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THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

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Contents for July

Voanioala, the Forest Coconut
John Dransfield 124
Some Field Observations of Brahea in Tamaulipas, Mexico
Bruce Erickson 128
The Use of Palms by the Pume Indians of Southwestern Venezuela
Ted L. Gragson 133
An Ethnobotanical Sketch of the Palm Bactris (Guilielma) gasipaes
Víctor M. Patiño 143
Borassus aethiopum, a Threatened Multiple Purpose Palm in Senegal
Bienvenu Sambou, Jonas E. Lawesson, and Anders S. Barfod 148
Biogeography of the Coconut Cocos nucifera L.
Hugh C. Harries 155

Features:
Editorial 123
Bookstore 127, 132, 142
Classified 123, 142
Chapter News and Events 163

Cover Picture

Ripe fruit of *Voanioala gerardii*, Madagascar. Photo by J. Dransfield.

PRINCIPES

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Principes, 36(3), 1992, p. 123

Editorial

Since "Genera Palmarum" was published, three new genera of palms have been described, two from Madagascar and one from South America. Our lead article, a story of the excitement of finding and the importance of *Voanioala*, the Forest Coconut of Madagascar, also includes a GP plate and description so that those who wish can keep the book up to date. A second article about palms in their native habitats is an intriguing account by Bruce Erickson of a trip to Mexico to see species of *Brahea*.

As the issue of *Principes* goes to press, the attention of the world has been directed by the Earth Summit in Rio de Janeiro to the erosion of the earth's biodiversity and rain forest destruction. How palms are utilized by native people living in fragile tropical environments often gives clues as to how such environments may be managed wisely. Three timely articles in this issue again emphasize the international scope of palm work with discussions of the uses of palms in Central America, Venezuela, and Africa. The series on Pejibaye, begun in April, is continued with a discussion of its ethnobotanical importance by Víctor Patiño. The peach palm has been known and used in many ways since the Spanish came to South America. A consideration of legends associated with it and how various parts are used makes very interesting reading. How four new world palms supply peoples' needs is presented in Ted Gragson's well researched account of the Pume Indians of southwestern Venezuela. The many uses of *Borassus aethiopum* in Senegal are impressive and well explained and illustrated by Sambou, Lawesson, and Barfod. We are pleased to present these new reports on the economic importance of palms.

Our issue ends with a long section on Chapter News and Events. Landscaping with palms adds beauty and interest to any area. Space does not permit us to comment on the many individual projects, but we have served you as editors since 1980 and can say that current activities of the chapters are unparalleled and impressive. Those attending the Biennial will be able to view firsthand the South Florida Chapter's extensive work at Miami's Metrozoo. We should all be proud that so much work with and about palms is underway worldwide.

NATALIE W. UHL
JOHN DRANSFIELD

CLASSIFIED

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Principes, 36(3), 1992, pp. 124–127

Voanioala, the Forest Coconut

JOHN DRANSFIELD

Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, U.K.

By now, many members of the Society may be aware of the existence in Madagascar of a palm nicknamed "the Forest Coconut." It was Mardy Darian who first brought the possible existence of this palm to my notice, but it was not until October 1986 that good scientific specimens were collected in the northeast of the island. The Forest Coconut has several unusual features that make it necessary to include it in a new genus. The name *Voanioala gerardii* has been validly published for the Forest Coconut (Dransfield 1989*a*). At first sight the generic name may be horrifyingly unpronounceable; however, it now trips euphoniously off my tongue! Pronounce it "voh-ann-ee-oh-al-a," but run the first two syllables together to give, almost, "vuan," and the "ee" and the "oh" should be run together too. This will then approximate to the Malagasy pronounciation! It is based on the Malagasy name for the palm, and means, literally, "Forest Coconut." In using a Malagasy name as a generic name, I followed a long established precedent—the names *Vonitra* and *Raphia* are based on Malagasy plant names while *Antongilia*, *Masoala* and *Marojejya* are based on Malagasy place names. The palm has proved to be of exceptional interest on many fronts. It is indeed a relative of the coconut and represents the first member of the subtribe to which the coconut belongs (Butiinae) to be recorded for Madagascar, though not the first cocoid palm (the others are the African Oil Palm, *Elaeis guineensis*, and the endemic *Beccariophoenix madagascariensis*). It is a big tree palm with massive leaf bases and big pinnate leaves. The inflorescence appears very much like that of the coconut but the male flowers have 12 stamens. Pollen is unlike that of other members of the Butiinae (Harley 1989). The fruit is 7–8 × 4–5 cm and appears superficially like a fruit of an *Attalea*. Inside the fruit there is a very thick endocarp that has irregular bumps on the inside that penetrate the seed, rather like a walnut. Seedlings grown at Kew caused great excitement as, from their root-tips it was discovered by my colleague Margaret Johnson, that the Forest Coconut has a very high number of chromosomes—at least 596 (Johnson 1989). In fact, the mass of chromosomes within the cell nucleus looks, under the microscope, almost like scrambled egg rather than the usual small ribbons. What the significance is of this astonishingly high chromosome number, the highest recorded for any monocotyledonous plant, no one really knows.

A popular account of the collecting of the first scientific specimens of *Voanioala* (Dransfield 1989*b*) is given in "Plant hunting for Kew," a book that describes the plant hunting activities of the Royal Botanic Gardens Kew. Since that first expedition I have returned with David Cooke of the Palm House at Kew to the original locality to look at the other palms that we had been unable to study for lack of time on the first trip. It seems certain that this palm is of very limited distribution, occurring as scattered trees in the rain forest. Villagers elsewhere in Madagascar have obliged by reporting the presence of other trees of "voanioala" but these have always turned out to be individuals of tall tree palms such as *Neodypsis lastelliana*. In

1989 in the National Park of Marojejy, I was told of the existence of five different types of "voanioala"; sadly not one of these was the true *Voanioala*, further emphasizing the restricted distribution of the true Forest Coconut.

News travels fast. Within a year of the collecting of the first scientific specimen, the villagers in one part of northeast Madagascar where several palm enthusiasts have visited, were well aware of the Forest Coconut and were busy collecting seed to sell to anyone who wanted to buy. Several private collectors may now already have seedlings of this remarkable palm.

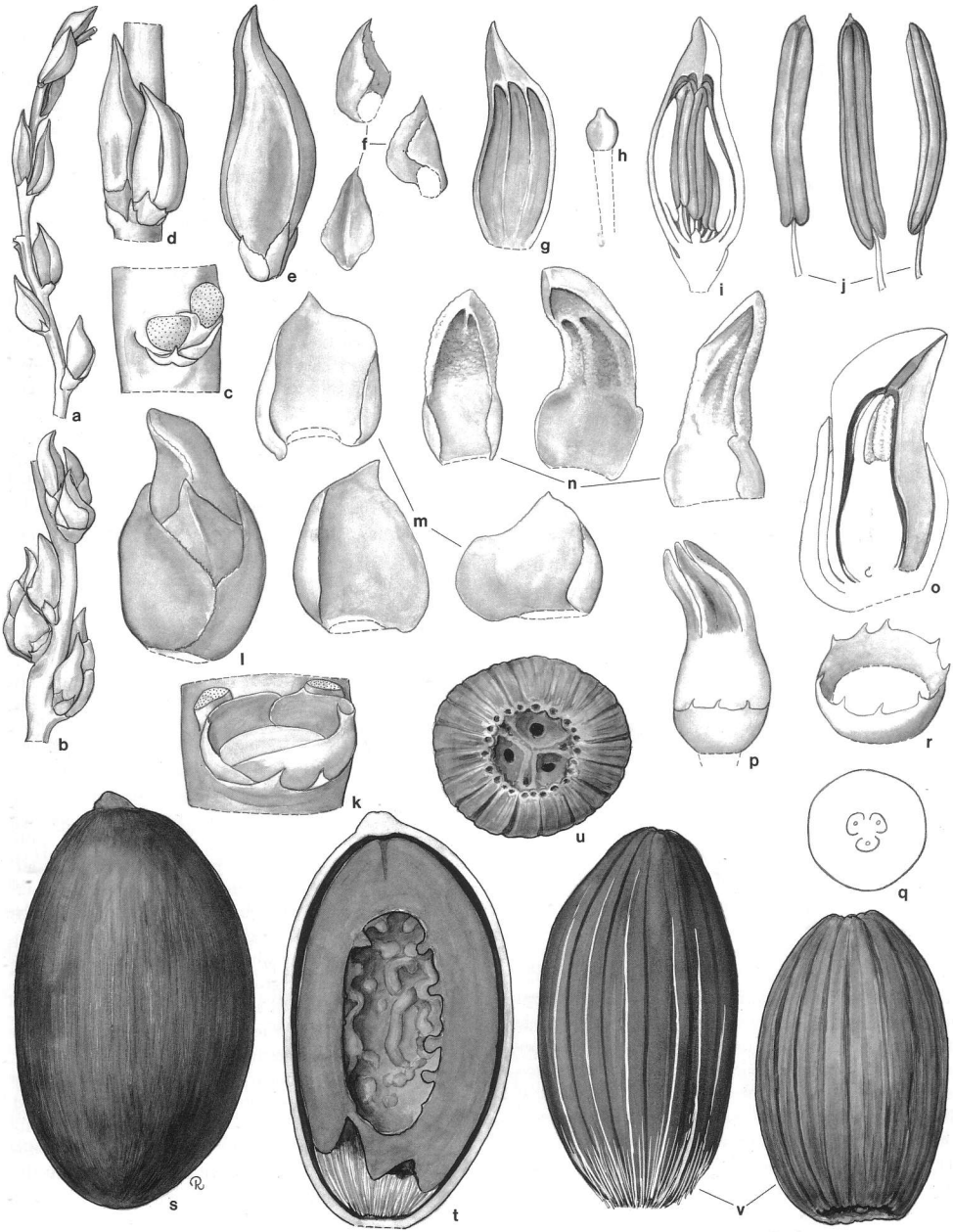
A detailed scientific description of the genus *Voanioala* is provided here, set out in the format of the descriptions in *Genera Palmarum* (Uhl and Dransfield 1987) so that you may make a copy of the description and plate (Fig. 1) and include it as genus 177A, after *Parajubaea*.

177A. **VOANIOALA** J. Dransfield, Kew Bulletin 44(2):192. Type: **V. gerardii** J. Dransfield.

Robust solitary, unarmed, pleonanthic monoecious tree palm. Stem erect, basally with a large root boss, distally the stem bare, very conspicuously "stepped" and ringed with oblique leaf scars. Leaves pinnate, reduplicate, cleanly abscissing; sheath tubular at first, fibrous, apparently soon disintegrating to leave a massive elongate rectangular leaf base, forming an apparent petiole with sparsely fibrous margins, abaxially densely covered with caducous brown indumentum; leaf base suddenly contracting into rachis, true petiole absent, the rachis more or less rectangular in cross section in the mid leaf region, abaxially densely covered with caducous brown indumentum as the leaf base; leaflets numerous, rather stiff, scarcely pendulous, very coriaceous, concolorous, unevenly bilobed at the tips. Inflorescences solitary, interfoliar, apparently protandrous, branching to one order, erect in bud, later horizontal; prophyll tubular, 2-keeled, fibrous, remaining hidden among the leaf bases; peduncular bract bright green and strictly tubular in bud, later splitting longitudinally, flattening and becoming somewhat cowl-like, abaxially deeply and closely longitudinally grooved, bearing scattered brown scales on the ridges between the grooves, adaxially smooth, glabrous, pale cream-colored; peduncle circular in cross section; rachis bearing spirally arranged rachillae, each subtended by a small triangular rachis bract; rachillae numerous, most with a basal bare portion, the rachillae bearing 0–7 triads near the base and paired or solitary staminate flowers distally, the flower groups spirally arranged, or becoming somewhat distichous by close-packing. Staminate flowers asymmetrical, broadly or narrowly triangular in outline, sepals 3, distinct, slightly to strongly imbricate at the base, triangular, acute to acuminate, membranous, glabrous; petals 3, distinct, unequal, valvate, glabrous, thinly coriaceous except at the thick angular tips, broadly and irregularly triangular-ovate, with acute or acuminate tips, abaxially smooth, adaxially marked with the impressions of the stamens and papillose near the thick tips; stamens 12(–13), filaments subulate, very short to moderate in length, anthers basifixed, basally sagittate, apiculate at the tips, latrorse; pollen circular or elliptic in polar view, monosulcate, intectate with microbaculae, granules and pilae (see Harley 1989). Pistillate flowers only known as buds, much larger than the staminate, irregularly triangular; sepals 3, distinct, unequal, strongly imbricate, broadly ovate, with triangular, keeled tips, coriaceous, glabrous, the margins minutely toothed; petals 3, distinct, longer than the sepals, basally irregularly imbricate, conspicuously valvate at the triangular tips, abaxially with scaly indumentum towards the apex, adaxially strongly papillose towards the tip; staminodial ring high with 9 irregular, triangular teeth, 0.1–0.5 mm; gynoecium syncarpous, tricarpellate, triovulate, stigmas 3, angled, papillose and scaly, ovules with axile placentation. Immature fruit green covered with dense chestnut brown scaly indumentum. Mature fruit one-seeded, somewhat irregularly ellipsoid, tipped with a short beak and stigmatic remains; epicarp red-brown, densely covered with brown scaly indumentum; mesocarp with an outer fibrous zone just below the epicarp, and an inner fleshy zone; endocarp ellipsoid, apically pointed, basally truncate, very heavily thickened, pale brown when fresh, becoming grey with age, very deeply and irregularly longitudinally grooved, with 3 very deep basal impressions each with a central germination pore, in section the body of the endocarp traversed by longitudinal irregular vertical canals and fibers, inner surface of the endocarp with numerous irregular rounded excrescences intruding into the cavity. Seed irregularly ellipsoid, filling the endocarp cavity, laterally attached with a narrow irregular hilum, endosperm homogeneous but irregularly intruded by the endocarp protruberances, very hard, white, with a narrow, irregular central lacuna; embryo basal, top-shaped, positioned opposite an endocarp pore. Germination remote-tubular; eophyll entire, lanceolate. 2n = 596+ (*V. gerardii*, Johnson 1989).

Anatomy.—Not studied.

Distribution.—A single species in northeastern Madagascar.



1. **Voanioala. a,** portion of rachilla with staminate flowers × ⅔; **b,** rachilla with triads × ⅔; **c,** pair of staminate flowers removed to show bracteoles × 5⅓; **d,** pair of staminate flowers × 1⅓; **e,** staminate flower × 2; **f,** staminate sepals × 3⅓; **g,** staminate petals × 2; **h,** pistillode × 5⅓; **i,** staminate flower in vertical section × 2; **j,** stamens × 3⅓; **k,** triads of flowers removed to show bracteoles × 2⅔; **l,** pistillate flower × 2; **m,** pistillate sepals × 2; **n,** pistillate petals × 2; **o,** pistillate flower in vertical section × 2; **p,** gynoecium with staminodial ring attached × 2; **q,** cross-section ovarian part of gynoecium × 6; **r,** staminodial ring × 4; **s,** fruit × ⅔; **t,** fruit in vertical section × ⅔; **u,** base of endocarp showing pores × ⅔; **v,** endocarp in two views × ⅔. *Voanioala gerardii*, Dransfield 6389.

Ecology.—*V. gerardii* grows in swampy valley bottoms and on gentle slopes at an elevation of about 400 m in primary rain forest.

Common Names and Uses.—Voanioala (Malagasy) (literally "forest coconut"). The apical bud is said to be edible. In view of the great rarity of the palm, it is perhaps not surprising that no other uses have been recorded.

Notes.—*Voanioala* possesses several unusual features, such as the multistaminate flower, the pollen and the endocarp with deep longitudinal grooves and internally with irregular swellings. The unique high chromosome number is remarkable, the only other high number recorded for the palms being in *Jubaeopsis caffra*, also belonging to the Butiinae.

Taxonomic Account.—Dransfield (1989a).

Acknowledgment

I should like to thank Marion Sheehan for preparing the analytical drawings.

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A Guide to the Monocotyledons of Papua New Guinea, Part 3, Palmae (R. J. Johns and A. J. M. Hay, Eds., 1984, 124 pp.) 8.00

Brazilian Palms, Notes on their uses and Vernacular Names (C. Pinheiro and M. Balick, 1987, 63 pp.) 9.25

Chamaedorea Palms (D. Hodel, 1992, 350 pp., 127 pp. of superb color) 59.95

Coconut Palm Frond Weaving (Wm. H. Goodloe, 1972, 132 pp.) 8.95

Coconut Research Institute, Manado (P. A. Davis, H. Sudasrip, and S. M. Darwis, 1985, 165 pp., 79 pp. color) 35.00

Cultivated Palms of Venezuela (A. Braun, 1970, 94 pp. and 95 photographs.) 7.95

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Diseases and Disorders of Ornamental Palms (A. R. Chase and T. K. Broschat, 1991, 56 pp., color on each page) 29.00

Ecuadorian Palms for Agroforestry (H. B. Pedersen and H. Balslev, 1990, 105 pp.) 15.00

Exotica (4) (A. Graf, 1982, pictorial encyclopedia, 2 vols., including 250 plant families, 16,600 illust., 405 in color, 2590 pp.) 187.00

Flora Neotropica Introduction and the Iriarteinae (A. Henderson, 1990, 100 pp.) 23.00

Flora of Tropical East Africa, Palmae (J. Dransfield, 1986, 52 pp.) 23.00

Flore des Mascareignes (La Reunion, Maurice Rodrigues, 1984, 31 pp.) 5.00

Florida Palms, Handbook of (B. McGeachy, 1955, 62 pp.) 2.95

Florida Trees and Palms (S. A. Rose, A. A. Will, Jr., T. B. Mack, 1984, 30 palm species, 120 pp.) 6.00

Genera Palmarum (N. W. Uhl and J. Dransfield, 1987, 610 pp.) 79.00

Harvest of the Palm (J. J. Fox, 1977, 244 pp.) 24.00

Index to Principes (Vols. 1–20, 1956–1976, H. E. Moore, Jr., 68 pp.) 4.00

(Continued on p. 132)

Principes, 36(3), 1992, pp. 128–132

Some Field Observations of Brahea in Tamaulipas, Mexico

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During January, 1990, I was fortunate in being able to visit populations of several *Brahea* species in the state of Tamaulipas, Mexico. These species are rare in cultivation and mature plants are virtually unknown outside of Mexico. Specimens at the Huntington Botanical Gardens, California, are among the oldest in the United States. Even with more than 20 years' growth most of these slow-growing plants are only beginning to show adult characteristics. At present these palms are best seen in their natural habitat.

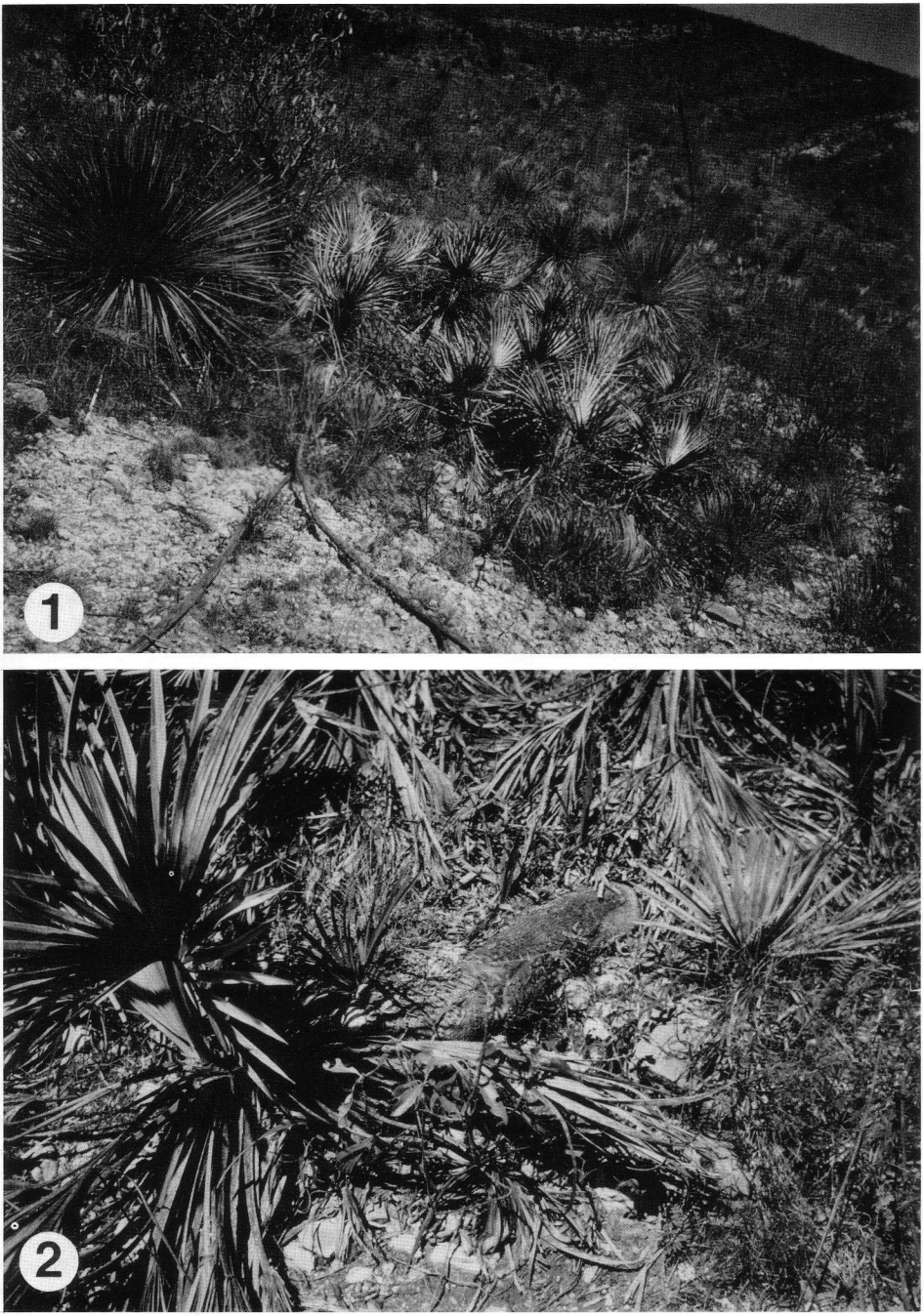
As a group, *Brahea* of northeastern Mexico prefer rocky limestone regions of 1,000–2,000 m elevation. They are distinct from others in the genus by their particularly small seeds and lack of a midrib existing beyond the petiole. There are also some startling differences within this group. *Brahea decumbens* J. Rzedowski and *B. moorei* L. H. Bailey are among the most distinctive species in the genus and we hoped to locate them on this trip.

Travelling east through the state of San Luis Potosi into Tamaulipas during January, fellow enthusiast and traveller Scott Hewett and I were doubtful that any palms would be found. It seemed incredible that populations of the distinctive *Brahea decumbens* could exist here. Unlike such desert palms such as *Washingtonia robusta* H. A. Wendl. and *B. armata* S. Watson, which prefer to grow in canyons in the vicinity of ground moisture, *B. decumbens* exists on seemingly dry slopes. Originally described in 1955 from plants in the vicinity of Guadalcazar, SLP, *B. decumbens* was not evident on the distant hills. Wishing to avoid any fruitless long distance excursions on foot, we continued on into Tamaulipas.

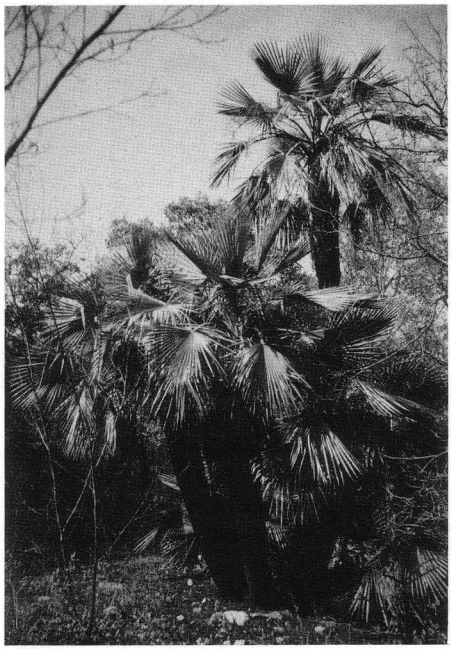
Late in the day, near the picturesque town of Palmillas, we found the palm for which the town was named. Shimmering in the sunlight, the hillside was speckled with clumps of the silvery-blue *B. decumbens*. A closer investigation followed the next day.

The population grew on rocky limestone slopes (Fig. 1) with seedlings taking root in pockets of humus. Despite the underlying limestone I wondered if the humus was actually alkaline. It is possible that limestone is not needed in cultivation, at least when young. Most plants occurred somewhat above scrub forest in direct sun on the drier portions of the slope in association with such xerophytes as *Agave*, *Dasylirion*, *Euphorbia antisyphilitica* Zucc., and various Cactaceae. It was clear that things were not altogether dry despite appearances, as evidenced by ferns and *Tillandsias* on the lower slopes.

B. decumbens is a very distinctive palm in its brilliant glaucous leaves and suckering, decumbent trunk (Fig. 2). Old specimens form thickets similar to those of *Serenoa repens* (Bart.) Small. The trunks are fairly straight and lie on top of the ground as if they have fallen except for the vertical orientation of the leaves. One particularly large individual had a main trunk length of 2.4 m. Interestingly the leaf glaucescence is not present in young plants or new offsets but develops only on



1. *Brahea decumbens* colony growing on a dry hillside near Palmillas, Tamaulipas, Mexico. 2. *Brahea decumbens* showing exposed decumbent trunk (center).



3. *Brahea* cf. *berlandieri*, a clump with fire-blackened trunks.

mature foliage. Leaves were surprisingly small at this site, being about 72 cm across and divided about three quarters of the way into the leaf. The petiole was generally about 32 cm long and smooth except for fine teeth near the base. The inflorescence on these palms does not extend beyond the leaftips. Some root formation was seen at the base of some offsets but in general it seemed most offsets depended on the main trunk for their continued existence.

Later, after a day on the hot shadeless hillside, we downed our refrescos at a roadside establishment and contemplated a trip into the village of Palmillas, which was well off the main highway and nearly out of sight. With a fine old church and cobblestone streets, Palmillas seemed of an earlier time—no stores, hotels, or cars, with nothing to spoil the illusion. Most unnerving of all, there was no evidence of any people! As we admired the town and its quiet ambience from the central square, we detected a few faint noises as we were watched by curious residents within the old brick houses. Later it was quite a surprise to us when we met a man here who knew the local palms were of the genus *Brahea* and other technical details about the plants. It was a reminder to us that local resources should not be underestimated.

Continuing our trip, we saw sporadic palms on the rocky limestone hills as we travelled northeast. These were giants compared to *B. decumbens*, with stout, erect trunks of more than 2 m in height. These palms have been considered to be *B. berlandieri* Bartlett; however, at a population we visited not far from Ciudad Victoria, some characteristics of *B. dulcis* C. Martius were present. Old specimens commonly had offsets at the base, forming attractive clumps. The rachillae were longer than described for *B. berlandieri* and in length more similar to those of *B. dulcis* except that they lacked the dense brown tomentum usually present on the rachillae of *B. dulcis*. Whether leafbases were persistent could not be determined as all large trunks were blackened from fires (Fig. 3). Leaves, about 1 m across, were most often dull green but varying degrees of glaucescence was present in some individuals. Petioles were about 90 cm long and armed near the base, but spine length was quite variable.

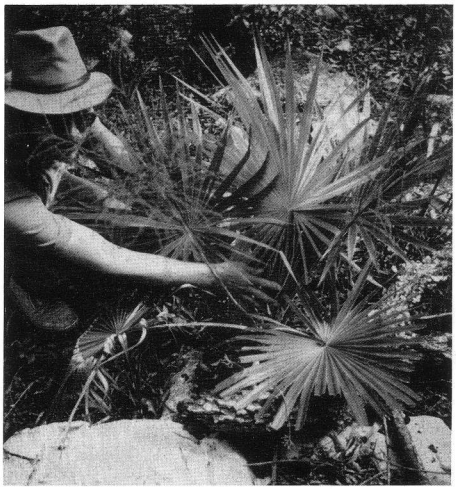
The differences between *B. dulcis* and *B. berlandieri* are not clear from a practical point of view. In *B. dulcis* the significant differences are its longer rachilla length, dense rachilla tomentum, and offsetting habit. It is noteworthy, however, that this population of *B. berlandieri* has offsetting trunks and long rachillae or perhaps this is a hybrid population. The leaves may be green or glaucus on either species. Tomentum may be a poor character, as it is lacking on a herbarium specimen of *B. dulcis* from western Mexico in the Huntington herbarium. The plant described as *B. bella* L. H. Bailey from Coahuila differs only slightly from *B. berlandieri* and is

generally thought to be synonymous. It is hoped that future investigations will clarify these relationships.

With some excitement, we found the elusive *B. moorei* (Fig. 4) in the shade of oaks in this same area, growing with *Dioon edule*. There was also a single juvenile example of a palm similar to if not identical with *Chamaedorea radicalis* Martius. An attractive miniature, *B. moorei* was first described by Bailey in 1951. It is similar to *Sabal minor* (Jacq.) Persoon not only in lacking an above ground trunk but also in its similar erect inflorescence extending well above the leaves. Most distinctive are the leaf surfaces. The underside is so extremely chalky white that it was evident on our hands after handling the leaves. The radically different upperside was dark green giving the plants a distinctive two-tone appearance. The petioles were unarmed and about 45 cm in length, the leaf diameter was about 70 cm and the proportionately long inflorescence reached 1.2 m. An excavation at the base of a particularly large individual revealed a short, vertical, subterranean trunk about 14 cm in diameter.

There is a *Brahea* in cultivation at Huntington gardens, identified as *B. moorei*. Quite different from the Ciudad Victoria plants, it is a seedling of a cultivated plant from Hidalgo state. The leaves on this plant are much less pruinose on the underside. More significant, it is more proliferous than any other *Brahea* I have seen; this small plant has already developed eight stems. In Tamaulipas not a single example of offsetting was seen. It is possible that significant differences exist between these two widely spaced populations.

Scott and I spent a good deal of time in the palm-covered hills above Ciudad Victoria searching for seed but to no avail until it was discovered that old animal droppings contained the small seeds of these *Brahea*. A thorough search ensued and some seeds were found in droppings that had been baking on the hot asphalt road-



4. *Brahea moorei*, mature plant with an inflorescence.

way, probably for months. Fortunately I did not find it necessary to explain what I was doing to any locals. The 6–8 mm diameter seeds were extremely hard and desiccated. It was quite a surprise when the first of these seeds germinated successfully 9 months later.

This site possesses a large and healthy population of palms. There are several environmental factors that may be beneficial to supporting *Brahea* in the area. The effect of periodic fire was noted in the fire blackened but otherwise healthy trunks. The ground surface was generally lacking in other plants and many palm seedlings were seen sprouting in the exposed pockets of humus. Animal droppings may be an effective dispersal agent, perhaps even benefiting germination.

No more *Brahea* were seen as we travelled south of Ciudad Victoria, as the lower elevations seem to discourage their growth. Severe frost damage to cultivated palms and citrus was evident throughout the region, no doubt a result of the cold spell of December, 1989. No frost damage was detected on any of the native *Brahea* species. It is not known what low temperatures occurred at these higher elevations but it

is likely that the native *Brahea* are fairly hardy.

On the return trip through the mountains of the Sierra Madre Oriental into San Luis Potosi, *B. decumbens* was again seen. Perched high above the Rio Verde and its deep canyon, the plants looked stunning with their stiff blue leaves radiating from near-vertical cliffs. It occurred to me that these beautiful palms seem to have developed a most exquisite taste in their choice of scenery.

Among others, I would particularly like to thank Jim Mintken for contributing to my interest in *Brahea*, Myron Kimnach for his helpful expertise, and Scott Hewett for motivating this most rewarding trip.

BOOKSTORE (*Continued from page 127*)

KEY GUIDE TO AUSTRALIAN PALMS (L. Cronin, 1989, 180 pp., 85 pp. color) 21.00

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(*Continued on p. 142*)

Principes, 36(3), 1992, pp. 133–142

The Use of Palms by the Pume Indians of Southwestern Venezuela

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ABSTRACT

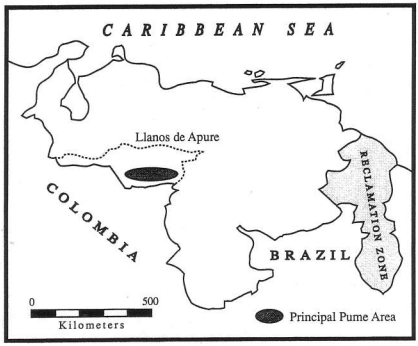
This paper presents information on the patterns of use of *Astrocaryum jauari*, *Euterpe precatoria*, *Mauritia flexuosa*, and *Mauritiella aculeata* among the Pumé, a native American group living in the seasonally inundated savanna region of southwestern Venezuela. Palm products form an integral part of everyday Pumé life providing fiber, food, and shelter. The use of these four genera of palms by the Pumé is compared to their use among other South American peoples.

In this paper are described the uses of *Astrocaryum jauari*, *Euterpe precatoria*, *Mauritia flexuosa*, and *Mauritiella aculeata* among the Pumé, a native American group living in the seasonally inundated savanna region of southwestern Venezuela. The close relation between humans and palms in lowland South America has been long remarked upon by botanists and ethnographers (Wallace 1853, Levi-Strauss 1950, Beckerman 1977, Anderson 1978, Balick and Beck 1990). Despite the fact that only a few palm species have ever been domesticated worldwide, palms probably provide more economic benefits to humans in the form of food, fiber, building materials, fuelwood, and folk medicine than any other family of plants, including grasses and legumes (Uhl and Dransfield 1988, Johnson 1988, Beckerman 1979, Levi-Strauss 1950, Balick 1986, Clement 1988). This is also true among the Pumé for whom palms provide fiber to manufacture artifacts and clothing, food in the form of fruits, palm heart, and grubs, and leaves used to thatch houses and make additional artifacts.

Background

The Pumé inhabit the *Llanos de Apure* located in southwestern Venezuela west of the Orinoco river and south of the Apure river (Fig. 1). The Llanos de Apure have an average elevation of less than 200 m above m.s.l. and lie at the center of the tropical savanna extending from the Delta of the Orinoco in northeastern Venezuela to the Guaviare river in southern Colombia. The most characteristic landscape features of the area occupied by the Pumé are longitudinal sand dunes less than 10 m high, 20–50 m wide, and up to 500 m long (Morales 1979). Average annual rainfall in the area occupied by the Pumé is nearly 2,000 mm, but most precipitation is concentrated in a six month rainy season. This climatic characteristic combined with the slight gradient of the Llanos de Apure results in extensive flooding that can last from one to 10 months of the year and be as deep as 1 m (Zink 1986, Andel and Postma 1954, FAO 1965, Goosen 1964).

The 1983 Indian Census of Venezuela recorded a total Pumé population of 3,873 (OCEI 1985). Of this total, about 83% refer to themselves as *bea khonome* Pumé and are called *Yaruro* by Spanish speakers (a name also commonly used in historic and older ethnographic accounts). The *bea khonome* Pumé live in permanent villages along the major rivers running through the Llanos de Apure: the Arauca, the Cunaviche, the Capanaparo, the Riecito, and to a lesser extent the Cinaruco. Their subsistence is based predominately on manioc



1. Location of the Pumé within Venezuela

horticulture supplemented with fish and other vertebrates obtained from the river courses and many of these Pumé work on a seasonal basis as migrant laborers. The remaining 17% of the Pumé population are referred to as *ciri khonome* Pumé by other Pumé and as *Capuruchano* by Spanish speakers. This subpopulation occupies the interfluvial savanna between the Capanaparo and Cinaruco rivers and represents the least acculturated segment of Pumé society. The *ciri khonome* Pumé live in semi-nomadic villages following a subsistence pattern based on fishing, hunting, gathering of wild foods, and some gardening of manioc and corn (Gragson 1989, in press).

Methods and Results

Ethnobotanical information on the Pumé is presented by Ramia (1962), Mitrani (1976), and Gragson and Tillett (n.d.). Ramia collected a limited amount of ethnobotanical information among the Pumé while conducting a botanical survey of the Llanos de Apure. Mitrani conducted ethnographic research on the medicinal use of plants by *bea khonome* Pumé living near the Cunaviche river. I have conducted ethnographic research since 1986 on *ciri khonome* Pumé subsistence ecology and settlement practices that is complemented with botanical collections. To date in this research, 103 plant specimens have been collected in the area bounded by the Capanaparo, the Cinaruco, and the Riecito rivers and processed by Stephen Tillett, Universidad Central de Venezuela. Voucher specimens and duplicates are currently deposited in the Dr. Victor Manuel Ovalles Herbarium (MYF), but matching sets will eventually be placed at the Venezuelan National Herbarium (VEN) and the New York Botanical Garden (NY). The palm species reported in this paper are part of this collection and their determinations were made or confirmed by Andrew Henderson (NY). The descriptions of palm biology and ecology in the next section derive from personal observations (Gragson 1987), the general works of Uhl and Dransfield (1987), and Braun and Chitty (1987).

Palm Use

Astrocaryum cf. *jauari* Mart. Pumé: bai to. Spanish: macanilla. Voucher specimen: TLG 46.

The "macanilla" is a monocaulous, arborescent, pinnate leaved palm growing to an approximate height of 5 m. The stem has well-defined leaf scars and is thickly armored with flat spines up to 12 cm long; the petiole and rachis combined reach a length of 3 m, and the underside of individual leaflets are covered with shorter spines. This palm tends to grow along the margins and in the more open areas of seasonally flooded gallery forests associated with major rivers throughout the Llanos de Apure (e.g., Riecito); it is sparsely distributed in the interfluvial areas with single specimens occasionally being found along seasonal streams.

The *bea khonome* Pumé use *A. jauari* extensively as a source for fiber to weave small bags and baskets used to hold personal items and to twine into cord for making hammocks. Fiber is extracted from leaf pinnae by beating and stripping, and the extracted fiber is whitened in boiling water before use. The *ciri khonome* Pumé seldom use *A. jauari* as a fiber source substituting instead *Mauritia flexuosa*. This

is a reflection of the lower availability of *A. jauari* in the interfluvial area since a large number of palms are needed to obtain the quantities of fiber required to manufacture most items. Nevertheless, items made from *A. jauari* fiber are preferred by both Pumé and Criollos over the same items made from *M. flexuosa* fiber, and are widely traded and sold throughout the Llanos de Apure. With particular reference to hammocks, the Pumé say those made from *A. jauari* fiber are smoother and more comfortable to sleep on, while both Pumé and Criollo say they wear better and last much longer than the same items made from *M. flexuosa* fiber.

Almost without exception, bows for hunting among both the *bea khonome* and the *ciri khonome* Pumé are manufactured from the stemwood of *A. jauari*. To manufacture a bow, a palm is felled and the trunk is split lengthwise to remove a wedge-shaped blank, which is then scraped into shape with a knife over a period of weeks. The woody, immature seeds of *A. jauari* are drilled length-wise to make the nose pieces on *yopo* (Spanish) inhalers. Yopo (an hallucinogen manufactured from the seeds of *Anadenanthera peregrina*) is used extensively by nearly all Pumé men on ceremonial and secular occasions (Fig. 2).

Euterpe cf. *precatoria* Mart. Pumé: h ẽnan to. Spanish: manaca. Voucher specimens: TLG 45 and TLG 96.

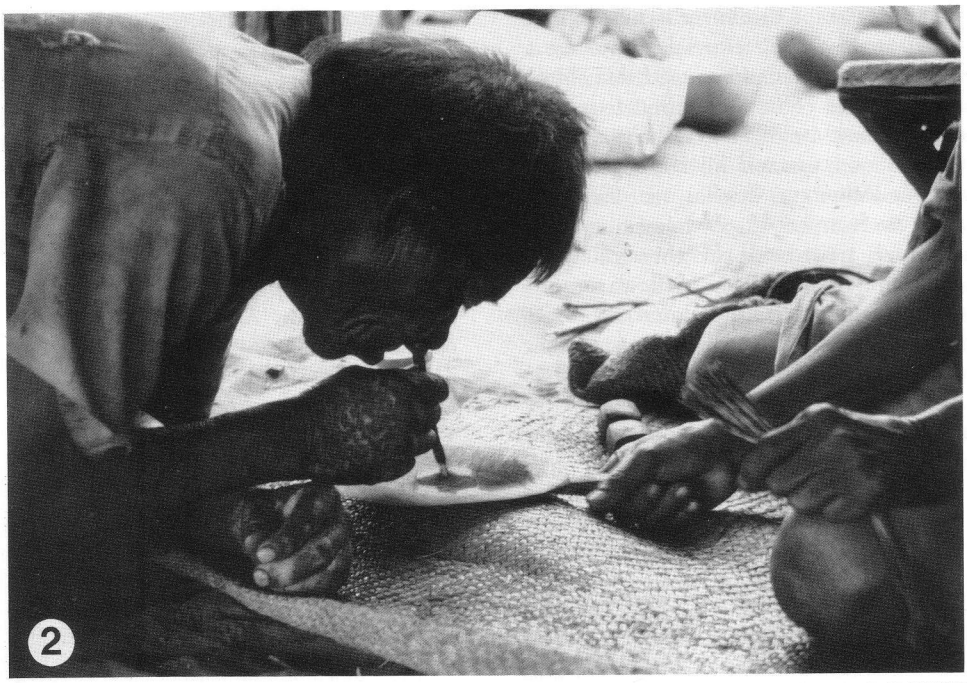
The "manaca" is a monocaulous, arborescent, pinnate leaved, palm growing to an approximate height of 20 m. The stem is gray-black in color and has well-defined leaf scars, while the stemwood is soft and stringy. The leaf sheath is up to 1.5 m long, and the petiole and rachis combined reach a length of 3 m. This palm is found growing in the Llanos de Apure in the deeply shaded interior of seasonally flooded gallery forests associated with permanent and temporary waters.

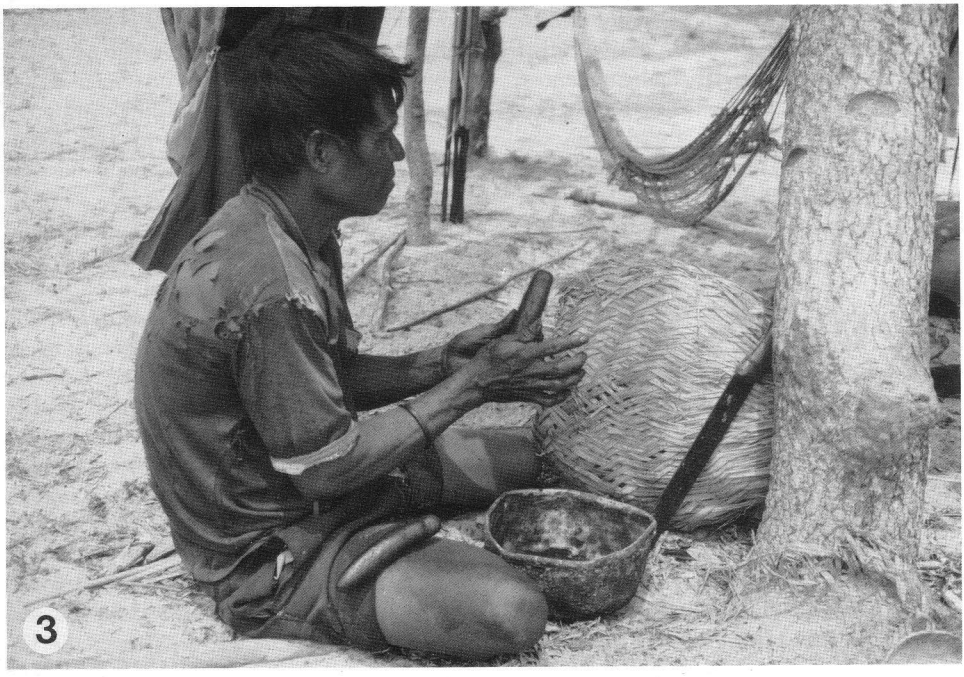
E. precatoria has a minor, and non-exclusive place in the economy of the Pumé. Its principal use is in the preparation of *peramán* (Spanish), a resinous substance used to seal, bind, and waterproof a multitude of manufactured items, and especially important in the manufacture of arrows. Droplets of resin collected from *Symphonia globulifera* are worked by hand into a single mass and then mixed with leaves of *E. precatoria* that have been burned into ash. Ash from *M. flexuosa* petioles may be substituted, however (Fig. 3). The fruits and heart of *E. precatoria* are occasionally eaten raw, but are not actively sought.

Mauritia flexuosa L.f. Pumé: tho to (mature), bObui to (woody-stemmed juvenile), chɛɛ to (acaulescent juvenile). Spanish: moriche. Voucher specimens: TLG 2 and TLG 3.

The "moriche" is a monocaulous, arborescent palm growing to a height of 30 m, that has reduplicate and briefly costapalmate leaves. The stem is unarmed, grayish-brown in color, and bears distinctive leaf scars. The petiole on mature specimens is up to 1 m long, but on acaulescent juveniles it can reach a length of 5 m. *M. flexuosa* can grow as a solitary individual in the interior of seasonally flooded gallery forests, but is often found in relatively dense, monospecific concentrations in seasonally flooded savanna (locally referred to in Spanish as a *morichal*).

M. flexuosa is the most widely used of all palms among the Pumé. Fiber is obtained from the young, unrolled leaf (sword leaf) and is used in a manner similar to the fiber extracted from the leaves of *A. jauari*. Fiber is extracted by placing the sword leaf in the sun for a few hours to dry and then separating the cuticle from the leaf segment by rolling them between the fingers and stripping; the cuticle is allowed to dry completely in the sun for several days before it is used to manufacture artifacts. The fiber obtained from *M. flexuosa*





2. Pumé man taking yopo through an inhalator. The nasal pieces are made from seeds of *Astrocaryum jauari* while the tubes (made of bird bone) are bound with peramán manufactured with ash from *Euterpe precatoria* leaves. The yopo pallet is being supported on a mat woven from *Mauritia flexuosa* leaf segments. 3. Pumé man making peramán. He is at the stage of incorporating ash (in this instance from *Mauritia flexuosa*) into the

leaves is dyed red by boiling in a decoction of *Arrabidaea chica* leaves and used without further modification as a "loincloth" by woman. The fiber is also used to weave small bags to hold personal possessions, slings for carrying babies, and most importantly to weave mats. Soils throughout the Llanos de Apure are loose and sandy, and mats are used for sitting on, laying uncooked and prepared food on, and as wind (or rain) shields. Twined fiber is used to manufacture the hammocks used by *ciri khonome* Pumé. A byproduct of fiber extraction which is occasionally used are the prominent midribs found on each leaf segment. These are loosely woven into manioc flour sifters.

Whole, mature leaves of *M. flexuosa* are used to weave floor mats, upright windshields, and the large baskets used as storage units for personal belongings inside houses, and by women to carry manioc, wild roots, and firewood. The major use of mature leaves, however, is for thatching houses. The attachment of the blade to the petiole of leaves is broken and the leaf is left to sun-dry for several days. In thatching a house, leaves are split in half lengthwise and hung over roof slats most frequently made of *Mauritiella aculeata*. (Between four and 1,200 leaves of *M. flexuosa* are used to thatch a single house depending on style, size, and season of use.)

Dry petioles of acaulescent juveniles of *M. flexuosa* are fairly straight, quite rigid, and extremely light. In this condition, individual petioles are used to make fences around small patches of squash or tobacco within the village. Several petioles can be pierced onto a stick to form a platform that is used as a shelf when suspended from the rafters of Pumé houses, or a windbreak/rainshield when stuck upright into the ground. The petioles may also be charred and the ash used to manufacture peramán in the manner already described for *E. precatoria*. Rafts are made by lashing together with vines (several genera are used) three to four platforms composed of 10 to 12 petioles each. (The number of platforms used depends on the weight of the person using the raft.) These rafts are used to cross rain-swollen streams in the wet season and to fish from in lakes and deep ponds poisoned with *barbasco* (Spanish, *Tephrosia sinapou*) during the dry season (Fig. 4).

The ripe fruit of *M. flexuosa* is actively sought during the wet season and favored for consumption over that of any other palm. The mesocarp is sucked and scraped directly off the endocarp without preparation. The palm heart is also eaten, although a palm will seldom be felled for the sole purpose of extracting the heart. If the sword leaf is taken for fiber or leaves are collected for thatch, then the heart is nearly always extracted as well. Large *Rhynchophorus palmarum* grubs, which are roasted and eaten, are collected from the rotten trunks of *M. flexuosa* felled in previous years to obtain thatch.

Mauritiella aculeata (Kunth) Burret. Pumé: kuecha to (mature), thonõnga to (juvenile). Spanish: moriche negro. Voucher specimens: TLG 6, TLG 7, TLG 42, and TLG 47.

The "moriche negro" is a multistemmed, arborescent palm growing to an approximate height of 10 m, that has reduplicate and briefly costapalmate leaves. The stem is silvery-gray in color, has distinct leaf scars, and is armed with stout, upward curving spines 1 to 2 cm long. This palm grows in deeply shaded areas of seasonally

←

softened resin of *Symphonia globulifera*. The man's left knee is touching a basket made from a mature leaf of *Mauritia flexuosa* and in the background is a hammock made of fiber extracted from the sword leaf of the same species.



4. Pumé man spreading barbasco in a river pond from a raft made with petioles of juvenile *Mauritia flexuosa*. He is poling himself with a petiole from the same species.

flooded gallery forests and is typically found growing in shallow basins retaining water year-round and located adjacent to streams or rivers.

The most important use of *M. aculeata* among the Pumé is in house construction. A mature palm is felled, the spines are removed, and the stem is split lengthwise into 6 to 10 slats. The spongy interior of the stem is scraped from each slat with a machete and discarded. Slats are tied to the roof beams on Pumé houses using vines (*Cynachum* ?) and serve to support the split leaves of *Mauritia flexuosa* used as thatch (Fig. 5). *Mauritiella aculeata* slats are also used to build shelves inside Pumé houses.

The petiole of acaulescent juveniles of *M. aculeata* are some 3 m in length and about 1 cm in diameter. After sun-drying for several days, the petioles are used to manufacture arrow shafts although the practice is now largely restricted to older members among the *ciri khonome* Pumé. This use of petioles appears to have been more widespread in the past before *Gynerium* sp. cane was widely planted in gardens; *Gynerium* sp. cane has greater rigidity and durability than *M. aculeata* petioles, and the sturdier arrows that can be produced are favored by the Pumé.

Leaves of acaulescent juveniles of *M. aculeata* are the most commonly used material for weaving fire-fans, while the fibrous outer layer of the petiole is used for ties and binding material once it is stripped away from the pithy interior. These bindings are obtained on a spontaneous, as-needed basis, and are readily discarded after use. The fruits of mature *M. aculeata* are reportedly edible, but are not actively sought by the Pumé. Table 1 summarizes the use of different palm species among the Pumé.

Discussion

In general terms, the Pumé appear to rely on a smaller number of palm genera than most native and non-native peoples throughout the lowlands of South America; more than a difference in native knowledge, however, this may simply reflect environmental differences between tropical savanna where the Pumé live and tropical forest where most of the work on palm ethnobotany has been carried out. There appear to be fewer genera of palms represented in tropical savannas than there are in tropical forests (Balick 1985, Boom 1988, Anderson 1978), even though the observations are largely unsystematic in nature. The intensity and variety of uses of the palm genera by the Pumé is nev-

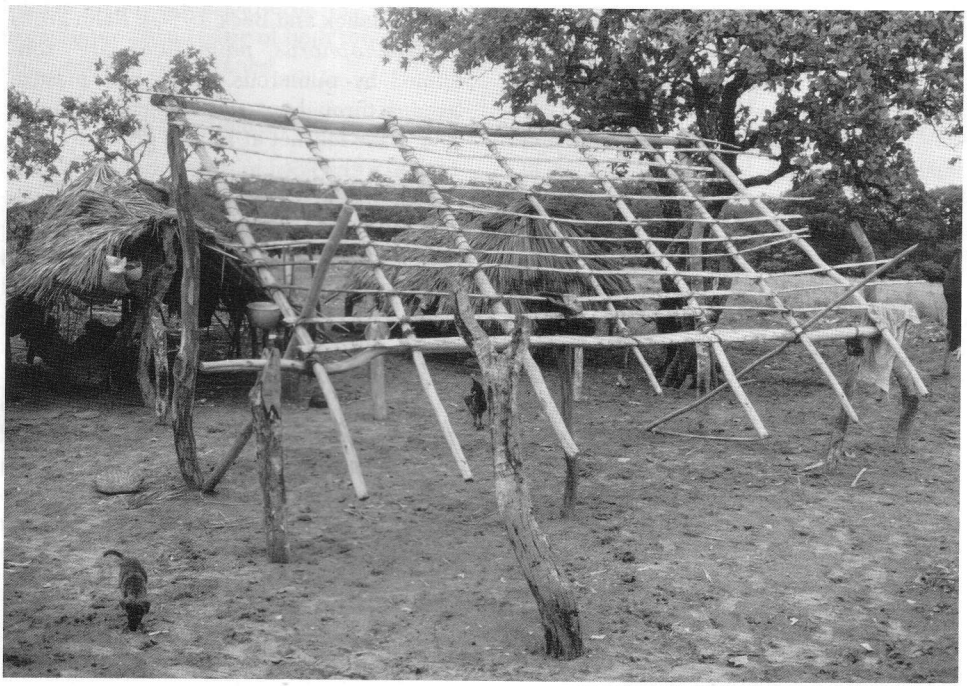
Table 1. The names and uses of palms among the Pumé.

Pumé Name	Spanish Name	Scientific Name	Edible Fruit	Edible Heart	Thatch	Building Material	Artifacts/ Handicrafts	Other
bai to	macanilla	*Astrocaryum* cf. *jauari* Mart.	●	●	●	●	×	○
hẽnan to	manaca	*Euterpe* cf. *precatoria* Mart.	○	○	●	●	●	○
tho to	moriche	*Mauritia flexuosa* L.f.	×	×	×	○	×	×
kuecha to	moriche negro	*Mauritiella aculeata* (Kunth) Burret	○	●	●	×	×	○

× = important or major use.
○ = unimportant or minor use.
● = no known use.

ertheless comparable to that of groups relying on a larger number of genera.

Like the Pumé, the Barí of the Maracaibo Basin and the Chácobo of northeastern Bolivia manufacture bows from the hard stemwood of *Astrocaryum* (species unknown for the Barí, and *A. aculeatum* for the Chácobo [Beckerman 1977, Boom 1988]). The Barí, the Chácobo, and the Yanomama of southeastern Venezuela also use *Astrocaryum* stemwood to manufacture arrow points (*A. aculeatum* in the case of the Chácobo and the Yanomama); the Pumé now use metal arrow tips exclusively, but may have made arrow tips from stemwood in the past before metal was so



5. Pumé dry season house in an early stage of construction showing the roof slats made from *Mauritiella aculeata*. In the background are two occupied houses thatched with *Mauritia flexuosa* leaves.

easily obtained. The Guahibo living in the *Llanos del Meta* just south of the Pumé in Colombia, use seeds of *A. acaule* to manufacture the nasal pieces of yopo inhalers similar in shape to those manufactured by the Pumé (Balick 1979).

The Barí and Guajajara of northeastern Brazil are specifically known to extract fiber from the leaves of several species of *Astrocaryum* (Beckerman 1977, Balick 1988), but the practice is widespread among lowland peoples (Levi-Strauss 1950, Uhl and Dransfield 1988, Kahn 1988, Balick and Beck 1990). Although the Pumé are not known to eat the fruit or the heart of *A. jauari*, these two items are obtained for consumption from various species of *Astrocaryum* by the Barí, the Chácobo, the Yanomama, the Guajajara, and mestizos throughout lowland South America (Beckerman 1977, Boom 1988, Anderson 1978, Balick 1988, Mejía 1988, Balick and Beck 1990).

The Pumé make limited use of *E. precatoria* compared to its use among other lowland South Americans. The fruit of various species of *Euterpe*, but most commonly *E. oleracea* (the assai palm), are widely used to manufacture beverages and mushes of various kinds by caboclos in Brazil as well as many native groups including the Barí, the Chácobo, the Guahibo, the Yanomama, the Apinayé (living in northeastern Brazil), and the Guajajara (Levi-Strauss 1950; Beckerman 1977; Boom 1988; Balick 1979, 1988; Anderson 1978; Strudwick and Sobel 1988). The palm heart of *E. precatoria* and *E. oleracea* are also eaten by many groups, and that of *E. oleracea* is the source of canned palmito sold in the United States and Europe (Balick 1985, Kahn 1988, Strudwick and Sobel 1988). Fronds of *Euterpe precatoria* are used for thatching houses by the Chácobo and the Guahibo, while the stemwood of this species is used by the Yanomama to build shelves and tables (Boom 1988, Balick 1979, Anderson 1978).

Throughout the seasonally flooded areas of lowland South America, *Mauritia flexuosa* is undoubtedly the most widely used of all palms. The Warao, a native group living in the Orinoco Delta region of Venezuela, make the most extensive use of this palm. They use the stems as piles to support their houses and to extract starch for consumption; they draw fiber from the leaves to manufacture clothing and hammocks; and they consume the fruits and the palm heart (Heinen and Ruddle 1974). The Yanomama, Apinayé, and Guajajara eat the mesocarp of *M. flexuosa* fruits without preparation like the Pumé, while the Guahibo make a fermented drink from the mesocarp (Balick 1979, 1988, Anderson 1978). Trade and sale of *M. flexuosa* fruit is a major source of income for residents of Iquitos, Peru (Padoch 1988).

Like the Pumé, the Guahibo and several Indian groups of the Guiana region favor *Mauritia* spp. for thatching their houses (Balick 1979, Levi-Strauss 1950, Thurn 1883, Balick and Beck 1990). Palm grubs (*Rhynchophorus palmarum*) are consumed by numerous native and mestizo groups throughout the tropical lowlands, and in the market at Iquitos grubs are sold both live and fried in their own fat (Padoch 1988, Kahn 1988, Mejía 1988, Balick 1986). The Guahibo and mestizos of the Peruvian Amazon extract grubs specifically from the rotten stems of *M. flexuosa* (Balick 1979, Padoch 1988). The Guahibo and the Pumé are the only two South American groups I am aware of who use the petiole from acaulescent *M. flexuosa* to build rafts (Balick 1979).

The Apinayé use the leaves of *Mauritiella armata* for manufacturing baskets, and the stemwood for manufacturing bows (Balick 1988). The stemwood of *M. armata* must have very different physical properties than *M. aculeata* used by the Pumé to manufacture house slats since the soft, spongy stemwood of this last species is inappropriate for making bows. Although the fruit of *M. aculeata* is not widely used

by the Pumé, the Apinayé, the Yanomama, and several mestizo groups in the Peruvian Amazon consume the fruit of several different species of *Mauritiella* (Balick 1988, Anderson 1978, Mejía 1988). In all, there are few references to the use of *Mauritiella* among lowland South Americans to compare with its use among the Pumé (Balick and Beck 1990).

Conclusion

Palms form an integral part of Pumé culture, as they do for many other native and non-native peoples of lowland South America. Some of the future investigations planned among the Pumé are aimed at formally assessing the economic value of palms particularly *Mauritia flexuosa*. Given the importance of this palm to the Pumé for thatching and fiber, the levels of extraction could have a significant effect upon nutrient cycling and ecosystem regeneration. The cumulative effects of human exploitation patterns on tropical ecosystems are an issue of both theoretical and practical importance.

Acknowledgments

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An Ethnobotanical Sketch of the Palm Bactris (Guilielma) gasipaes

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The pejibaye palm (*Bactris gasipaes* Kunth) is a domesticated species and as such is expected to have a rich ethnobotanic lore handed down from time immemorial. This is indeed the case, but, unfortunately, the early Spanish chronicles do not convey all of the information that one would like about this obviously extremely important species. In many areas the pejibaye was so important that it was considered to be a sacred plant, a gift of the gods. In this short contribution, a little of the ethnobotanical lore about the pejibaye will be presented, enough, I hope, to stimulate the interested reader to delve into much earlier writings, both by the author and others.

Geographic Distribution

Available historic data from the 16th century show that when the Europeans arrived the pejibaye was found in the Isthmus of Panama and neighboring regions, Costa Rica and further to the northwest, the Chocó area (north Pacific coast of Colombia), and the Cauca and Magdalena River valleys, especially Muzo, and further to the southeast, all of the upper Amazon River tributaries, from the Caquetá River south through the Putumayo, Napo, Pastaza, Santiago, Zamora, Marañón and Ucayali Rivers (what is today the foothills of the Colombian, Ecuadorian and Peruvian Andes). Somewhat later there is data from Nicaragua and Honduras, the Orinoco River in Colombia and Venezuela, the main valley of the Amazon River down to its mouth at Belém, Pará, Brazil, the Beni River in Bolivia and the Madeira River in Brazil (a southern tributary of the Amazon). In all of these areas the palm was found cultivated.

Indigenous Names

In its vast geographic distribution many more than 100 indigenous languages were spoken at the time of Columbus' arrival. Patiño (1960) published a list of 338 Amerindian names for the palm and its fruits, later organized into 66 divisions that group the known variants (Patiño 1963). Since then at least 100 additional names have been collected, frequently from small tribes whose languages are poorly known. The names most frequently mentioned by the Spanish chronicles and missionaries, and therefore the most widely spread at or just after the discovery of America, are the following:

1. *Pijibay*, *pejibaye* (the current name in Costa Rica and used in much of the modern international literature) and *pixbae* (the current name in Panama). There are at least 40 other close variants in the Isthmus of Panama, Costa Rica, and the Chocó (Colombia). Strangely enough, the last remaining populations of the Chokó tribe use *uerre* and its variants, perhaps because they have supplanted the previous inhabitants who used the *pejibay* variants. In Amazonian Peru, the only part of the country where the palm is known, the name is *pifuayo* or *pijuayo* and its variants.

2. *Pepire* or *pipire* are the names in the Colombian Llanos (which drain eastward into the Orinoco River), the first of which was registered as early as 1672. The Tunebo tribe uses *bibura* or *vibura*, which is an evident variation of *pipire*. A little further east, in the Venezuelan Orinoco, the names pirijao and pihiguao are current. All are based upon the *pi* radicle, which defines their inter-relatedness with the first group of names.
3. *Cachipay*, *cachipae* were the names used by the Muzo tribe in the Magdalena River valley (Colombia) in the sixteenth century, and they are still used there. This is the name that Alexander von Humboldt and his colleagues, Bonpland and Kunth, found when they described the species in 1816, based upon material collected in Ibagué, Colombia, in 1801. They Latinized this Amerindian name to the present *gasipaes*.
4. *Pupunha* is the palm's name in Brazil. According to the botanist and linguist J. Barbosa Rodrígues, this name derives from the Tupi or Lingua Geral syllables *by* (skin) and *nha* burning charcoal (as in red-hot), to give the name "skin the color of red-hot charcoal". While the *py* radicle appears similar to the *pi* mentioned above, the Tupi languages have very little in common with the others, so that the name appears to be a separate development. In fact, the name only appears in Brazil in the 17th century, when the Portuguese started to penetrate the Amazon River. This suggests that the name is artificial or made-up from other names that the Portuguese came across, as is the case of the next name.
5. *Chontaduro*. This name is surely an artificial name invented by the Spanish missionaries and civil servants from the Quechua words *ruru* (eggs) and *chunta* (palm), to give the name "palm that produces eggs" (referring to the ovoid shape of the fruit). Since the Spanish used Quechua as the Lingua Geral of the Andes and the missionaries distributed it beyond the Inca areas, chontaduro displaced indigenous names in Ecuador and south-western Colombia, where it is dominant today.

Archeological Data

Few archeological data exist in which this palm is positively identified. In the region of San Agustín, upper Magdalena River valley, Colombia, scorched or carbonized seed have been found and dated to 770 ± 200 years before present, perhaps as early as the 9th century AD. The palm remains were found with those of the Andean nut (*Juglans neotropica* Diels), a cultivated peanut (*Arachis hypogaea*) and a cultivated, primitive variety of maize (*Zea mays*), of the Reventador type (Duque Gómez 1964, pp. 388–390, 457).

Recently, well preserved seeds have been found in several archeological sites on the Caribbean and Pacific coast of Costa Rica that are dated between 300 BC and 300 AD (Mora-Urpí, personal communication).

Although the archeological record is scant, the palm's enormous genetic variability indicates that it must have entered the domestication process very early (see also Clement 1988).

Reasons for Its Importance

The pejibaye was not simply another fruit species domesticated by the Amerindians, rather it was something special. The stem wood was preferred by all the tribes where the species occurred for making arms (lances, bows and arrows, awls); its fruit were not only eaten directly, but also (perhaps most importantly) used to prepare a widely consumed, very popular fermented drink, frequently called "Chicha" (possibly because of the 70–80% starch levels in highly selected pejibayes). All parts of the palm were used.

Harvest and Fertility Festivities

The pejibaye harvest varies during the year in different parts of its geographical distribution. Generally, however, the harvest occurs during the two or three months that coincide with the spring (February–April) and fall (August–October) equinoxes. The Amerindians celebrated the abundance of the harvest season with great festivities, which also had many characteristics of fertility rites. For example, the Guaymie, of Panama–Costa Rica, celebrate the "balseada", generally in November, in which sporting events between neighboring groups were amply supplied with chicha of pixbae.

In Amazonia the harvest coincides with the spring equinox and even today many of the remaining Amerindian tribes celebrate the pejibaye harvest, even the more primitive, proto-agricultural tribes like the Yanomamos and Guaikas in Venezuela and Brazil. Usually the celebrations include considerable dancing and singing and consumption of chicha. The arrival of guests converts the celebration into a social exchange as well.

The Pejibaye Calendar

As a natural corollary of the preceding section, the pejibaye harvest is used as a basis for calculating time, because this harvest is frequently the most important agricultural event of the year. The Yuracaré, of Bolivia, are an example of this: any happening is three months before the beginning or two months after the end or in the second month of the harvest.

Myths

Anthropologists have collected myths and other legends that show the great importance of the pejibaye to the Amerindians in the equatorial regions. The myths and legends contain pejibaye in one of two ways: explaining how humans obtained such a valuable plant or showing its importance to the tribes.

Among the Catio of Urabá, Colombia, a myth refers to the origin of maize and pejibaye, both obtained from heaven (Bajia) (Chaves 1945): two women were permitted two days in heaven. Upon returning to the world they brought seed of the Chococito maize and pejibaye hidden in their mouths. They told the other indians that one dies and will meet again in Bajía, and that they had brought seeds from these two plants from there. They then planted the seed, grew the plants and ate the fruit. All who tried the fruit thought that they were good and proceeded to plant more.

Among the Ahuaruno of the Marañon River, Peru, a myth mentions the importance of pejibaye and how the sun, which was previously human, left the earth for the skies, because of a lazy woman (Wavrin 1937): . . . On another occasion he went to hunt. He had instructed his wife to clean the fields and prepare pifuayos. Upon his return he found his wife still cleaning the fields. Irritated by such laziness, he put a cassava grinding board on a pifuayo leaf of a young plant. On this he put a basket and then climbed in. The tree grew rapidly and the sun climbed to the skies. Those who attempted to follow after could not get so high and all fell. They attempted, in vain, to cut the tree.

Among the Catio, from the Chocó region of Colombia, the pejibaye is also mentioned in another myth (Rochereau 1929): . . . Geru-potó-uarra was searching for the killers of his mother. He arrived in the domain of Tutriacá, one of the divine creators, situated in the antipodes. The land there is perfectly flat and sown completely with pejibaye, there being no other vegetation, and the stones are blue for sharpening knives. . . . Many strange things were observed by the traveller, among which, the people there did not die, nor did they eat. They lived on the vapor given-off by cooking pejibayes and did not have organs to defecate. The traveller was soon offered

some cooked pejibayes and proceeded to eat them, much to the astonishment of the natives. The traveller asked "Why don't you eat them also, since you have mouths? If the smell is good enough to live on, imagine the actual fruit". Three of the natives proceeded to experiment with the fruit and in due course needed to defecate. Because they were unable to, not having the correct organs, they implored the traveller to break them open, which resulted in their deaths. Seeing this the other natives urged the traveller to leave, before any could experiment again and need to defecate.

Beliefs

A plant that was so important in the diet and the culture of the indigenous people took on a sacred character. For example, among the Jivaro of Ecuador, the punches or needles used to sew the lips of shrunken heads, or tzantzas, are always made from the wood of pejibaye. Among the Ticuna of the upper Amazon River, the fences that ritually encircle youths coming into puberty were made from strips of this wood.

Among the Huitoto of southern Colombia, who divide themselves in clans with their respective totems, one of the clans is called the Jimene, that means people of the pejibaye, from the name that they apply to the palm.

Post-Columbian Folklore

In many areas the pejibaye continued to be important after contact. For example, in the Colombian and Ecuadorian Pacific coast its wood was used to make "marimbas", a wooden percussion instrument of African origin. Strips of pejibaye wood are used to cover the open end of a bamboo tube and are then beaten with a mallet; the instrument will produce a lower or higher tone depending upon the length of the bamboo tube. This instrument was first recorded in the 18th century.

Several couplets are known from the folk music of Colombia, one of which includes the following verse:

"De la palma de chontadura la raíz también se pudre;
con una mujer celosa, el hombre también se aburre".
"Of the Chontaduro palm even the root rots; so with a jealous woman, a man also becomes bored".

Uses

The roots are occasionally used as a vermifuge.

The entire stem, generally armed with stout spines, was used to make blockades in Central (Corotapa, Costa Rica) and South America (Chocó, Magdalena, Llanos, Amazonas). When the stem dies and rots it becomes infested with Coleoptera larvae, which are greatly appreciated by the Amerindians. The split stem was worked and polished to make lances, clubs, bows, arrows, punches, stabbers, games for children, etc.

The heart of palm is one of the most delicious among the Palmae. It has less tannin than other palms and remains white much longer in storage. There is currently a strong export industry in Costa Rica, and Colombia (Urabá) and Brazil (São Paulo, Bahía) are developing theirs.

The inflorescence, freshly opened, is boiled and served as a vegetable by many tribes, according to numerous reports by the Spanish in colonial Amazonia and Panama.

The fruit, however, is by far the most important product, and can be used in numerous ways. Some tribes only use the fruit to make "chicha" (the Guaikas, for example), which is prepared not only for harvest festivities but during the entire harvest period. The indians of the Vaupés River prepare the mashed moist fruit ready for fermentation, then bury it until they want some chicha, at which moment they uncover it and add water; this mass can be stored in underground holes covered with leaves of a Marantaceae without decay for very long periods.

Nevertheless, the major use is as a cooked fruit, generally without salt, although this is frequently added now-a-days, especially by acculturated indians. The fresh or cooked fruit does not keep well in the tropical climate and must be consumed quickly. Some tribes are known to preserve the fruit by smoking or dehydration, which allows preservation for several months.

Most tribes do not use the seed, although a few consume the endosperm which has the flavor of coconut (*Cocos nucifera*) but with more fiber.

Harvest Methods

Although spineless types exist, most pejibaye are densely armed with thin or stout spines on the internodes. Some look like *Astrocaryum* because they are so densely spiny. Because of this most tribes have developed methods that do not involve climbing the stem unassisted.

Along the Orinoco River, the Amerindians tie cross-bars between adjacent palms or a palm and another species. Others erect a separate post beside the palm and from its top pull down the bunches with a hook. The Huitoto and other Amazonian tribes generally plant another kind of spineless fruit tree beside the palm and climb this to pull down bunches with a hook. Many others just use a long pole with a hook.

An ingenious apparatus found in Panama and along the Orinoco is used to climb the spiny stem itself, while keeping the body away from the spines. A pair of crosses in the form of an X or a pair of triangles with an open V at one extreme are tied to the stem with vines or stout cords. The harvester will step on the lower cross, which becomes immobile on the trunk because of this weight, and will raise the upper cross. He then sits on the upper cross, which becomes immobile, and pulls the lower cross upward with his feet. He then steps on the lower cross and repeats the process until arriving at the top of the tree where he will collect the ripe bunches, without ever coming into contact with the spines. A skilled harvester can climb a 15 m palm, collect the bunches, and return to the ground in 10 minutes. A good photograph of this apparatus is presented by Chagnon (1968).

Acknowledgments

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(This paper is a very condensed version of previous articles by the author. The interested reader should consult these major works, which also contain abundant bibliographical references.)

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Principes, 36(3), 1992, pp. 148–155

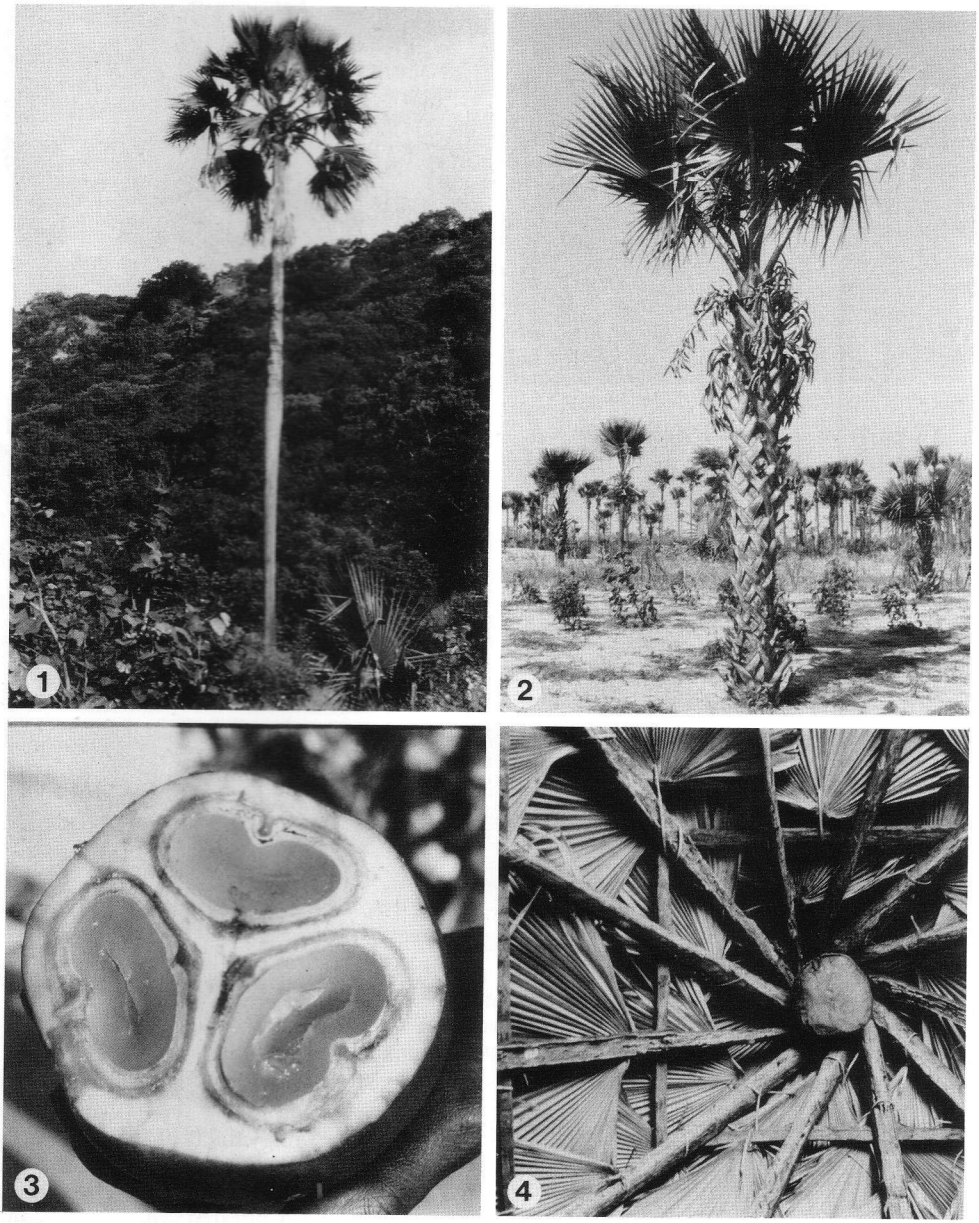
Borassus aethiopum, a Threatened Multiple Purpose Palm in Senegal

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Borassus aethiopum is an economically and ecologically important palm tree of the Sahelian and Sudanian zones in Africa (Giffard 1967, Gschladt 1972). This majestic representative of the subfamily Coryphoideae is often found in dense populations in periodically inundated depressions in the landscape or along rivers and lakes (Chevalier 1949, Chevalier and Dubois 1938). *Borassus aethiopum* was originally described by C. F. P. von Martius (1838) who separated it from the widespread and closely related Asian species, *Borassus flabellifer*, based on a description of Thonning in Schumacher (1829). According to this, *B. aethiopum* is characterized by the ventricose stem (Fig. 1) of old individuals and the five to seven male flowers in each flower cluster (cincinni) as opposed to ten to fifteen in *B. flabellifer*. The number of flowers per cincinni is variable and in *B. aethiopum* it is typically 8–10, thus it is not a good distinguishing character. In other and older works, *B. aethiopum* is either cited in synonymy with *B. flabellifer* or retained as a variety under this. The only existing monographic treatment of the genus *Borassus* is that of Beccari (1924). This work includes seven species and recognizes *B. aethiopum* with three variants: var. *senegalensis*, var. *bagamojensis* and the typical form. *B. aethiopum* is distinguished from *B. flabellifer* by having a calyx that is connate to the middle and not split to the base as in this species. In modern treatments, e.g., Flore du Sénégal (Berhaut 1967), Flora of West Tropical Africa (Hepper, 1968), Flora of Tropical East Africa (Dransfield 1986) and, Flore illustrée du Sénégal (Vanden Berghen 1988) the position of *B. aethiopum* is maintained. We have accepted *B. aethiopum* in this paper based on the differences given by Dransfield (1986). *Borassus aethiopum* is accordingly more massive than *B. flabellifer*. The leaves are more rigid, less deeply folded and greater in number. Along with the ventricose stem, this gives a different appearance from *B. flabellifer*.

Borassus aethiopum plays an important role in Senegalese rural life where it is the source of a number of products (Niang 1975, Diouf 1982, Sambou 1985). It is called "ron" in Wolof dialect from which the French "rônier" is derived. Destructive agricultural practices and lack of management is now threatening populations all over the country (Bellouard 1950, Diallo 1987, Sambou 1989). Dense populations of *Borassus aethiopum* are found in the southern and southeastern parts of Senegal close to rivers and lakes where the groundwater level is high. Natural populations of *Borassus aethiopum* are rare in the northern part of Senegal, but the palm is often planted in fields (Fig. 2). The best climatic conditions for this palm prevail in the middle part of the country where large populations once occurred.



1–4. *Borassus aethiopum.* 1. Old individual. Note the swollen or ventricose stem. 2. Palm tree planted in mixed cropping system. Note the male inflorescence and the persistent leaf sheaths characteristic of young plants. 3. Cross section of immature fruit. Note the fleshy mesocarp and the three pyrenes that each contain the gelatinous endosperm. 4. Roof thatched with the leaves.

Overexploitation and habitat degradation is threatening this palm so seriously that Senegalese authorities are now trying to protect it. It is illegal to exploit the wood for commercial purposes and other laws regulate its use in the common lands of the villages (Government of Senegal 1973). Despite these efforts the destruction seems to be continuing. This paper will first describe some of the many uses of *Borassus aethiopum* and then mention the various threats to which it is exposed in Senegal.

Uses

All parts of *Borassus aethiopum* are exploited and used for a wide array of purposes (Table 1). The products can be divided into three major groups which will be treated shortly in the following: ligneous products (wood, fibers, etc.), food, and medicine.

A number of parts of the palm are edible. The young gelatinous endosperm is a highly esteemed and nutritious snack (Fig. 3). The mesocarp is fleshy when ripe and can be prepared and consumed in many ways: grilled, boiled, or mixed with sugar or honey. The cotyledonary haustorium of the germinating seed is soft and sweet and highly appreciated. The premature folded leaves of the seedling are collected from below the soil and eaten. They have a fleshy texture and are very tasty. The palm heart of *Borassus aethiopum* is also exploited although the difficulties involved in extracting it somewhat limit its importance as a food source. A sap, which is very high in sugar content, is tapped from near the apical meristem at the base of the palm heart (Bismuth and Menage 1961).

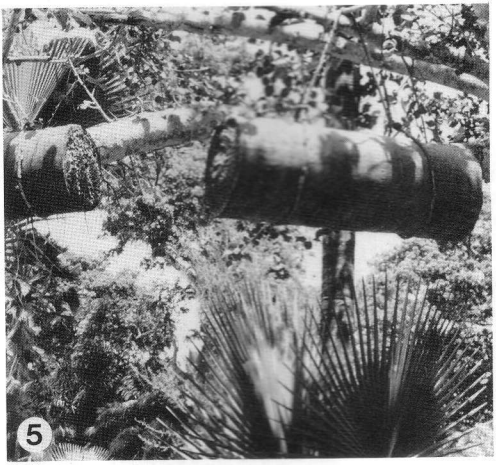
Borassus aethiopum is also used for a number of medicinal purposes (Giffard 1962). An infusion of the roots is used to treat miscellaneous ailments such as stomach ache, throat infections, bronchitis and syphilis. The flower-bearing branches or rachillae of the staminate inflorescences are used to treat venereal diseases. The stamens are mixed with Shea-butter and used to heal wounds. The mesocarp of the ripe fruit is used as a stimulant and against tetanus. It is said to be a very efficient remedy against intestinal parasites too. The eophyll (the first leaf) of the seedling and the sap are also used as stimulants. The sap tapped from the stem is believed to stimulate the growth of teeth in children.

Table 1. The Different Parts of Borassus aethiopum *Used by Man*

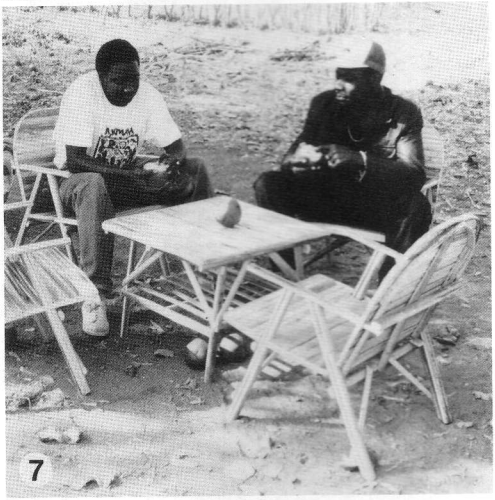
I. Uses based on structural properties
- Stem (timber, boards)
- Leaves
  - —petiole (fences, fibers)
  - —blade (roofs, baskets, mats, rugs, furniture)

II. Uses based on nutritional and medicinal properties
- food
  - —endosperm
  - —cotyledonary haustorium
  - —palm heart
  - —mesocarp
  - —sap tapped from near the shoot apex (alcoholic beverage)
- medicinal
  - —roots
  - —male rachillae
  - —stamens
  - —mesocarp
  - —hypocotyl
  - —sap tapped from the trunk or near the shoot apex

The stem of *Borassus aethiopum* delivers a hard wood that is resistant to decay and the damaging effects of seawater. The durable wood is rarely attacked by termites and fungi and is said to have excellent working properties. It is used extensively by local carpenters for multiple purposes, to mention just a few: furniture, timber in heavy construction such as bridges and houses, boards for making floors, walls and roofs in houses. The soft swollen part of old trunks serves other purposes (Fig. 5). A rich cottage industry is based on the extraction of the leaves. The blade or seg-





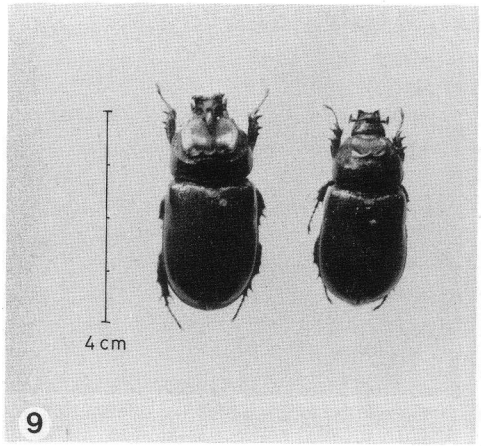


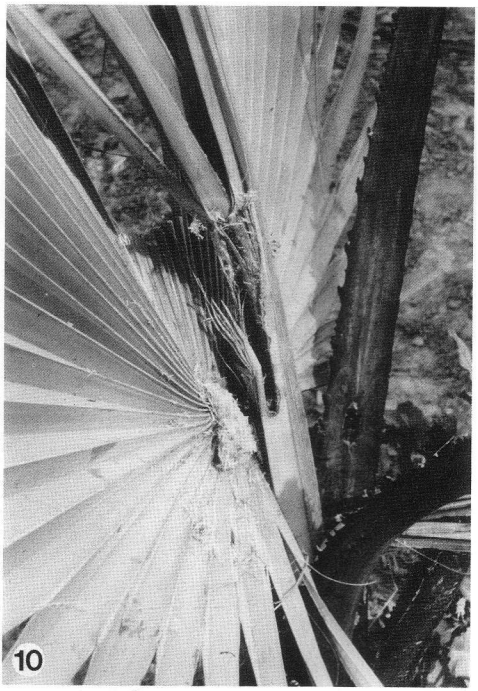


5–8. *Borassus aethiopum.* 5. A beehive made of the swollen and soft part of the trunk. 6. Baskets braided from the major veins of the leaves. 7. The fruit mesocarp offers a nutritious snack. The chairs and table are made from leaf petioles. 8. The death of some old palm trees such as these is probably related to drought.

ments of the blade are used with great ingenuity for making thatch, mats, rugs, baskets (Fig. 4), bathtubs, etc. The leaf fibers are extracted and used for brooms and baskets (Fig. 6). The leaf petioles are skillfully exploited in arts and crafts (Fig. 7) and are used to build fences around houses and pastures. In the North, where the vegetation is sparse, leaf petioles often serve as firewood.

Several aspects of the ecology of *Borassus aethiopum* make it an interesting plant from an agricultural point of view. Its fibrous root system forms a dense mat in the surface layers of the soil which helps to prevent soil erosion. It has been demonstrated that the staminate rachillae release potassium upon decomposition thereby enhancing soil fertility (Maydell 1983). These beneficial effects are exploited in many parts of Senegal where agro-forestry systems are based on managed natural populations of *Borassus aethiopum.*





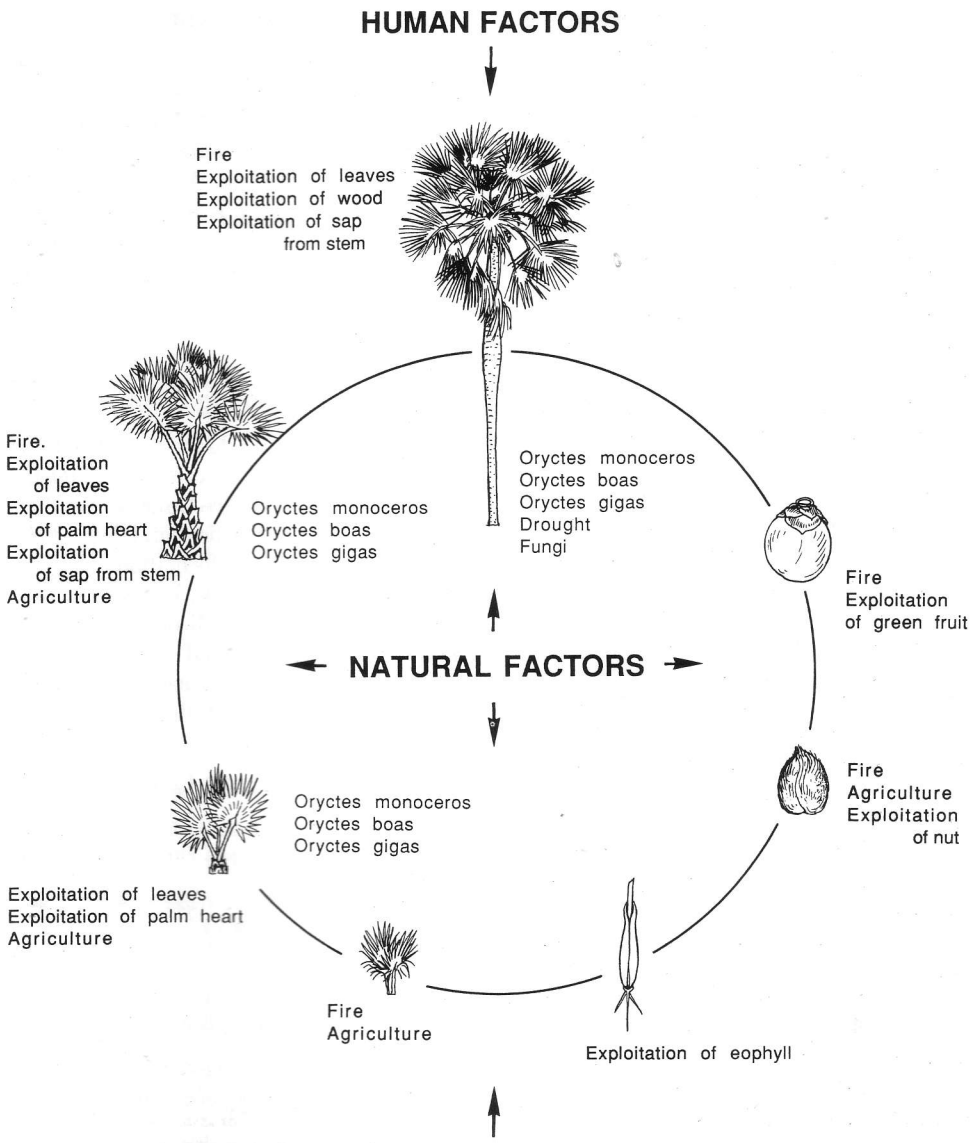




9–12. *Borassus aethiopum*. 9. Male (left) and female of *Oryctes monoceros* Ol. (family *Scarabeidae*). 10. The signs of an *Oryctes* attack in a juvenile palm. 11. Tapping of sugar from the crown. Exploitation has caused the death of the palm tree at the left. 12. *Borassus aethiopum* must give way for the cultivation of millet.

Threats

The destruction of *Borassus aethiopum* is either a result of complete removal of natural populations or a slower process where age distribution becomes progressively more skewed. This process may eventually lead to a complete lack of young stages in the population which can prevent future regeneration. The factors respon-



13. Natural and human factors causing degradation of *Borassus aethiopum* populations in Senegal.

sible for destruction of *Borassus aethiopum* can be divided into two major groups: natural and anthropogenic (Fig. 13).

The most important natural factor threatening populations of *Borassus aethiopum* is probably drought. A steadily growing rain deficit during the last two decades has caused high mortality among older palm trees that are sensitive to fluctuations in the ground water level (Fig. 8). Destructive insects also represent a serious threat to *Borassus aethiopum* (Castel-Branco and Tordo 1956, Lepesme 1947). After the apical meristem has appeared

from below the soil, it is exposed to the attack of three species of *Oryctes* Illiger (*Scarabeidae*) in particular. The two most common species are *Oryctes monoceros* Olivier (Fig. 9) and *Oryctes boas* Fabricius. The third species, *Oryctes gigas* Castelneau, is rare but is found in the humid southern part of Senegal. All three beetles dig into the base of the apical meristem (Fig. 10) and suck the sap which often results in the death of the palm tree. They can reproduce in the swollen subdistal part of the stem of old individuals. The partly decomposed dead stems offer ideal conditions for the development of larvae.

Man's activities have had a severe impact on natural populations of *Borassus aethiopum* in Senegal. The main factors contributing to the destruction are agriculture (Fig. 12), fire and, exploitation of wood, and use of palmheart and sugar sap tapped from near the apical meristem. The latter is a very destructive practice where a hole is drilled through the leaf bases (Fig. 11) and a sap is tapped from the soft and fleshy tissues near the apical meristem. Usually the palm dies after having been exploited in this way. It should be noted that in India and SE Asia, inflorescences of *Borassus flabellifer* are tapped without damaging the plant.

In some *Borassus aethiopum* populations, the age-distribution is so skewed that certain developmental stages are completely lacking. What appears to be seedlings are in fact very old individuals, that remain small due to agricultural practices such as burning of the ground cover.

Adult individuals of *Borassus aethiopum* deliver a number of products that are highly appreciated by village people and they are consequently threatened by overexploitation. Thus, repeated collection of leaves may severely limit the growth of the palm and excessive extraction of green fruits, germinated seeds or young seedlings may impede the potential of natural regeneration.

Conclusion

Borassus aethiopum, a genuine multiple purpose palm tree, is a victim of its own high utilitarian value. Both human and natural factors are threatening the natural populations in Senegal. As long as the use of this valuable palm is not regulated, the situation will probably worsen. Only strict management of the remaining natural populations will save an important plant resource for future generations.

Acknowledgments

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Biogeography of the Coconut *Cocos nucifera* L.

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ABSTRACT

The conditions under which coconut (*Cocos nucifera* L.) evolved can be quite precisely specified. Those conditions still exist today and the coconut palm can be found growing in its original habitat where it will continue to thrive, with or without human intervention. The coconut can be considered as perhaps the most successful member of the world's oldest and most durable ecosystem. Yet the major component of that ecosystem, the coral reef, is constantly changing its form. As a result the precise location of a center of origin for the coconut will probably never be known.

The coconut, like the calabash and the bottle-gourd, is used as a convenient container wherever modern man has not yet brought the ubiquitous benefits of plastic. Unlike the calabash or the gourd, the coconut comes already filled with a drinkable liquid. This liquid is pure, it is palatable and it is portable. Unlike a plastic container the coconut fruit is non-returnable, absolutely disposable and totally recyclable. These qualities are found in the immature coconut and they are well known

wherever the palm grows. But, for the last one hundred years, the fresh young coconut fruit has been taken for granted by agricultural scientists who have, instead, carefully studied the mature, hard-shelled, hairy, brown coconut of commerce. The water in this ripe nut is insipid and it is the high oil content of the dried endosperm, at around 70%, that interests the economic botanist. As far as the botany of the crop is concerned, the research worker has assumed the commercial plantation coconut to be representative of all coconuts. It has even been classified as *Cocos nucifera* var. *typica* (Narayana and John 1949, Liyanage 1948). This is misleading because the commercial coconut is not typical. It is nothing more than a random sample, taken into cultivation, of material that has achieved pan-tropical distribution for totally non-agricultural reasons (Harries 1978).

The concept that the coconut occurs as a wild species that survives without human intervention will only be accepted when two conditions are fulfilled. Firstly, applied scientists undertaking germplasm collections must not restrict themselves to the coconut palms that are conveniently lined up in plantation rows. Secondly, pure scientists collecting taxonomical specimens must no longer reject every *Cocos nucifera* as merely an escape from cultivation.

Center of Origin

The origin of the coconut has often been debated and there have been proposals for both New World and Old World origins for the genus *Cocos*. The taxonomic argument based on similarities between cocosoid palms native to Central and South America (Martius 1823–50) was taken to extreme lengths at a time when the commercial importance of coconut encouraged the idea of introducing it to southern California (Cook 1901, 1910). When the American palms were assigned to genera other than *Cocos* the coconut became monotypic with closest associations to *Jubaeopsis caffra* in southern Africa (Beccari 1916*a*, 1917).

Proponents for an Old World origin, have suggested Indian, Indo-Malesian and Melanesian centers for the specific type *Cocos nucifera*. An origin in the western Indian Ocean, although seemingly supported by the link with *Jubaeopsis caffra* and the presence of an Eocene fossil, *Cocos sahnii* in the Indian desert, has not been generally accepted (Chiovenda 1921). An Indo-Malesian origin was proposed in the region to the northwest of New Guinea, mainly for geological and biological reasons related to Wallace's line (Mayuranathan 1938). Prior to the time that this suggestion was made a fossilized coconut fruit had been found at Aitape on the north New Guinea coast in association with a human skull but the fact was not published until later (Hossfeld 1948). The material was estimated by radiocarbon dating to be 4,555 years old. Unfortunately, the whereabouts of the fossil coconut is not now known and it may well have been destroyed in the dating process. Very recently remains of coconuts, dated at about 3,500 before present, have been found associated with human settlements and Lapita pottery in the St. Matthias group of islands in Papua New Guinea (Kirch 1987, personal communication). A precise New Guinea origin cannot be based on such comparatively recent remains, but most modern text books generally favor somewhere in Melanesia (Child 1974, Fremond et al. 1966, Ohler 1984, Purseglove 1972, Williams 1975).

The antiquity of the coconut in the Indo-Pacific region is borne out by the part it plays in the life of the people; as shown by the names it receives (Merrill 1946), the implements with which it is processed (Werth 1933) and the uses to which it is put (Chiovenda 1921). But these all represent factors of domestication and diversity rather than of origin. Similarly, the Miocene fossil, *Cocos zeylandica* in North

Island, New Zealand (Berry 1926, Couper 1952) could represent fruit which had floated from elsewhere and not necessarily have grown in situ. The best argument so far put forward in support of a Melanesian origin is that of Lepesme (1947), who drew attention to the high proportion of insects in the Melanesian region which have coconut as a primary host. He also supported the thesis that one animal, the coconut crab (*Birgos latro*), has a close biological association with the coconut. More recently it has been suggested that this land-living crab could not have achieved a widespread inter-island distribution with only a 30 day aquatic larval stage unless the post-larval glaucothoe stage was spent in the moist husk of a free floating coconut (Harries 1983). Evidence for wild type coconuts actually growing in the region has been found in Vanuatu where fossil shell and roots dated at 5,420 years before present apparently pre-date human settlement (Spriggs 1982). Taking all the foregoing factors into account, and using data from present day coconut populations in Vanuatu that have a large number of thick husked but comparatively small fruit it is possible to suggest an origin in the region of the Lord Howe Rise-Norfolk Island Ridge at a time when that fragment of Gondwanaland was submerging, some 15 million years ago (Harries 1978).

Dispersal

Natural dispersal by floating was readily accepted by earlier taxonomists but later workers assumed that coconuts were always closely associated with human activities and therefore were distributed by cultivation. Any references to wild coconuts, in the sense that they were indigenous and never cultivated, have been disregarded. For example, an excursion flora for Java (Koorders 1911) recorded that in 1889 such a form was easily recognized where it occurred on a remote coast by its very small fruit with extraordinarily thick and firm husk yet when a botanical reconnaissance was made of the area in 1957, coconuts were not even mentioned (Jacob 1958). Similarly, reports of coconut growing spontaneously at several points on the Queensland coast of Australia (Mueller 1867, Thozet 1869, Bentham 1863–1878) were ignored until recently when a self-sown coconut was found on a Great Barrier Reef island (Buckley and Harries 1984). Even in the Philippines, where coconuts have reached their most important commercial development and might be thought to have eliminated all progenitors, wild types can still be found (Gruezo and Harries 1984) close to the place where they were first described at the time of the 17th century European settlements (Alzina 1668).

Some of the antagonism against coconuts floating and establishing naturally arose from arguments about the Kon Tiki expedition (Dennis and Gunn 1971) because it was not even realized that the type of coconut in question was not the wild type. Only when it is understood that wild coconuts have particular characteristics and preferred localities is it possible to suggest what plant characteristics to look for and just where to look for them (Table 1).

In the absence of man and predatory animals such as pigs (the coconut crab might be considered a symbiont since its presence would aid natural selection for a thick husk and slow germination), coconut palms must have been restricted to the strip of beach just above the high water mark. Under exceptional circumstances Ernst (quoted by Beccari 1917) found strand plants, including coconuts, 300–500 meters inland after Krakatoa erupted in 1883 and fifty years later Hill and van Leeuwen (1933) reported forty-one germinating coconuts on the beach of the newly emerged Anak Krakatoa IV. Coral fringed islands, and particularly atolls, are preferred habitats and to get from one to the next the coconut must float. Thick-

Table 1. Characteristics of wild, domestic and cultivated coconuts.

	Tall Phenotypes		
	Wild	Domestic	Cultivated[1]
Predominant Form	Niu kafa Type	Niu vai Type	Introgressed
Where Found	Uninhabited islands isolated beaches	Certain isolated human settlements	Almost everywhere
Stem	Slender, curved, leaf scars are irregular	Robust, erect, base can be very large	Intermediate
Leaves	Long, may hang down when green	Not so long, rarely hang down	Intermediate
Flowering Pattern	Cross-pollination is not absolute	Cross-pollinated but selfed often	Intermediate
Fruit	Long, angular, thick husk	Spherical, thin husk	All combinations possible
Nut with Husk Removed	Ovoid or spindle shaped, thick shell, little water, thick endosperm, high oil content	Spherical to obovate, thinner shell, much water, thinner endosperm, lower oil content	All combinations possible
Germination	Slow	Fast	Intermediate
Growth rate	Slower	Quicker	Intermediate
Response to MLO Diseases	Susceptible	Tolerant	Intermediate
Response to Windstorm	Susceptible	Tolerant	Intermediate

[1] Wild and domestic types are also cultivated.

husked, long, angular fruit float better, the embryo is better protected (and so are any passengers, such as *Birgus latro*). Slow germination will allow longer distances to be traversed and germination data supports this. Even after 200 days from reaping, germination is not complete (Whitehead 1965).

However, a successful species such as the coconut keeps its options open and the germination rate is much quicker when the same type is generously supplied with fresh water. It is possible to show from the results of two experiments where coconuts were floated in the open sea, that such immersion can delay germination (Edmondson 1941). It has been argued that dormancy is induced and that germination is controlled, to a large extent by the osmotic potentials in the husk (Harries 1981*a*). For the wild coconut under atoll conditions the fruit that falls to the ground germinates slowly depending on how much rainfall there is and on the amount of shade. In this situation a seedling can be present to replace any mother palm that is destroyed by lightning, old age or pests, any time for the best part of a year after the fruit matures. The fruit that falls into the relatively calm waters of the lagoon does not get saturated with salt water. Instead, the embryo is in an aerated, humid and non-saline environment produced by continual absorption, diffusion and evaporation of water through the husk under the hot tropical sun. It germinates quickly, as Edmondson's floating experiment on a sea water reservoir demonstrated. The end result is, that by the time the seednut washes ashore at another part of the same atoll, where adult palms, seedlings and seed might have been destroyed and washed away by a windstorm or tsunami, it can already be growing and can thus maintain a population of coconuts with a common genotype against competition from other plant species.

On a coral island, the only other place that a coconut can fall is into the open sea where, due to normal wave action, it will

absorb considerable amounts of sea water into the husk, thereby inducing dormancy (Harries 1981*a*). If currents and winds are favorable this fruit might drift, along with any passenger crabs it may carry, to another coastline, perhaps one where coconuts (and the crab) do not already occur. Just how far this might be is a matter of opinion and computer simulation studies on long distance dispersal (Ward and Allen 1980) and plans for a free-floating experiment between mid-Pacific atolls and the coast of Central America must use the proper, wild type, coconut and take into account the possibility of sea-water induced dormancy.

It may never be known whether the coconut originated in the Indian Ocean or the Pacific Ocean or somewhere in between but wherever it started from, given enough time the truly wild coconut could, and probably did, spread from island to island as far as the Seychelles Islands to the west (Sauer 1967) and the Line Islands to the east (Beccari 1916*b*). It is also probable that the coasts of Africa, Asia, Australia and America did receive, and still do receive, coconuts that have floated from oceanic islands. These islands, which on a geographical time scale are constantly changing their size and position, have acted, and still act, as a natural conservatory for coconut genetic resources, at least for the wild type.

Domestication

Once the coconut came into contact with man there would be selection pressure for other characteristics that were unimportant to the wild type, or indeed downright disadvantageous to it. These characteristics represent the results of domestication, not agricultural cultivation which did not happen till very much later. Unconscious selection pressure for many generations (both human and coconut) improved one characteristic, the water content, and other changes depended on this. The first human contact with a coconut must have been on the sea-shore and it is possible to argue that the sea-shore is an optimal habitat for both man and the coconut. The coconut is a source of drinking water, and one that can be obtained without digging and without tools. The immature fruit is simply banged on a rock to split it. Originally, man may just have been another predator, picking up and eating coconuts that floated ashore, even as Australian aboriginal children do today (Hynes and Chase 1982). Mature palms might be considered tabu and would certainly not willingly or easily have been cut down until good steel axes became available. If the Vanuatu fossil shows that coconuts grew there for at least 2,000 years before the present Melanesian people reached these islands then, in the same way, it may have been the presence of the coconut palm, purely and simply as a source of water, that assisted the aboriginal migrations from Asia to Australasia at an earlier time. An even more radical idea is that man and the coconut may have been interdependent, in much the same way that the robber crab and the coconut may have been, and at a very early, possibly aquatic stage in human evolution (Harries 1979).

The contrasts between the characteristics of the wild and domestic coconuts (Table 1) reflects the contrasts between the environments in which the first evolved and the second was domesticated. For the wild type the curved stem allows palms to lean out over the water, gaining space and light, effectively increasing the leaf and fruiting functions despite the limited rooting area on a narrow beach. In contrast the domestic type develops a sturdy bole and erect stem to withstand hurricanes and compete with other tree crops. The wild type is susceptible to certain (MLO) diseases because it was isolated from infection whereas the domestic type show tolerance brought about by repeated exposure to infection (Harries 1978).

At some stage the domestic type would have been taken a little way inland around coastal and river settlements on the con-

tinental mainland and the larger islands of southeast Asia. The two types would remain geographically isolated from one another and the domesticated coconut would be preferentially planted in new settlements, for instance, those made by Polynesians on isolated Pacific Islands. At about the same time it was probably carried to India (Mayuranathan 1938). In Africa, coconut dissemination did not follow the route that bananas took—overland from east to west across the continent—but they were carried by sea to a specific region and within a specific 50 year period. The Portuguese took the predominately wild type from the western Indian Ocean into the Atlantic Ocean, around the Cape of Good Hope to the Cape Verde region between 1499 and 1549 and from there it went to the Caribbean and to Brazil (Harries 1977). Nor were coconuts carried across the Central American isthmus by the Spaniards as is often supposed. The Spaniards took the predominately domestic type from the Philippines after 1650 and disseminated them along the coast of Central and South America. The type of coconut found on the Caribbean coast of America is totally and unmistakably different from the one on the Pacific coast. It was realization of this fact that gave the original clue to the recognition of wild and domestic types. Not until there was extensive river travel during the Californian gold rush, around 1850, and again after 1915 when the Panama Canal was opened, did the two types come into contact there (Richardson et al. 1978).

Elsewhere the two contrasting types the wild and the domesticated have undergone introgressive hybridization whenever they have been brought into proximity because there seems to be no barriers to cross-fertilization.[2] The introgressed populations which developed show characteristics of both types or some intermediate condition. They are so common and yet so variable—both within populations and between populations—that calling any of them *typica* is meaningless. Yet, once industrial demand for vegetable oil production accelerated in the 19th and 20th centuries, all the forms—the introgressed, the domestic and even the wild—have been taken into cultivation.

A convenient way to distinguish wild, domesticated and introgressed populations is by fruit component analysis. The wild, or Niu kafa type, is found to have a higher proportion of husk and a slightly lower fruit weight than the domestic or Niu vai type. The proportions of water, shell and endosperm also differ in characteristic ways. The great advantage of fruit component analysis is that it avoids the subjective descriptions upon which previous classifications were based. It has already been used to generate data from many 10-nut samples taken in the field during germplasm collecting expeditions, from larger samples on agricultural research stations and even from 10 thousand-nut samples on commercial estates (Harries 1981*b*). However, many more data need to be accumulated and correlated with other studies, such as germination rates and so on, before coconut varieties can be considered to be well and truly documented.

Finally, even the shapes of the nuts are diagnostic and make it easy to distinguish the wild and domestic types. This observation has been applied to interpretation of archeological coconut remains from Brunei in Borneo (Harries 1981*c*).

Conclusion

Wild, domestic and cultivated coconuts are quite distinct in all biogeographical features except one—they can interpollinate—and the resulting introgressed populations have made classification difficult in the past. The conditions under which

[2] Dwarf coconut types (with the exception of the Niu leka, or Fiji Dwarf type), are fundamentally domestics since they cannot survive without human involvement. They show predominately domestic characteristics and, in particular, very bright fruit colors.

coconut evolved can be quite precisely specified as can the purpose for which it was first domesticated. The isolated conditions still exist today and the coconut palm can be found growing in its original habitat where it will continue to thrive, with or without human intervention. But the importance of the domestic form was displaced by the production of copra and this, in its turn, has been superseded by other sources of vegetable oil. The coconut can be considered as perhaps the most successful member of the world's oldest and most durable ecosystem. It is also the most widespread and well known tropical tree crop. The coral reef ecosystem is constantly changing its form and as a result the precise location of a center of origin for the coconut will probably never be known. The agro-industrial specifications for the cultivated form of the coconut are not inflexible and the type that has the highest oil content, which does not deteriorate by early germination and which has many small fruit suitable for mechanical processing—the wild type—may yet again come into its own as a renewable energy resource wherever and whenever nuclear or fossil fuels are not available.

Acknowledgments

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CHAPTER NEWS AND EVENTS

South Florida Chapter Adds Palm Accent to Miami Metrozoo

In probably the most ambitious landscaping enterprise undertaken by a plant hobbyist group in Florida history, the South Florida Chapter of the International Palm Society in 1991 completed the third, and largest, phase of a project that has added more than 800 palms to the grounds of the Miami Metrozoo (Figs 1–12).

The figurative seeds of our presence at the zoo were sown at a Chapter meeting in February 1981. With excess money in our treasury for the first time, thanks to two consecutive successful sales, members voted to create a Community Service Committee to recommend avenues for distributing Chapter funds in support of palm-related projects. For reasons to be elaborated below, Metrozoo was soon placed on a list of potential recipients.

Since that meeting, the Chapter has supported many other projects, donating palms for plantings in Dade, Broward and Palm Beach Counties and funds for palm-related research by both the University of Florida and Fairchild Tropical Garden. The Chapter has also financed the printing of 4,000 "Plant a Palm" bumper stickers for public distribution, initially in support of the Repalming Project of Agricultural Extension Agent Bill Moore and, since his retirement, as an independent effort. The popular stickers have been reprinted several times. We have been active outside South Florida as well, contributing $12,000 for color plates in *Genera Palmarum* and making donations for structural upkeep and descriptive markers at The Retreat Estate in Nassau.

But easily our most visible community service undertaking has been the Metrozoo Project. In July of 1980 the zoo opened with a 25-acre preview phase on an expansive tract of land once used as a blimp base by the United States Navy.[1] Landscape materials were generally small and

[1] The predecessor to Metrozoo was Crandon Park Zoo. Its beginning was modest: In 1948, a traveling circus went broke and settled its debt to the county by giving up its entire animal collection—about two black bears, two monkeys and a goat. Eventually Dade County developed 25 acres of a 45-acre parcel on Key Biscayne, just a few miles southeast of downtown Miami. However, its fixed boundaries precluded significant expansion, and its island location made it vulnerable to hurricane tidal surges (in 1965, Hurricane Betsy left Crandon Park under three inches of water). Consequently the county and the Zoological Society of Florida sought a larger, inland site. In 1972 voters approved a bond issue to fund a new zoo, and in 1974, following protracted negotiations, the federal government donated a tract of about 740 acres to Dade County to house the new facility. In 1975 construction was begun on Metrozoo's first two improvements, a perimeter moat and a quarantine building.

The land now occupied by red kangaroos, white tigers and golden lion tamarins has always had a colorful history. In World War II, when it was known as Richmond Naval Air Station, blimps and conventional aircraft occupied a trio of 1,000-ft. hangars which were among the largest wooden structures in the world. Unfortunately, even in Florida's soggy summer climate wood can burn, and in 1945 fires—ostensibly sparked by hurricane-generated tornadoes and lightning—put an end to U.S. air supremacy over the Orange Bowl. But there were immediate and strong suggestions that it wasn't Mother Nature who torched the hangars.

Two decades later, just after parting with the land, the federal government decided to remove some quonset-housed equipment from the property. This sounds tame enough, except that the movers did their work undetected in the middle of one night, and the equipment turned out to have been owned and operated by the CIA as its communications base for Central and South America.

But what the neighborhood now lacks in flammable buildings and after-hours excitement, it makes up for in incendiary politicians: Since early 1990 the Metropolitan Detention Center next door to the zoo has provided a home away from home for Panamanian Gen. Manuel Noriega. Gen. Noriega reportedly has been too busy to join the Palm Society.

particularly bereft of palms—only five species had been incorporated into the design. The potential for a Palm Society role was enticing, if not yet well-defined. Though dialogue between the Palm Society and Metrozoo had actually begun some years earlier with efforts by Paul Drummond, a series of personnel changes on the county side disrupted continuity, and the venture lay dormant until revived by the Community Service Committee.

In the fall of 1981, the Chapter Board initiated Phase I of the Zoo Project by voting to buy five field-grown royal palms. The following April, with the onset of consistently warm weather, members helped plant the palms in a prominent location on the north shore of the central lake. Later in 1982, as zoo administrators recognized the seriousness of our commitment, they provided fenced, irrigated nursery space on the property.

Initially, plant acquisitions for the nursery came through member and institutional donations. Daniel and Jane Lyons started the ball rolling with a generous contribution of Malayan coconut and royal palms. Plants have also been obtained by purchase and trade from time to time, but the greatest number of species has come to the nursery in the form of seeds provided by the State Coconut Orchard, Fairchild Tropical Garden, the Palm Society Seed Bank and Chapter members.

Since its low-key beginning, the Zoo Project has placed palms into the landscape regularly. In 1983, members dug and moved several species of palms donated by longtime members Lillian and William Hodgin. Some of the trees were installed in the Wings of Asia aviary during the year prior to its official opening in December of 1984. Later additions to the aviary include spiny specimens of *Aiphanes* and *Astrocaryum* donated by Jean and Clyde Wooten and transplanted by members perhaps best described as masochists. Now over 50 species in addition to the original 15 have found a home in the forest-like acre-and-a-half bird sanctuary.

Phase II of our endeavor commenced in November 1984, when Chapter volunteers planted a grove of over 60 coconut palms on a lawn across from the zoo water-

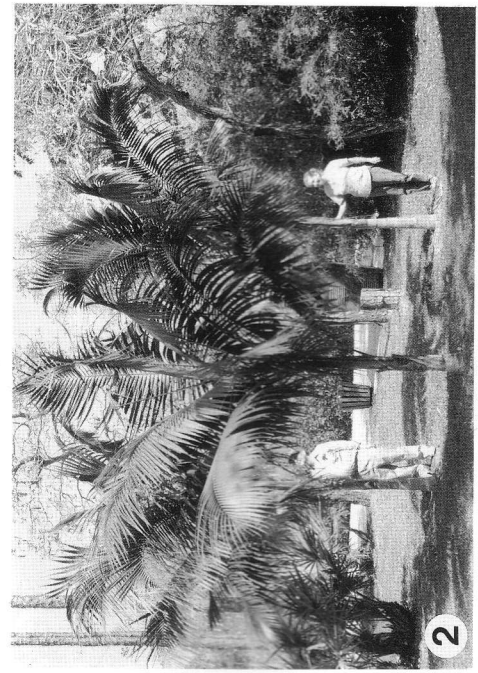
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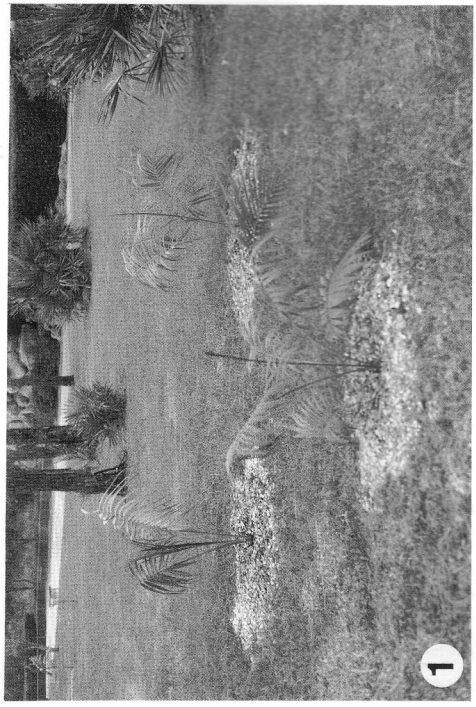
1–4. 1, 2. Perhaps because of slow seedling growth, *Heterospathe* is much underused in south Florida. But as these photos show, patience is rewarded. Planted out from two-gallon containers in late 1987 (Fig. 1), the trio of Pacific palms, probably *H. elata*, has attained impressive proportions when inspected by Frank Hausman and Louise Futch in the spring of 1992 (Fig. 2). 3, 4. A field traversed by the zoo monorail was planted out in Phase III of the Chapter project with *Wodyetia* (foreground), *Coccothrinax* spp. (midground) and *Bismarckia* (background), shown here in October 1988 (Fig. 3) and April 1992 (Fig. 4). Though most of the planting holes at this site had to be chipped out of rock with hand tools, growth of all palms there has been vigorous.

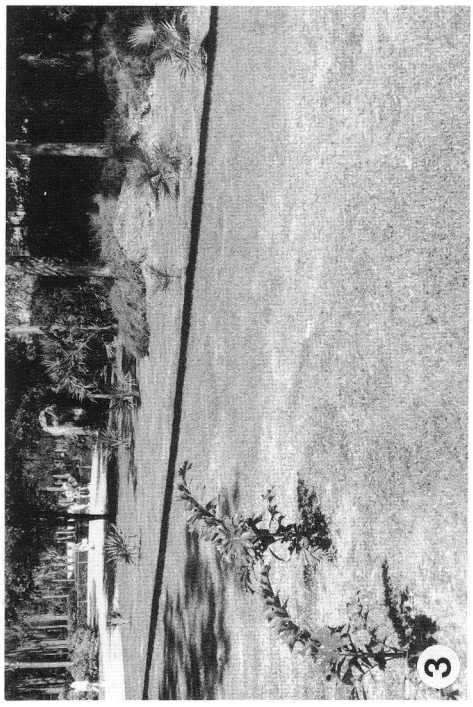
5–8. 5, 6. Since planting day in October 1985 (Fig. 5), the unirrigated Entry Mound has proven to be well-suited to several eastern hemisphere palm species: *Livistona decipiens* and *L. mariae* (background, L to R); and *Arenga engleri*, *L. carinensis* and *L. drudei* (foreground, L to R). Thirstier *L. saribus* stands rather modestly next to Petersen family plant fanatics, newcomer Caitlin and old hands Bob, Krystal and Heather (L to R) (Fig. 6). 7, 8. A dry field adjacent to the entrance road was selected for heavy landscaping with Maypan coconuts. Photos show the palms in late 1987 (Fig. 7) and April 1992 (Fig. 8), by which time they had obscured a long section of perimeter fence. The only freeze loss in this area was the straggly hardwood seen in the photo at left.

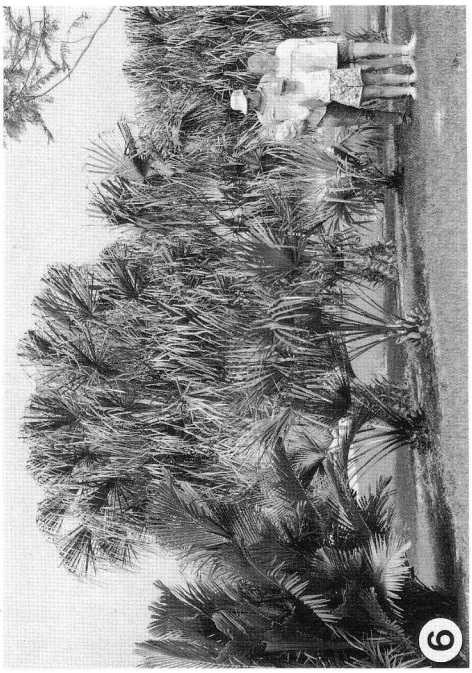
9–12. 9, 10. Though fairly tender, the tall-growing *Veitchia* species are fast growing and undemanding in south Florida. The five in this planting are shown in shots taken 4½ years apart (Figs. 9–10). In this genus, lethal cold damage may not become manifest for many months after a freeze. 11, 12. *Bismarckia nobilis*, a palm practically unavailable in south Florida in 1981, has since been popularized almost entirely through the efforts of palm growers who participate in the Chapter's sales. *Bismarckia* is particularly well-suited to the wet summer/dry winter moisture cycle. Those shown here are as they appeared in autumn 1985 (Fig. 11) and spring 1992 (Fig. 12) and are not under irrigation.


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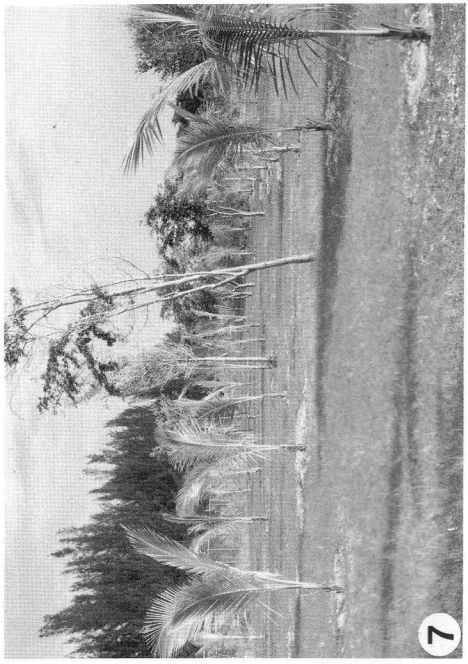
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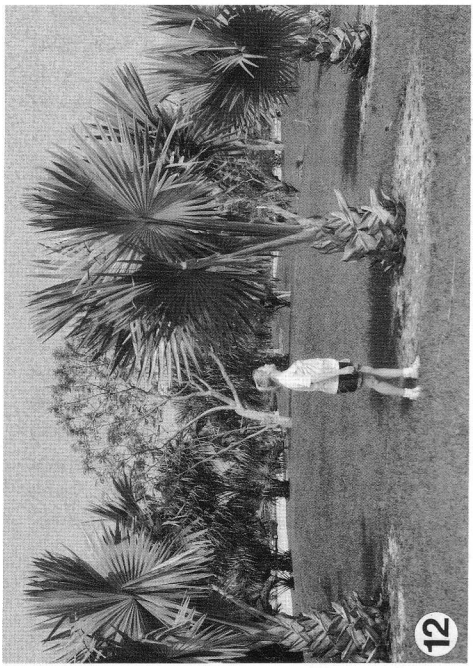


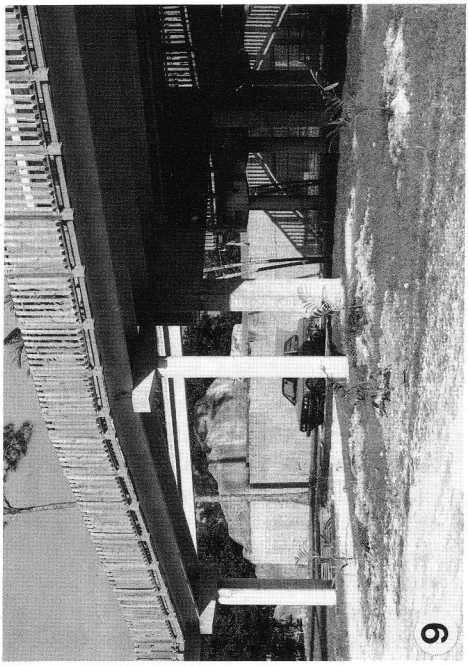
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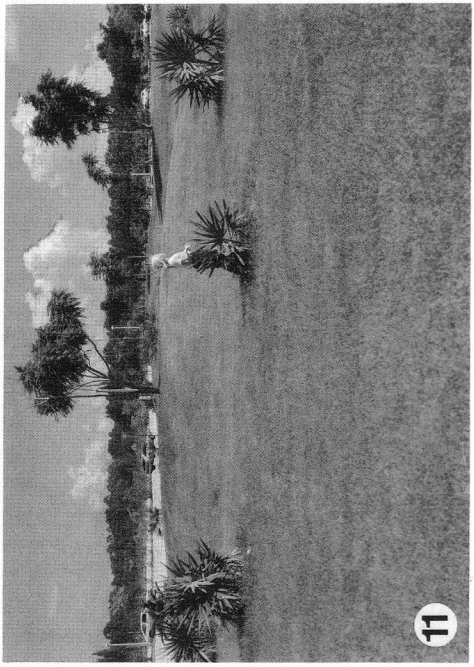


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fall. Members planted Maypan, Panama Tall and three Malayan Dwarf varieties, but there remains room for Red Spicata, Fiji Dwarf and other varieties and hybrids expected to become available in the future.

In late summer of 1985, the Chapter paid for root pruning and moving a *Bismarckia* specimen donated by Marge Corbin. The 30-foot tree almost certainly represents the largest *Bismarckia* ever moved successfully in Florida, and it now occupies a prominent position in front of the waterfall. In October of the same year, we began landscaping the Entry Mound and Promenade, a T-shaped feature that extends a thousand feet from the end of the main road to the large *Bismarckia*. The space on and around the mound was planted with 16 palm species in the first stage of a plan developed by landscape architect Allen Fernandez. Species were chosen with an eye toward their suitability for an area exposed to winter winds. Included in the planting were several old specimens of the Silver Palm, *Coccothrinax argentata*, which in 1983 had been moved at the eleventh hour from a native area about to be cleared on Big Pine Key. They were grouped with other Silver Palms donated by member Colleen Boggs. The Promenade itself, flanked by eight grassy parallelograms on each side, was planted with royal palms in the initial step toward establishing a species grouping reminiscent of that depicted on the front of the Society's old Invitation to Join.

In 1986, in connection with expansion of Metrozoo's African lobe, the county landscape architect incorporated about 55 palms of six species from the Society's nursery. The largest palms planted were specimens of *Chrysalidocarpus cabadae* and *Neodypsis decaryi* that we had moved to the nursery a couple of years earlier from the yard of Frank Hausman. Also during the summer of 1986, chapter members twice undertook the arduous task of digging and moving *Rhapis excelsa* from a large, dense clump donated by Mrs. Hodgin.

By 1987 the South Florida Chapter was primed for its most significant effort at Metrozoo. Not only had the grounds been expanded from 25 to 290 developed acres, but the palm nursery had burgeoned as well, from 91 plants at the beginning of 1983 to almost 5,000 four years later. Clearly a major landscaping project was feasible, but planting in southern Dade County is not as simple as pushing a shovel into the ground. In fact, it is nearly impossible just to push a shovel into the ground. What passes for soil in much of the area is oolitic limestone, a material perfect for holding up buildings, but somewhat less suited to supporting plant life. At best, the limestone resembles Swiss cheese and contains varying amounts of sand. At worst, the rock is solid and extremely dense, with limited porosity and permeability. 95% of zoo property consists of that execrable oolite.

In order to provide a satisfactory planting environment in the limestone, it is advisable to excavate a hole. Because county budgetary conditions since 1985 have made it impossible for Metrozoo to hire augering services, the Palm Society chose to take on the responsibility. The Chapter hired a drilling contractor who used a 36″ bit to auger about 600 holes at a cost of just over $6 a hole. At Fernandez' recommendation, most of the holes were drilled 36″ deep, opening up a 158-gallon "container." Only where the rock was more porous or utilities ran beneath the planting site were shallower holes bored.

Fortunately, in many cases the auger-crushed limestone yielded sufficient organic material to permit backfilling almost entirely with what came out of the ground. However, in areas where the rock was nearly white and thus almost devoid of nutritional value, the holes were filled with a replacement soil provided by the zoo. The remaining holes were not augered.

Some had been drilled previously by the zoo for landscape materials, but abandoned for one reason or another. Others had to be chopped open with a digging bar or mattock because electrical conduit or water pipes near the surface made it dangerous to drill with motorized equipment. Only a tantalizing half-dozen holes, less than 1% of the total, could actually be dug with just a shovel.

Planting of Phase III began on a hot, steamy August day (pardon the redundancy) in 1987 with a force of 18 volunteers, some not even Palm Society members. Before a mid-afternoon electrical storm broke up the party, the workers had set out over 100 coconut palms, mostly Maypans, along the flanks of the long Metrozoo entrance road. Ultimately about 180 coconuts were installed on the roadside. Most of those plants had been grown in the nursery from Maypan seed provided by the State Coconut Orchard run by Palm Regeneration Specialist Bill Theobald. The orchard was established at Chapman Field in 1977 to create a seed source for Lethal Yellowing-resistant coconuts and to distribute them to South Florida municipalities and other governmental entities. Many of the palms that germinated in the nursery in 1983 had reached the 8–10 foot range in four years and made an immediate impact on roadside scenery.

But much smaller materials also have been incorporated successfully into the landscape. Zoo officials, to their credit, never have pressured us to provide instant size in palm plantings, understanding that the Society's goal is to introduce as wide a variety of desirable palm species as will succeed under the climate and soil conditions of Metrozoo. Consequently we have been able to set out rare or otherwise notable palms without having to confine them to container culture for many years.

And with the benefit of almost a decade of experience on site, the Chapter has actually been able to expand its original list of tolerant palms. Despite the zoo's inland location six or seven miles from Biscayne Bay, it stays relatively warm in winter because it is situated on pineland, which means that the coldest air drains into subtly lower surrounding land. Moreover, efforts have been made to plant the more tender palms in microclimates created by shrubbery, trees or buildings that afford some protection until the plants become more mature. Barring the freeze of the century, most of the palms used there should tolerate winter conditions quite well.[2]

In the design of plantings in or behind public areas of the interior zoogrounds, we followed several guiding principles: (1) wherever possible, palms have been planted in colonies, using at least three plants of a given species; (2) in areas large enough to accommodate several colonies, attention has been paid to incorporating a variety of shapes, textures, and hues; and (3) the palms have been afforded optimum visibility. This means more than just planting near public walking paths; several tall-growing species have been situated behind animal paddocks in order to enhance background scenery and avoid disrupting scale.

Another strong element influencing design is the monorail which runs throughout the zoogrounds. In the flatlands of Miami, a monorail is as good as a mountain, and many plantings have been placed so as to afford riders an overview of palm crowns. In fact, this dimension has per-

[2] This does not mean that the plants are left to the whims of nature. When a severe cold snap occurs, Palm Society volunteers spray a mix of manganese- and copper-based fungicides into the buds of all but the most hardy palms to ward off secondary infections. The treatment should be applied as soon as possible after the event, then repeated about 10 days later. This tactic paid off following two nights of freezing weather at Christmastime 1989. The combination of fungicide and above-normal January temperatures succeeded in keeping losses under 2½%. The warm weather appeared to push damaged or necrotic foliage out of the bud area, where it might otherwise have wreaked havoc.

mitted us to landscape a large, open plain in a non-public area behind one of the four monorail stations. We were thus able to plant colonies of *Veitchia*, *Bismarckia*, *Thrinax*, *Gastrococos*, *Elaeis*, *Chrysalidocarpus*, *Corypha*, *Roystonea*, and several species of *Livistona*. The station itself proved an ideal structure around which to transplant three pairs of 25–30 ft. *Ptychosperma elegans* which were beginning to press against the screen that encloses the aviary. We hope to continue in the future to relocate palms which have outgrown the aviary and replace them with younger specimens raised in the nursery.

As a result of Phase III of our project, some 50 additional palm species have been incorporated into the zoo landscape. Many interesting vistas will mature in upcoming years, but perhaps the most striking plantings will be those where the vast zoogrounds permit the use of species almost never seen in large colonies elsewhere in South Florida: 29 specimens of *Corypha umbraculifera* (Talipot Palm), now 7–9 years old, have been situated throughout developed areas of the property in several groups, the largest of which number nine and 10 plants, respectively. 44 seedlings of two *Borassus* species, *flabellifer* and *aethiopum*, have been used. The largest colony consists of 29 plants bordering a lake in the African lobe, and the site has room for expansion. A grove of 27 *Copernicia baileyana* plants has been introduced along the approach to the popular aviary and will grow up slowly on both sides of the monorail at a point just before the guideway passes into the aviary.

While more than 40 members of the South Florida Chapter have worked on the Zoo Project at one time or another, special recognition is due the core of volunteers who performed yeoman's service in response to the scale of the Phase III planting. For Louise Futch, Bob Grimm, Frank Hausman, Stanley and Mary Kiem, Bob Petersen and Anne Throssell, this meant coming to the nursery on many unscheduled workdays.

Though Phase III persisted beyond the end of the decade, the bulk of the planting activity was done from late 1987 through early 1989. During that time, a major boost was provided by members of Boy Scout and Explorer Scout troops who participated in separate planting days. Their efforts significantly increased the number of palms that provide the backdrop to animal exhibits. Some of the trees are already visible from hundreds of feet away, enhancing the element of depth in the landscape.

But even as Phase III was rolling toward completion, there arose a series of activities which might collectively be labeled Phase IV of the Metrozoo Project. In 1989 the Chapter began participating in Earth Day events at the zoo. A very enthusiastic group of volunteers has worked with us: Students from a Dade County science/math magnet program at Richmond Middle School coordinated by Meri Cummings. On the past three Earth Days, these potential scholars and leaders have planted specimens of *Thrinax morrisii*, *Areca vestiaria*, and *Ravenea rivularis*. For both local and global reasons, we hope that a Palm Society Earth Day planting will continue to be an annual rite at Metrozoo.

Another very strategic part of Phase IV is the increasing focus on the upkeep of palms in the ground. A lot of the guidance in this area has come from Bill Theobald, a man who wears many hats around South Florida: State forester, member of the Chapter Community Service Committee, editor and ex-officio board member of Trees for Dade, liaison to the Texaco/Global ReLeaf urban reforestation program,[3] and

[3] Global ReLeaf is a program of the American Forestry Association. Since 1990 the A.F.A. has been in partnership with Texaco to conduct tree-planting projects in cities around the United States. In both 1990 and 1991 Texaco granted $1 million to support the enterprise.

avid power-boat skipper. In 1991 Theobald managed to juggle the first four hats at Metrozoo, not only coordinating the planting of much-needed shade trees, but also devising a comprehensive maintenance plan for trees and palms on the interior grounds. Integral to this program is the use of Palm Society and Forestry Division volunteers to help fertilize, mulch and occasionally prune the broad array of ornamental materials in the landscape. While, in the ideal world, government would be expected to provide continuity for its programs, in real-life 1990's fiscal inadequacies make it imperative that concerned citizens participate directly or risk stagnation of projects which are valuable and worthwhile, if not essential, to the vitality of a community.

What lies ahead in the immediate future for the Zoo Project? This year is bound to be a busy one for the Palm Society at Metrozoo, for in addition to the Chapter's usual activities, the 1992 Biennial Meeting will make a stop there. Visitors will be able to see the animal collection and park grounds by foot, monorail or tram. And in a quieter moment, the Chapter will dedicate a commemorative plaque in honor of Ed McGehee, whose election to two terms as president of the International Palm Society was only one manifestation of an abiding interest in conservation causes.

What lies ahead in the long run for the Palm Society Zoo Project? Certainly no predictions can be made with crystal-ball certainty, especially when the object of our affection is an arm of government, subject to the Byzantine vagaries of politics and budgets. However, we have reason for optimism. In a region where most of the oldest institutions have yet to crack the century mark, Metrozoo is still a baby. We trust that as the zoo's reputation grows, both its animals and plants will mature into a showcase for this community.

In closing, not enough can be said of the cooperation received from the administration and staff of Metrozoo at all stages of the palm project. Typical of that support has been work by zookeepers in the aviary to dig up overgrown palms so that they could be transplanted instead of cut down. But the warm relationship between Palm Society members and Metrozoo employees is, after all, understandable, for it brings together individuals with a special respect for living things. Long may it continue.

LEONARD GOLDSTEIN

Metropolitan Miami became the initial beneficiary of 1991 funding, following first-year recipients Houston, Denver, New Orleans and Charleston. The $250,000 provided for "Leaves Over Miami" has been allocated among Metrozoo, Dade County Public Schools, Habitat for Humanity and Trees for Dade. The zoo's share of the gift covered purchase, installation and irrigation of 59 large specimens of live oak, mahogany and black olive.

Palm Society Plants Palms at the Peace Arch

Several months of effort came to fruition on April 4, 1992, when three palms were planted within yards of the historic Peace Arch at the Canada–USA border between Washington and British Columbia (Fig. 1).

Peace Arch Park straddles the 49th parallel, often called the longest undefended border in the world. At the point where the border meets the Pacific Ocean, a beautiful white arch was erected in 1914 to commemorate 100 years of peace between Canada and the United States. U.S. Interstate Highway 5 runs through the park and becomes Highway 99 in British Columbia. This is the busiest border crossing west of the Great Lakes, 2,000 miles to the east.

Members of the Pacific Northwest Chapter of the IPS were instrumental in this project, originally suggested by Pacific Northwest Palm & Exotic Plant Society member Tim Murray of Bothell, Wash-



1. Palms at the Peace Arch.

ington in August, 1991. Tim thought palms would be a pleasant diversion for people waiting to cross the border and a reminder to travellers of the area's benign northern climate. Of course, it would be good publicity for the Park and the Palm Society.

The PNWP&EPS executives supported this bilateral project and funds were approved at the November 1991 meeting. Both Canadian and U.S. Park officials responded favorably. Tom Poploski from the Washington State Park Service got the ball rolling by selecting a site. [The final location was changed at the last minute to a spot adjacent to I-5, about 60 yards (55 meters) south of the 49th parallel.]

Tim Murray and Michael Furguson obtained prices from nurseries on both sides of the border. Two *Trachycarpus fortunei* were purchased from Don Platter of Platter's Palms of Issaquah, WA. Society member Gerard Pury of Vancouver donated a smaller palm to complete the arrangement. It is appropriate that the palms in the planting came from both sides of the border.

On April 4, the palms, society members, and park officials were all on hand. With a little help from everyone, the palms were planted in less than two hours.

Like the Peace Arch itself, this project is another symbol of the goodwill and cooperation which exists between Americans and Canadians and is a statement on the duality of the PNWP&EPS Chapter of the IPS.

NICK PARKER
North Vancouver, B.C.

Hawaiian Palm Giveaway

In early December of last year, Hawaii Island Palm Society members received a notice from the chapter that seemed too good to be true. The flier promised "The Great Ninole Palm Giveaway" and was emblazoned with the words, "Free Palms."

It included the message, "Bring anything that would be helpful to you in moving large quantities of plants," and "If you have a pickup truck, bring a tarp—you will probably fill your truck." Words like

these cause dilation of the pupils and an elevated heart rate in any palm person worthy of the name. The flier also advised, "We plan to control the giveaway to the degree necessary to assure fairness; what one gets won't be dependent upon the size of his elbows. . . ."

A call to chapter president Dave Sylvia confirmed that the announcement was for real. There were thousands of interesting palms to be given away, growing in everything from seedling flats to five-gallon bags. Dave expressed his concern with keeping things orderly—to keep palm lust from turning to confrontation or even violence.

On Sunday, December 15, with clear skies all over the Big Island and temperatures in the high seventies, the parking lot of Waikaumalo County Park on the Hamakua Coast was packed with trucks, vans, and cars by noon. Chapter members milled everywhere, most of them carrying boxes and nursery flats to haul away the anticipated loot. The crowd was concentrated around the pavilion, where the palms waited.

The event was organized like a supermarket shopping spree, in which winners have a limited time to load a shopping cart. Participants were to be admitted in lots of ten at a time, each of which would have five minutes inside the pavilion to load as many plants as members could on the large nursery flats provided for them. Members drew numbered tickets from a paper bag to determine the order of entry. Several spouses and friends of chapter members, who had been tagging along to chapter events for years, experienced sudden conversions and paid dues on the spot for the privilege of taking a number.

Hawaii Island Palm Society members are an experienced group, and they came prepared with labels, pencils, plastic bags, flats, boxes and grubby clothes. As the final preparations were made, they greeted old friends and discussed strategies and priorities as they edged around the pavilion perimeters to survey the waiting palms.

Several lists of the giveaway palms, by genus and species, were posted. Members unfamiliar with one or another of them asked all comers for information: "How big does it get? What does it look like? Does it like shade? Will it grow at my elevation?" Everyone had his strategy as to which palms to go for first. As the clock ticked down, *Iriartea*, *Wettinia*, and *Socratea*, in the far corner, seemed high on nearly everyone's list.

Concerns that the event would turn into a riot proved unwarranted, as participants kept their sense of humor and their manners. The scene was comic as participants struggled with burdens and bystanders called out advice. As it turned out, there were plenty of palms for everyone: the groups of 10 got as many as four five-minute turns to load up.

At the end of each five-minute opportunity, participants struggled to their vehicles to unload and then returned to wait their next turn. Despite intense efforts to memorize the names of unfamiliar palms grabbed on the fly (most of the specimens were unlabeled, with only a nearby sign to identify them), everyone learned once again how much alike most young palms look!

According to organizers of the event, sixty-one members participated, with a total attendance of 80 to 90 people. Before the giveaway, a drawing was held for a *Phoenix reclinata* in a 25-gallon bag. This was won by Earling W. Hedemann, Jr., of Hakalau. The donated palm was grown by Don Hendrickson of Pahoa.

Chapter officers said that the source of the palms, who wished to remain anonymous, was a "significant collector and grower," who decided to switch from unusual palms to raising more commercial varieties. The grower contacted Hawaii Island Palm Society members Roger Fischer and Grace Kissell, who conceived of the Great Palm Giveaway. Roger, Grace, Dave Sylvia and other members spent several days moving the plants, first to Roger and Grace's driveway, which they nearly filled, then to the park in Ninole. According to Roger, there were 4,000 plants in indi-

vidual pots and thousands more seedlings in community trays. There were more than 50 species, including *Areca vestiaria*, *Asterogyne martiana*, *Astrocaryum standleyanum*, *Bactris* sp., *Carpentaria acuminata*, *Chamaedorea* spp., *Geonoma congesta*, *G. densa*, *G.* spp., *Hyophorbe verschaffeltia*, *Iriartea* spp., *Laccospadix australasica*, *Pholidostachys* spp., *Sabal mauritiiformis* and other *Sabal* species, *Socratea* spp., *Wettinia goffits*, and another *Wettinia* species.

After the event, there were exhausted smiles all around. An informal survey a few weeks later indicated that casualties amongst the stressed-out plants were minimal. Human casualties were zero. In response to speculation concerning who donated the plants, or why, member Richard Myers summed up the Great Ninole Palm Giveaway best, "The island is the richer now because of this donation to the members."

KEN BANKS
Pahoa, HI

Florida First Coast Palm Society

On March 14th, the FFCPS attended a joint meeting with the Central Florida Chapter at Ed Hall's garden. This meeting coincided with the plant show at Les Gardens.

The FFCPS met April 18th at the Palm Garden of FCCJ, South Campus, located in Jacksonville, Florida. It was a working meeting for the Palm Garden maintenance (pruning, fertilizing, etc.) and was well attended. Several members commented on the lack of winter damage due to the mild winter (only one or two nights in the 20° F's). Some members donated palms to the Palm Garden, adding to the extensive list of palm species and hybrids on display.

After the working session, a meeting was held during which a new slate of officers was elected. See roster in this issue for results. Discussions were held on a possible field trip to the FIT palm garden in Melbourne, FL, this spring, and a barbecue at Jim Menge's home/garden on September 13, 1992. Several members volunteered to produce a pamphlet on palms recommended for northeast Florida gardens.

DOUGLAS HOWK
Jacksonville Beach, FL

Sydney (Australia) Chapter News

The group met at the Maiden Theater, Royal Botanic Gardens, Sydney, on Tuesday, March 17th at 7:00 PM. The new Chapter President, Peter Byrne, gave a slide presentation on his recent trip to Tahiti. The next weekend, March 21–22, the chapter had a stall for exhibition and sale of palms and cycads at the St. Ives Show. The Sydney Branch also held an outing to the Central Coast on Sunday, April 26th. Paul Anderson led the group on an interesting walk.

In addition to his chapter Vice-Presidential duties, Peter Kristensen has taken over from Paul Anderson as Editor of *Principes Minor*, the magazine of the Sydney Branch of PACSOA. Many thanks to Paul for a job well done over the last several years. The March 1992 issue of *Principes Minor* has intriguing articles on two New South Wales cycads, *Macrozamia diplomera* and *M. stenomera*, by Paul Kennedy. Other articles in this series will be forthcoming in future issues. If you are interested in subscribing, please so indicate on the PACSOA membership application.

News from Southern California

Membership in the Southern California Chapter is currently over 650, with a marked increase in membership over the past two years. The January 1992 banquet had an attendance of 140 with a little over $1,700 taken in from the auction and raffle tables.

The May meeting of the Southern California Chapter was held at the home of Philip and Audry Keeler, 2242 Liane Lane,

Santa Ana, on May 23, 1992, starting around noon with a pot luck luncheon. The meeting included the customary raffle and auction.

The Ventura/Santa Barbara section's annual Tour of Lotusland was held on June 20, with the tour limited to 60 persons and 30 cars. Ventura College held a palm sale from 8:00 AM to noon, which facilitated car pooling from the college.

On Saturday, July 25th, the chapter will tour three mature gardens in the San Diego area with many rare species. The private gardens of Bill and Amelia Clark, Joe and Marsha Kelly, and Ski and Peggy Torzeski will be visited. A palm raffle and auction will follow the tour at the Torzeski garden. Contact an officer of the Southern California Chapter for additional information.

The Southern California Chapter recently announced three additional Patrons of the Chapter. Chris Hill, M.D., became a patron at the January banquet. John Tallman announced that Friends of the Ventura College Palm Garden will become a Patron. Subsequently, Lois and Kurt Rossten boosted their membership from Life to Patron. The IPS offers thanks and congratulations for this great level of local support.

Search for Mature *Syagrus*

Dr. Larry Noblick has recently finished his Ph.D. in Chicago and a flora for the state of Bahia, Brazil. He is now at Fairchild Tropical Garden, working with Dr. Sanders on a detailed study of *Syagrus* and its related genera (*Allagoptera*, *Butia*, *Elaeis*, *Jubaea*, *Jubaeopsis*, *Lytocaryum*, *Parajubaea* and *Polyandrococos*). Other genera now considered in *Syagrus* include: *Arecastrum*, *Arikuryroba*, *Barbosa*, *Ryticocos*, and *Chrysallidosperma*. Larry is especially interested in examining mature flowering or fruiting specimens on any of the above genera. If you have obtained trees or seeds from sources other than FTG, he is also interested in seeing your immature plants, subject to logistics of course. Call or write to Dr. Larry Noblick at FTG, Montgomery Foundation at 305-665-2844.

An interesting article reassessing the *Syagrus* collection of the Fairchild Tropical Garden recently appeared in the *Fairchild Tropical Garden Bulletin*, January 1992 issue. If this *Bulletin* isn't a regular addition to your library, you should strongly consider subscribing through FTG or joining the garden membership.

JIM CAIN

Two More Palm Societies Affiliate with the IPS

Two palm societies on two continents have requested IPS affiliation in 1992. Affiliation was approved by the Executive Committee subject to full board approval in November.

The West Palm Beach Chapter in Florida has been in existence for several years and has a very active group with several worthwhile civic projects.

The European Palm Society, with headquarters in the United Kingdom, was formed to help fill the void caused by the demise of the Temperate Chapter of the IPS. This group offers mainly a mail-order membership through publication of the journal *Chamaerops*. Six issues of *Chamaerops* have now been published. This is now a nice A-5 sized journal with color photographs interspersed throughout.

For information on joining either chapter or subscribing to *Chamaerops*, see details in the front section of your IPS roster enclosed with this issue of *Principes*.

Palm (or Palm & Cycad) Societies around the world which are not directly affiliated with the IPS are encouraged to consider such affiliation. The only requirements are:

(1) Chapter officers must be (or become) individual IPS members,
(2) The local society By-Laws or Articles

of Formation must not be in conflict with those of the IPS, and
(3) The local society President or Chairperson must request IPS affiliation.

There are no further requirements! The cost to the local society is zero. All directly affiliated groups have their contact and newsletter information listed in the front section of the IPS roster. In addition, all IPS chapters will receive a free subscription to *Principes* (or an additional one if already subscribing)! Come on in, the more the merrier!

South African Announcements

The Pretoria members of the South African Palm Society will take a stand at the Exotica meeting being held in October 1992 at Verwoerdburg. Members from other provinces have enthusiastically promised assistance with donation of plants.

The next SAPS Annual General Meeting will probably be held either at the "Lost City" or at nearby Kwa Maritane. Further details to follow.

The SAPS advises a new change in administration address. The correct administration address is now SAPS, 30 Charbury Road, Lynnwood Manor 0081, R.S.A. In addition, SAPS has increased membership dues for all classes of membership. See your new IPS roster for the updated rates.

South Queensland Group, PACSOA (Australia)

The PACSOA-SQG 1992 annual show and sale, held on March 7–8, was widely acclaimed as the group's best display ever. In spite of the recession, 1,600 entrance tickets were sold. Plant sales yielded a revenue for the Society of A $8,851 against costs of A $4,347, leaving a profit of A $4,504. This profit is used to partly cover costs of PACSOA publications, run the Seed Bank, and generally maintain the running of the Society. Even with the good revenues, there were many plants left over. Many exhibitors had the task of taking much of their stock back home.

In addition to the general display, there was a section on *Chamaedorea* which gave an indication of the great variety of plants making up this very interesting genus. This section was proposed in anticipation of the upcoming book *Chamaedorea Palms* by Don Hodel, being published by the IPS for release around August.

Another section features cold-tolerant palms and cycads. Again, this feature was in anticipation of the book *Palms and Cycads Beyond the Tropics* by Keith Boyer, soon to be published by PACSOA. This should be of great assistance to enthusiasts living in cooler regions.

The April 13th meeting featured Ray Baker of the Lyon Arboretum, Hawaii. Ray presented a slide show of palms, cycads and other plants from many parts of the world including Central America. The May 18th meeting featured Robbie Kelly (of the Sunshine Coast PACSOA branch) who spoke about his recent trip to Madagascar.

A camping trip is tentatively planned for Easter of 1993 (April 9–12) to the Carnarvon Gorge. This is highly recommended for those that can make it. The scenery and plant life are quite breathtaking. Due to the popularity of the gorge, bookings need to be placed one year in advance.

Central Florida Chapter News

The Central Florida Palm Society (CFPS) Chapter met on March 14th for a luncheon meeting. The day began at 10:00 AM with a tour of Ed and Nancy Hall's plant collection, followed by the meeting at the China Jade Buffet restaurant. Dave Besst and Ed Hall gave a presentation on their March 1991 trip to Mexico in search of *Chamaedorea stolonifera*. One specimen of *C. stolonifera* was available as a raffle plant. Also raffled was a *Rhapidophyllum hystrix*, donated by Anita Lee, and a beautiful wood carving by Bernie Peterson was auctioned with proceeds to the CFPS.

On the west coast of Florida, a meeting and tour of Richard Vlasic's garden in Naples was held on March 7th. Also, the annual USF Spring Sale was held on April 18th in Tampa.

News from South Florida

In addition to the November IPS Biennial events, future South Florida Chapter meetings are scheduled at Fairchild (7:30 PM) on August 19 [Larry Noblick], October 21 [Election, Fall Sale, Special TBA], and December 16 [The Holidays and Palms]. On September 19–20, a field trip is planned to Naples, Ft. Myers, and Tampa. Mark your calendars and contact local chapter officers now if you are interested in attending.

Mackay (PACSOA) Activities

The Mackay Palm and Cycad Society (PACSOM) of PACSOA held an excursion to Queens Park on April 5, 1992, followed by lunch and a tour of "Orchidways" at Homebush. Queens Park is in good shape after recent rains. The old plantings attributed to Robert Bell are mostly still there. More recent plantings of *Arenga engleri*, *Wallichia caryotoides*, *Calamus caryotoides*, *Rhopaloblaste* sp. and *Bentinckia nicobarica* were particularly admired. The most impressive of the new palms is *Raphia australis*.

The March meeting was held at the Farleigh home of Keith and Ailsa Boyden. The Boydens have been in their new home with a 3 acre garden for 18 months. The garden has many sheltered/hidden corners and undulating grassland areas which make for interesting plantings of natives and exotics.

March 29th also saw another working party at the Farleigh Plot, weeding and trimming the new area, with another scheduled for June 28th. The palm plantings include 265 species within 96 genera, at the last count. Recent plantings of gingers, heliconias, and foliage plants give the area a pleasing garden effect. The placing of tables and seating has proved popular.

The April meeting at the home of Les and Gwen Shailer at Sarina was attended by fifteen persons. The six acres has been extensively planted with palms, exotic fruits and flowering trees. They have 62 genera and 126 species in the ground plus additional palms in a full bush house and patio.

The PACSOM Anniversary/Birthday Party was held on May 24th at 8 Jansen Street, Slade Point, the home of Lois McGregor. A grand afternoon's entertainment was had by all!

Northern Territory (Australia) Bulletin

[The following article "Rare Palms to be Fenced" is reprinted from *Northern Territory News*, Saturday, February 1, 1992 issue. The NTP&CS is to be commended for their continuing conservation efforts!]

The last group of a species of palms growing in the wild will be protected at Howard Springs.

The *Ptychosperma bleeseri* palms were known nowhere else in the world, the Australian Palm & Cycad Societies President, Mrs. Marty Bishop, said, "It was vital that they be preserved."

Mrs. Bishop of Bees Creek, also Northern Territory Palm and Cycad Society's secretary, was commenting on a bushland protection scheme.

An A $11,000 grant has been awarded by the scheme, Save the Bush, to help protect the palms at Bankers Jungle, Howard Springs.

The money will be used to build a fence around the site to stop the palms being destroyed by feral pigs.

The [Australian] Federal Government has awarded A $1.1 million to be spent on 149 Save the Bush projects around the nation this year.

"Many of Australia's unique plants and wildlife are under siege," the Federal Environment Minister, Mrs. Ros Kelly, said.

The Bankers Jungle grant is the only NT project listed in the national program.

Texas Chapter Name Change and Other News

The Houston Area Chapter of the IPS met on Saturday, June 6, 1992, at the home of Gordon and Shirley Hintz in Cypress, northwest of Houston. A large thunderstorm moved through that morning, but the rain had stopped by meeting time. After a soggy tour of Gordon's lovely garden, the first item of business was a resolution to change the chapter name to the Texas Chapter of the IPS. This passed unanimously. When first formed in the early 70's, there was optimism that there would be several Texas IPS chapters. This has not materialized and doesn't appear to be imminent. An announcement of intent to change the chapter name to the Texas Chapter was circulated to all Texas IPS members for comments. All replies received were favorable. Note that a large percentage of the current chapter membership resides outside of the Houston area—spread throughout the state—and in contact only via the newsletter. Tentative plans include meetings/field trips to some of these other areas of the state.

At the June meeting, Gordon presented his recent public lecture on "Palms for the Houston Area" at Mercer Arboretum, since many chapter members had not had the opportunity to hear it. This was followed by a great buffet meal coordinated by Shirley. *Coccothrinax miraguama* seedlings and night-blooming *Cereus* cactus plants donated to the chapter were given to all interested attendees.

The July 18th meeting is scheduled at the home of Jim and Liz Cain in Houston. After a tour of the Cain garden, the pool and spa will be open. Jim will give a slide presentation on "Current Plantings on the San Antonio Riverwalk" from notes and slides taken during a May 1992 visit to the area. A buffet dinner will be served and *Phoenix* sp. seedlings from seeds collected last year by Jim in Taiwan will be given as "seedling of the month" to all attendees.

The tentative trip to the Stonedale Nursery in Palacios on August 22nd is postponed to a future date to be advised, due to schedule conflicts. Future Texas meetings for this year are scheduled for September 12th at 3:00 PM at the home of Bernard and Grace Green and on October 10th (with members only sale) at the home of Horace Hobbs and Cynthia Ford. Both locations are in Houston.

News from New Zealand

The Palm and Cycad Society of New Zealand (NZPACS) met on April 6, 1992, for a palm and cycad discussion evening, and to display or ask questions about specific problems with plants brought in by members.

May 2nd saw the annual Palm and Cycad Sale Day at Turners and Growers Auction Markets. This sale provided the local populace with quite a few unusual palm and cycad plants, information on NZPACS, and needed revenue for the society.

On May 6th, the meeting featured Betty Gross, President of the Epiphyllum and Hoya Society. This offered members an excellent opportunity to learn about these two groups of plants from a prominent New Zealand authority.

The June 3rd meeting featured Max Goodie who described palms, cycads, and other plants encountered on his recent trip to Australia. The Annual General Meeting was also held on this date. A new executive was elected and membership dues increased. The new information is given in the IPS roster which accompanies this issue of *Principes*.

A field trip was scheduled for Saturday, April 11th to Lothlorien Orchard. This orchard is managed solely by biological methods. They grow a wide range of fruit trees for commercial production and have 60 *Jubaea chilensis* in the ground. The

property is located 14 km from the Huhoi exit off State Highway 1. It is in a park-like setting with a good picnic spot beside a dam.

Hawaii Island Palm Society Meetings

The Hawaii Island Palm Society met on April 24th. After the business meeting, David Sylvia presented slides of his recent trip to Thailand.

The chapter's field trip to Kona was held on May 17th, visiting the garden of Norman Bezona, an IPS director, and Living Designs Nursery.

The annual Rare Palm Auction was held on Sunday, June 7, at Mooheau Park Bandstand starting at 1:00 PM. To supplement the auction this year, Ray Baker, of Lyon Arboretum on Oahu (and an IPS director), sent over palms of 22 hard-to-find species (approximately 90 individuals). All were in superb condition and large for their container size.

Western Australia Group Meets

The Western Australia Palm & Cycad Society met on Monday, April 20th. The meeting topic was potting mix pH (acidity and alkalinity of mixes). Members brought their mixes which were tested and discussed.

Cleanup days at Gascoyne Park were held on Saturday, April 25th at 8:00 AM, followed by a "sausage sizzle" and drinks and again on May 23rd. Two large donated *Howea forsteriana* were dug and transplanted to holes prepared for them in the park, with the aid of hard working members and a crane. The previous meeting had cleaned and checked the drippers on 500 palms, all of which were treated with fertilizer and snail pellets. There are 950 palms in the park, at latest count. On June 20th, another maintenance day was held, with Tim Erceg and members marking the route for the main waterline to handle the 1992 plantings. The next cleanup date is scheduled for July 25th.

The group held a large display at the Karrinyup Shopping Centre during the week of May 11–16. Neil Ford negotiated the arrangements with the shopping center. Glenn Lee came up with the grand design, which featured a pergola, a gazebo, and lattice edging supplied and installed by WESFI PINE to help enhance the palm display. Thanks to Sam and Angie Fagnani who supplied all the huge palms to make the centerpiece.

A palm and cycad auction night was held at the May 18th meeting at the Leederville Town Hall, with proceeds to the Society. The June 15th meeting featured Norm Patterson, who described his recent tour of the Australian East Coast nurseries he visited and the marvelous plants he saw. He also shared more news to clarify a few points on the *Neodypsis* genus. The Annual General Meeting was set for the July meeting.

IPS Loses Two Members

Robert Tucker who developed the Townsville Palmetum, Townsville, Australia, and hosted the IPS Biennial at its dedication in October 1988 died on May 19, 1992. Robert contributed in many ways to the appreciation and knowledge of palms. The next issue of *Mooreana*, the new palm journal he created, will be dedicated to him.

Bill Gunther, former director of IPS and a frequent contributor to *Principes* died on April 12, 1992. We will have an article about Bill in a subsequent issue.—Eds.

Back Cover

A tree of *Voanioala gerardii* in the rain forests of northeast Madagascar. Note the conspicuous leaf scars on the trunk. Photo by J. Dransfield.

