 2. Regression coefficients (estimates of crude population growth rate) and their significances for selected examples. All cases in which 10 or more individuals were encountered at some time during the study are included in this table. Asterisks indicate significance at the .05 level.

Species	Plot	Regression Coefficient	Significance
Asterogyne martiana	D1	2.9	.13
Astrocaryum alatum	D1	1.1	.52
Astrocaryum alatum	D2	1.4	.20
Astrocaryum alatum	D3	3.5	.15
Astrocaryum alatum	D4	2.5	.07
Astrocaryum alatum	F1	7.9	.14
Astrocaryum alatum	F2	8.9	.24
Astrocaryum alatum	F3	5.2	.91
Bactris 1	D2	3.0	.12
Bactris 1	D3	3.5	.05
Calyptrogyne sp.	B1	2.7	.06
Cryosophila albida	D1	2.1	.38
Cryosophila albida	D4	4.5	.2
Geonoma congesta	D1	4.5	.37
Geonoma congesta	D2	−6.5	.14
Geonoma congesta	D3	13.0	.17
Geonoma congesta	D4	10.5	.02*
Geonoma congesta	B1	−2.2	.38
Geonoma congesta	B2	1.5	.15
Geonoma congesta	B3	−2.0	.18
Geonoma congesta	F3	4.2	.07
Geonoma longevaginata	D1	2.9	.04*
Geonoma longevaginata	D3	16.0	.38
Geonoma longevaginata	D4	5.5	.33
Geonoma longevaginata	B3	1.5	.59
Geonoma longevaginata	F1	2.7	.25
Geonoma longevaginata	F2	3.7	.19
Geonoma longevaginata	F3	−2.1	.64
Prestoea decurrens	D3	1.0	.55
Reinhardtia latisecta	B1	1.3	.40
Reinhardtia latisecta	B3	2.5	.33
Reinhardtia latisecta	F2	−1.0	.71
Reinhardtia latisecta	F3	1.2	.80
Welfia georgii	D1	2.7	.12
Welfia georgii	D2	−0.5	.67

←

1. Photos of the area immediately after and four years after the hurricane. Top photo is near Delicias in February of 1989, four months after the hurricane. Note the individuals of *Geonoma congesta* clearly visible, and the damaged *Welfia georgii* to the left. Bottom right is an individual of *Geonoma congesta* in the understory of the same forest in February of 1993. Bottom left is an individual of *Welfia georgii* in the understory of the same forest in February of 1993.



2A. Line graph of number of individuals of *Astrocaryum* over time. 2B. Line graph of *Geonoma congesta* over time. 2C. Line graph of *Geonoma longevaginata* showing number of individuals and time scale.

adults were seen in 1989, and it was not until 1993 that a single individual (at Fonseca) was seen fruiting, probably indicating a dramatic change in the demography of the species. Also, Chazdon (personal communication) reports that large individuals of *W. georgii* can be found in secondary forests in Costa Rica, presumably evading the teeth of the chain saw by keeping their meristems under the ground.

The very long term effects of periodic hurricanes are difficult to judge from the data available. While it can be said with some confidence that the hurricane does not significantly affect the palm flora over the short term, many long term effects could exist. For example, the same periodic resetting of population densities thought to prevent competitive exclusions of canopy trees (Vandermeer et al. 1993) might be very important here in that subcanopy and canopy dicot trees may eventually outcompete the palm understory, but with a hurricane every century or so (Boucher 1992) a short advantage is given to local populations, at least those that have some sort of mechanism to withstand the physical damage of the hurricane.

A particularly interesting case is that of *Socratea exorrhiza*. Three adult individuals of this species were encountered in 1989, but none since. Since this species is so obvious and striking because of its large stilt roots, it is easy to spot in the forest. Subsequent to the detection of these three individuals in 1989 (all of which died during the following year), successive expeditions have been unable to spot a single individual of the species. Each year all participants in the expedition (typically between 20 and 30 people) are instructed

3. Photo in plot D-1 of large specimen of *Asterogyne martiana*.

to "find" *S. exorrhiza*, and during the two-week stay in the area, traversing not only the 10 permanent plots but also surrounding logging roads and hunters' trails. As of 1993 none had been encountered. This species is well-known to resist physical damage by rerooting along its trunk (Bodley and Benson 1980), and it seems likely that the only reason this was not possible was due to the large size of the damaged individuals encountered in 1989. Apparently unlike other arborescent species (e.g., *Welfia georgii*, *Prestoea decurrens*, *Cryosophila albida*), a significant reservoir of juveniles with protected meristems did not exist in the area, possibly due to a failure in the seed dispersal mechanism of this species. The lack of abundant juveniles seems to have caused a local extinction in the case of this formerly rare but extant species.

Finally it is worth emphasizing that all the species encountered in this study appear to have some mechanism for withstanding physical damage, as noted earlier. It could be that species lacking such mechanisms simply do not exist in the area precisely because of periodic hurricane damage.

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Talk about New World Thrinacinae

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Talk about New World what? THRY-NAY-SIN-EYE, Latin for "Thrinax type". *Genera Palmarum* (Uhl and Dransfield 1987) says this is a subtribe of the Coryphoid fan palms, most of which are New World palms, and three of which are native to south Florida, and all of which are well worth knowing, growing, and promoting.

Every self-respecting palm lover should want to know the obvious differences between *Thrinax* and *Coccothrinax*, and have knowledge of their handsome relatives. Without becoming technical or resorting to what few scientific words they know or use with confidence, the authors want to tell you what they think they know about the new world Thrinacinae, starting with the three south Florida natives.

Thrinax and *Coccothrinax* are what the authors wish to be: elegant but often informal, with sometimes well wrapped, slender trunks, comfortable in high winds and in harsh, hot environments, moderately cold tolerant and highly salt tolerant, slender but in time quite tall (some to forty feet or more). *Thrinax* has divided leaf bases; *Coccothrinax* does not. If these provide an attractive criss-cross pattern to *Thrinax* above their trunks, *Coccothrinax* has, at least in its younger years, a fabric wrapping which holds both complete, fresh and older broken off leaf bases. *Thrinax* has white fruit looking like wax, and *Coccothrinax* dark black or purplish fruit, looking, one might say, like dehydrated blueberries from an Egyptian tomb.

Thrinax radiata

Of the four *Thrinax* which exist in the Caribbean basin, *T. radiata*, sometimes called the "green key thatch palm", is the most common in Florida, and the only one found on the Florida mainland. In Everglades Park, on the shores of shallow bays inland from Florida Bay and difficult to reach by car or boat, there are crowded colonies of *T. radiata*. Because of its relaxed leaf tips it has an informal, even tousled look compared to most Thrinacinae. Although slow-growing (20 feet in 20 years?), it is tolerant of beach sand or of alkaline rocky soil, requiring little care and little protection from wind. Its fronds are green on both faces, a bright yellow-orange-green. Grown in the sun, its many fronds are tightly grouped.

The authors recall, years ago, that there were in the Florida keys many emergent *T. radiata*, countless undersized key palms, growing on rock, holding small pom pom heads high above the lower scrub, looking like small explosions. The better the soil, the larger the crown, but in shade, like most of its relatives, the palm attenuates incredibly, displaying a languorous reaching for space.

Thrinax morrisii

(Of mo-riss-ee-eye, morris-ee-eye, or morris-eye, the authors prefer the one which leaves Morris's name undamaged and pronounces "ii" as "eye".)

South Florida's second native *Thrinax* is a more formal, even slower growing stiff-stemmed, less hairy brother to *T. radiata*, sometimes called "silver key thatch palm". Its handsome fans are blue green on top and silver beneath, colors which automatically relate well even to the ersatz turquoise of typical swimming pools. Like *T. radiata*, *T. morrisii* needs little care in calcareous soils; to fertilizers it responds so well, however, that its trunk sometimes swells and its crown becomes much larger than its wild-growing counterpart. Along with most *Coccothrinax*, *T. morrisii* is even more drought resistant than *T. radiata*.

Coccothrinax argentata

Among the slowest growing of the world's slow-growing palms, this delicate dwarf "silver palm" from the pine scrubs is as endangered as its habitat. Although there are countless *C. argentata* in south Dade County, it is worth a trip to the lower Florida Keys to see taller ones (to 15 feet) growing among the *Thrinax* and *Serenoa repens*. The palm's exceptional character results from dark green leaf tops, intensely silver undersides, and

1. *Thrinax excelsa* at Fairchild Tropical Garden. Photograph by L. Pancoast.

very relaxed and narrow radial leaflets, the ultimate informal palmate elegance.

C. argentata was the subject of last year's poster produced by Fairchild Tropical Garden and the South Florida Chapter of the International Palm Society, the first print of twenty-one to be made from splendid palm watercolors painted in the 1950's by artist Lee Adams. Both painting and poster capture *C. argentata*'s curvaceous grace which is almost ethereal.

Sadly, the palm transplants with great difficulty. With prices reflecting its speed of growth, it is available commercially and at occasional palm shows. It wants a sunny, well drained alkaline location, free from distracting plant competition, where its refinements can in time unfold.

Rhapidophyllum hystrix

Although the endangered needle palm grows well in south Florida, it is native to north Florida and to other southeastern states where it grows in sandy, moist woods and swamps. The round pinwheels of its divided fans are pleasing to the eye, but few observers other than those with an emotional identity with *R. hystrix* would classify this slow-growing, suckering, prickly clumper as elegant.

The Other Thrinax

Two splendid *Thrinax* with relaxed leaflets come to us from Jamaica, *T. parviflora* and *T. excelsa* (Fig. 1). *T. parviflora* is larger than *T. radiata*, cruder in all parts, with some cultivars possessing remarkably curly leaflets. *T. excelsa*, formerly called *T. rex*, possesses much larger fronds and is regrettably scarce, perhaps due to cold sensitivity.

The Other Coccothrinax

Genera Palmarum claims that there are forty-nine species in the Caribbean Basin, with thirty-four of these in Cuba. *Coccothrinax miraguama*, long a collector's item for its rigid fans covering 360 degrees or sometimes more, the more deeply folded of which have the look of Elizabethan collars, is a Cuban palm which varies from one end of the seven-hundred-mile-long island to the other. As if those formally held round fans aren't enough,

the trunk fabric is three-layered and long-lasting. Although increasingly available, the demand for *C. miraguama* will always overreach the supply.

Coccothrinax crinita, also from Cuba, is easily identified by its light brown, wavy trunk hair, merely typical *Coccothrinax* fabric with split ends. While the "old man" hair gets more attention, the crisp, rigid, refined crown is just as worthy of note. Almost as slow-growing as *C. argentata*, and fussy about nutrients, in enough time it can grow to twenty feet or more before losing its Solomon hair.

The fastest growing of the *Coccothrinax*, winners of the turtle race, may be two that are often confused with each other, *C. dussiana* from Guadalupe and *C. alta* from Puerto Rico, both of which have large fronds with drooping leaflets. Some people say that *C. proctorii*, a fine but scarce palm from Cuba, is faster yet. *C. dussiana*, however, wins any contest of flashing the undersides of its fans in the wind.

Other New World Thrinacinae

The first three genera addressed below, while splendid, are not horticulturally challenging or hard to find in south Florida collections. These should be used far more often than they are. The three genera more difficult to find and to grow will be approached last.

Cryosophila

Whether one chooses to accentuate the "soph" or the "phi", or neither, this is a genus of perhaps ten species, any one of which is well worth growing. Their divided fans are superb, far more lovable than the root spines some of them sport on their trunks. The fans are held in the crown in such a way that they can be individually appreciated. Slightly larger, if less tall than *Thrinax*, they are softer and less windworthy. They prefer to begin life in shady conditions on the damp side, but will mature in shade or full sun. They range from Mexico to Columbia. *Genera Palmarum* says they need study, as apparently do a surprising number of the world's most desirable palms.

Four species are listed here as growing in the Miami area, although there may be more. *C. warscewiczii* from Panama was represented at Fairchild Tropical Garden by a forty foot specimen, impressive with its shaggy fronds, but it was lost to Hurricane Andrew and is now being replaced by a smaller one. *C. albida* is thought to be smaller, and is much in demand for intensely silver leaf undersides. *C. guagara*, a more recent import, is growing well, showing promise. The *Cryosophila* "to die for" is *C. nana*, most elegant of an elegant family, with perfectly round fronds of narrow leaflets divided to the hastula. While other *Cryosophila* accustomed to rain forest existence are happier with ample rainfall, *C. nana* can be grown drier because it is found, or perhaps can only now be found, in dry ravines on the west central coast of Mexico. As if perfection of form were not enough, its sweet, shiny fruits are "suitable for wine making". Regretably, *C. nana* is scarce in south Florida.

Schippia concolor

A species distinction of this Central American monotype, the only species in its genus, is said to be that it stays small (twelve feet overall) when grown in the sun. That may or may not be true; *Palms of the World* (McCurrach 1960) describes it as reaching 33 feet "in the woods". *Schippia* carries its 190 degree *Thrinax*-like fronds on long petioles, giving its crown a nicely open character; one can look into the crown. After years of slow but steady performance in calcareous soil, having built a stocky grey trunk, the palm produces a flossy white inflorescence which yields, within a very short time, to showy white fruit sometimes as large as ping pong balls, and visible from a considerable distance. The authors are hoping to learn what color inspired the name "concolor".

(M. Burret described *Schippia concolor* in 1883. The original description read: "Lamina utrinque fere concolor . . ." which translates: Lamina (or blade) nearly the same color on both sides.—Eds.)

Zombia antillarum

Causing amazement in first-time observers, intricately woven, successive collars of rigid spines are prized by collectors who grow *Zombia*. It has been so popular with collectors for many years that it is well represented in Miami collections, but along with other splendid palms is apparently almost extinct in its native Haiti. Among its handsome multi-trunks, smallish white waxy seeds can be found, but care is advised in collecting these from among the spines. Another monotype, it is rumored to have consorted with certain *Coccothrinax* to cause taxonomic frustration among those who are quite sure they know the names of everything. Some *Zombia* lovers prefer their *Zom-*

2. *Chelyocarpus ulei.* Watercolor by L. Pancoast.

3. Containerized *Itaya amicorum* at Fairchild Tropical Garden. Photograph by L. Pancoast.

bia grown in the shade because a more open habit permits a better view of the trunks. The authors hope that this palm does not need to lose its name to *Coccothrinax*, as did poor *Rhyticocos* to *Syagrus*, through a corporate merger prescribed by science.

Trithrinax

Of about five species in cold-hardy *Trithrinax*, the authors have only met two: *T. acanthocoma* and *T. campestris*. Both sport woolly trunks worthy of a musk ox, but with protruding spines. They are slow-growing. Their alert, rigid crowns are exceedingly handsome, and they are tolerant of high pH's. But they are easily put off by too much water and so must be banished to Santa Barbara to join a list of dry-growing palms Floridians must envy, which have those ever-so-dry California roots. They are sometimes seen in south Florida, especially after long dry periods, belonging to the few growers who can force themselves not to water certain palms they grow. Four species, says *Genera Palmarum*, grow in dry areas of South America from Bolivia to Brazil, and one, *T. biflabellata*, grows in sandy marshes (in Brazil?) along river banks! Someone must expose this one to Florida's rains and avid waterers.

Chelyocarpus

Five medium-sized, sometimes clumping palms which grow at lower elevations of the Amazon and in Columbia's Choco, suggesting much moisture, low pH's, and high iron, are *C. longibracteata*, which the authors suspect has long bracts, *C. chuco*, with divisions in its palmate leaves which cause these to look like hands, seen and desired by a South Florida Chapter of IPS/Fairchild Tropical Garden excursion to Bolivia which found it not in seed, and a dark horse, *C. dianeurus* which occurs in Pacific coastal Colombia. Another palm "to die for", however, is *C. ulei* (Fig. 2). With widely divided palmate pinwheels strongly serrated on their tips, *C. ulei* creates a startling silhouette

against the sky (see *Supplement to Palms of the World* (McCurrach 1960), page 42), remarkably Licual-esque. *Chelyocarpus* is described (along with dry *Trithrinax*) as one of the most primitive (least specialized) of the palms. Primitive or not, south Florida is fortunate indeed if *C. ulei* can be coaxed into its future. The fourth species, *C. repens*, from Amazonian Peru, was described in *Principes* by Francis Kahn and Kember Mejia, where one can read about it (32: 69, 1988).

Itaya amicorum (Fig. 3)

A monotype from only two known locations in the western Amazon "seasonal rain forests at low elevations", few Floridians have seen its handsome, *Licuala*-like, *Chelyocarpus*-like leaves, but many know of it from an article in *Principes*.

Fairchild Garden has two *Itaya* which survived the sudden brightness after hurricane Andrew in the "Rare Plant House" which it intends to use in the plant exhibit house to be built on the same site. Probably the best specimen in Florida grows in Peter Whelan's Key West garden. Whelan believes the palm may be overly tender to cold weather to survive north of the Keys.

Itaya's long and slender petioles are held onto the trunk by leaf-bases elegantly split. In regard to these leaf bases, Bob Read is said to have pronounced the following ponderable, "*Chelyocarpus* and *Cryosophila* are to *Itaya* as *Coccothrinax* and *Zombia* are to *Thrinax*." Now it should all come clear.

PALM RESEARCH, 1993 (See *Principes* 38(3): 169)

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(*Continued on p. 203*)

Principes, 38(4), 1994, pp. 195–203

Ravenea in Madagascar

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Ravenea is becoming popular again. In the latter part of the 19th century, *R. hildebrandtii* was much sought after for the drawing room; nowadays this species is very rare in cultivation, and our more climatically advantaged members proudly grow their *R. rivularis*. Several entrepreneurs are trying to obtain seed of the rare *R. xerophila*, which would thrive in rather arid climes. However, the bulk of the genus is still unknown to the palmeteers' world at large, and that is sad, because there are some beautiful species as well as some very interesting ones. The genus is restricted, in the wild, to Madagascar and the Comoro Islands; your editors have described the Comoro species in this journal (Dransfield and Uhl 1986) and in a recent article I have described the amazing aquatic *Ravenea* (Beentje 1993). In 1995, John Dransfield and I hope to publish "Palms of Madagascar" which will contain full descriptions of the species, identification keys, and drawings as well as photographs. In this article I'd like to give you an overview of the genus.

Diversity

One of the more amazing things about *Ravenea* is the sheer diversity of the species. Their habit ranges over a wide spectrum, including small undergrowth palms (*R. hildebrandtii*), short and squat palms (*R. louvelii*), slender middle-sized trees (*R. madagascariensis*) and forest canopy giants with bulging trunks (*R. robustior*); habitats include dense lowland rain forest where the palm collects litter (*R. albicans*), littoral and montane forests (*R. sambiranensis*), ravines in rather dry areas (*R. glauca*), river banks in dry areas (*R. rivularis*) and hilltops in arid areas (*R. xerophila*).

In fact, the genus itself is a member of a closely knit group of genera, the tribe Ceroxyleae, from a diversity of continents. There is *Oraniopsis* from Queensland, Australia; both other members of the tribe grow in South America; there is *Juania* from 'Robinson Crusoe' (Juan Fernandez) Island, and the Andean wax palms, *Ceroxylon*, occur in the high mountains of the Andes.

There used to be a fifth member of the tribe, *Louvelia*, also from Madagascar; however, John Dransfield and I have re-found the two most mysterious *Louvelia* species, and some intermediates, and it has turned out that there are no true differences between *Ravenea* and *Louvelia*. The two genera form a continuum, with the species at the opposite ends of the spectrum *very* different; if just the extremes were known, you would certainly put them in different genera. But, if you look at the other species, you can form a chain, of which the links are formed by species which are quite close to each other—and so you can link the extremes, making this a single genus. Between the bulk of the genus *Ravenea* and the other genera of this group, however, there are differences which cannot be bridged by intermediates. And so it goes.

History of the Genus

One of the main difficulties in the early days of *Ravenea* taxonomy was the scarcity of collections and the sex question. Species were described based on one or two collections, and often from very scrappy ones; this was the reason why early keys to the species were based on the strangest of characters, such as the keel of the leaf rachis, or little black hairs on the petiole (probably a fungus). By 1945, when the Flora of Madagascar and the Comoros was published (Jumelle and Perrier 1945), nine species had been recognized in *Ravenea* and three in *Louvelia*, and all but one of these have survived my critical revision (Beentje 1994).

Several new species have come to light since 1945. Dransfield and Uhl (1986) described the imposing *Ravenea moorei* from the Comoro Islands. John Dransfield found a new species during his field work in the late 1980's, which was intermediate between *Ravenea* and *Louvelia*. During my own field work in Madagascar in 1991–1993, three more new species came to light, one

of which was described in this journal (Beentje 1993).

The main difficulty during my revision of the genus was the distinction of taxa which are quite close to each other, such as *R. madagascariensis*, *R. latisecta*, and *R. sambiranensis*. In the field these seemed quite distinct, but the types, the specimens on which the first descriptions were based, were scrappy, or even completely missing—such as the type of *R. latisecta*—in which case I had to go by the rather hazy published description. The fact that this is a dioecious genus, with male and female trees, made the identification of scrappy specimens difficult, and so was the linking of the females with the appropriate males. So some mysteries remain; probably a good thing, as mysteries are the spice of life!

List of Species

Ravenea albicans (Jum.) Beentje (formerly *Louvelia albicans* Jum.)
"Hoza-tsiketra" (Fig. 1)

This used to be a *Louvelia*, as well as a mystery. The type had been collected by Perrier de la Bâthie in the Masoala Peninsula, but without an exact locality. The date must have been circa 1925. This species is immediately recognizable by the white underside to the leaflets (hence the specific name) and a kind of zebra-striping on the leaf rachis. It should be quite unmistakable in the field—the problem was, which field? None of the botanists who have collected in the Masoala in recent years had seen it, and this includes Dransfield, who had searched for it. The original description of 1933 says "common between Fenerive and Antalaha", casually mentioning an area of some 250 miles of coastline. After a year of fieldwork I was beginning to despair about this species. Then, in April 1992, John Dransfield and I were working in a forest near Mananara when John called out, and started dancing—he had red-discovered it, ending a sixty-five year old mystery. It is a 3–6 m tall undergrowth palm with litter-trapping sheath bases and the typical 'shuttlecock' crown of many Raveneas. The male inflorescence is hidden among the sheath bases, but we found a plant in old pistillate inflorescence, and this stuck out from the sheaths. We still have not seen the fruit, but some seedlings growing under the tree had the characteristic white undersurface of the leaf. One of the rarest Raveneas, growing in the wettest rain forests of the country.

Ravenea dransfieldii Beentje
"Ovotsarorona" (Fig. 2)

This species was really the missing link between *Ravenea* and *Louvelia*, and the link was found by John Dransfield on his first trip to Madagascar in 1986. This medium-sized palm grows in lowland rain forest in eastern Madagascar. It has a hard layer around the seed as well as the condensed female inflorescence of *Louvelia*, but only a single seed per fruit, and a male inflorescence branched to two orders, just as in *Ravenea*. So far, it is only known from four sites. Young leaves are used for making high-quality hats.

Ravenea glauca Jum. & H. Perrier
"Sihara" (Figs. 3,4)

A very graceful palm, which would probably do quite well in cultivation; in the wild, it occurs along streams and in ravines in the drier (but not arid) parts of southern-central Madagascar. The trunk is slender, the crown consists of 14–20 slightly arching leaves, and the leaflets have a slightly waxy layer on the underside, which gives the species its name. I have seen it growing on sandstone walls of ravines, in tiny cracks, but also in dry sandy riverbeds; both sites seemed quite dry, but probably get wet at intervals. The original description reports vast forests of this species in the Andringitra Mountains of central-southern Madagascar (again, on their drier slopes), without any undergrowth. I find this hard to believe, but

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1. *R. albicans*. Note whitish under-surface of leaflets. Photograph by John Dransfield. 2. *R. dransfieldii*. The hanging leaflets are characteristic. Photograph by John Dransfield. 3. *R. glauca*. A middle-sized specimen, in young fruit, in an Isalo canyon. 4. *R. glauca*. A small specimen, but with old inflorescences. Rosie Beentje lends scale.


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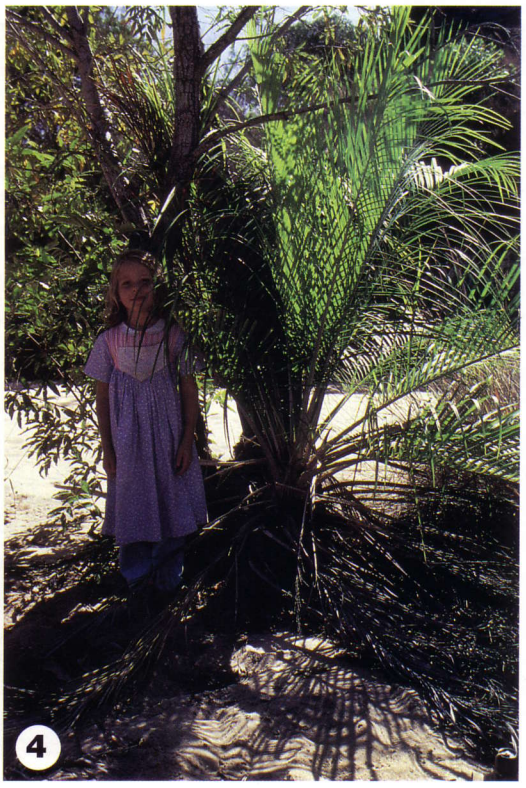
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I must admit my two attempts to reach these mountains failed. It would be a wonderful sight, if it were true.

Ravenea julietiae Beentje
"Vakapasy" (Figs. 5,6)

An elegant palm, which I named after my wife, who first pointed it out to me. After I had drawn up the description, I discovered that a rather meager collection by Cours, dating back to 1951, was in fact the same species. Male trees may resemble both *R. madagascariensis* and *R. sambiranensis*, but the female trees are unmistakable when they are in flower or fruit; the peduncle, the stalk on which the inflorescence is borne, is about twice the length of the leaves and may be up to 4 meters long. I have found it in lowland rain forest, or its remnants, along the east coast; the outer wood is used in construction, and hollowed-out trunks are used as irrigation pipes.

Ravenea krociana Beentje
"Vakakabe" (Fig. 7)

A majestic canopy tree palm, up to 30 m (100 ft) tall, only known from lowland rain forest from the far southern tip of Madagascar. It rather resembles *R. robustior*, which also occurs in that area, but the fruit is much larger (over an inch across), the wood is very light, and female flowers have ten staminodes. Male flowers are still unknown, but by the time this article is published I'll be in Madagascar once more, looking for them. The species is named after Ray Kroc, founder of the McDonald's Restaurants, the organization which funded the 4-year project to study the palms of Madagascar.

Ravenea lakatra (Jum.) Beentje (formerly *Louvelia lakatra*)
"Lakatra"

A medium-sized, slender palm of the eastern rain forests, with very hard wood; one of its local names can be translated as "cannot be cut down by an army". The leaf sheath and petiole are both quite long and also very hard, but the most distinctive character is the seed, which is black and carries a sharp point and is covered by a hard layer; there can be one, two or three seeds per fruit. The male inflorescence was first found in 1993; the search for *lakatra* is documented in earlier numbers of *Principes*. Young leaves are used for making high-quality hats.

Ravenea latisecta Jum.
(no local name known)

This still remains one of the main riddles of the genus. I have been unable to find the type (the only certain collection of this species—dating back to 1912), either in Paris or in any other herbarium, and this hampers my interpretation of the species. The original description highlights the leaflet width (over 5 cm wide), and I did find a population at the type locality which agrees with this and other characters. However, the male inflorescences were multiple, not solitary as Jumelle described them; I was unable to find any female trees. I believe this is close to, or even the same as, *R. madagascariensis*, but until the type comes to light, or until female trees are found, this will remain a mystery.

Ravenea louvelii (Jum. & H. Perrier) Beentje (used to be *Louvelia madagascariensis*; upon its being transferred to *Ravenea* I had to change its epithet, since '*madagascariensis*' already existed in *Ravenea*)
"Lakamarefo"

This is the archetypal *Louvelia*: squat, with marcescent leaves and a trunk covered in tattered leaf bases, and very condensed inflorescences which are almost hidden by the leaf bases. It is still only known from the single rain forest site where it was first found over eighty years ago, and it looks rather mysterious as well as quite archaic.

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5. *R. julietiae*. A female tree, with the extremely long fruiting stalks. 6. *R. julietiae*. A male tree, with *R. robustior* in the background. 7. *R. krociana*. Even the fruits are enormous—for a Ravenea, that is.

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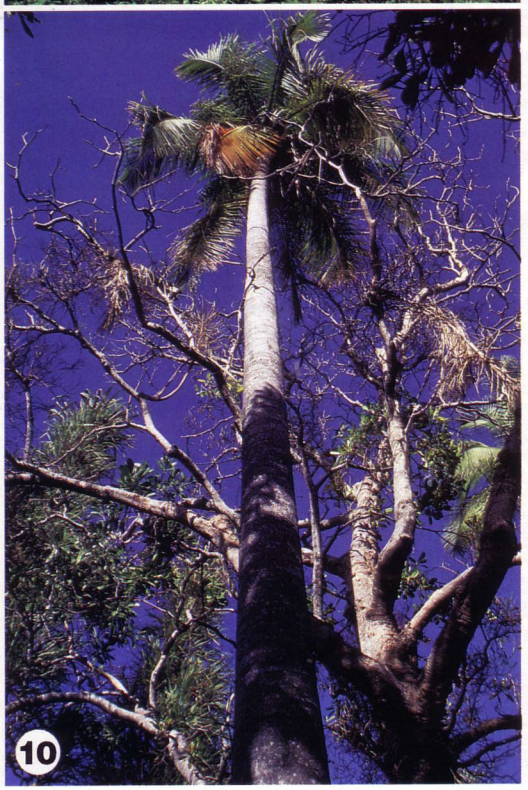
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Ravenea madagascariensis Becc.
"Anivo" (Fig. 8)

One of the most widespread species of the genus and one of the first to be described, this is quite common all over the eastern escarpment and parts of the central plateau, and has the 'shuttle-cock' crown which makes one think '*Ravenea*' straight away. There is no true distinction between typical *madagascariensis* and the variety *monticola*, and so this variety has now been 'sunk' into, or declared the same as, *madagascariensis* itself. These are handsome trees of rain forest or slightly drier hill forests, and can be found from sea level to 1,700 m (6,000 ft) on both rich forest soils and quite leached, almost sandy soils with just a thin layer of humus. The outer wood is used for house walls and floors.

Ravenea musicalis Beentje
"Torendriky"

First described in *Principes* of October 1993. A true aquatic with a bottle-shaped trunk, whose seedlings start off under water—the only palm in the world known to do this. It is known only from a single river, and the total number of trees is about 450. Probably closest to *R. rivularis*.

Ravenea nana Beentje

This is an enigma, and the only Madagascar *Ravenea* I have not seen in the field. The only habit description I have seen is "small palm, 3–4 meters". I don't know whether the male inflorescences are solitary or multiple, so I cannot decide on its affinities, but it looks rather like *R. hildebrandtii* from the Comoro Islands. I believe this is a high-altitude species from health vegetation or low-canopy forest on rocky sites. It has been found five times, in the mountains of eastern Madagascar, but has not been seen since 1963.

Ravenea rivularis Jum. & H. Perrier
"Vakaka" (Figs. 9,10)

This is a very handsome *Ravenea*, which grows along rivers in southern-central Madagascar in what is really a rather dry area. It has a full crown of slightly arching leaves, emerging from an imposing, tall, pale grey trunk which may be swollen halfway up. It is not common in the wild, but where it grows it can often be found in large stands, along rivers or swamp margins, and always in permanently wet sites; I always get my feet wet when collecting this palm! It is becoming common in cultivation, and growers might be interested to know that all seed almost certainly derives from the same population where Perrier de la Bâthie collected the type specimen in 1924.

Ravenea robustior Jum. & H. Perrier
"Munimuni" (Fig. 11)

A truly majestic palm of lowland and sub-montane rain forest of the east coast. To stand at the foot of one of these giants and look up at the crown, some 30 meters (100 ft) above you, is an experience which fills one with awe. The base of the tree is usually bulbous and up to a meter (3 feet) across; the trunk is swollen halfway up, and the leaves are held in the familiar "shuttlecock" mode. This species is quite widespread in the wetter forests of Madagascar; it is cut down for its palm-heart, and planks are made from its outer wood, which is very hard and termite resistant. A smaller form with a slender trunk grows in the open where forest has disappeared, but I cannot find enough differences to separate it off as a species or even as a variety.

Ravenea sambiranensis Jum. & H. Perrier
"Mafekely" (Fig. 12)

A very widespread species, and very variable too: it can be a small, slender tree on poor soils of the peaks of the high mountains of the north (this form used to be *Ravenea amara*) and in the dry forests of the west; it may be a medium-sized tree on the east coast or (rarely) a forest giant in the Sambirano; and it can even grow as a small, almost shrubby palm on white sand near the sea. This group caused me many problems, and there

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8. *R madagascariensis* at Perinet. Photograph by John Dransfield. 9. *R. rivularis* in the type locality, neatly in a row next to a small stream. 10. *R. rivularis* in the type locality. 11. *R. robustior*, the smaller open-air form.

were times when I felt there were at least three species involved; the white-sand or coastal form was going to have the name "littoralis", as it seemed so very striking. But then I found trees that looked like "littoralis" in wet forest at medium altitudes, and the more collections I made, the more the distinctions blurred; even varieties seem unjustified. The outer wood is used for house walls and floorboards, and the palm-heart is sometimes eaten, though it is said to be somewhat bitter; hence its name, Mafekely (from *mafa*, bitter, and *kely*, little, a bit). A handsome palm which would probably do well in cultivation, especially the littoral form which grows on very nutrient-poor soils not far from the sea; this form stays more compact than the other, more inland, forms.

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12. *R. sambiranensis.* A large specimen in the drier western parts of Madagascar. Photograph by John Dransfield. 13. *R. xerophila.* A full-grown specimen.

Ravenea xerophila Jum.
"Anivona" (Fig. 13 and Back Cover)

This medium-sized palm of the far south is beautiful, with its pale trunks and gracefully arching leaves. Its habitat is the dry thorn forest, where it seems to favor hilltops—I believe this may allow it to catch a bit of moisture from the clouds. Soils were poor, gritty sands with lots of rocks. The upper trunk is clothed in leaf base remnants and Perrier, in 1932, reported epiphytic orchids growing among these sheath bases. In 1992 I saw a population of *xerophila*, and I can confirm that a large orchid seems confined to this very specialized habitat. Fibers from young leaves are used in making hats and winnowing baskets. This wonderful palm would make an excellent species for drier areas, but careless collecting could wipe out the entire population. This is a truly endangered species.

Acknowledgments

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At the Royal Botanic Gardens, Kew, I would like to thank John Dransfield for starting the Madagascar Palm Project, for involving me in it, and for many enjoyable discussions, both in the field and in the Herbarium.

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Illegal Palm Felling in Lokobe Reserve, Madagascar

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ABSTRACT

Six species of palm grow in Lokobe Reserve, Madagascar. Three are illegally exploited. The methods of felling and processing are described and the implications of palm exploitation on the survival of the palms and on the forest ecosystem is assessed. The current policing of the reserve is described and recommendations for improved palm protection are given.

Site and Methods

The Réserve Naturelle Intégrale de Lokobe (from here on referred to as Lokobe Reserve) consists of 740 ha of primary lowland rainforest. It is located on a steep basaltic hill (summit altitude—430 m) at the southeast edge of the island of Nosy Be off the northwest coast of Madagascar (Long. 13°23′–25′S, Lat. 48°18′–20′E; see Fig. 1). Lokobe Reserve is a Strict Nature Reserve; therefore, no exploitation of its natural resources is allowed and access is restricted to scientists with permits (Decree 66-242, 01.06.66) (IUCN/UNEP/WWF 1987). The climate is markedly seasonal with a hot, wet season between October–May and a warm, dry season between June–September.

The palms of Lokobe Reserve were identified with the assistance of Dr. H. Beentje and with reference to Jumelle and Perrier de la Bâthie 1945, Moore 1965, and Uhl and Dransfield 1987. Herbarium specimens were made by H. Beentje and the authors. Between July 1991 and April 1993 the activities of the palm thieves in the northwest, west, southwest, and south of the reserve (covering ca. 10% of the Reserve area) were monitored. The date, location, and area (where appropriate) of each felling episode, and the number, species and maturity of the felled palms were recorded. For a sample of each of the felled species, measurements were taken of the trunk diameter at the top of the stump and the length of trunk left in the forest. An interview with a former palm thief provided information on palm felling methods. A broad survey of the reserve was made to assess the extent of the problem. The incidental damage to the forest was quantified by counting the number of saplings and trees, in various trunk diameter classes, which had been snapped during the felling of a sample of 13 palms.

The importance of palm fruits in the diet of the black lemur (*Lemur macaco*), Lokobe's largest fruit-eating animal, was investigated by habituating a black lemur group and recording the activities of a focal animal at 5-minute intervals. Whenever the animal was recorded as feeding, the plant part and species were noted.

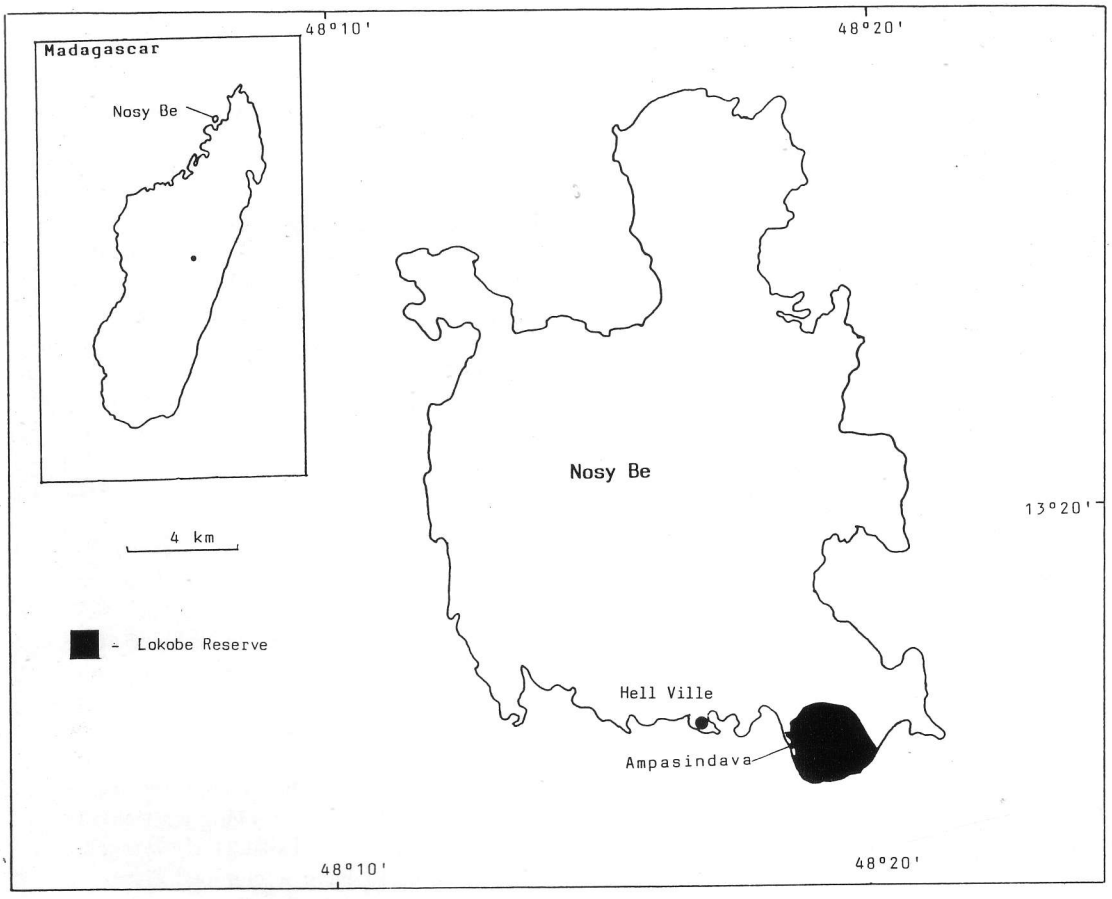
The Palms of Lokobe Reserve

Six species of palm are found in the reserve:

Chrysalidocarpus madagascariensis Beccari (Fig. 2) is a solitary palm with a mature height of 6–20 m (height to base of crown). It is the most common palm in the reserve and grows at all altitudes, although it is most frequent close to the sea. It is also found in patches of scrubby, secondary forest next to the reserve. In Lokobe Reserve this palm flowers between September and February and carries ripe fruit between February and May. This species is endemic to west Madagascar (Jumelle and Perrier de la Bâthie 1945) and is classified as Rare (Beentje 1992).

Neodypsis loucoubensis Jumelle (Fig. 3) is a solitary palm with a mature height from 8–20 m. It occurs throughout the reserve but is rare; where it occurs, it is possible to find several together. A search of 20 ha in the south of the reserve revealed just 5 mature plants (compared with ca. 200 plants of *C. madagascariensis*), but 1 ha in the northwest of the reserve contained 23 plants. *N. loucoubensis* may flower during any month of the year but fruiting occurs in two distinct periods, April–May and September–December. It is endemic to Lokobe Reserve and is classified as Endangered.

Ravenea sambiranensis Jumelle and Perrier



1. Location of Lokobe Reserve.

(Fig. 4) is a solitary palm with a mature height of 8–20 m. It is very rare in the reserve, where only four mature plants are now known, after five other plants were felled during the course of the study. Fruiting plants of *R. sambiranensis* were noted in June, July, November, and December. This genus is dioecious and all the known plants in Lokobe were female; nevertheless, two produced viable seed (one had empty fruits and one was not examined). *R. sambiranensis* is endemic to Madagascar where, in addition to Lokobe Reserve, it is known from the Manongarivo and Tsaratanana massifs in the northwest, the Bongolava embankment in the west, and in the eastern rain forest between Mananara to Vangaindrano (H. Beentje, pers. comm. 1993). It is classified as Vulnerable.

Vonitra nossibensis (Becc.) Perrier is either a solitary or a clustering palm with two or three major stems. At maturity it is 5–12 m high. Flowering was recorded between December–June and fruiting between September–March. It occurs throughout the reserve but is most frequent at higher altitudes. It is endemic to Lokobe and is classified as Endangered.

Dypsis sambiranensis (Jum.) Jum. is a slender solitary understorey palm with a mature height of 6–10 m. Its phenology was not monitored closely, but flowering was noted in November and December and fruiting in February and March. This palm is occasional throughout the reserve. Elsewhere it occurs in a few localities in northern Madagascar and is classified as Vulnerable.

Phoenix reclinata Jacq. is restricted to the maritime edge of the reserve, where it grows in low, infertile clumps, less than 1 m high. Larger, fertile plants are found in scrubby vegetation throughout Nosy Be. It grows in northwest, northeast and north Madagascar, and around the maritime fringe of tropical and sub-tropical Africa (Jumelle and Perrier de la Bâthie 1945). Its status

as a native in Madagascar is uncertain. It is classified as Not Threatened.

Theft of Palms

In Lokobe Reserve, *C. madagascariensis*, *N. loucoubensis* and *R. sambiranensis* are exploited for timber, in particular for planks that are used as floor boards in traditional houses. On only two occasions was the heart removed from the felled palm. Sometimes, when the palm thieves have trouble locating sufficient palms to complete a commission, *Ravenala madagascariensis* (Travellers Palm, Strelitziaceae) is also felled. It produces planks which are inferior but superficially very similar to those obtained from the palms and, when mixed with palm planks, passes unnoticed. Only mature palms are taken, as the trunks of young plants are too soft to produce durable planks. The range and mean (with standard deviation) trunk diameters (20 cm above the palm "foot") for a sample of felled palms for each of the three species are:

	Range (cm)	Mean (cm) (s.d.)
N. loucoubensis (n = 23)	19–32	23.4 (3.2)
R. sambiranensis (n = 3)	21–25	22.2 (2.3)
C. madagascariensis (n = 11)	20–32	24.9 (3.2)

Palm exploitation is hard work and requires a good knowledge of the forest and experience in methods of felling and processing; not surprisingly, it is conducted by only a small number of professional palm thieves. These men work alone or in groups of two to three in response to a specific commission from a house-builder. An area of forest is located which is rich in mature palms and these are systematically felled over two to four weeks. At the end of felling, no mature palms remain at the site. The palms are felled using an axe, 30–60 cm above the palm foot. The lower portion of the trunk is cut into one to three sections either 3 m or 4 m long, according to the specifications of the commission. Only the lower portion of the trunk is used, as the upper portion is soft. The upper portion is left in the forest (mean length of discarded trunk = 8.7 m, s.d. = 2.9, range = 2.3–15, n = 37). The sections are split in half using an axe, and the soft central core removed using a tool called a "*fisitry*" to produce two curved planks (Fig. 5). Thus, depending on their size, a palm can yield from 2–6 planks. The bark covering the planks is scraped off using another tool called a "*gory*". The planks are tied together in bundles of four to six using liana and carried to the edge of the forest where they are hidden. They are then transported away by pirogue (dugout canoe), at dusk or during a moonlit night, often when the tide is particularly high so the boat can be loaded close to the forest. Generally the thieves work in the relatively cool period between dawn and mid-morning, felling and processing four to five palms a day. The planks are sold for 1,500 FMg each ($0.75); therefore a whole palm may yield up to 9,000 FMg ($4.50)—a relatively large amount given that typically a laborer earns just 2,000 FMg a day.

The number and species of felled palms and the area of felling for nine palm felling incidents recorded between July 1991 and April 1993 are shown in Table 1. The stumps of felled palms can be found from sea level to the highest altitudes and in all parts of the reserve except for inaccessible, steep, boulder-strewn ravines.

Felling and processing the palms causes some incidental damage to the neighboring vegetation. This is usually superficial, being restricted to saplings and young trees (Table 2). However, because the palms often have a clumped distribution, a large number may be felled within a small area; the combined impact of their loss from the forest canopy together with the damage to neighboring vegetation can be considerable.

Policing the Reserve

Lokobe Reserve is under the protection of the Department des Eaux et Forêts, whose regional office is in Hell Ville, Nosy Be, 7 km from the forest by track and 4 km by sea. The office is staffed by a regional director and four forest guards. The guards have bicycles and a pirogue. Routine patrolling of the reserve is limited to monthly perambulations around the seaward edge of the reserve (coinciding with the lowest low tides). Apart from occasionally walking a well worn path to a reservoir which lies within the reserve, the guards rarely enter the reserve. During the study, no palm thieves were apprehended and no caches of palm planks were confiscated, except those found by us. The guards are young, unarmed, and avoid confrontation with the thieves as they are afraid

that they may be attacked with axes and machetes. Moreover, the guards also have responsibility for all areas of Classified Forest on the island of Nosy Be, leaving little time for the effective policing of the reserve.

Importance of Palm Fruits in the Diet of Lokobe's Frugivores

In Lokobe Reserve, the Madagascar Blue Pigeon (*Alectronenas madagascariensis*) feeds on the fruits of *R. sambiranensis*, and the Grey-backed Sportive Lemur (*Lepilemur dorsalis*—classified as Endangered, Harcourt and Thornback 1990) and the Black Lemur (*Lemur macaco*—Endangered) feed on the fruits of *N. loucoubensis*, *C. madagascariensis* and *R. sambiranensis*.

The importance of palm fruits in the diet of the

←

2. *Chrysalidocarpus madagascariensis*. 3. *Neodypsis loucoubensis*.

4. *Ravenea sambiranensis.* 5. Processed palm planks.

→

black lemur was investigated in detail. This species spends a large proportion of its total feeding time eating palm fruits when these are available. For example, during March 1992, March 1993 and April 1993, a group spent 32.3%, 45.9%, and 30.4%, respectively of their feeding time eating *C. madagascariensis* fruit (total number of Feeding Records: 194, 74, and 79, respectively). Ian Colquhoun (pers. comm., 1994) reports that on Nosy Faly peninsula, where *C. madagascariensis* is locally abundant, during February 1992 and March 1992, four black lemur groups spent on average 49.5% and 47.5% of their feeding time eating the fruits of this palm (total number of Feeding Records: 204 and 99, respectively).

The seeds of *R. sambiranensis* are swallowed by the blue pigeon, and seeds of *C. madagascariensis* and *N. loucoubensis* are swallowed by the black lemur. Palm seeds collected from blue

Table 1. Felling incidents July 91–April 93.

Date	Location	Area	Species
July–Sept 91	N.W. Reserve, 150 m alt., close to path from Ampasindava and Reservoir	ca. 2 ha	23 × *N. loucoubensis* 3 × *R. sambiranensis*
Nov 91–Jan 92	W. Reserve	?	? (thieve's pirogue on beach for two months)
Feb–Apr 92	S. Reserve, between 50 and 150 m alt.	ca. 3 ha	20 × *C. madagascariensis*
Apr–May 92	S. Reserve, along maritime fringe for 300 m	?	20 × *C. madagascariensis*
May 92	N.W. Reserve, 100 m alt. close to path from Ampasindava to Reservoir	ca. 2 ha	6 × *C. madagascariensis* 2 × *N. loucoubensis*
July 92	N.W. Reserve	?	? (thieves seen loading planks onto pirogue at Ampasindava)
Nov 92	S. Reserve	0.8 ha	3 × *C. madagascariensis* (thieves frightened off)
Jan 93	W. Reserve	?	? (a considerable number—a loaded pirogue was seen travelling from the forest to Hell Ville on 7 successive evenings)
April 93	S. Reserve, along maritime fringe for 600 m	?	10 × *C. madagascariensis* 1 × *R. sambiranensis*

pigeon and black lemur droppings were viable, suggesting that these frugivores disperse the seeds of these palms.

On Nosy Faly peninsula, I. Colquhoun also observed the Western Gentle Lemur (*Hapalemur griseus occidentalis*—Vulnerable) eating the fruits of *C. madagascariensis*. The flesh was nibbled off the fruit and the seed had been spat out.

Table 2. Incidental damage to neighboring trees during felling.

Palm No.	No. of Trees Snapped in Various "Diameter at Breast Height" Classes		
	5–10 cm	10–15 cm	>15 cm
1, 2	1	0	0
3	2	0	1 (17 cm)
4	1	0	0
5, 6, 7	6	2	0
8	0	4	0
9	0	0	0
10	2	0	0
11, 12	0	0	0
13	2	0	0
Total	14	6	1

Palms bracketed together grew close together and damage caused by the felling of each was difficult to differentiate.

Discussion

During the course of this study, several hundred palms were felled in Lokobe Reserve. It is difficult to predict the consequences of this rate of felling on Lokobe's palm populations. On the one hand, the palms are not felled until they are relatively old, giving them at least some time to reproduce, the steep ravines probably provide refuges, and they seem to have effective dispersal agents which would allow them to recolonize the over-exploited parts of the forest from their refuges. However, on the other hand, the reserve is small, the rate of felling is high, and the palms have a clumped distribution, so they can be exploited efficiently. *R. sambiranensis* and *N. loucoubensis* are particularly at risk because their populations are small and they are felled along with the more common *C. madagascariensis*. In the absence of a commoner species, one might expect felling of these species to stop once their population had fallen to a level at which the time required to locate the few scattered plants made the exercise uneconomic. Currently, all three of the exploited species still regenerate. However, while young plants of *C. madagascariensis* and *N. loucoubensis* were locally frequent (in the vicinity of mature palms), those of *R. sambiranensis* were very rare.

Even if these species escape extinction, the reduction in palm density is to be regretted, as this reserve is one of Madagascar's few remaining

areas of lowland primary rainforest and as such should be maintained in a pristine condition. In addition, a reduction in palm density could lead to a decline in the populations of palm-fruit-eating animals.

Recommendations

To improve palm protection in Lokobe Reserve it is recommended that:

i) forest guards visit the reserve more frequently and patrol more thoroughly (this may require the employment of additional guards);
ii) the commitment and confidence of the guards be increased by rewarding hard work, training in self defense, providing good pay and work conditions, and emphasizing the importance of their work;
iii) consideration be given to the feasibility of enriching secondary forest elsewhere with the exploited palm species to provide an alternative source of palm planks;
iv) plants of *N. loucoubensis* and *R. sambiranensis* should be cultivated in a secure tropical garden or arboretum.

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CLASSIFIED

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A Gem for Tissue Culture: Asterogyne spicata of Venezuela

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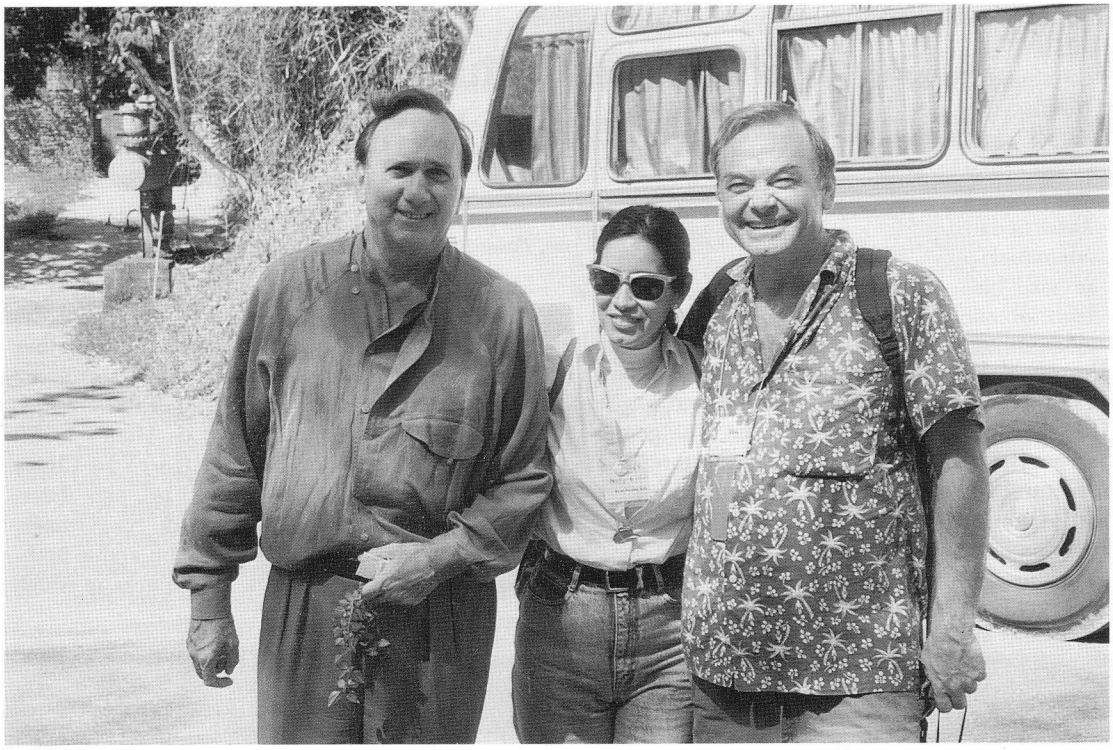
According to *Genera Palmarum* (Uhl and Dransfield 1987), the genus *Asterogyne* belongs to the largest subfamily, Arecoideae, and to tribe Geonomeae, where *Geonoma* is the type genus.

For *Asterogyne*, five species have been reported in Central America and in northern South America. *Asterogyne martiana* is native in Central America and has been found also in Colombia. It grows in wet forest, often at low elevation ca. 200–400 m above sea level. There are three other species which occur in Venezuela: *Asterogyne ramosa*, in the state of Sucre (Gulf of Paria: Cerro Espejo 750–850 m and Cerro de Humo 1,060 m) and in the state of Yaracuy (cerro La Chapa north of Nirgua at 1,200–1,300 m), and *Asterogyne yaracuyense* Henderson & Steyermark, which has a very limited distribution and is probably an endangered species, as the area in which

1. The blood-red center leaf of a juvenile *Asterogyne spicata*. 2. Dr. John Dransfield with an adult *Asterogyne spicata*. individual, which has at least four new flower bracts, in Guatopo National Park.



3. IPS President Jim Cain, who masterminded the Caracas Biennial; Venezuelan guide Nelly Esteves, who animated the busloads of IPS participants; and Oscar Martinez, host at Hacienda Carabobo, who will propagate *Asterogyne spicata* by tissue culture in the AGRICAR labs at Turgua, near Caracas, Venezuela.

it has been found is being destroyed (Henderson and Steyermark 1986). The third one in Venezuela, *Asterogyne spicata*, has been found in Guatopo National Park in the state of Miranda at about 500–600 meters elevation. There is also a new species, *Asterogyne guinanense*, recently discovered in an expedition to Mt. Belvedere in southeast French Guyana.

Asterogyne spicata is an elegant, small, solitary palm, very well adapted for horticulture. It is also relatively easy to propagate. The genus *Asterogyne* is monoecious, with male and female flowers on the same plant. *A. spicata* has a spicate inflorescence and the male flowers have 21–24 stamens, whereas *A. ramosa* has a branched inflorescence with 4–12 unbranched rachillae. Male flowers of *A. ramosa* have 10–12 stamens.

The seeds germinate in 3–4 months and the seedlings are relatively slow in growth. However, given the same conditions as in its habitat—good well-drained soil, which should not be too difficult to comply with—it is a fine palm, excellent for indoor cultivation (Hoyos and Braun 1984, Wessels Boer 1988).

In the forest one can see grown-up individuals of up to 8 m high, stems ca. 4 cm diameter, and leaves erect up to 120 cm long, multinerved at 25 degrees to the center nerve. The first young leaf is frequently red colored, which gives the palm a very great ornamental value (Figs. 1,2). At a distance it seems as if the plant were in flower.

The local name in the state of Miranda, Venezuela, is "Palmiche" and the dark red ovoid fruits, 18 mm long and 7 mm wide are edible. The endocarp has a sweet acid taste.

The red leaves also occur in quite a few species of trees in genera like *Mesua, Calophyllum, Cinnamomum, Eugenia, Diospyros, Brownea, Saraca, Mangifera, Bombax, Pachira, Lophira, Triplaris, Coccoloba, Ricinus*, as well as in plants like *Coleus, Acalypha, Cordyline, Codiaeum, Caladium*, etc. The coloration is sometimes so vivid that from a distance the plants seem to be in flower.

4. Author Sven Nehlin of Venezuela and Sue Rowlands of Southern California at Guatopo National Park during the June IPS Biennial with new leaf of *Asterogyne spicata*. Photograph by Jim Cain.

Some other palms in the tropics show the same phenomena, but usually to a lesser degree. There are brown reddish leaves in *Pinanga kuhlii*, *P. patula*, *Heterospathe elegans*, some *Oenocarpus* from the Amazonas area, and *Salacca zalacca*. Yellow/orange young leaves also occur in species like *Phoenicorium borsigianum*.

The coloration of the leaves certainly gives these palms an increased ornamental value, as do the the red or orange crownshafts of *Cyrtostachys renda* and *Areca vestiaria* or the violet/blue leaf borders and shoots of *Latania lontaroides* and *L. loddigesii* in young plants. All this gives these palms special attraction as ornamental species for horticulture in general and especially for palm enthusiasts who like myself enjoy collecting rare and ornamental species.

Here is where the new methods in tissue culture with massive propagation can be applied to shorten the production time, preserve the genetic properties of any particular specimen, and also save endangered species.

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The Biennial Meeting of the International Palm Society (IPS) in Caracas, Venezuela

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The 1994 Biennial meeting of the International Palm Society was held in Caracas, Venezuela, from Sunday, June 12, to Thursday, June 16. Beginning Friday, June 17, were 13 different post-biennial tours, each lasting from two to ten days.

Caracas is located in a mountain valley at 900 meters elevation above sea level and has a mild tropical upland climate that is nearly ideal for growing most tropical and subtropical palms. Caracas is less than one hour's trip from lowland tropical and mountain cloud forest environments, each with different palm floras. The Biennial was based at the Hotel Avila, an older luxury hotel located in a setting of lawn, flowering trees, palms, cycads, and other tropical plants.

IPS President Jim Cain selected Caracas as the 1994 Biennial site following the previous Biennial in late 1992. He initiated contacts with Jesus Hoyos F., President of the Asociación Venezolana de Palmas (AVEPALMAS) who then formed the AVEPALMAS Biennial Planning Committee, consisting of Jesus Hoyos F., Sven Nehlin, Francisco Monaldi, Roger Cardona, Fred Stauffer, Harry Gibson, Francisco Guánchez, and August Braun. The Committee met regularly to review planning for the proposed Biennial. E-Mail communication between AVEPALMAS and the IPS President was established by AVEPALMAS Vice President Sven Nehlin, who provided guidance on critical questions during the Biennial planning. Francisco Monaldi and Roger Cardona provided fax services. Jim Cain negotiated the contracts for lodging, meals, and events with Hotel Avila and those for almost all in-country services through Lost World Adventures (LWA).

The Lost World Adventures personnel carried out their assignments with gracious efficiency. Andrew Gilchrist, LWA Operations Manager, was responsible for all in-country arrangements, and ensured that each day's operations went smoothly. He and Jim Cain selected and planned the post-biennial tours so that they would be of interest to palm enthusiasts. Hugo Ortiz, Manager of the LWA Caracas Office, booked all buses, catered meals, and arranged simultaneous translation of lectures. Mariela Perez, Customer Liaison for Lost World, arranged airport transportation and return flight confirmations, and stayed at the hotel to solve any problems that arose during the conference.

IPS members came from 14 countries and included palm taxonomists, seedsmen, commercial growers, landscape designers and contractors, and nurserymen, although most of us were non-commercial palm enthusiasts. There were over 30 people from Venezuela participating in the Biennial, many of whom were associated with our local host institutions, the Fundación Instituto Botánico de Venezuala (FIBV), and the Asociación Venezolana de Palmas (AVEPALMAS).

AVEPALMAS provided knowledgeable guides for the Biennial tours, and Sven Nehlin wrote the English language tour guidebook. The careful planning and participation by our two local host institutions made the Biennial a success.

Our host institutions conducted a three-day palm fair at the Caracas Botanical Garden, Friday, June 10 through Tuesday, June 14. Distribution of free seeds of native palms and sale of palms in containers took place during the fair.

We made our first field excursion to El Avila National Park on Sunday, June 12, a day before the meetings formally began. The park is located on the steep mountain range immediately north of the city. Four-wheel drive vehicles took us to an old coffee estate of Los Venados at an elevation of 1,437 meters (4,715 feet). From there, we hiked up hill through cutover land into older cloud forest. AVEPALMAS guides encouraged us to hike up the steep trail and provided information on the park and local vegetation.

First seen along the trail was *Geonoma pinnatifrons*, then *Ceroxylon klopstockia* (Fig. 1), *Catoblastus praemorsus*, *Bactris setulosa*, a sec-

1. *Ceroxylon klopstockia* in El Avila National Forest.

2. *Ceroxylon interruptum* in cloud forest near Colonia Tovar.

ond *Geonoma*, and a single tall *Dictyocaryum fuscum*. At the top of the ridge we walked to the now inoperative cable car station for refreshments, and strolled to the defunct Hotel Humboldt for a beautiful view of the Caracas valley. We then returned in four-wheel drive vehicles to Los Venados for lunch.

On Sunday evening, we gathered at a welcoming reception followed by three slide lectures. Dr. Otto Huber, an authority on Venezuelan ecology and the co-author of the *1988 Vegetation Map of Venezuela*, spoke on the phytogeographic zones of Venezuela. Bernard Fischer, who has published extensively on South American palms in *The Palm Enthusiast* (the journal of the South African Palm Society), and Adrian van Rensen, Editor of *The Palm Enthusiast*, presented a slide lecture tour of South American palms. The presentation surveyed over 40 genera and illustrated the striking diversity in morphology, ecology, drought and cold tolerance, and ease of cultivation. Many of the slides presented were of exceptional quality. Henk Beentje of Royal Botanical Gardens, Kew, then lectured on the characteristics and habitats of several very different *Ravenea* and *Louvelia* palms of Madagascar, which Henk had researched on the island.

On Monday, the IPS Board of Directors and members of IPS Standing Committees met all day at Hotel Avila. Most non-directors left on two buses for an all-day trip to Colonia Tovar, a mountainside village in the cloud forest zone originally settled by immigrants from southwest Germany in 1843, and very isolated until recent years. We ate a very good traditional meal at the Kaiserstuhl restaurant and looked in at the tourist oriented shops and took in the buildings, many with German decorative details. On the return trip, we stopped to photograph tall examples of *Ceroxylon interruptum* (Fig. 2) rising from cleared slopes. Sven Nehlin later guided us at a site with remaining cloud forest where we observed *Catoblastus praemorsus*, *Geonoma undata*, *Geonoma simplicifrons*, *Chamaedorea pinnatifrons*, *Bactris setulosa*, *Euterpe acuminata*, and a group of *Euterpe* with red crownshafts. We also observed a tree sloth feeding on a newly opened leaf of *Catoblastus praemorsus*. We made a lot of noises, which caused the sloth to go up, and down, and up into the crown again, to escape from our harassment.

On Monday evening, members of AVEPALMAS joined us for the Biennial reception and dinner held at the Hotel Avila. Honored guests included Francisco Guánchez of the Caracas Botanical Gardens, Francisco Monaldi, IPS Life Member from Venezuela, and Jesus Hoyos, President of AVEPALMAS. Caracas honoree August Braun was unable to attend. After dessert and coffee, the main speaker for the evening, Dr. John Dransfield of Royal Botanical Gardens, Kew, presented a slide lecture on the palms of Madagascar. He discussed over 55 palms in an interesting and entertaining way, and gave us examples of thought-

3. Lunch under the Tent, Caracas Botanical Garden.

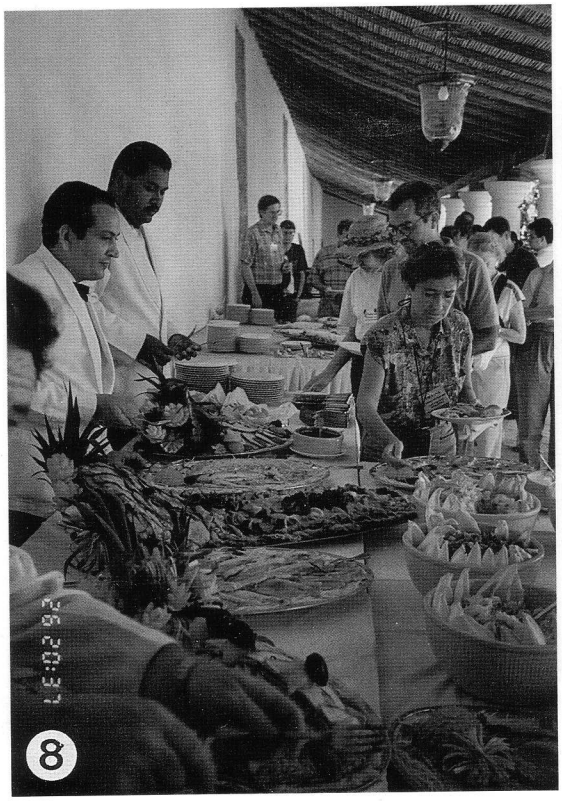
provoking problems faced in classifying Madagascar plants. His lecture prepared us for many name changes, including the probable discontinuation of some generic names. It was at dinner that many of us learned that the *Palms of Madagascar*, by Drs. John Dransfield and Henk J. Beentje, will be published in 1995, jointly funded with costs and profits to be shared by Royal Botanical Gardens, Kew, and the International Palm Society.

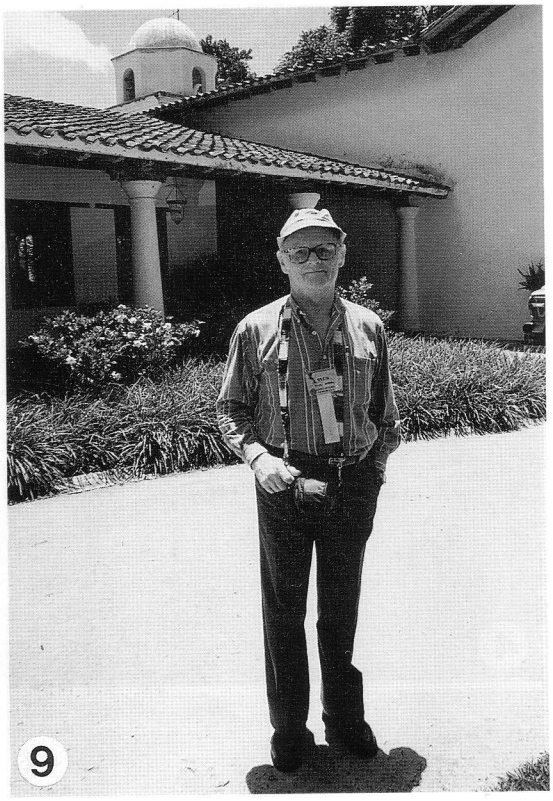
Tuesday's program was a full day of activities at the Caracas Botanical Garden. The Fundación Instituto Botánico de Venezuela and AVEPALMAS had organized a full morning of lectures and research papers. Concurrently during the day were tours of the herbarium and library, as well as the sale of books and periodicals published in Venezuela on environment, botany, and palms, and the continuing sale of palms in containers.

The morning lecture session began with a welcome by Francisco Guánchez, Director of the Fundación Instituto Botánico de Venezuela. His talk gave us an overview of the Institute and the Caracas Botanical Garden, which is administered by FIBV. Jim Cain, IPS President, spoke on palms in the Caracas Botanical Garden and their evolution over time that compared the Garden's palms 25 years ago to the collection today. Francisco Monaldi, architect, spoke about the non-profit Paria Project Foundation, and its activities in rain forest conservation. Hector Pacheco, Lagoven agronomist, spoke on research results of experimental planting of criollo-Malaya variety of hybrid coconut in the Orinoco River Delta area of Amacuro State. Francisco Guánchez, botanist, spoke on the Amazonian piassava palm of the genus *Leopoldina*, its economic uses and its threatened status. Jesus Hoyos F., botanist, spoke on the moriche palms of the genus *Mauritia* and their uses by indigenous peoples of eastern Venezuela in a joint presentation with Francisco Delascio, botanist, who spoke on medical and other uses of palms by the native peoples in Venezuela. The morning session ended with Fred Stauffer, agronomist, speaking on the palms of the Venezuelan cloud forest in the Henri Pittier National Park.

The afternoon activities began with a luxurious lunch under a white tent set in the botanical garden (Fig. 3). After lunch, a few of us went to the Institute library to view some of the plates in the folio-sized volumes of Von Martius's Historia Naturalis Palmarum. The rest of the afternoon we

4. *Roystonea venezuelana* in Guatopo National Park. 5. A *Sabal mauritiiformis* group in Parque del Este. 6. *Acrocomia aculeata*, Parque del Este. 7. The patio garden at Hacienda Carabolo.





8. Lunch at Hacienda Carabolo. 9. Vice President Sven Nehlin of AVEPALMAS, whose efforts made the Biennial such a success.

toured the garden in small groups guided by August Braun, other garden staff, and AVEPALMAS members. The Caracas Botanical Garden is one of the largest and oldest palm collections in the Americas with over 250 species in 89 genera. (See Phil Bergman's article in this issue of *Principes*.) Completing the afternoon was a reception hosted by the Fundación Instituto Botánico de Venezuela and AVEPALMAS. A flock of wild macaws came to feed in the fruiting *Mauritia* palms overhead as the afternoon drew to a close—almost as if this was part of the arranged entertainment to cap the day.

For Wednesday, we were given a choice for the all-day field trip—cloud forest environment in the Henri Pittier National Park or the more tropical lower elevation Guatapo National Park. In Guatapo Park, older secondary forest is adjacent to the paved road. We stopped at several locations to observe *Roystonea venezuelana* (Fig. 4), *Euterpe microcarpa*, *Oenocarpus bataua*, *Asterogyne spicata*, *Bactris* sp., *Aiphanes* sp., *Geonoma* sp. and other plants of interest. The buses also stopped so that the participants could get a look at a group of capuchin monkeys crossing the road. After a streamside lunch break, a group of us went on a one-hour hike on forest trails guided by Sven Nehlin (Fig. 9). This was an extremely satisfying walk, and I especially enjoyed Sven's commentaries as we walked through the forest containing tree-ferns, heliconia, cyclanths, and numerous plants in the understory. Older trees were festooned with bromeliads and other epiphytes.

The group that went to the Rancho Grande Biological Station in Henri Pittier National Park also had a rewarding day. They were guided by AVEPALMAS member Fred W. Stauffer, who had just published an article in the January 1994 issue of *Principes* on the palms in this cloud forest. The palms seen that day were *Dictyocaryum fuscum*, *Hysopathe pittieri*, *Bactris setulosa*, *Geon-*

oma pinnatifrons, *G. simplicifrons*, and *G. spinescens*.

On Thursday morning, we visited Parque del Este. This is a city park with multiple functions—including a zoo, an aviary, a planetarium, recreation areas, and extensive open spaces with groupings of Venezuelan and foreign palms. The park was designed by the famous Brazilian landscape architect Roberto Burle Marx, in collaboration with John Stoddard and others.

The number of palm species is not great, with a recent survey recording 22 species in 17 genera. However, the visual impact is striking because groups of individuals of a given species were carefully placed for visual impact on an open grass landscape. Noteworthy native palm groupings included *Roystonea venezuelana*, *Seheelea macrocarpa*, *Sabal mauritiiformis* (Fig. 5), *Acrocomia aculeata* (Fig. 6), and *Bactris major*. Striking groups of *Neodypsis decaryi*, *Pritchardia pacifica*, and other imports were also present.

Our afternoon destination was Hacienda Carobolo. Our bus took us through suburbs on the slopes above the city, then along a very narrow road on the top of a narrow precipitous ridge to the entrance of an old coffee estate. The old house and work rooms with coffee drying patio have been remodeled by our hosts, Dr. Oscar Martinez and his wife, into a beautiful period residence with the patio garden (Fig. 7) designed by Burle Marx. A superb lunch, considered by many to be the epicurean event of the Biennial, was served in this patio garden area (Fig. 8). Following lunch, we visited our host's commercial tissue culture laboratory, producing improved forms of *Eucalyptus*, bananas, orchids, and other plants mainly grown for export to other tropical countries. According to Dr. Martinez, palms and cycads are other targets for potential culture at the laboratory.

On Thursday evening, we attended the final IPS banquet, which featured typical Venezuelan cuisine at the Tarzilandia Restaurant on the edge of Caracas. The restaurant had an outdoors motif with many tropical plants and birds surrounding the diners. The next day, many of us left for one of the post-biennial tours that took us to distant and isolated areas of Venezuela, but that is another story.

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Principes, 38(4), 1994, pp. 220–225

Jardin Botanico de Caracas: A Tour by August Braun

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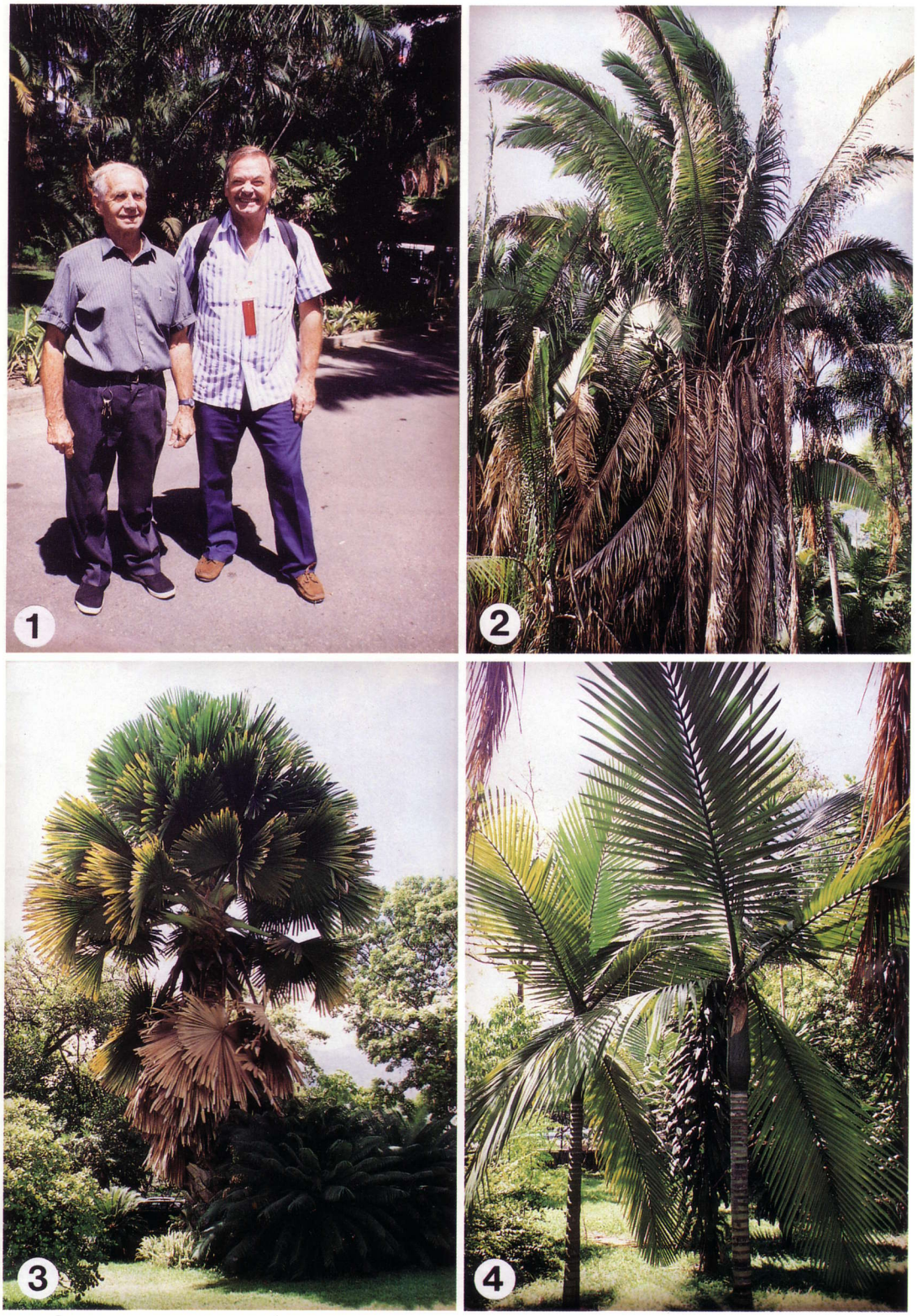
I arrived in Caracas late in the afternoon of June 12, a day or two behind most members attending the 1994 I.P.S. Biennial in Venezuela. Tardy by a preceding trip through the Caribbean to look at endemic palms, I immediately wondered what I had missed in arriving behind others. No one else on my plane seemed to be a palm person, so I made my way solo through the minor maze of entry inspections and, on reaching the lobby, was immediately greeted by I.P.S. hosts in the terminal. After a brief stop with my new Spanish-speaking friends at a local restaurant to have a "comida typico", we headed over a huge range of steep mountains. I had heard that the one hour's drive from the airport was dramatic with the change in climate and scenery. Like a kid on his first trip from home, I peered out the windows looking for excitement, especially palms. As we entered the downtown area of Caracas I was struck by two things. First, Caracas is a beautiful city with more "high-rise buildings" than I had ever seen in one place. Second, before I could ask what it was, my host proudly said "and there's the Botanical Garden of Caracas". Right next to the freeway was a huge collection of towering palms!

I've always told my friends that "a real vacation means that you go somewhere warmer than you are now". Of course, that translates into "you go somewhere where there are more palms than you have in your area". A corollary to this is that you figure out the best way to see the most palms in a limited time. This philosophy began in the early 1970's when I first began to appreciate that botanical gardens are one of the best ways to see magnificently grown palms. When in a foreign country, I always remember to visit the old parts of town, the old churches and established universities to see their plantings. But I never forget to visit botanical gardens. So, here in Caracas, the Jardin Botanico De Caracas would be a highlight.

We were told that an "early bird bus" would be leaving promptly at 7:00 A.M., Tuesday, to visit the Botanical Garden. I figured very few people would be as eccentric as I, so before dawn I struggled out of bed, threw on my clothes and grabbed a cup of coffee before jumping on the bus. There weren't too many of us on that first bus, but all the people of Caracas seemed to be heading straight for the Garden. As we zigged back and forth through narrow streets, our driver told us that these were the students from the University going to their first class just beyond the Garden. I was relieved, as we were the first ones allowed through the gates on a special early morning opening for the Palm Society. There in front of us on a beautiful 160 acres were over 250 species of palms!

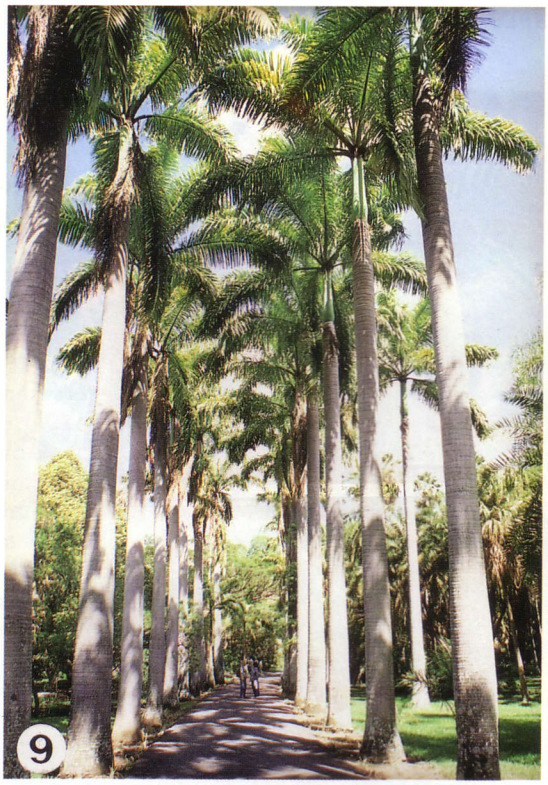
As I readied my camera, I began wondering when we would see the famous August Braun. I had heard of him but a lot of my information about Mr. Braun was from brief notations about the author in any of his ten books on palms, or from stories given me by Jim Cain who has been fortunate enough to known him for almost two decades (Fig. 1). Mr. Braun began his work at the Garden in 1952 and specialized in adding new palms to the collection. The garden actually was founded in 1944, but it was not until August started obtaining new species from around the world that it attained its reputation as one of the best palm collections in the world. It presently displays 89 different genera of palms.

This particular morning was somewhat damp with a light rain. I knew my first few rolls of film would become famous for their dreary backgrounds. Trying to save my camera for better sun, a few of us teamed up together for a quick first pass through the garden. I was amazed at the size and stature of many of the specimens. With wet tennis shoes, we made our way back to the Garden's auditorium for the scheduled speakers on palms. I wondered if I was the only one barefoot in the auditorium. Trying to dry out my shoes and socks in an inconspicuous place, I noticed a sea-



1. August Braun, left; Jim Cain, President of the IPS, right. 2. *Scheelea macrocarpa.* 3. *Corypha umbraculifera.* 4. *Kentiopsis oliviformis.*

5. *Syagrus orinocensis.* 6. *Copernicia macroglossa.* 7. *Acrocomia aculeata.* 8. *Sabal umbraculifera.*



9. *Roystonea venezuelana.* 10. *Borassus flabellifer.* 11. *Raphia hookeri.* 12. *Raphia hookeri*, trunk detail.

13. Left to right: Henk Beentje, Dr. Natalie Uhl, Dr. John Dransfield, in front of two different forms of *Chamaerops humilis*. 14. August Braun pointing to crown of *Burretiokentia vieillardii*.

soned man walking among the crowd with an air of understanding about him. Others were biding for his time. This man must be the creative force behind the Garden. This was August Braun.

Having promised our Editor, Natalie Uhl, that I would write an article on the Garden, I promptly introduced myself. Flanked by two volunteer translators from Avepalmas, I asked August if he would tour us through the Garden with comments on some species. He gave his approval with a modest smile and off we went. Not only did we view palms, but each palm came with a story. With his crystal-sharp memory, he could typically remember when he obtained the seed on a given plant and who gave him the seed. With his forty-three years experience at the Garden, he explained how the Caracas "eternal spring" weather gave average high temperatures of 33 Centigrade, lows of 10 Centigrade and ideal growing conditions. The garden "is at 900 meters elevation and has fifteen different areas of planting".

Mr. Braun explained how 30 years ago he was given seeds of *Scheelea macrocarpa* (Fig. 2) and presently the garden hosts a near mature plant. "This Venezuelan palm is economically important because of its oil". The *Corypha umbraculifera* (Fig. 3) is 35 years old and needs 60 years to flower". Loving New Caledonian species, I inquisitively asked the age of the stand of *Kentiopsis oliviformis* (Fig. 4). "Twelve years old" he responded. The *Syagrus orinocensis* (Fig. 5) is from the Orinoco River area of Venezuela and Columbia" and "the *Copernicia macroglossa* (Fig. 6) seed came from Cuba 35 years ago". August raised all of these palms from seeds he obtained around the world. "Fortunately I had friends in Miami who helped me get seeds". His favorite *Copernicia* is *Copernicia tectorum* from Venezuela. "To see this species you have to go to the plains area of Venezuela". In the Garden we have only *Copernicia* from Cuba.

"*Acrocomia aculeata* (Fig. 7) is from the mountains in Venezuela. One can make wine from the seeds but they are also an aphrodisiac for

women". Then he smiled at me and said "in Venezuela women are fertile without the benefits of this palm". "It is a favorite *Acrocomia* and the trunks reach up to 18 meters tall". He then explained how *Sabal* (Fig. 8) species provide lumber for construction. "My favorite palm is the *Roystonea venezuelana*" (Fig. 9). "It's one of the best palms in the world and comes from Venezuela and Equador". He then opened up his arms to the two long rows of forty-four year old *R. venezuelanas* that lined the main entrance into the Garden. Pointing out a large *Borassus flabellifer* (Fig. 10) near by, he described how "a member of the Society and an aviator, Harry Gibson, donated one seed from Indonesia 25 years ago."

One of my favorite palms from my morning outing was the *Raphia hookeri* (Fig. 11). I had never before seen such a different palm. A large, suckering pinnate palm with a most unusual trunk, it appeared as if someone had attached thousands of epiphytic bromeliads to the trunk (Fig. 12). Directing Mr. Braun's attention to this curious palm, he explained how *Raphia hookeri* is from Central Africa. "Our specimen is thirteen years old and began to sucker eight years after planting". This palm is in sharp contrast to the *Raphia australis* with its orange petioles. He also pointed out multiple forms of *Chamaerops humilis* (Fig. 13) and the beautiful crown on *Burretiokentia vieillardii* (Fig. 14). "The *Hyospathe pittieri* (Fig. 15) is only found in the Henri Pittier National Park in Venezuela". The tour continued as we talked about characteristics of hundreds of palms.

Having spent several hours viewing the garden and en route to a beautiful dinner that Avepalmas had waiting for us, I decided to sneak in two more questions. I asked first if there were any more palms that he wanted to see planted in the Garden. He quickly responded "Yes, more native species from Venezuela. Then young people can learn to take care of them." "And finally, Mr. Braun, where do the best palms in the world come from?" Despite criticism of my question from another member of our Society, I put on my interviewer's hat and pushed forward for an answer. He turned, looked directly at me and in a most diplomatic fashion said "Venezuela does have nice palms . . . and other countries do as well". Smiling, I knew he was right. Our many thanks for a tour by August Braun.

15. *Hyospathe pittieri.*

CHAPTER NEWS AND EVENTS (*Continued from page 181*)

The accompanying show educates and inspires those who attend on numerous aspects of palm horticulture, including planting, diseases, and identification. This fall's show was held at Fairchild Tropical Gardens on November 5 and 6, 1994.

The Florida Chapter has donated $795 to Fairchild Tropical Gardens for Global Positioning System (GPS) satellite surveying equipment which will be utilized to determine latitude and longitude of rare palms and plants in the wild. This will give researchers and scientists the opportunity to return to the exact site for research and/or seed collection.

News from Palm Beach (Florida) Chapter

The Palm Beach Palm & Cycad Society met on September 7 at Mounts Botanical Gardens. Paul Craft showed slides of his recent trip to research palms in Cuba with other members of the Palm Beach Chapter. A plant auction followed.

A workday was held at Norton Sculpture Gardens on September 17, fertilizing the over 300 species of palms planted there.

The Palm Beach Palm & Cycad Society held their 6th annual fall sale at Murakami Park on October 1–2, 1994.

A field trip was held on October 15 and 16, with the Palm Beach Chapter hosting the Florida First Coast Chapter from the Jacksonville area. The first stop was the Norton Sculpture Garden at noon on the 15th. After a lunch and tour of the gardens, the group proceeded to Gemini Garden in Manalapan. This is a private botanical garden featuring the palms and other plant life of the Caribbean. On October 16, the group visited Norm and Ann Moody's 5-acre tropical paradise garden. This was followed by a visit to Paul Craft's Palm Nut Nursery, where over 400 species of palms and cycads are grown.

Central Florida Palm Society (CFPS)

A two-day meeting was held the last weekend in October (October 29 and 30) in the Orlando area. The event kicked off Saturday morning at 10 a.m. with a tour of the Pat and Gordon Smith residence in Maitland. The Smiths live on a peninsula on the north side of Lake Maitland and have an extensive, mature palm collection. After lunch of your choice, a guided tour of the Leu Botanical Gardens was followed by a tour of Bob and Marita Bobick's wholesale palm nursery. Later, beer and soda was followed by a barbecue ($18 fee). Sunday morning began with a free visit to Disney World's Discovery Island at 10:00 a.m. This visit was courtesy of Bill Gillette, Discovery Island Operations Coordinator. Bob and Marita arranged an excellent buffet style lunch ($13 fee) at Disney's Yacht & Beach Club, where they handle the catering for all major food events.

The University of South Florida held a fall sale on October 8–10, 1994. Ted Langley coordinated this sale.

Leu Botanical Garden held a sale on November 12 and 13. This sale was rescheduled from the earlier planned dates in late September.

News from Florida First Coast

On October 15 and 16 the group made a trip to the Ann Norton Sculpture Gardens and Gemini Gardens in the Palm Beach area. Matt Encinosa coordinated the visit with the Palm Beach Chapter. On December 10, Ed Brown graciously offered to host a Christmas potluck dinner at his residence. In addition Ed is making arrangements with The Florida Community College at Jacksonville to establish new palms at the campus garden.

News from The Louisiana & Gulf Coast Chapters

Forty-four members and friends attended Danny Draud's open house on September 18. The weather was perfect, food and drinks were plentiful and comradery was unexcelled. Danny's new front garden featured 22 new palms, adding to his already large collection. Jack Chisholm conducted a palm sale which included some large palms.

The fall meeting of the Louisiana Chapter was held October 16 with The Gulf Coast Chapter. The meeting was hosted by Maxwell Stewart at his residence in Mobile, Alabama. Lunch was provided. A discussion was presented on palm fertilization followed by a palm auction and Tee Shirt Sale.

News of the Pacific Northwest Society

The Pacific Northwest Palm & Exotic Plant Society is dedicated to the successful cultivation of palms and other exotic plants outdoors in British

Columbia, Washington and Oregon. With that large a geographical area the group has numerous activities. On August 14 they held the summer barbeque at Donna and Rudi Pinkowski's residence in North Vancouver, BC; on August 22, the general meeting was held at Van Dusen Gardens, Vancouver, and on August 20 through September 5 the group manned a Palm Society Booth at the Pacific National Exhibition. The next general meeting with elections is scheduled November 28.

Autumn 1995 IPS Board Meeting in Central Florida

The Central Florida Chapter of the IPS will host the fall 1995 meeting of the Board of Directors of the International Palm Society. The meetings were arranged by Libby Besse and Ed Hall. The meeting will convene on October 26 at the Sarasota Hyatt. That evening the group will tour the Besse's palm and cycad collection and then go to dinner at the Field House on Sarasota Bay.

Friday, the day will be consumed in meetings with the group touring Selby Gardens in the late afternoon, followed by a cocktail party and a dinner at Selby. CFPS and other IPS members are invited to attend the Selby event for the cost of the dinner. Scott Zona will be the featured after-dinner speaker.

On Saturday, the group will head for St. Petersburg and Tampa to join the CFPS in its fall meeting. After a brief tour of the Gisella Kopsick Arboretum, the group will head to Ben and U. A. Young's residence. They will help conduct a plant auction and enjoy the excellent plant collection with the CFPS members.

More details will be provided early in 1995. Make your plans now if you wish to attend. Contact Ed Hall or Libby Besse if you have any questions.

News from Southern Queensland, Australia

Make your plans to attend the 1995 Annual Show and Dinner at the Mt. Coot-tha Botanic Gardens in Brisbane on March 4 and 5. Mr. Loran Whitelock of California will be the featured speaker at the Saturday dinner. Loran is one of the most knowledgeable cycad experts in the world and known as an interesting speaker.

News from South Australia

The Palm & Cycad Society of South Australia (P.A.C.S.O.S.A.) met at BJ's nursery (Brian Boltos Nursery) at Port Adelaide. Brian's specialty is the growing of Kentia palms (*Howea forsteriana*), primarily from local South Australia seed sources. Judging by the quality and numbers of plants, this is quite successful. Various stages of development were present, from newly sprouted seedlings to 5-meter (16 feet) fully grown specimens, with every size in between. Also available at BJ's were *Jubaea chilensis* of various sizes, *Archontophoenix*, *Sabal*, *Chamaedorea*, *Rhapis* and *Phoenix* species as well as good sized specimens of *Arenga*, *Butia*, *Livistona*, *Trachycarpus*, *Syagrus*, and *Washingtonia*. The group next toured the West Lakes park area, planted extensively with palms. Seen were *Syagrus romanzoffiana*, *Butia capitata*, *Chamaerops humilis*, *Livistona australis*, *L. chinensis*, *Phoenix canariensis*, *P. reclinata*, *Trachycarpus fortunei*, *Neodypsis decaryii*, and *Acoelorraphe wrightii*. The landscaping was very well done. The next stop on the itinerary was the home of member Dean Hoy. Dean has a number of container-grown cycads and palms, all very neat, tidy and well labeled.

P.A.C.S.O.S.A. held their Annual General Meeting on August 31 at the home of President Tony Brady in Bedford Park. Details will follow later.

The Palm & Cycad Society of Mackay (Queensland, Australia)

The Palm & Cycad Society of Mackay (PACSOM) met on July 25 at the home of Percy and Val Simonsens in Sarina, with bring-your-own BBQ lunch. The group also met on August 22 at King's place in Eimeo.

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BOOKSTORE UPDATE

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Back Cover

Ravenea xerophila, growing in dry thorn bush.