PRINCIPES

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THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

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Contents for July

Front Cover

Cryosophila nana in its dry-forest habitat south of Puerto Vallarta, Jalisco, Mexico. Photo by R. Evans. See pp. 129–147.

PRINCIPES

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Principes, 40(3), 1996, p. 123

Editorial

For many years not much has been published about the palms in Cuba. In this issue Celio Moya Lopez and Peter Mayotte describe a "palm paradise" in Sancti Spiritus province. The many *Copernicia* are especially beautiful specimens.

A second intriguing story, this one featuring an Old World palm, is written by Dick Phillips about the genus *Pelagodoxa* and its history in Fiji.

Randy Evans undertook a detailed study of *Cryosophila* for his doctoral dissertation. His extensive field work has revealed that the genus has ten species, two of them seriously endangered. His article, prepared especially for *Principes*, is well illustrated and will give growers information on what different species are like and on their conservation needs.

Our last major article is an unusual one. Jack Fisher and collaborators have grabbed a unique opportunity provided when Hurricane Andrew felled a mature *Gastrococos*. A chance to look at the internal structure of this "belly palm" has provided answers to questions of long standing about these strange swollen trunks.

July also contains our annual list of books and papers on palms that appeared in the previous year. We are, as ever, grateful to Dr. Andrew Henderson for preparing this list. Within the perhaps rather dry pages is access to a whole cornucopia of information on palms.

There is an abundance of news. Read especially Jim Cain's final Presidential Message following this editorial. Note also the corrected address for Paul Craft, now Horticultural Correspondent, and an article by Don Tollefson on the gardens to be seen at the Biennial in August.

We look forward to seeing you all there!

NATALIE W. UHL
JOHN DRANSFIELD

Principes, 40(3), 1996, pp. 123–124

Note from the President

Since I will be going out of office as the President of the International Palm Society in August 1996, this is my last "Letter from the President" for *Principes*. I would like to take this opportunity to offer a personal "THANK YOU!" to each member of the IPS and each of our local affiliates who have helped to make my four years as president so enjoyable. There are so many of you who contributed to make my job easier!

Within the past several years, the IPS has provided moneys to many worthwhile research and educational palm projects. We have added several new affiliate societies and have recently been involved in the publishing of three significant palm books: *Chamaedorea Palms*, *Palms of Madagascar* (joint publication with Kew Gardens), and, most recently a soft-cover reprint of the out-of-print classic *Genera Palmarum* (joint publication with Cornell University). All of these books can be ordered from the IPS headquarters or from the IPS Bookstore.

The two things that I am most proud of personally are integrally related. These are the increase in the truly "international" nature of our society and the Society's progress on the InterNet and electronic media presence. The increased InterNet presence makes international communications so much simpler and faster. The IPS has established a full suite of InterNet services for the World Wide Web homepages (http://www.palms.org), palm newsgroups (news://palms.org), palm FTP facilities [(ftp://palms.org), and several palm email listservers] as well as set up two different palm discussion areas (initially on Genie and recently on CompuServe). These electronic media offer rapid and efficient information exchange between our individual members and between the IPS and affiliate societies. The IPS plans to expand these services significantly over the next several years, which should further enhance our

already steady membership growth, particularly outside of the USA, which has been one of my major goals.

I anticipate that the IPS will probably have well over 3 000 members by the end of 1996. Our InterNet presence will hopefully make this grow much higher in 1997 and later years.

Again, thanks to each of you for assisting me in making the IPS a better organization. I am sure our Society will continue to prosper under its new leadership. I expect to continue to assist where I can—helping out with Chapter Relations, InterNet services, communications, and other areas where I can be of assistance. Feel free to continue to send your comments and criticisms to me if you wish—I will make sure they go where they are needed!

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CHAPTER NEWS AND EVENTS

Own a Piece of the Islands

The Hawaii Island Chapter's T-shirt is now available to all IPS members. The new design features the costapalmate leaf of *Bismarckia nobilis*, with scientific nomenclature for various parts of the leaf. Educational as well as stylish! Color is a dark slate blue and shirts are of a heavy weight, high quality 100% preshrunk cotton material. Available in L, XL, XXL sizes for US$20 within USA or $26 for other addresses, inclusive of air shipment. Allow 6–8 weeks for delivery. Send check or money order in U.S. funds only to Hawaii Island Palm Society, P.O. Box 1585, Keaau, Hawaii 96749, USA.

News from the Texas Chapter

The Texas Chapter of the IPS met on March 9 at the Cockrell Butterfly Garden at the Houston Museum of Natural History, Hermann Park, Houston. The garden contains a "new world" palm collection, including several very rare *Chamaedorea* donated by local palm society members. Nancy Greig, Director, guided the group through the collection, and Eddie Holick, horticulturist, gave a tour of the greenhouse.

Immediately following the tour of the Cockrell Butterfly Garden, a Hobby Esplanade planning meeting was held at the home of Horace Hobbs and Cynthia Ford. Planting materials and resources were inventoried, organized, and a visit made to the site. The first planting for the new Hobby Esplanade project was held on March 23. Thanks to member Bill Burhans for his unceasing efforts in promoting this palm planting project—both within the palm society and to the City of Houston. Thanks also to Horace Hobbs for helping Bill survey the site, cross-reference water and sewage drawings, and assist in the layout planning.

A meeting was held in April at the Houston Zoo, which features many palms and tropical plantings. The tour was led by Joe Flanagan, a local chapter member who is also a veterinarian at the Zoo. The nearly annual treks to the Zoo have always been great, and this year's meeting attracted chapter members from all over the state.

The Texas Palm Society 1995 field trip to the Rio Grande Valley has been one source of inspiration for a new effort to establish a separate chapter to serve the Rio Grande Valley and Coastal Bend areas of Texas. Bill Bittle in Rockport and Lloyd Van Epps in Donna are spearheading the efforts. An organizational meeting was held on March 9 and since then they met again and published their first newsletter, which was quite informative. The Texas Palm Society is helping to support this effort and provided start-up money

(*Continued on p. 161*)

Principes, 40(3), 1996, pp. 125–128

Stem Structure of the Cuban Belly Palm (Gastrococos crispa)

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ABSTRACT

Tissue samples were taken from the periphery and center of a single trunk with a pronounced swelling (three times the basal stem diameter) halfway up the trunk. In the hard peripheral region, fresh density increased and percent water content decreased from the upper to the lower levels of the trunk. In the trunk center, fresh densities of upper and lower levels were similar and twice that of the swollen middle level. The dry density of the trunk center was greatest at the base, which was 10 times that of the swollen middle level. Percent water content of the trunk center at the middle level was about twice that of the lower and one-third more than the upper level. The observations on density and anatomy support the view that the peripheral ring of lignified tissue is the main mechanical tissue in the trunk. The swollen region had little or no starch and is the main water-storing region of the trunk.

The localized trunk swellings in some palms have long attracted the interest of botanists and palm enthusiasts. The Cuban belly palm, *Gastrococos crispa* (Kunth) H. E. Moore (formerly *Acrocomia crispa* (Kunth) Baker ex Becc.) with its pronounced trunk swelling is a fine example. The spongy tissue that makes up the bulk of the swelling is assumed to be an adaptation for water storage in this endemic from seasonally dry areas of Cuba. However, we found no published information on the structure or density of the trunk of this species. There are no documented observations as to how the swelling develops: whether it is a result of primary growth within the leaf crown or whether it develops by later thickening when the region is older and some distance below the leaf crown (Tomlinson 1990: p. 171).

On 24 August 1992 a mature specimen of *Gastrococos* growing on the grounds of The Montgomery Foundation in Miami, Florida was blown down during Hurricane Andrew. This presented a unique research opportunity to collect and examine trunk material of a precious horticultural specimen that would not otherwise be sacrificed for study. The effects of Hurricane Andrew have already been described (Klein 1992) and illustrated on the cover of the October 1992 issue of *Principes*.

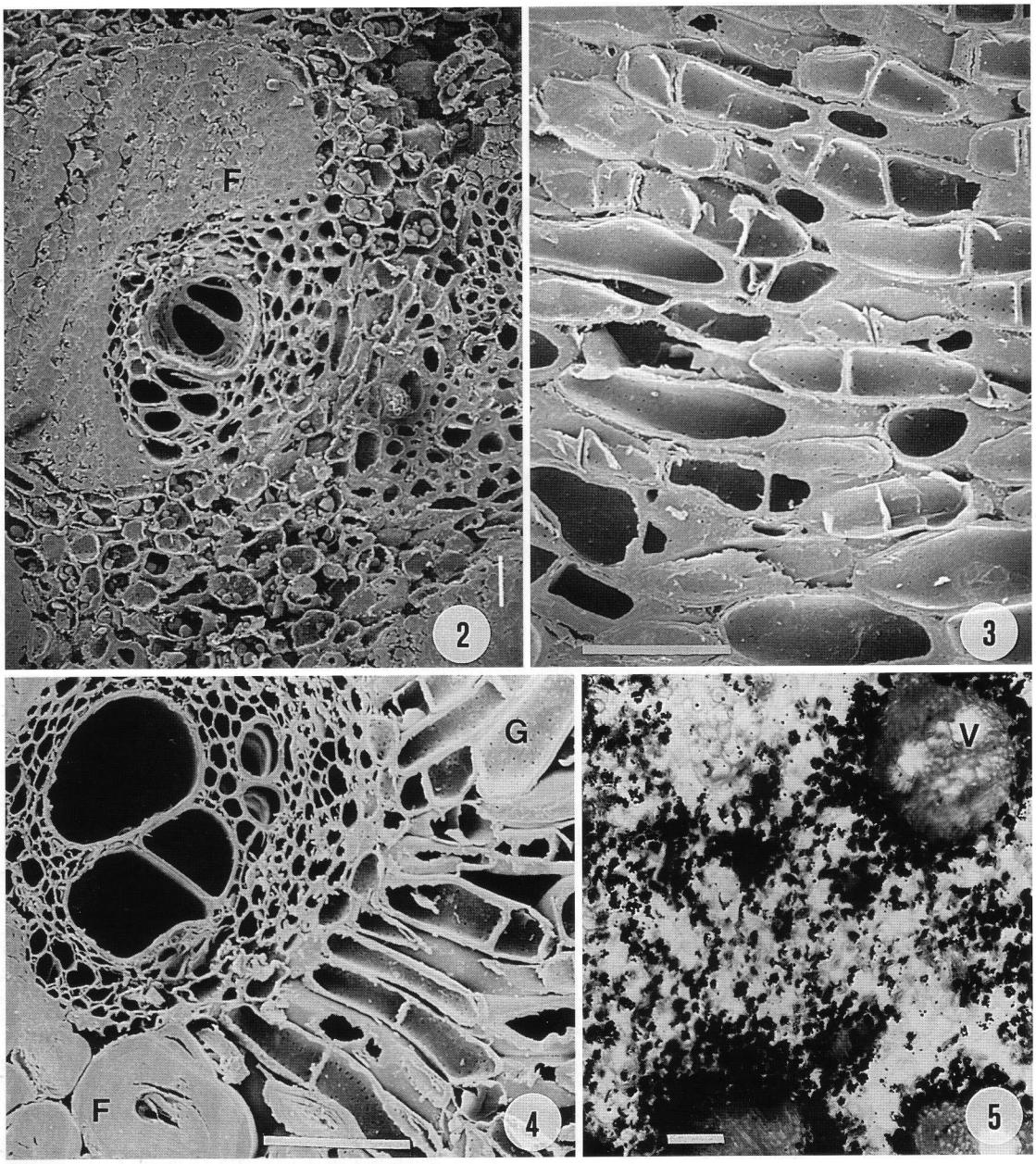
Materials and Methods

A tree of *Gastrococos crispa* (FTG 91-426A) estimated at over 40 years old was collected at The Montgomery Foundation, Miami, Florida on 19 September 1992, more than 3 wk after it was blown down. The leaf crown was still green and had 17 expanded leaves and three spear leaves. The trunk was cut with a chain saw (Fig. 1). Six small samples were collected from the periphery and center of each of three disks cut from lower, middle (swollen), and upper levels of the trunk. The lower level was 180 cm long and cylindrical with a diameter of 25 cm. The middle, swollen level was 460 cm long with a maximum diameter of 70 cm. The upper level was 260 cm (to the

1. Collecting trunk samples of *Gastrococos*. Entire lower region (held by J. Burch on left), half of the swollen middle region (held by L. Noblick on right).

[1] Correspondence to the Fairchild Tropical Garden address.

[2] Present address: Montgomery Foundation, 11901 Old Cutler Road, Miami, Florida 33156.

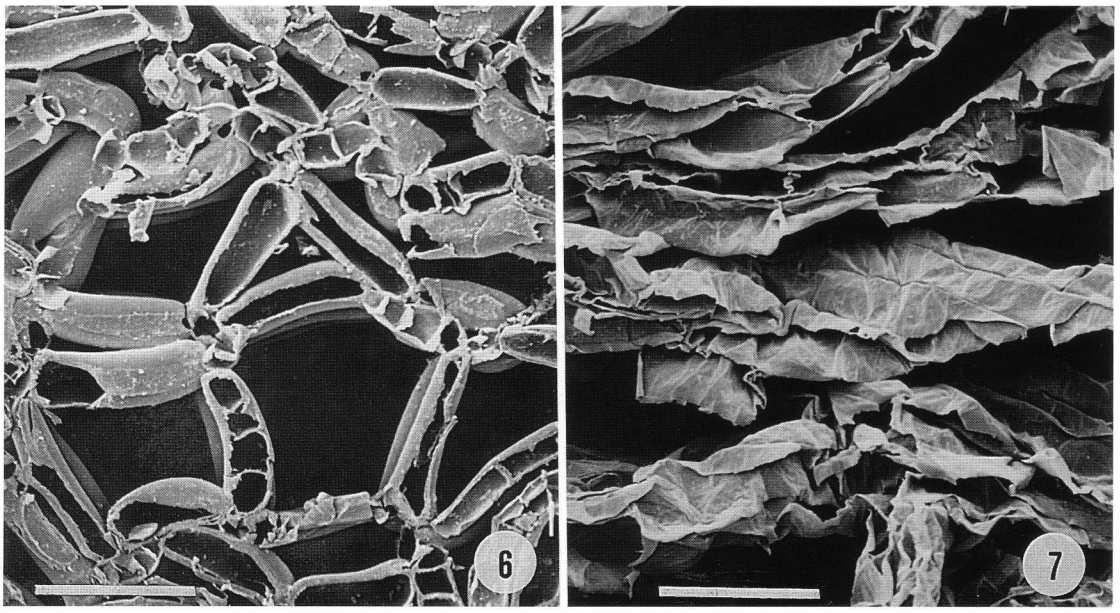


2–5. Cross sections of trunk tissue. 2. Peripheral vascular bundle of upper trunk; note region of very thick-walled fibers and starch grains inside cells of the ground tissue. 3. Peripheral ground tissue of middle trunk; starch grains absent. 4. Central vascular bundle of lower trunk. 5. Central vascular bundles and ground tissue of upper trunk, stained with I_2KI that stains starch grains black. F, fibers; G, ground tissue; V, vascular bundle. Bars: 50 μm (2, 3, 4); 100 μm (5).

base of the leaf crown) and cylindrical with a diameter of 21 cm.

The tissue samples were weighed fresh and their volume calculated by water displacement (adjusted for water absorption into the spongy tissue by reweighing after volume measurements). The samples were dried in a 75°C oven for 4 wk and weighed.

Adjacent tissue samples were preserved in FAA (formalin-alcohol-acetic acid) and stored in 70% ethanol. Sections were later cut with a razor by hand and stained with aqueous toluidine blue for



6, 7. Central ground tissue of trunk in cross section. 6. Lower trunk; note thick cell walls. 7. Swollen, middle trunk; note larger cells with thinner walls that collapsed during preparation. Bar: 50 μm (6, 7).

general anatomy, with I_2KI solution for starch, and with phloroglucinol-HCl for lignin. Some blocks of tissue were air-dried, sputter coated with gold-palladium, and observed with a scanning electron microscope (I.S.I. Model Super IIIA).

Results

Anatomy. The peripheral region of the trunk was dense and extremely hard throughout its length. Vascular bundles were arranged close together, and each had a wide zone of thick-walled fibers (Fig. 2). The cells of the ground tissue between the vascular bundles were thick-walled and lignified (Fig. 3). The hardest tissues with the thickest-walled fibers and ground parenchyma cells were at the lower level of the trunk. The cell lumen was barely visible in each fiber (Fig. 2).

The trunk center had more diffuse vascular bundles, each with a wide fiber zone (Fig. 4). Bundle density was similar in the upper and lower levels and was least in the swollen middle level. The cells of the central ground tissue (Fig. 4) were more radially elongated than in the periphery. The cell walls were thickest and most lignified at the lowest level (Fig. 6). Walls are thinnest and unlignified at the middle level (Fig. 7). Intercellular spaces, which impart the spongy consistency to the tissue, were most numerous at the middle level and related to the elongated shape of these cells. It was difficult to cut the central part of the middle region without crushing because the tough fiber bundles were imbedded within the soft spongy ground tissue.

Chemical tests for starch (I_2KI solution) showed that large amounts of starch occurred in the upper level of the trunk in the ground cells of the peripheral and central regions (Figs. 2,5). No starch was present within the vascular bundles. We found from little to essentially no starch in the lower and middle levels of the trunk (Fig. 3). The spongy central tissue in the swollen middle level lacked starch but had small cytoplasmic structures that were possibly plastids or lipid droplets.

Tissue Density. Fresh and dry tissue densities were directly correlated to the relative wall thickness and lignification in the fibers and ground tissue (Table 1). The most dense tissue was the peripheral region of the lower level. The least dense tissue occurred in the central region of the middle level. The maximum difference in peripheral dry density was 7:10 (middle to lower). The maximum difference in central dry density was approximately 1:10 (middle to lower). Percent water content was greatest in the central middle region, twice that of the central lower and one-third more than that of the central upper region (Table 1).

Table 1. Comparisons of trunk tissues in the trunk of Gastrococus crispa. *Averages of six tissue samples are given for each location.*

Level in Trunk	Fresh Density (g/cm^3)	Dry Density[a] (g/cm^3)	Water Content (percent)
	Periphery of trunk		
Lower	1.264a	1.011a	20.0a
Middle	1.172b	0.692b	41.1b
Upper	1.144b	0.693b	38.9b
	Center of trunk		
Lower	0.893a	0.483a	46.0a
Middle	0.418b	0.048b	88.5b
Upper	0.807c	0.305c	62.2c

Within each column, values followed by the same letter are not significantly different (using an F test with $P = 0.001$). Periphery and center regions are compared separately.

[a] Presented as dry mass per original fresh mass.

Discussion

The dense, lignified peripheral tissues form a cylinder of supporting tissue in the trunk. The density of older tissues increases at the base of the trunk, as in other palms (Rich 1986, 1987*a*, *b*). The cell walls of fibers and parenchyma cells (ground tissue), which appear to remain alive for the life of the palm, increase in thickness and degree of lignification as they age. Thus, the mechanical strength of the trunk increases at lower levels as the trunk grows taller.

In *Gastrococos*, the swollen middle level is a result of ground tissue cells becoming radially elongated with these thin-walled, unlignified cells radiating around each of the vascular bundles in the central region, similar to other palms with soft, spongy trunk centers, e.g., *Socratea* (Tomlinson 1990) and *Roystonea* (*Oredodoxa*), *Caryota*, and *Ptychosperma* (*Actinophloeus*) (Schoute 1912). Prolonged expansion and cell division within the ground tissue of the central region of the trunk of *Archontophoenix* were demonstrated convincingly by Waterhouse and Quinn (1978). However, the timing of such ground cell expansion, whether within or below the crown, is undocumented for *Gastrococos*.

The suggestion that the swollen region acts as a "bottle" to store water is supported by the high percentage of water contained in the spongy central tissues.

Acknowledgments

This research was supported by grants from the National Science Foundation (grant DEB-9224126) and The John D. and Catherine T. MacArthur Foundation. Larry Noblick was supported by a Montgomery Foundation postdoctoral fellowship. We thank Birgith Phillips for technical assistance and George Taylor for help with the SEM.

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Principes, 40(3), 1996, pp. 129–147

Conservation Status of Cryosophila with Special Reference to the Critically Endangered Cryosophila cookii and Cryosophila williamsii

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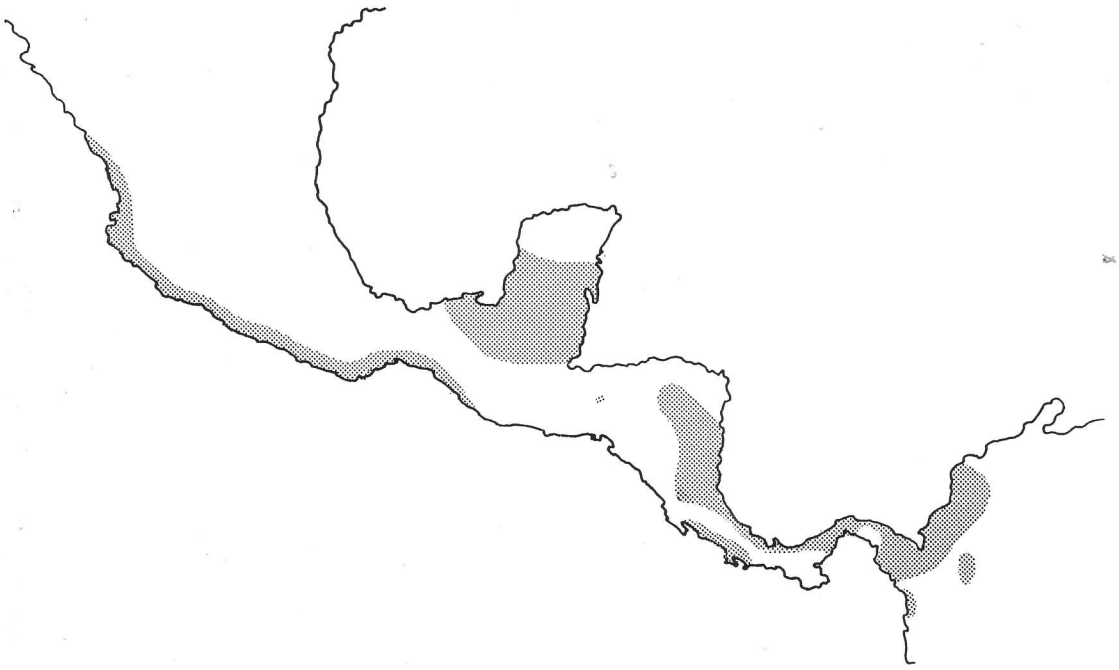
As is now widely known, the world's remaining tropical forests are rapidly disappearing. This has serious consequences for the long-term survival of many palms since an estimated 75% of the roughly 2 700 palm species are rain forest species (Dransfield 1978) and fully 80% of palm species are found only in the wild, having never been cultivated (Johnson 1988). Furthermore, since geographically restricted species are those most immediately and generally most gravely affected by local tropical deforestation and more than 90% of palm species have such restricted distributions (Good 1974), the palm family is probably the most threatened among all major plant taxa (Myers 1984).

The International Union for the Conservation of Nature and Natural Resources (IUCN) Threatened Plants Unit has provisionally identified about 100 seriously threatened palm species worldwide (Dransfield et al. 1988, Johnson 1988). Although this might not seem exceptionally high for such a large, mainly tropical, family, many more palms are undoubtedly endangered since the conservation status of the majority of palm species is unknown. In the New World, for example, data for about 60% of the over 1 100 palm species were insufficient to allow the Palm Specialist Group of the IUCN Species Survival Commission to determine whether they were threatened or not (Johnson 1986, 1987; Dransfield et al. 1988). Such ignorance reflects how poorly known botanically many tropical areas still are, but it is also a result of palms having been historically ignored by most general plant collectors because they are so difficult and time-consuming to collect (frequently being large and inaccessible). Consequently, for most palms, reliable demographic and distributional data do not exist. Until recently this has been the case for most species of the largely Mesoamerican palm genus *Cryosophila*. However, extensive field studies carried on throughout the range of the genus (Fig. 1) as part of a critical taxonomic revision (Evans 1995) have provided the information necessary to evaluate the conservation status of all but one species of *Cryosophila*.

Following a brief synopsis of the genus, I will summarize the important diagnostic features, geographic distribution (for detailed distribution maps see Evans 1995), and conservation status for each of the 11 taxa of *Cryosophila* (ten species and two subspecies). Lastly, I will consider in more detail the status of the two most critically endangered species of *Cryosophila*—in fact, probably two of the most threatened neotropical palm species—*Cryosophila cookii* and *Cryosophila williamsii*.

General Information on the Genus Cryosophila

Unique to *Cryosophila*, and its most distinctive generic characteristic, are the usually descending, often numerous, long, branched spines derived from roots that grow out from and are distributed variously along the usually solitary trunk, sometimes forming a basal cone. These root-spines make *Cryosophila* one of the most easily recognized genera of palms. *Cryosophila* flowers are also distinctive and essentially of similar form across the genus. They possess three basally connate sepals, three distinct petals, an androecium with six flat thin filaments connate for some length in a narrow tube, and three separate carpels with long thin styles exserted at anthesis. Several distinctive leaf characteristics are shared by *Cryosophila* and only two or three of its seven most closely related genera (i.e., the neotropical apo-



1. Distribution of *Cryosophila*.

carpous Corypheae clade; Uhl et al. 1995). These are: (1) leaf blades that are split near the midline along an abaxial fold, usually nearly to the base, effectively dividing the leaf into two halves—shared by *Cryosophila*, *Chelyocarpus*, *Itaya*, and some species of *Trithrinax*; (2) leaf segment midribs with vascular bundles embedded within a central colorless ground parenchyma and completely enclosed within a fibrous cylinder occupying most of the rib—apparently shared only by *Cryosophila*, *Itaya*, and *Schippia* among all 40 genera of coryphoid palms; and (3) petiole bases that are split basally and through which the developing inflorescence buds emerge—shared by *Cryosophila* (all species except *C. nana*), *Itaya*, and *Thrinax*.

Although *Cryosophila* is relatively widely distributed geographically (see Fig. 1), all ten species of the genus have rather limited distributions (eight of the ten species are confined to only one or two countries) and several are extremely local endemics. Costa Rica, with four, has the most species of *Cryosophila*—*C. cookii*, *C. grayumii*, *C. guagara*, and *C. warscewiczii*. *Cryosophila* is the only coryphoid genus with its distribution centered in Central America, with extensions east into South America and north into Mexico. Only three instances of sympatry occur in the genus, and each of these involves one species occupying a specialized habitat within the range of another more generalist species (the local endemics *C. cookii* and *C. bartlettii* within the range of the widely distributed *C. warscewiczii*, and *C. grayumii* within the range of the similarly distributed *C. guagara*). *Cryosophila grayumii* and *C. guagara* are occasionally syntopic, and the rare *C. cookii* is usually found with *C. warscewiczii* (Fig. 2). For the most part, the species of *Cryosophila* are distributed as a more or less linear series of disjuncts across the Central American corridor.

All species of *Cryosophila* are forest understory trees (to about 15 m tall). With the exception of the dry-forest *C. nana*, all species of *Cryosophila* are found in lowland (rarely over 1 200 m) humid to wet forests. *Cryosophila kalbreyeri* and *C. stauracantha* occur in both moist and dry forests. Five of the ten *Cryosophila* taxa are calciphiles (*C. bartlettii*, *C. grayumii*, *C. kalbreyeri*, *C. stauracantha*, and *C. williamsii*), with *C. bartlettii* and *C. williamsii* being restricted to rocky limestone outcrops (Figs. 3, 4). With the exception of *C. nana*, the remaining *Cryosophila* taxa are apparently calcifuges.

Although all species of *Cryosophila* were

apparently used extensively at one time, such use is fairly limited today. The name *escoba* ("broom") or *palma de escoba* is used variously for most species throughout the range of the genus and refers to the once common practice of using the very durable leaves to make brooms (Figs. 5, 6). In addition, all the larger leaved species were frequently used for making thatch before the widespread availability of cheap, corrugated metal roofing, and they still serve this purpose in some rural areas. The bitter tasting "palm hearts" of most species are still eaten occasionally to commonly for various intestinal ailments. In fact, this use has decimated populations of *Cryosophila* in some areas. Lastly, various species of *Cryosophila* are sometimes cultivated as ornamentals, the root-spines being easily removed if desired.

Seven of the ten species of *Cryosophila* are currently endangered or threatened (*C. bartlettii*, *C. cookii*, *C. grayumii*, *C. guagara*, *C. nana*, *C. kalbreyeri*, and *C. williamsii*), with *C. cookii* and *C. williamsii* unlikely to survive, except for perhaps a few isolated individuals, much past the end of this decade. *Cryosophila macrocarpa* appears to be extremely rare, but its distribution and demography are too poorly known for an assessment of its conservation status. The populations of the remaining two species (*C. stauracantha* and *C. warscewiczii*) are rapidly declining, but since these are the most widely distributed species they are for the moment relatively secure, at least in portions of their ranges. Unless the destruction of tropical forests halts immediately throughout the range of the genus, which is, unfortunately, an unlikely occurrence, I see little chance of long-term survival for most species of *Cryosophila*.

The Species

Cryosophila bartlettii R. Evans (Fig. 7)

This species is most similar to *C. kalbreyeri*, but can be distinguished by its typically longer, more spiny stems, smaller leaves, inflorescences with longer prophylls, and flowers with longer stamen tubes. It is characterized by small fruits and seeds. Only *C. stauracantha* typically has fruits as small, but the inflorescences of *C. stauracantha* are usually larger with fewer peduncular bracts and more and larger first-order branches. *C. bartlettii* is known only from limestone outcrops in the Lago Alajuela (formerly known as Madden Lake) watershed in central Panama at an elevation of about 100 m.

Little undisturbed forest remains in the Lago Alajuela watershed area, and this species is extremely rare. Presumably much of the original habitat of this species was inundated by the rising waters of Lago Alajuela, formed by the damming of the Río Chagres during construction of the Panama Canal. It is reportedly present on some of the small forested islands in Lago Alajuela near the mouth of the Río La Puente, which enters the lake from the southeast. Although more field work is needed to delimit better its exact distribution, this species is unquestionably endangered.

Cryosophila cookii Bartlett (Figs. 8–10)

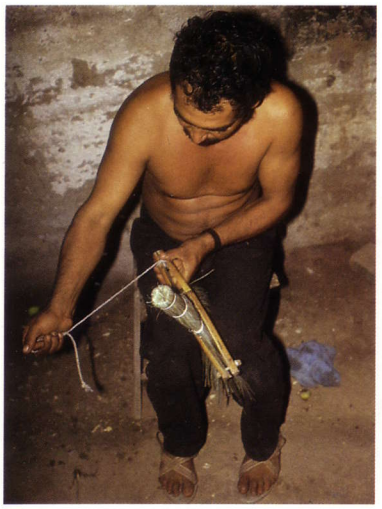
The inflorescence of this palm, with its characteristic densely fastigiate rachillae spiraling around the main axis, makes it the most distinctive species of *Cryosophila*. Its large size and extremely spiny trunk are also diagnostic. The type specimen (*Cook & Doyle 635*, Río Hondo, Costa Rica) appears to have uncharacteristically small leaves and a similarly small infructescence. This species is confined to a small area of Caribbean lowland wet forest in eastern Costa Rica, just south of Tortuguero National Park. Within this area it is restricted to low-lying lands, near sea level, having very wet soil most of the year, yet never seasonally inundated for lengthy periods.

Nearly all of the original forest in which this species presumably once occurred has been converted to cattle pastures or banana plantations. Extrapolating from estimates of present population density and the amount of original forest remaining in the presumed historical range of this species, I suspect the total adult population size to be only about 100, with perhaps only a small fraction of this occurring within Tortuguero National Park, which for the most part lacks suitable habitats.

Cryosophila grayumii R. Evans (Figs. 11,12)

This *Cryosophila* is characterized by possessing the fewest peduncular bracts (2–3) in the genus. The leaf blade is also diagnostic, being less divided than in other species of *Cryosophila*. Its inflorescences have the shortest first-order branches and rachillae in the genus, and its inflorescences and leaves are typically smaller than those of any other species except *C. nana*. *Cryosophila gra-*

2. Syntopic *Cryosophila warscewiczii* (left) and *C. cookii* (right). About ½ km northwest of San Geraldo, Costa Rica. 3. Stem base of *Cryosophila bartlettii* showing adventitious roots and root-spines. Plant from which *Evans 157* was collected. Natural limestone bridge over Río La Puente, Panama, type locality for this species. Note limestone outcrop, habitat to which this species is restricted. 4. Stem base of *Cryosophila williamsii* showing adventitious roots and root-spines. Plant from which *Evans 157* was collected. Punta Gorda, Lago Yojoa, Honduras, type locality for this species. Note limestone outcrop, habitat to which this species is restricted. 5. Wild-collected leaves of *Cryosophila nana* spread out to dry in preparation for making brooms. Zapotillo, Jalisco, Mexico.



6. Local craftsman making a broom-head from the dried leaves of *Cryosophila nana*. Zapotillo, Jalisco, Mexico. 7. Inflorescences of *Cryosophila bartlettii*. Plant from which *Evans & Grayum 183* was collected. Natural limestone bridge over Río La Puente, Panama. 8. *Cryosophila cookii*. Uncollected plant about 3 km north of San Gerardo de Colorado, Costa Rica. Note height (stem about 14 m tall) of this, typically the largest, species of *Cryosophila*. 9. Stem base of *Cryosophila cookii* showing the dense, tangled mass of extremely long root-spines, diagnostic for this species. The single individual (uncollected) encountered during a 1-wk search in Tortuguero National Park. Vicinity of the abandoned Río Sierpe guard station on the Río Sierpe north of La Aurora, Costa Rica.

10. Inflorescences and infructescences of *Cryosophila cookii* showing the fastigiate rachillae spiralling along the inflorescence rachis, diagnostic for this species. Plant from which *Evans 133* was collected. About 1 km northwest of San Gerardo de Colorado, Costa Rica. 11. *Cryosophila grayumii* showing typical arching stem habit and leaves with relatively few divisions, diagnostic for this species. Uncollected plant about 8 km north of Ciudad Neily, Costa Rica, the type locality for this species. 12. Small infructescences of *Cryosophila grayumii*. Plant from which *Evans 173* was collected. Same locality as in Figure 11. 13. Large, deflected inflorescences of *Cryosophila guagara*. Plant from which *Evans 147* was collected. About 5 km southeast of Paso Canoas, Panama. Note large, persistent rachis bracts, diagnostic for this species.

yumii is known only from the Pacific slope of Costa Rica at elevations of 100–650 m. It is found in small, scattered populations on slopes along the Fila Costeña in the south and a single more northerly disjunct population in the Cordillera de Tilarán.

This species can be found syntopically with *C. guagara* on Fila Retinto, just north of the town of Palmar Norte in southern Costa Rica. Whereas *C. guagara* was common throughout the Golfo Dulce area to about 500 m or more, this palm is restricted to limestone slopes. Within this specialized habitat, it is relatively common. This habitat is very limited in Costa Rica, and its forests are rapidly disappearing. There may be a few more remote undiscovered populations, but even so, the species must be considered endangered. A search for it in Panama near the Costa Rican border east of the Fila de Cal population failed to locate any individuals. Future searches in Panama are also very likely to be unsuccessful since almost no forest remains in this part of the country, having already been converted to agriculture.

Cryosophila guagara P. H. Allen (Fig. 13)

This species is characterized by its long, deflected inflorescences with especially persistent rachis bracts, many of which remain on the inflorescence into fruit. Its long styles are also diagnostic. It is found at elevations from sea level to more than 500 m in the lowland moist to wet forests of the Golfo Dulce area of southern Costa Rica and adjacent Panama, and north along the Costa Rican Pacific coast to near the Río Grande de Tárcoles.

In its natural habitat, this palm is often common. Unfortunately, most of this habitat outside the Osa Peninsula (particularly Corcovado National Park) has disappeared. Except on the Osa Peninsula, it can easily be found only in the most remote areas, near the upper elevational limit of the species. Corcovado National Park harbors a large population.

Cryosophila kalbreyeri (Dammer ex Burret) Dahlgren

This species is extremely variable morphologically in most of the characters that are useful elsewhere in the genus for circumscribing species. Consequently, it has few diagnostic features, being identifiable primarily by what it lacks (a less than ideal situation). It is intermediate between *C. bartlettii* and *C. stauracantha*. Although sharing more character states with *C. bartlettii* than *C. stauracantha*, more often *C. kalbreyeri* exhibits a state intermediate between those of these other two species. It differs from *C. bartlettii* by its typically shorter, less spiny stems, larger leaves, inflorescences with shorter prophylls, and flowers with shorter stamen-tubes. It differs from *C. stauracantha* by its more persistent rachis bracts, usually more numerous peduncular bracts, and shorter rachises with shorter first-order branches. This palm is found in a variety of moist to dry forest habitats in eastern Panama and northwestern Colombia at elevations from sea level to 1 200 m.

Cryosophila kalbreyeri comprises two subspecies, reflecting a geographic disjunction. *Cryosophila kalbreyeri* subsp. *kalbreyeri* is a more widespread northern taxon, occurring in northwestern Colombia and extreme southeastern Panama, while *C. kalbreyeri* subsp. *cogolloi* is endemic to Antioquia, Colombia. Subspecies *kalbreyeri* is distinguished from subsp. *cogolloi* by having inflorescences with the rachillae typically proportionately shorter relative to the first-order branches and typically smaller flowers. Although the two subspecies overlap broadly in flowering times, subsp. *kalbreyeri* tends to flower earlier (usually beginning in July) than subsp. *cogolloi*.

Cryosophila kalbreyeri subsp. **kalbreyeri** (Fig. 14)

This subspecies is restricted to northwestern Colombia and adjacent Darién Province in southwest Panama at elevations from sea level to 1 200 m. Nearly all of the original dry forests of northwest Colombia (northern Antioquia, Córdoba, Sucre, and northern Bolívar Departments) have been converted to pasture lands. Consequently, within this area, this palm is very rare, persisting only as scattered individuals or small isolated populations. However, in the western portion of its range (Darién Province, Panama) much forest remains intact and it is still common. The same presumably holds true in the large intact tracts of forest in northern Chocó Department, Colombia, but the demographics and therefore conservation status of the subspecies in this region are unknown.

Cryosophila kalbreyeri subsp. **cogolloi** R. Evans (Fig. 15)

This subspecies is known only from Antioquia Department, Colombia. It has been collected at elevations of 300–1 200 m in the valleys of the Río Porce in central Antioquia and the Río Claro-

Corconá Sur in extreme southeast Antioquia. Little remains of the natural vegetation of the inter-Andean valleys of Antioquia Department. This palm is known from only a few small (with one exception) populations, and must therefore be considered endangered. The one known relatively large and stable population occurs in a small area of primary forest along the steep slopes of the Río Claro canyon. This forest occurs within a privately owned ecological refuge in San Luis "Municipio" (≈Township), about 30 km west of the Río Magdalena, just south of the highway from Medellín southeast to Puerto Triunfo on the Río Magdalena. The future of this small island of intact forest, and therefore that of the only known substantial population of this subspecies, is uncertain.

Cryosophila macrocarpa R. Evans (Fig. 16)

This palm is easily recognizable by its very large fruits and very large, deeply sulcate seeds. The inflorescences, with a long prophyll and relatively few, long peduncular bracts, are also diagnostic, as are the large leaves. It is known only from the type locality, an area of slightly disturbed lowland wet forest, near sea level, on the floodplain of the Río Valle near the northern limit of the Golfo de Tribuga, Colombia.

Extensive primary forest remains in the immediate area of the type locality as well as most of the entire Golfo de Tribuga coastal region, due to its remoteness. The area is very poorly known botanically, and therefore this species may occur throughout the region. However, it is very rare and localized within its known bottomland habitat, apparently occurring only in scattered small populations. It does not occur on the nearby slopes where *Chelyocarpus dianeurus* (Burret) H. E. Moore is very common. One local resident, knowledgeable enough to distinguish these two superficially similar palmate-leaved species, reported *C. macrocarpa* to be more common on Cabo Corrientes than in the El Valle area. Cabo Corrientes delimits the southern end of the Golfo de Tribuga about 70 km to the south.

18. Stem of *Cryosophila nana* showing the dense, tangled mass of short root-spines, typical for this species. Uncollected plant in the same population as the individuals in Figure 17.

←

14. *Cryosophila kalbreyeri* subsp. *kalbreyeri*. Plant from which *Evans & Cogollo 228* was collected, with Alvaro A. Cogollo of the Jardín Botánico "Joaquín Antonio Uribe" in Medellín, Colombia. About 40 km northwest of Montería, Córdoba, Colombia. Compare the deep splitting of the leaf blades, typical for this species, to the shallower splits in the leaf of *C. warscewiczii* in Figure 21. 15. Old infructescences (all fruits having fallen) of *C. kalbreyeri* subsp. *cogolloi*. Plant from which the type of this subspecies (*Evans & Cogollo 247*) was collected. About 4 km northeast of the bridge over the Río Claro on the Medellín–Puerto Triunfo highway, Antioquia, Colombia. Compare the long, pendulous rachillae, typical for this species, to the shorter, often erect rachillae of *C. warscewiczii* in Figure 21. 16. Infructescence of *Cryosophila macrocarpa*. Plant from which the type of this species (*Evans & Ramírez 213*) was collected. About 2 km north of El Valle, Chocó, Colombia. Compare these larger fruits, diagnostic for this species, to the smaller fruits, more typical for the genus, of *C. grayumii* in Figure 12. Also, note the splits at the base of the leaf petioles, characteristic for mature individuals of all species of *Cryosophila*, except *C. nana*. 17. *Cryosophila nana* showing leaves with deep divisions along almost every blade segment, diagnostic for this species. Uncollected plants in the same population from which the neotype of this species (*Evans 239*) was collected. About 18 km N of El Tuito, Jalisco, Mexico.

19. *Cryosophila stauracantha*. Uncollected plant near Teapa, Tabasco, Mexico, the probable type locality for this species. All but four leaves have been removed by locals, presumably for making brooms. Compare the deep splitting of the leaf blades, typical for this species, to the shallower splits in the leaf of *C. warscewiczii* in Figure 21. 20. Young inflorescence and very young infructescence of *Cryosophila stauracantha* showing persistent apical-most rachis bracts on inflorescence, diagnostic for this species. Plant from which *Evans 193* was collected. About 4 km west of Teapa, Tabasco, Mexico. 21. Inflorescences of *Cryosophila warscewiczii*. Plant from which *Evans 140* was collected. About 9 km SW of Bribri, Costa Rica. Compare the shallow splitting of the leaf blade (except the central split), typical for this species, to the deeper splits in the leaves of *C. kalbreyeri* in Figure 14 and *C. stauracantha* in Figure 19. 22. Ascending, compact inflorescence and young infructescence of *Cryosophila williamsii*, diagnostic for this species. Plant from which *Evans 194* was collected. Punta Gorda, Lago Yojoa, Honduras.

Cryosophila nana (Kunth) Blume ex Salomon (Figs. 17,18)

This *Cryosophila* has more unique character states than any other species in the genus. Its unsplit petiole bases, only one order of blade dissection, and sparse abaxial laminar pubescence, as well as the short, dense, spreading root-spines, differentiate it from all other species of *Cryosophila* and make it the only easily and unambiguously identifiable species in sterile condition. It is found at elevations from sea level to 1 700 m (the only *Cryosophila* reported from over 1 200 m elevation) in the dry, deciduous forests (often pine-oak forests) of Pacific coastal Mexico from southern Sinaloa to southern Chiapas near the Guatemalan border.

Much of the original, particularly lower elevation, dry forests along the Mexican Pacific coast have been removed or greatly altered. Consequently, this palm is rare or has disappeared completely from many areas of its former range. However, in other, even disturbed, areas it is still quite common—in Jalisco State, for example. Overall, due to its relatively large geographic distribution, this species appears likely to survive into the foreseeable future, even though many of its populations throughout the range of the species are threatened by continuing dry-forest conversion.

Cryosophila stauracantha (Heynh.) R. Evans (including *Cryosophila argentea* Bartlett and *Cryosophila bifurcata* Lundell) (Figs. 19,20)

The inflorescences of this species are most similar to those of *C. warscewiczii* in having long, narrow, first-order branches, long rachillae (although both are usually shorter in *C. stauracantha* than in *C. warscewiczii*), and caducous rachis bracts. This palm has one inflorescence feature unique within the genus: the apical rachis bracts are briefly joined at their apices and persist longer than all but the most basal bracts. These apical bracts typically fall as a single unit. *Cryosophila stauracantha* also differs from *C. warscewiczii* in having usually smaller inflorescences, smaller fruits and seeds, more deeply divided leaf blades, and a more densely armed trunk, with the basal adventitious roots not morphologically distinct from (only longer than) the root-spines above. This species is found in moist to dry lowland forests of extreme southeastern Mexico, Belize, and northern Guatemala at elevations from sea level to 600 m.

This palm has been extirpated in many areas, but is still locally common throughout much of its historic range.

Cryosophila warscewiczii (H. Wendl.) Bartlett (including *Cryosophila albida* Bartlett) (Fig. 21)

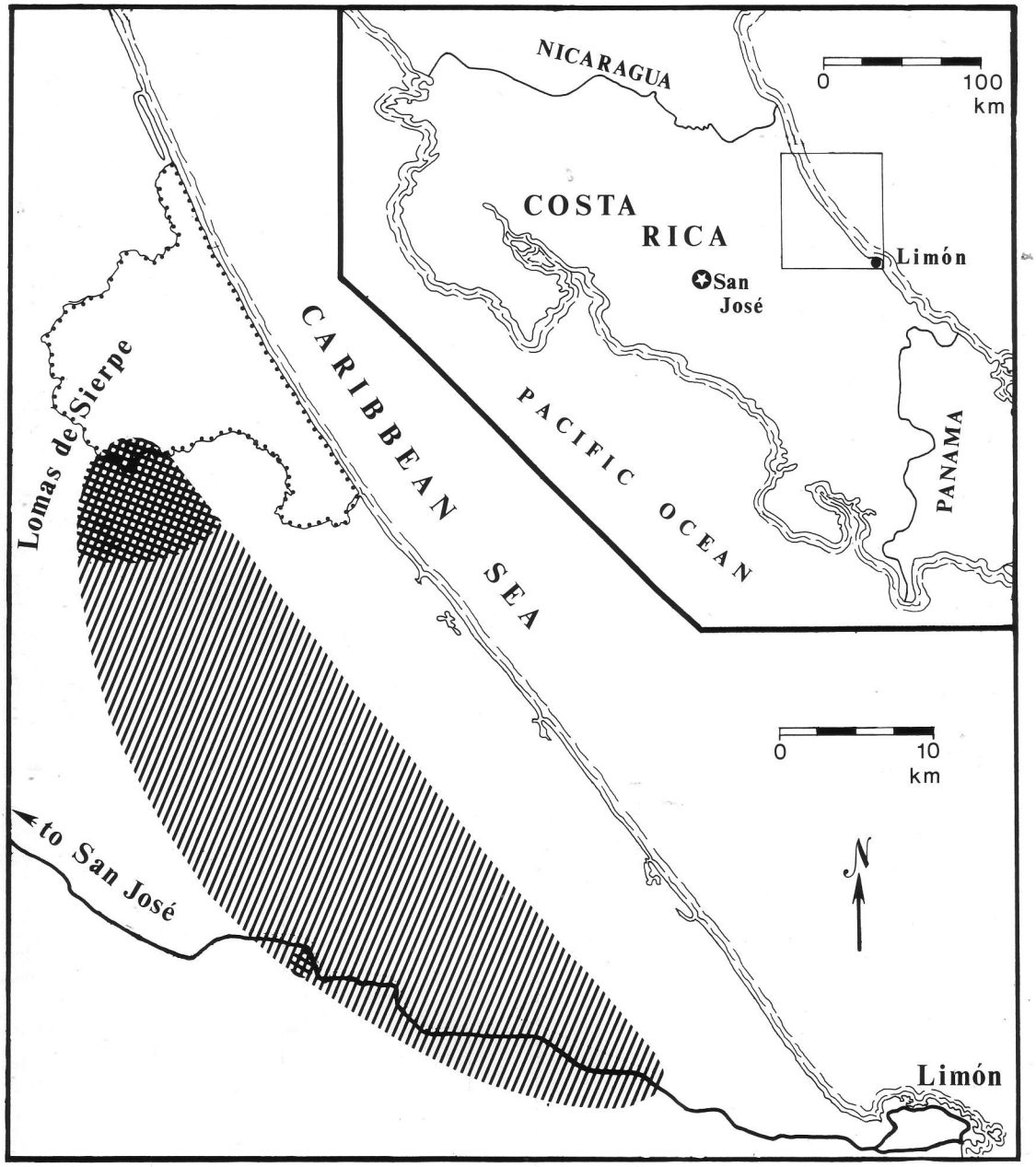
This species is characterized by typically large inflorescences with long first-order branches and rachillae, caducous rachis bracts, basal adventitious roots morphologically distinct from the root-spines above, leaves that are usually less deeply divided than in other species of *Cryosophila*, and fruits and seeds that are larger than in all other species except *C. macrocarpa*. *Cryosophila warscewiczii* is found at elevations from sea level to 1 200 m in lowland moist to wet forests on the Carribean slope from southern Nicaragua to central Panama, where its range crosses the isthmus to the Pacific coast. It has been reliably reported from northern Nicaragua, and presumably extends into southern Honduras (W. D. Stevens, personal communication).

This palm has been extirpated in many areas, but is still locally common throughout much of its historic range.

Cryosophila williamsii P. H. Allen (Fig. 22)

Ascending inflorescences with closely spaced peduncular-bract nodes are diagnostic for this species. Also characteristic are the consistently large number of veins per leaf segment. It is restricted to the steep limestone slopes of the Lago Yojoa watershed in west-central Honduras at an elevation of about 650 m.

Standley in 1930 described Lago Yojoa as "surrounded on all sides by lofty, heavily forested mountains whose sides remain untouched by man." The majority of this forest was still intact as recently as the mid-1970s (A. Molina, personal communication). Today, probably less than 5 km^2 of relatively undisturbed primary forest remain on the slopes surrounding Lago Yojoa below 1 000 m. In this small area this palm is common, with probably a few thousand adult individuals remaining. However, because of the extremely limited size of this area, if current deforestation rates continue, all remaining low-elevation Lago Yojoa watershed forest, including all known *C. williamsii*, will disappear by the end of this decade.



23. The present-day (cross-hatching) and approximated presumed historical (diagonal hatching) distributions of *Cryosophila cookii*. The dotted border outlines Tortuguero National Park, Costa Rica.

The Conservation Status of Cryosophila cookii

Cryosophila cookii was described by Bartlett (1935) based on a single collection made in 1903 from near the Río Hondo, on the Caribbean coast of Costa Rica (Fig. 23). It was not found again until 1988, when it was relocated at the type locality. Subsequently, it has been collected just south of Tortuguero National Park about 30–40 km northwest of the Río Hondo type locality.

Cryosophila cookii is most often known locally

as *súrtuba* although sometimes called *escobón*. Even though *C. cookii* is apparently not currently being used by local people, both common names suggest past use. The name *súrtuba* is occasionally used in other parts of Costa Rica for both *Cryosophila guagara* and *C. warscewiczii* (although both of these are more commonly called *guágara*) as well as several other palms (especially *Geonoma* spp.) that have bitter tasting palm hearts. *Escobón* ("large broom") presumably refers to the fact that *C. cookii* is the large *Cryosophila* relative to the sympatric *C. warscewiczii*. *C. cookii* is not known in cultivation, but occasionally is left standing when the forest is cleared (Fig. 24).

Cryosophila cookii occurs in Tropical Wet Forests as classified by the Holdridge system of tropical forest classification (Holdridge 1966, 1967), in a climatic zone characterized as being "very hot, very wet" (to over 6 000 mm of precipitation annually), without an annual water deficit during the dry season (starting in late December to early January and ending sometime in April) (Herrera 1985). A large portion of the geographic range of *C. cookii* is coincident with the only area of humic tropofibist histosol soils in Costa Rica [Gómez 1986 (=tropical bog forest *sensu* UNESCO (1973) according to Gómez)]. Although *C. cookii* is also found outside this area on other soil types, it may very well be edaphically limited, as it grows only on warm, dark and acidic soils with a high organic content, developed in water-saturated environments.

Within the area characterized by the above broad soil and climate types, *C. cookii* is further restricted to those low-lying areas (usually at elevations of less than 20 m) having very wet soil most of the year, yet never seasonally inundated. It has not been found on the hills or in the swamps common in the area.

Throughout its range, *C. cookii* occurs syntopically with *C. warscewiczii* (Fig. 2), a morphologically very different species with a considerably broader distribution [Panama to Nicaragua (Honduras?)]. In contrast to *C. cookii*, *C. warscewiczii* is a generalist species adapted to a wide variety of forest habitats. *C. warscewiczii* is found everywhere *C. cookii* occurs; within the range of *C. cookii*, *C. warscewiczii* also occurs on hilltops, slopes, and in seasonally inundated hollows. In other parts of its range, *C. warscewiczii* is found in drier habitats and up to about 1200 m elevation. *Cryosophila cookii* is a considerably less abundant species than *C. warscewiczii*. Although both species tend to have a patchy distribution with individuals occurring in well-defined populations, *C. cookii* populations are far smaller and much more widely separated. In a given area there may be as many as 100 individuals of *C. warscewiczii* for every one of *C. cookii*.

In the range of *C. cookii*, the rainy season typically begins in mid-April and ends around the beginning of January. It is usually divided into two parts by a relatively dry period in September. *Chryosophila cookii* apparently flowers continuously throughout the early portion of the rainy season, from April to August, producing about ten inflorescences sequentially. Fruits can still be found on trees at the end of the rainy season in late December. Typically, all the flowers of about half the inflorescences produced per year abort and fail to set fruit. Nothing is known about pollination or seed dispersal in *C. cookii*. However, *C. warscewiczii* is thought to be primarily pollinated by weevils (*Derelominus* sp.) (Henderson 1984), and seeds of *C. kalbreyeri* subsp. *cogolloi* in Colombia are thought to be dispersed by the Oilbird (*Steatornis caripensis*), which swallows the fruits whole, digests the pericarp, and then regurgitates the intact seeds (A. Cogollo, personal communication). Seeds were rarely encountered on the forest floor, even beneath trees bearing mature fruit. Seeds either rot quickly on the very wet forest floor or are soon taken by predators. Their germination rate is unknown (two attempts at germinating seeds in the laboratory failed), but recruitment is very low, as no seedlings and only two juveniles were ever encountered in the forest. Seedlings were found beneath a reproductive adult that had recently been felled, following which the area was burned. Therefore there is at least a limited seed bank, and removing the forest cover must be conducive to germination and/or rapid seedling growth in full sun.

Since *C. cookii* was known previously from only its type locality, it is not possible to determine with certainty its historic distribution. However, if, as suspected, *C. cookii* is limited by edaphic and various microhabitat requirements, the species was probably never much more widely distributed than it is today (Fig. 23).

Despite the relatively high level of environmental awareness and concern in Costa Rica, as reflected by the large amount of land under some form of protection (roughly 30% of the total land area, with about 10% in national parks), outside these protected areas (and too often, within) defor-

24. *Cryosophila cookii* left standing in cleared field, the typical habitat today for most of the surviving individuals of this species. Same plant as in Figure 10. 25. Martín Rojas Q., owner of the small farm bordering Tortuguero National Park, Costa Rica where the majority of the *Cryosophila cookii* remaining in intact forest are found.

estation is going on at a rate reported to be the highest per capita in the world (Myers 1989). In the vicinity of Tortuguero National Park (Fig. 23) this deforestation is such that the park will soon be an island of forest in a sea of cattle pastures and banana plantations, as clear-cutting is rapidly approaching the park from every landward direction, having already reached the park boundary in certain places. Ongoing deforestation is particularly acute west of the park, long an area of intense banana production. These immense corporate plantations are expanding rapidly as are smaller privately owned conversions, mainly for cattle ranching.

Despite the magnitude of deforestation outside the park, *C. cookii* could perhaps survive indefinitely, if there were a viable population within the park. Unfortunately, that does not appear to be the case. Although there is a fairly healthy population in a small forested area just south of the park border across the Río Sierpe, I was able to locate only one adult *C. cookii* (Fig. 9) within the park (in the vicinity of the abandoned Río Sierpe guard station) during a 1-wk search. The apparent reason for this is that there is a fairly abrupt change in habitat from south of the Río Sierpe to within the park. Just north of the river, conditions abruptly become too wet (to the east) or too hilly (to the north and west) for the specialized *C. cookii*. In another search near the Agua Buena Park Station, north of the ridge of hills (Lomas de Sierpe) that bisects the park southwest to northeast, I found no *C. cookii*, although *C. warscewiczii* is common.

As indicated previously, I estimate the present population size of *C. cookii* to be only about 100 adults. Although a crude estimate, I feel this accurately reflects the seriousness of the situation. That is, even if the estimate is, in reality, several times too low, it still does not change the overall picture relative to the chances of long-term survival for this species. Also, it must be remembered that as more and more land is cleared and individuals lost, the remaining plants are becoming increasingly isolated from one another, often as single individuals left standing in cleared fields (Fig. 24). Consequently, effective population size is, in terms of successful pollination rate (*Cryosophila*, although bisexual, are self-incompatible) and likelihood of seedling survival (essentially zero in the cleared fields) undoubtedly much lower than actual population size.

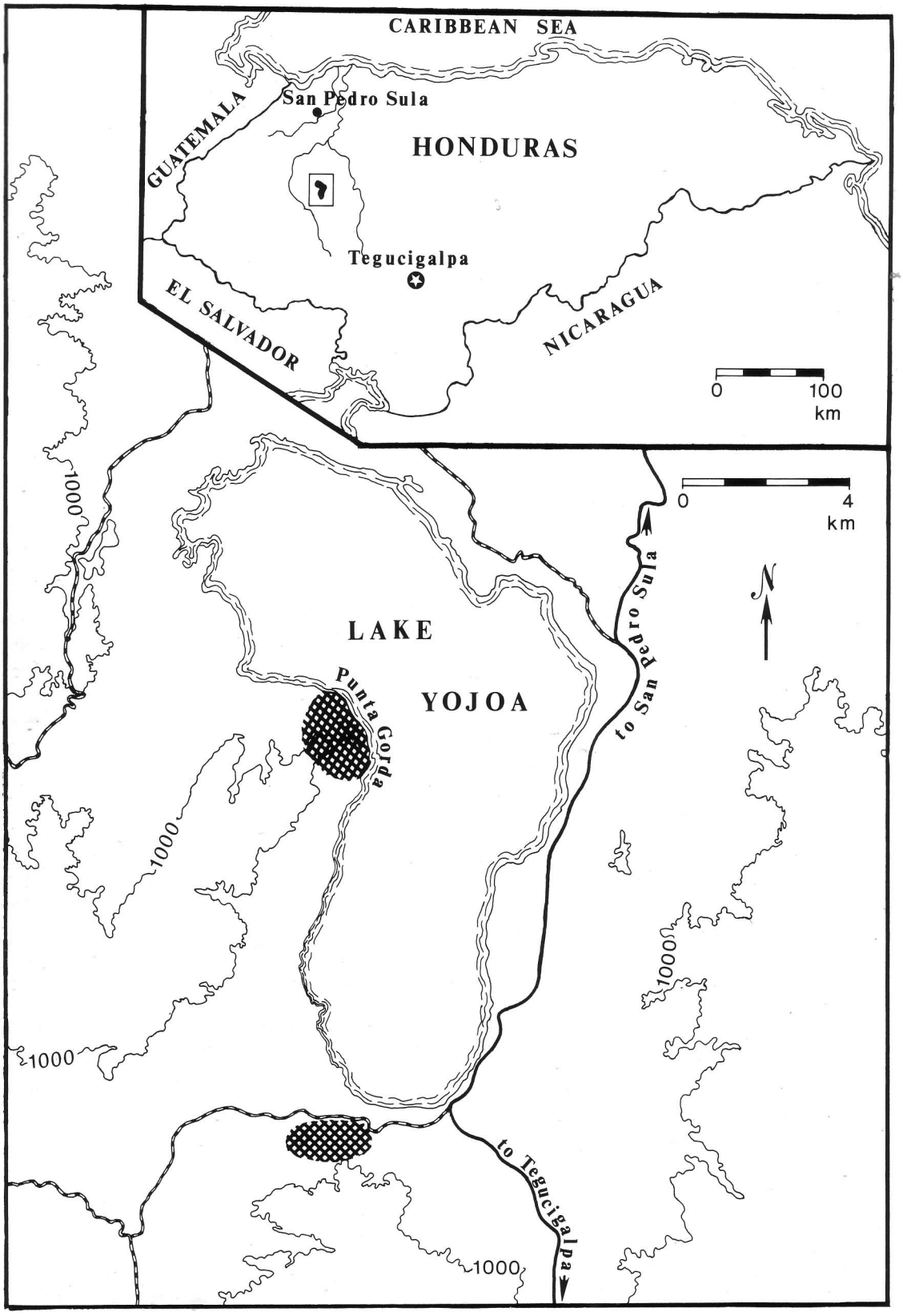
Since the key to saving *C. cookii* lies in protecting at least one viable wild population, I suggest that an exhaustive search for individuals be made within Tortuguero National Park, concentrating in the area to the east of the old Río Sierpe Park Station, just north of the Río Sierpe. This survey should be carried out at the height of the dry season (around March), since much of the forest in this area is flooded for the greater portion of the rainy season.

If, as I suspect, a viable *C. cookii* population does not occur in the park, perhaps the only other hope for preserving this species in the wild is to bring land south of the park, which is known to contain a stable population of *C. cookii*, into the park system. Adjacent to the present park boundary is a small (approximately 200 ha) private farm, which is still mostly forested and contains numerous adult *C. cookii*. The owner (Fig. 25) bemoans the disappearance of essentially all the forest outside the park surrounding his land, and he is very concerned that unless his land is incorporated into the park, it too will be cleared soon after he is gone. Adding this small piece of property to Tortugurero National Park could be the best and perhaps only opportunity for preventing the likely imminent extinction of *C. cookii*. Furthermore, as a result of the abrupt habitat change at the park boundary (the Río Sierpe) such a modest park expansion could very well be adding to the park a number of species other than *C. cookii* that are currently rare or absent inside the park.

At the very least, an effort should be made to collect seed (mature from June to December) in order to try to bring *C. cookii* into cultivation. The Río Hondo type locality is very accessible from San José (one individual being visible from the San José to Limón highway). This distinctive palm has potential as an ornamental, despite its spininess. Unfortunately, collecting mature seeds is difficult because they are rarely encountered on the ground, and collecting infructescences from these tall, extremely spiny palms is very difficult (and only a small fraction of the fruits are mature at any given time).

The Conservation Status of Cryosophila williamsii

Paul Allen described *Cryosophila williamsii* in 1953 based on his own 1952 collection from Punta Gorda on Lago Yojoa in west-central Honduras (Figs. 26,27). It was recollected at the type locality


CARIBBEAN SEA
GUATEMALA
San Pedro Sula
HONDURAS
Tegucigalpa
EL SALVADOR
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0
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km
N
LAKE
YOJOA
Punta Gorda
to San Pedro Sula
to Tegucigalpa
1000
1000
1000
1000
1000

in 1987, and in 1990 was first collected from an area immediately south of the lake.

Allen (1953) reported that *C. williamsii* was known locally as *mojarilla*, but I found no one in the Lago Yojoa area who recognized this name. Rather, it was most commonly called *palmiche* or simply *palmera*. Like most species of *Cryosophila*, *C. williamsii* leaves were formerly used for thatch (Allen 1953), although apparently they no longer are. The palm heart is apparently eaten, as numerous felled individuals were encountered in which the "heart" had been removed.

Lago Yojoa, the only large natural lake in Honduras, lies at 635 m elevation between the valleys of the Otoro-Ulua rivers and the Humuya-Comayagua rivers in west-central Honduras. To the west, south and southwest of the lake, the land rises abruptly up the very steep and rugged, limestone boulder strewn slopes, soon reaching an elevation of over 2 000 m. After a slight rise in elevation north of the lake, there is a gradual descent along the Ulua River valley to the Caribbean.

According to the Holdridge Life Zone System (Holdridge 1966, 1967), the Yojoa watershed area below 1 500 m is classified as Very Humid Subtropical. However, such a broad category masks numerous habitat differences in the area resulting from varying weather patterns, topography, and elevation. For example, precipitation is greatest (to over 3 000 mm annually) along the western, southern, and eastern slopes above the lake, as northerly winds from the Caribbean pick up additional moisture over the lake, which is then deposited on these slopes. This high rainfall on these relatively low-elevation, steep limestone slopes has resulted in a habitat type unique in Honduras, and undoubtedly explains the extremely restricted distribution of *C. williamsii*. Although the flora of the Lago Yojoa watershed area is poorly known, it very probably harbors other local endemics.

Cryosophila williamsii is known from only two localities around Lago Yojoa (Fig. 26). Although the upper elevation limit of *C. williamsii* is unknown, species of *Cryosophila* rarely occur above 1 000 m. This elevation contour is included in Fig. 26, in order to demonstrate what the historical distribution might have been. Unfortunately, the only forests remaining below 1 000 m are a small patch on Punta Gorda and an even smaller area along the slopes south of the lake.

27. Punta Gorda, Lago Yojoa, Honduras. Site of the last known viable population of *Cryosophila williamsii*.

As reported by Allen (1953), *C. williamsii* was very common in the primary forests of Lago Yojoa. Within the small area of remaining intact forest, this is still true today. This situation contrasts with that of *C. cookii*, a much less common species within its forest habitat. Similar to *C. cookii*, individuals of *C. williamsii* apparently flower continuously during the rainy season from August to December. Fruits are probably still present on trees in March and perhaps even April. Nothing is known about pollination and seed dispersal of *C. williamsii*. Seedlings and juveniles are common, and germination and recruitment rates must therefore be high.

On account of habitat specificity, *C. williamsii*, like *C. cookii*, was probably never much more geographically widespread than it is today, but this likewise cannot be confirmed from herbarium records.

More than half of Honduras's 112 088 km^2 is still forested (Myers 1980, 1989; Lanly 1982; FAO 1988). However, the overwhelming majority of these forests are concentrated in the very remote eastern third of the country, the "Mosquito Coast" area, comprising the eastern portions of Colón and Olancho Departments and the entire Department of Gracias a Dios. Approximately 90 000 ha of Honduran forest are destroyed annually (Myers 1989). As indicated above, only about 500 ha of

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26. The distribution of *Cryosophila williamsii*. The present-day distribution is indicated by cross-hatching and the lakeward slopes below the 1 000-m contours approximate the presumed historical range of the species.

forest containing *C. williamsii* remain surrounding Lago Yojoa.

Extrapolating, as for *C. cookii*, from estimated population density and area of intact forest, I estimate a total population size of a few thousand remaining individuals of *C. williamsii*. Even though this is considerably (by at least an order of magnitude) larger than the estimate for *C. cookii*, of the two species *C. williamsii* is probably in the most immediate danger of becoming extinct because of its more restricted distribution.

In contrast to the factors affecting primary forest in the range of *C. cookii*, deforestation in the Lago Yojoa area is generally due to small scale "slash and burn" subsistence agriculture (mainly corn). As previously indicated, an additional threat to *C. williamsii* is the selective felling of individuals, presumably in order to collect the palm heart.

The entire Lago Yojoa watershed area was declared a forest reserve in 1971. Unfortunately, this designation is meaningless in reality, as most of the deforestation in the area has occurred since that time.

A thorough demographic survey of remaining *C. williamsii* is needed. The Lago Yojoa watershed, as well as surrounding areas away from the lake, should be included, in order to accurately assess current population size. Since *C. williamsii* is also unknown in cultivation, efforts should be made to collect seeds for introduction into the horticultural trade. Because of its smaller size and fewer spines, *C. williamsii* has greater potential as an ornamental than does *C. cookii*.

The difficulty in proposing a meaningful conservation strategy for the preservation of *Cryosophila williamsii* is that the government of Honduras has already recognized the significance of the Lago Yojoa area, having designated the watershed a reserve. The fact that the area has now been identified as harboring at least one Honduran endemic (and I suspect numerous others) could bolster the argument for upgrading the protection status of the remaining forest (e.g., to some sort of "biological refuge" or "scientific reserve") so as to at least increase the chances for real protection.

Either *C. cookii* or *C. williamsii* could easily become the first example of the contemporary extinction of a neotropical palm species. The precarious situations of both species result from their small population sizes and the rates of deforestation occurring in the very small area of suitable habitat still remaining. It is very difficult to argue for the preservation of single species from a biological standpoint, except perhaps when the species are genetically isolated (i.e., as in a monotypic genus). Therefore it should be reemphasized that by protecting the specialized habitats of *C. cookii* and *C. williamsii*, undoubtedly numerous other localized endemics (such as *Arberella costaricensis*, a localized bamboo known only from the area of the type locality of *C. cookii*) will also be protected, since it would be expected that species in other plant groups would also have become adapted to the same localized environmental conditions that help explain the historically restricted distributions of *C. cookii* and *C. williamsii*.

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Addendum

A number of cultivated, fertile *Cryosophila williamsii* were recently (April 1996) discovered in the town of Sesesmil, Honduras near the Guatemalan border about 10 km north of Copán Ruinas. The original plantings were said to have been made about 25 years ago from seeds collected in the forested hills nearby. The palm is known locally as amargo ("bitter"), but wild individuals are extremely rare today as they are sought out for their highly desirable, albeit bitter tasting, palm hearts. In fact, no wild adults are known to still occur in the vicinity, and a search turned up only two (5–10 years old?) juveniles. These too will undoubtedly be cut as soon as they are larger.

The significance of this recent discovery is that the geographical distribution of *Cryosophila williamsii* is considerably greater than previously thought. Sesesmil is approximately 120 km west of Lago Yojoa, and presumably *C. williamsii* occurs, or at least did occur, in the intervening area between these two disjunct populations. In addition, the proximity of Sesesmil to the Guatemalan border argues for the occurrence of *C. williamsii* in extreme eastern Guatemala. Lastly, since the two wild, juvenile *C. williamsii* encountered were not growing on limestone, this species is obviously not restricted to this habitat type as previously presumed.

Although *Cryosophila williamsii* is now known to be much more widely distributed geographically than previously realized, I do not think this significantly changes the conservation status of the species. It still must be considered extremely endangered, particularly since no viable populations are yet known to occur outside the Lago Yojoa area.

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Pelagodoxa henryana in Fiji

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Pelagodoxa henryana Becc. is a rare palm from Nuku Hiva in the Marquesas Islands reportedly growing in dense rain forest about 135 m above sea level *in a humid valley*. This description from *Genera Palmarum* probably gives some indication of the rarity of the palm. Its status on the island is doubtful in that one search party was unable to locate the palm, but another report speaks of collecting fruit.

Just how and when this palm reached Fiji I do not know. John Parham (*Plants of the Fiji Islands* 1972) reports that three specimens had been growing in the Suva Botanical Gardens (now the Thurston Gardens) but that they had died. The photograph in *Genera Palmarum* (p. 142) was certainly taken in the Thurston Gardens, but although I have lived in Fiji for many years, I do not remember having seen the palm.

My real interest in palms began in about 1976—I attended my first International Palm Society Biennial in 1978—and I assumed that *Pelagodoxa henryana* had been lost to Fiji. However, I kept looking in all the old gardens in Suva and encouraged several friends to do the same.

My best collector was Nacani, who seemed to have inumerable relatives who died with monotonous regularity; as a result, he was always short of money. He came to my house one day with an almost round, smooth seed, slightly smaller than a golf ball and announced that it was the seed of a palm. I had never seen a palm seed that looked like that so I demanded an explanation. The more details Nacani gave me, the more excited I became, particularly when he mentioned the corky warts on the fruit.

He led me to an abandoned garden quite close to the Thurston Gardens and there, in all its glory, was the palm. It took only a quick look for me to know that it was *P. henryana*. Better still was the fact that it was loaded with several hundred seeds in various stages of development and, on the ground below, there were about 40 seedlings growing strongly.

Fortunately, I knew the owner of the property so we stole all the seedlings and then phoned and told the owner what we had done. As I expected, he approved. The seedlings grew well, as did many more plants, which I have grown from seeds from this palm.

Over the years I have sold and given away more than 100 palms to friends who had fairly permanent gardens. Four specimens have been planted in the Botanical Gardens section of the University of the South Pacific in Suva and three in the Thurston Gardens (Fig. 1). All of these are growing well.

Collectors coming to Fiji have also been happy to take a few seeds with them, and it soon became known, through the Palm Society, that there was a fruiting *P. henryana* in Fiji. This led to numerous letters asking for seed. The request I do remember was from Germany—a Society member rang me to see whether seed was available. Unfortunately he forgot that there was a 12-hour time difference between Germany and Fiji. At 3 a.m. I was not very receptive to a request for seed!

A member in southwestern England wrote asking for seed. As I had a friend flying to the U.K., it was arranged that he would carry two seedlings. The member rode a bus from his home to Heathrow, picked up the seedlings, and rode the bus back to his home. The seedlings were out of the ground for not much more than 60 hours and were not troubled by the trip half way around the

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1. Three young specimens of *Pelagodoxa henryana* growing in Thurston Gardens, Suva in 1993. 2. Fruits on one of the *Pelagodoxa* in the Phillips' garden. The palm first flowered in 1993; the lowest inflorescence is the second or third formed. 3. A germinating seed of *Pelagodoxa*.

world. They grew well but succumbed when a hail storm broke the panes in the glasshouse roof and let in the cold winter air.

I planted three palms in my own garden about 1980. These have grown well in the shade of several large trees, which also sheltered them from some of the wind (Fig. 2). In January 1993 Cyclone Kina passed through at about 200 km per hour. The shelter trees blew over but the palms remained. They were, however, left in full sun. The same hurricane demolished the one fruiting *P. henryana* that had given me so much seed.

A month later I noticed an inflorescence on one of my palms and there was a certain amount of celebration, though I thought it possible that the inflorescence had been triggered by the stress of the storm and the sudden increase in light. There was more celebration when inflorescences continued to appear—and, better still, seed set regularly. In April 1995 the second palm started to flower and this was followed by the third palm in June 1995.

This palm is said to be protandrous so, from experience, I expected the female flowers of the first inflorescence to be pollinated by the male flowers on the second inflorescence. The female flowers on the first inflorescence, however, were well past the receptive stage when the pollen was available from the newer inflorescence. But nearly 25 seeds set on the first inflorescence (Fig. 3). How were they pollinated? I do not know but, now, more than two and a half years later as the fruit is finally maturing, the first seeds appear to have viable embryos. This I leave to the experts to consider.

The long delay between pollination and maturity of the seed has surprised me. Perhaps it is that these palms are not common so no one has checked this point, but I have seen nothing in any literature that had commented on this long period of development.

I would estimate that the first of my palms to flower has well in excess of 200 seeds in various stages of development. Hopefully, this means that there will be a steady supply of seed ripening throughout the year.

It has been reported that the palms in the Marquesas and Tahiti have a very small number of seeds. The seeds are also much larger than those on my palms. I doubt that the difference in the size of the seeds is sufficient to suggest that there are two species.

This small-seeded variety is also reported from the Solomon Islands (Dowe: *Palms of the South West Pacific*), but as it is in association with a deserted village it is probably introduced and not native. In November 1994 I was in Vanuatu with John Dowe and Suliana Siwatibau for the *Carpoxylon macrospermum* project to locate and enumerate these palms in the wild and in cultivation and, hopefully, to initiate a species regeneration scheme. During that period we visited most of the villages on the northeast coast of the island of Malekula. We found *P. henryana* in a number of villages (Fig. 4). Indeed, the most beautiful specimen of this palm I have seen was in a village garden in this area. It was protected by the trees and, as a result, there was little damage to the leaves. It was growing with *Cocos nucifera* and *Metroxylon warburgii*. The villagers did not mention any uses for the palm.

It would be my guess that *P. henryana* travelled around the Pacific with Catholic priests. They

4. *Pelagodoxa henryana* with *Metroxylon warburgii* and *Cocos nucifera* in a garden on the island of Malekula, Vanuatu.

are the ones most likely to have seen the palm in Tahiti or the Marquesas and, if the report that the young endosperm was eaten is correct (*Genera Palmarum*, p. 420), this might be sufficient reason to take the palm to new lands where the value of the edible endosperm was forgotten during the 20 years that it would have taken for the seeds to grow and the trees to mature.

There have been problems with the germination of the seeds. Originally I used to clean the seed, soak it in a fungicide and an insecticide, and place it in a plastic bag with damp spaghnum moss, which fortunately grows in Fiji. The bag was then hung up in strong light but not in any direct sun. Inside the plastic bag some heat would build up during the day, but the temperature would drop at night. In this way I obtained only 30% germination over a period of three to six months. The seeds that were left were then thrown under a bench in one of my shade houses on a bed of damp wood shavings or rice husks. Often a few more would germinate over another three or four months.

Then a friend of mine tried constant heat. He cleaned and treated the seed as I had done and put them into plastic bags with damp vermiculite. They then went into a heated cabinet, which maintained a constant 30°C. On a trial of ten seeds, several germinated within a month and the rest germinated intermittently over a ten month period, but he did obtain 100% germination. It would appear that heat is essential for good germination.

I would hope that *Pelagodoxa henryana* is now well established in Fiji and that, unless there is a major catastrophe, the numbers will not fall as dangerously low as they did in the past.

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"Paradiso Principum"— A Palm Paradise in Cuba

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Sancti Spiritus province is located in the center of Cuba. It is gifted with beautiful countryside and a rich flora, in which palms are well represented. Of the 14 indigenous Cuban genera, nine are found in Sancti Spiritus, with a total of 23 species. The genus *Copernicia* is especially prominent with nine species, three of which are thought to be natural hybrids (Table 1).

In the southeastern part of the province, between the rivers Zaza and Jatibonico del Sur, lies a particularly rich palm habitat. Seven species have been identified growing here by the principal author (Table 2). This area is a flat coastal plain, with tidal areas and mangrove colonies along the southern coast. Much of the area has been given over to sugarcane cultivation and ranching. However, large local stands of *Copernicia* palms remain, often in spectacular local abundance.

One notable, and mosquito-infested, habitat occurs south of the village of Los Galleguitos in an area known as La Sierpe. Here, very near the sea, are dense stands of *Copernicia rigida*. Fire seems to occur periodically here as evidenced by scorched trunks of older plants (Fig. 1). In this population there is marked variation among individuals in leaf width (Fig. 2), as well as leaf color. Leaf color seems to be somewhat dependent on wax coating. Plants with denser coatings have a more blue-gray leaf color.

Although the leaf of *C. rigida* is described as lacking a petiole, one may rarely see seedlings and juveniles with petioles. Many individuals have conspicuously long hastulas. These often persist on older plants after the dried leaves fall (Fig. 3).

Mixed with *C. rigida* in this locality are many individuals of *C. macroglossa*, easily distinguished by the wider, semi-orbicular leaves and stouter, less-branched inflorescences. *C. baileyana* and *C.*

Table 1. Palms indigenous to Sancti Spiritus Province, Cuba.

Acoelorraphe wrightii (Griseb. & H. Wendl.) H. Wendl. ex Becc.
Calyptronoma plumeriana (Martius) Lourteig
Coccothrinax clarensis Leon
C. littoralis Leon
C. miraguama (Kunth.) Leon
C. trinitensis Borhidi & Muniz
C. sp. "blue leaves"
Copernicia baileyana Leon
C. gigas Ekman in Burret
C. hospita Mart.
C. macroglossa H. Wendl. ex Becc.
C. molineti Leon
C. rigida Britton & Wilson
C. × *burretianum* Leon
C. × *textilis* Leon
C. × *vespertilionum* Leon
Gaussia spirituana Moya & Leiva
Gastrococos crispa (Kunth.) H. E. Moore
Roystonea regia (Kunth.) Cook
Sabal maritima (Kunth.) Burret
Sabal palmetto (Walt.) Lodd. ex Schultes
Thrinax morrisii H. Wendl
T. radiata Lodd. ex Schultes

Table 2. Copernicia *species found in Rio Zaza/ Rio Jatibonico del Sur area ("Palmar Romero").*

Copernicia baileyana Leon
C. gigas Ekman in Burret
C. hospita Mart.
C. macroglossa H. Wendl. ex. Becc.
C. molineti Leon?
C. rigida Britton & Wilson
C. × *textilis* Leon
C. × *vespertilionum* Leon

1. A stand of *Copernicia rigida* near Los Galleguitos with fire damage. 2. Striking younger plant of *Copernicia rigida* with narrow leaves.

3. Persistent hastulas in old plant of *Copernicia rigida*. 4. *Copernicia x vespertilionum* (center) in habitat with *C. rigida* (L) and *C. x textilis* (R). 5. Older *Copernicia gigas* near Siete de Noviembre, Cuba. 6. *Copernicia x textilis* with fusiform trunks. Older individuals in background.

× *vespertilionum* rear up here and there as scattered individuals. *C.* × *vespertilionum* (Fig. 4) has been described as a natural hybrid of *Copernicia gigas* and *C. rigida* by Leon (1931). It is differentiated from *C. rigida* in having a petiole, a shorter hastula (up to 10 cm), and more segments (32–40). It differs from *C. gigas* in having persistent dried leaves, a shorter petiole, and fewer segments. *C.* × *vespertilionum* is found only in Central Cuba, and is classified as rare by the IUCN (1989). It is known to local people as the "*jata de los murcielagos*" or "bat palm" because bats seem to prefer roosting in its crown.

Although *Copernicia gigas* does not occur in this locality, large populations exist nearby, close to the pueblo Siete de Noviembre. Cultivated land intervenes. These populations appear to be almost pure stands of the palm. Many plants have an attractive yellow-stripe margin to their petioles. Older plants grow quite tall (at least 12 m) forming impressive specimens (Fig. 5).

Copernicia hospita is seen as widely scattered individuals and small groups in the entire region, often kept on cultivated land. Dahlgren and Glassman (1963) described it as one of the parents (with *C. baileyana*) of the natural hybrid *Copernicia* × *textilis*. This palm also is found in the Los Galleguitos area (Fig. 6) and is restricted to central Cuba. It differs from *C. baileyana* by having fewer leaf segments (68–84) of shorter length and by its more delicate inflorescences. It is distinguished from *C. hospita* in having a larger number of segments and a more robust petiole. *Copernicia* × *textilis* often displays a fusiform or ventricose trunk. This palm occurs in small-to-moderately sized stands and does not appear threatened.

Copernicia molineti is a species that has not been collected since 1931. If still present it should grow in an estuarine area directly on the southern coast in the region under consideration. This area is difficult to reach due to poor or absent roads and estuarine channels. The status of this population is unknown.

Recently a proposal has been made to create a natural reserve in southern Sancti Spiritus to include the areas described. This reserve would be called the Palmar Romero, and would represent a vibrant living legacy of the evolution of the genus *Copernicia* in central Cuba.

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PALM RESEARCH IN 1995

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LETTER

Dear Palm Enthusiast,

Jean-Christophe Pintaud of O.R.S.T.O.M. in Noumea and I are writing a book about the taxonomy and culture of the New Caledonia palms. The book, which we hope to publish in 1997, will include chapters on ecology, soils, and distribution, as well as extensive descriptions of the island's 40 endemic palm species (eight new species have been discovered since Moore and Uhl's 1984 work!). The book will be richly illustrated with over 100 color photographs. Perhaps most importantly, we plan a large chapter on culture of the New Caledonia palms.

To make the chapter on culture most useful and valuable for people who grow palms, we are soliciting your experiences growing the New Caledonia palms in containers and the ground. We will include this information and recognize your contribution in the book. Information about the New Caledonia palms we would like includes, but is not limited to, the species grown, seed propagation and germination, growth rates, your climatic and environmental conditions, and any special or unusual cultural techniques you used to grow the New Caledonia palms successfully. Likewise, we would like to know any special cultural techniques which turned out to be failures. Generally, we would appreciate any information which might help someone grow these palms more successfully.

Avoid generalizing; be as specific as possible. Send the information to me at the address below. Your contributions can and will make a difference in this book. Thanks for your help.

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1996 I.P.S. Biennial Private Garden Tours

DON TOLLEFSON

599 California Ave., Venice, CA 90291

If you live in a temperate climate, and you have a desire to learn about growing the many beautiful, exotic palms that can be grown in your area, then don't miss the private garden tours at the 1996 California Biennial. California is one of the world's leaders in the cultivation of temperate climate grown palms, and there are many California gardens that are now among the best in the world. It's a sophisticated skill to grow tropical palms in a temperate climate, but once you obtain the basic know how it's surprisingly easy, and you'll be amazed with how lush and tropical a garden you can develop.

A test of my ability to develop a palm collection in a temperate climate came with a visit from friend and fellow I.P.S. member, Garrin Fullington, a couple of years ago. I took Garrin to one of my gardens in Venice, California and showed him an extensive assortment of tropical and temperate climate palms. It was at the end of winter and the daytime temperatures were in the 40s. I thought my garden looked excellent, but I didn't know how Garrin would react, being from the Hilo area of Hawaii, with annual rainfall of over 200 inches, and temperatures that had never fallen below 60 degrees.

At the end of the tour, Garrin said, "Your garden looks great! I'm impressed with the palms that you can grow, and I'm even more impressed with how good they look." Garrin tends to be understated, so I was exhilarated with his compliment. "I can't take all the credit," I explained, "I've done the Southern California Palm Journal Close Ups (interviews) for the past few years, and I've learned how to grow these palms in a temperate climate from the people I've interviewed. You might say I've learned from the best, and I'm grateful for their interviews."

Now the opportunity to see some of these gardens is near. The August schedule for the 1996 International Palm Society Biennial in California includes four private gardens and the ability to see first hand some of the many exotic and beautiful palms that can easily be grown in a temperate climate. There is no substitute to learning from experienced growers, and seeing their mature collections. These gardens and these growers are among the best anywhere. The four gardens are those of Lois Rossten, Ralph Velez, Pauleen Sullivan, and Louis Hooper. What follows is a summary of each garden and the unique growing techniques of each grower.

Lois Rossten emphasizes the importance of a greenhouse, and the ease with which you can grow beautiful, lush palms once you have a basic concept of growing tropical palms in a temperate climate. Lois has a small greenhouse, which is shaded from sunlight due to the canopy formed by her mature palms. She keeps the temperature warm during the winter months with a natural gas heater. The temperature seldom exceeds 80°, or drops below 60°. Lois finds that most small palms will not grow well in a temperate climate without winter protection and greenhouse-induced size. She leaves the palms in the greenhouse until they are ready to move from a four inch into a one gallon container at which time she places them outdoors to harden off. Louis likes to bring the palms out of the greenhouse in the spring after the nighttime temperatures stabilize at or above the high 50s. She then allows the palms to grow to a large one gallon size outdoors and plants them in the ground during the spring and summer months as a one gallon, digging a hole just large enough for the palm to fit into.

Lois' philosophy is basically to plant the palm and wait. Nothing happens at first. Nothing happens next. Nothing happens after a year. Nothing happens after two years. And just when it seems that the plant is going to remain a runt forever it begins to grow and it continues to grow becoming a large fast-growing palm. Her system is simplistic and highly successful, but it does require more patience than most other systems.

Lois has a fabulous palm collection with over 150 species on her standard city lot. Included in her collection of specimen palms are *Veitchia joannis*, *Veitchia arecina*, *Dictyosperma album*, *Wallichia disticha*, *Carpentaria acuminata*, *Roystonea regia*, and *Parajubea cocoides*.

Ralph Velez stresses the importance of a greenhouse, and the ultimate size and time to plant most palms outdoors. Ralph has two greenhouses, and a palm growing career, which has included some form of greenhouse from the beginning. Ralph's lower greenhouse is his cool greenhouse in which he grows many greenhouse-only palms. His upper greenhouse is the warm one in which he grows his seedlings to planting size. Ralph installed his upper greenhouse because the sunlight to his lower greenhouse became blocked from his mature palms.

Ralph feels that it's not productive to attempt to grow small tropical palms without the benefit of greenhouse heat. They simply will not grow satisfactorily, and a normally two-year effort can turn into a ten- or twelve-year odyssey, with the probable loss of the palm before it obtains planting size.

Ralph prefers to grow the palms to a five gallon size in the greenhouse. He notices the palms obtain a large five gallon size much more quickly in a greenhouse than outdoors and feels that a rapidly grown greenhouse palm is far more suitable for temperate climate adaptation than a slow outdoor-grown palm. Ralph places the palms outdoors in the spring when the nighttime temperatures remain in the high 50s or above, and plants them in the ground from late spring to late summer. Ralph has discovered that there is a perfect size for planting palms and that is from a large five gallon to a small seven gallon. He particularly avoids planting larger greenhouse-grown palms that have developed trunk because they often suffer "post greenhouse shrink," from which they can never recover.

Ralph's is probably the most extensive small private collection anywhere. On a standard corner lot, Ralph has over 200 species, and he has palms growing throughout his neighborhood. Some of his most significant mature palms are *Roystonea regia*, *Roystonea oleracea*, *Roystonea borinquena*, *Marojejya darianii*, *Prestoea montana*, *Catoblastus praemorsus*, *Arenga pinnata*, *Dypsis madagascariensis*, *Rhopalostylis baueri*, and *Rhopalostylis sapida*.

Pauleen Sullivan emphasizes the importance of a small greenhouse "slider" and her indoor heated poolroom. Pauleen calls her small greenhouse slider her "hot house," which consists of sliding patio doors in which she raises the small palms, and a heated poolroom into which she moves the palms after they reach a one gallon or larger size. Pauleen prefers to plant the palms outdoors in the ground after they obtain a three to five gallon size, although she has planted many at smaller sizes. She believes that most palms do best with an abundant supply of water. Her theory is that you can't overwater a palm, which makes sense because in habitat, most palms come from areas of 100 to 300 inches of annual rainfall. Pauleen even allows some of her palms to sit in an inch or so of water, and she has developed a system of swirling out the old water so that fresh, oxygenated water is provided to the palms each time she waters.

Pauleen's collection includes some species that no one else has been able to grow, so be certain to make a note to see them. Most significantly, Pauleen has *Ceroxylon ventricosa*. It has about 18 feet of trunk with upright fronds extending shaving brush style up to about 33 feet tall overall. It's easy to miss this tall plant because at Pauleen's garden your eyes are constantly drawn toward the many beautiful shorter palms. Nowhere else in the northern hemisphere can such a large and majestic *Ceroxylon* be found except at one of Pauleen's other gardens, which is not on the tour. Pauleen planted her *Ceroxylon* in the ground in its present location as a two-leaf seedling! Also of significance is a *Chrysalidocarpus decipiens*, *Chambeyronia macrocarpa*, *Kentiopsis oliviformis*, *Hedyscepe canterburyana*, *Dypis leptocheilos*, *Ravenea monticola*, *Ceroxylon hexandrum*, *Basselinia favierii*, *Normanbya normanbyi*, *Lepidorrachis mooreana*, *Ptychococcos elatum*, *Pinanga javana*, and many other mature specimens.

Louis Hooper emphasizes the importance of a greenhouse, and he has developed an excellent system for potting up the palms. Louis has discovered that the palms just can't seem to survive outdoors in California unless they have obtained three or four leaves in the greenhouse. Louis' potting system is very effective. He starts with a rose pot, and goes from that size to a four inch, to a gallon, to a five gallon, potting up the palms after they become a large plant with a solid, substantially rootbound rootball. He moves the palms

out of the greenhouse as a large one gallon, potting them into a five gallon size and growing them under 70% shade cloth until they reach a good size, at which time he plants them outdoors in the ground. Louis likes to prop open his greenhouse door in the summer, and expresses great appreciation for the heat that he enjoys at his La Habra, California growing area.

Louis has a splendid outdoor palm collection, which includes a *Roystonea regia, Ravenea madagascariensis, Ravenea rivularis, Pseudophoenix sargentii, Licuala ramsayi, Licuala peltata,* and several other beautiful palms, including a splendid collection of *Chamaeodorea.*

Growing exotic tropical palms in a temperate climate involves obtaining the basic knowledge necessary to do it. At past biennials I've met many members from areas throughout the world that should be capable of producing gardens similar to those of Southern California. People from the southeastern United States, South Africa, South Australia, New Zealand, Southern Europe, and Israel for instance that could have palm collections equal to or better than those in California, but when they inform me of what they are growing, their collections are lacking compared to what they could be growing if only they were aware of what could be grown, and could obtain it. Most often they state that their climate is too cold to grow what can be grown in California, but the true cut off point should be cold temperature and not a psychological one.

Most California gardens have little or no frost or freezing temperatures, and some have none at all so if your area fits this description, there is no reason why you can't grow the same palms, except for a lack of knowledge and experience which you can obtain at the Biennial. Come to the Biennial. Plan to visit the four private gardens on the Biennial tour. Take notes. Take pictures. Ask questions. Ask more questions. And go home prepared to develop a fabulous temperate climate palm collection of your own.

CHAPTER NEWS AND EVENTS (*Continued from p. 124*)

for the group, which will affiliate with the IPS as a chapter.

News from the South Florida Chapter of the IPS

The South Florida Chapter met on March 30 for a field trip/work party at the Miami Metro Zoo. The chapter's palm collection at the zoo was in need of spring maintenance. Fertilizing, mulching, and trimming were the orders of the day.

The group held a general meeting at Fairchild Tropical Garden on Tuesday, April 23. The guest speaker was a landscape architect who discussed general design, texture, planning, and species selection. Members brought donated palms for auction afterwards.

News from the Palm Beach Chapter

The Palm Beach Palm and Cycad Society held a general meeting at Mounts Botanical Garden on May 1, 1996. The meeting featured De Armand Hull sharing the experience of his recent trip to China. A plant auction followed the presentation.

In keeping with the far eastern theme, Chuck Hubbuch spoke to the group about palms of Thailand at the June 5 general meeting. Chuck is the Director of Curators at Fairchild Tropical Gardens and his presentations are always interesting and insightful. The traditional plant auction followed the general meeting.

The chapter continued its work at the Norton Sculpture Garden during a May 18 work day. This endeavor was organized as a planting event and the volunteers were treated to lunch.

Pacific Northwest Chapter News

The Pacific Northwest Palm and Exotic Plant Society (PNWP&EPS) held its annual sale at Van Dusen Botanical Garden on Palm Sunday, March 21. The sale was open to the public for the first time and was a resounding success, producing about $600 in net profit for the club.

Many rare plants were sold by ten different vendors, and sales were almost twice that of last year. In addition to the sales, three new members joined the club.

The Pacific Northwest Chapter was founded eleven years ago and its membership has grown to over 220. The group started primarily of Vancouver (B.C., Canada) gardeners but is now expanding rapidly in Seattle, Washington and Portland, Oregon. Upcoming meetings are scheduled for September 23 and November 25. The group will participate in the coming Pacific National exhibition in Vancouver August 17 through September 3.

News from New Zealand

The Palm and Cycad Society of New Zealand met April 2 for slide show and discussion of "Palm Companions For The Landscape." This was the second in a series hosted by Ted Smithe and Gil Hanly. Prior to the meeting, the group participated in a field trip to John Petit's Palm Farm where the day was dedicated to Palm Society members and plants were priced at "Mates Rates."

The May regular meeting featured an interesting talk on the genus *Rhopalostylis* presented by member Keith Boyer.

News from Louisiana

The Louisiana Chapter of the IPS is continuing to grow and its roster now boasts nearly 80 members. The group got together for its first meeting of 1996 at Audubon Zoo in New Orleans. Member Stephen Asprodites is director of horticulture for the Audubon Institute and organized the event. The business meeting included election of new officers and free palm seeds and treats from Marguerite's kitchen.

Elected chapter officers are: President—Danny Braud, Vice-President—Gary Fleming, Secretary—Richard Kennedy, and Treasurer—Jack Chisholm.

The chapter met again on June 2 at The Property, home of Mal and Mich Mele in Covington, LA. Following lunch and palm discussions, the first palm auction of the year was held. On July 14 (Bastille Day), Chapter members spent the afternoon on the Tchefuncte at the home of member Eddie Assmann. A summer meeting is also planned for August 4 at the home of members Kit Blue and Robert Whitney in the Lakeview area of New Orleans.

The Louisiana chapter is continuing its focus on planting palms in public areas around the state. To date, some 75 palm trees have been planted by the chapter and its members, and this year they hope to increase that number. The chapter has been very fortunate to have members with resources to do major plantings on its behalf.

Above Chapter News by Horace Hobbs

News from the French Palm Society, Fous de Palmiers, for the second half of 1995

(The previous issue of *Principes* covered Fous activities for the first half of 1995. Here is a recap of their activities for the second half of 1995, prepared by Fous Chapter Correspondent, Steve Swinscoe.)

The journal *Le Palmier* #12 came out in late June 1995, with articles by Thierry Roy, Michel Autones, and Dominique Lucchini, dealing with the complex and fascinating subject of hybridization in palms. Many notable examples grow along the Riviera.

On July 1, we held our annual assembly at the Hopital San Salvadour in Hyres-Les-Palmiers, located in a splendid park overlooking the Mediterranean. Fous de Palmiers has helped create a sister organization of Italian Palm Enthusiasts, Beccariana, as well as Palmarum Cultores, regrouping palmophiles from all around the Mediterranean basin. Pierre-Olivier Albano and Thierry Roy were elected to the board of directors, while Patrick Marty will serve in an advisory position. Steve Swinscoe gave a slide show of the Fous trip to Southern California in October 1994, where members were fortunate enough to visit most of the gardens on the itinerary for the upcoming IPS Biennial in August 1996. This was followed by an aperitif and stroll through the gardens of San Salvadour. After lunch, members followed a circuit prepared by Nicolle Lucchini, visiting some of the finest century-old private estates of Costobelle, a quarter dominating Hyres, full of venerable palm specimens. We wrapped up the day with an evening garden party in the beautiful property of Monsieur and Madame De Pins, organized by Sylvette Viale and Violette Duculgis.

After the success of our California trip, Alain Jamet, our secretary, and Steve Swinscoe once again joined forces—this time to organize a trip to Florida. With valuable help from Broward County Palm and Cycad Society Vice President Sandy Haller, a 10-day itinerary was put together to see the highlights of South Florida's Gold Coast and the Keys (for details, see *Principes*, January 1996 Chapter News and Events, pp. 55–58 by

Ralph Velez). During their stay, the 40 Fous visited public palm collections, including those of Fairchild Tropical Gardens, Flamingo Gardens, Norton Sculpture Garden, and the Montgomery Foundation.

Thanks to help from IPS members Rick Leitner, Jeff Searle, Paul Craft, and Pat Tierney, les Fous were welcomed to private gardens from Palm Beach all the way to Key West. Simultaneous translations were assured by Marguerite Depeille and Peter Mayotte, Fous who live in central Florida. Following torrential rains early in October, the Fous trip from October 20 to 31 was blessed with sunshine and torrid temperatures. The gardens of South Florida are graced with more different species of cultivated palms than anywhere else in the world, making it a real paradise for palm nuts. Without a doubt, this trip will be a hard act to follow.

Two new books on palms in French came out during the semester, welcomed by members who do not read English. Vice-President Jacques Deleuze wrote *Palmiers pour le Climat Méditerranéen,* dealing with those species best adapted for the Mediterranean climate, full of detailed information and color photos. The book is available through the Fous de Palmiers association for 150 French Francs (approximately $30). Fous President Alain Herve wrote *La Passion des Palmiers,* guide to a dozen species of palms growing in different sites along the French and Italian Rivieras. The fine photographs and poetic text faithfully transmit the author's passion, making it a true collector's item for all palm lovers. This book, too, is available through the association for 150 FF. We had tote bags made, emblazoned with the name of our chapter, great for trips to the beach or on seed-collecting expeditions. We also offered 1996 desk calendars for sale, with each month illustrated by an original watercolor by Lester Pancoast, member of the South Florida chapter of the IPS, who had opened his garden to visiting Fous in October.

We wound up 1995 with publication of *Le Palmier* #13 journal, featuring translations of articles of Phil Bergman and Bill Dickenson on palm seed germination, as well as an update on the status of *Jubaea chilensis* in Chile and plans for a vast operation for 1996 to plant this rare palm widely throughout western and southern France.

STEVE SWINSCOE
Fous de Palmiers

The following news items were prepared by Jim Cain except as noted:

Address Correction for the New IPS Horticultural Correspondent:

As mentioned in the April issue of *Principes,* Paul Craft has agreed to serve as the IPS Horticultural Correspondence Committee Chair. However, an incorrect address was posted for him in that announcement. Please correct your records to reflect the following corrected address and keep your cards and letters coming. Send your questions to the attention of Paul Craft at 16652 Velazquez Boulevard, Loxahatchee, FL 33470 or send them via electronic mail to PalmNut@icanect.net on the InterNet.

News from Broward County, Florida

The Broward County Palm & Cycad Society (BCP&CS) met on March 28 to hear Dr. Jeff Block, an anesthesiologist at South Miami Hospital. Jeff has over 15 years experience in both horticulture and landscape design. His presentation discussed garden planning as it pertains to positioning, light, ventilation, nutrition, and microclimates. Another chapter meeting was held on May 23.

The Broward County Palm and Cycad Society Spring Sale was held on May 4 and 5 at Flamingo Gardens. Over 20 vendors provided an unbelievable variety of plants for sale—over 500 species of palms and over 60 species of cycads were offered.

News from the Florida First Coast Chapter

The Florida First Coast Chapter of the IPS held a joint meeting with the Southeast Palm & Exotic Plant Society on April 27, 1995. Participants gathered for a tour of the Palm and Cycad Garden of the Florida Community College, Jacksonville (FCCJ), then proceeded to the residence of Kyle and Jeanette Brown for the remainder of the day. Activities included a tour of the Browns' fine garden, a southern BBQ spread for lunch, and an afternoon of palm exchange and purchase.

The Chapter has continued its periodic maintenance of the palms at the Hart Bridge Expressway Project and at the FCCJ Garden. New 1995 additions at the FCCJ Garden include *Hyphaene coriacea,* several *Phoenix theophrasti, Syagrus*

romanzoffiana, Copernicia alba, Sabal domingensis, Trithrinax sp., and others. New labels for the garden palms are expected soon. Dr. Kyle Brown of the group gave a presentation on *Sabal* palms to the Central Florida Chapter at their June 1 meeting at Pinellas Park, St. Petersburg, FL.

News from South Australia Branch of PACSOA

The Palm and Cycad Society of South Australia (PACSOSA) branch of PACSOA held their 1996 Annual General Meeting (AGM) at the Waite Arboretum in Netherby on May 25, 1996. Further meetings are planned for September 15 and November 30, 1996.

News from the Sunshine Coast, Queensland, Australia

The Palm & Cycad Society, Sunshine Coast Group of Queensland, Australia, met on December 4, 1995, at the Nambour Band Hall. The theme for this meeting was "The Palms of New Guinea," with guest speaker Michael Ferrero. Michael is employed by the Flecker Botanical Gardens in Cairns and has spent a considerable time studying the palms in New Guinea, both from a botanical aspect and possible future use as commercial plants for the Australian nursery industry. The raffle plant was a New Guinea palm. The 1995 Christmas Party was held on December 17 at Clayton York's nursery on Ninderry Slopes Road in Valdora.

In February, the group met to see the 70-minute color video of the lecture given by Loran Whitelock on his visit to Australia in 1995—"Cycads of the Americas." The April 1 meeting featured a theme of "Palms in Hawaii." Tony Huntington presented his video on palms and tropical plants of Hawaii. This includes a visit to Foster Botanical Gardens, The Lyon Arboretum, and the Alii Gardens of Hana on Maui.

Sunshine Coast President Leo Gamble has also set up a world wide web homepage. If you have InterNet access, check out the web site http://peg.apc.org/~futurecom/aasunzine/palms.htm for "Palms for the Sunshine Coast." This is a very nice site and can also be reached by direct link from the IPS web page at http://www.palms.org through the "other places" connection. Leo does not currently have an email address, but has put together a very nice web page on palms.

News from North Queensland

The Cairns, Mackay, and Rockhampton Palm Societies were invited to join the North Queensland Palm Society (NQPS) on the Queen's Birthday weekend celebration on June 8–9, 1996. A full program of garden tours, lectures, and meals was organized.

A Palm and Cycad Symposium and PACSOA weekend are scheduled for October 11–13, in conjunction with the Townsville Branch and Friends of the Palmetum. This is planned to feature Don Hodel (author of *Chamaedorea Palms*) from California, Ray Osborne from Africa, John Dowe, and others yet to be confirmed. Year 1996 will culminate on December 2 with the society Christmas Party.

News from Gold Coast—Tweed (Australia)

The Gold Coast—Tweed Palm & Cycad Society of PACSOA met on April 14 at the home and garden of Angelo and Elaine Cassar in Banora Point. Members enjoyed a bring-your-own-lunch at the BBQ facilities provided.

News from the Sydney Branch, PACSOA, Chapter

The Sydney Branch of PACSOA and Chapter of the IPS met on March 19 at the Maiden Theatre, Royal Botanic Gardens, Sydney. Dr. Peter Fahy, Plant Pathologist from the Department of Agriculture, presented a slide show and talk on "Brown Waste Made Green"—composting human waste. The meeting was followed, as usual, by an auction.

The May 21 meeting featured Lynn Stewart and Steve Tornquist presenting *Archontophoenix*. All the latest information concerning the recent revision of the genus by John Dowe and Don Hodel was made available.

The Sydney Branch Committee for 1996–1997 has Lynn Stewart as President, Paul Anderson as Secretary, Hans Olminkhoff and Peter Kristensen as Vice-Presidents, and Peter Carroll as Treasurer. Other members of the Committee are listed in the May issue of *Principes Minor* magazine, which focuses on the palm genus *Brahea*.

News from Southern Queensland

The Southern Queensland Group (SQG) of PACSOA met on March 18 at United Church,

New Farm. Michael Ferrero from Cairns was the feature speaker, giving his renowned video and slide show, which he has collated during his trips to New Guinea and surrounding areas. Most outstanding was one shot of an *Orania glauca*—20 meters (65 feet) plus with leaves 6 meters (20 feet) long! There was also footage of the Bewani area at the far east near the border, the Sepik River, and the Tooricelli Mountains. Many compliments to Michael Ferrero's efforts, blood, sweat, and tears in capturing these fantastic images. The raffle featured a fine array and variety of plants donated by various members.

On Sunday, April 21, the group outing was at Clayton's Nursery in Valdora, as guests of Clayton York. This nursery covers many acres so the tour took members quite a bit of time. There were palms, cycads, and seeds for sale.

The May 20 meeting at United Church featured guest speaker Kery Rathie, who presented slides and a talk on cycads of the Northern Territory and *Brachychiton*. An outstanding 150 cm (5-foot) *Rhapis excelsa* in a 300 ml pot made an excellent raffle prize at this meeting.

The PACSOA Annual General Meeting was held on May 27 to discuss various aspects of the Society's business. PACSOA can now be reached by electronic mail: pacsoa1@ozemail.com.au for bookstore, general inquiries, and magazine information and pacsoa2@ozemail.com.au for seedbank and membership inquiries. PACSOA is also investigating the setup of a WWW home page. The IPS has offered PACSOA server space for this on the IPS WWW home pages at http:/www.palms.org, where a PACSOA page already exists (as does a home page for EACH IPS affiliate) as an IPS member service.

South African Palm Society News

The South African Palm Society (SAPS) 1995 Annual General Meeting (A.G.M.), held in Carpe Diem, proved to be a most enjoyable weekend for all. Members from as far as East London, Durban, Botswana, as well as local members from the Tzaneen area made this an occasion to be remembered.

The SAPS 1996 A.G.M. was held on March 21–23 at Hectorspruit, near the South African Palm Society Palmetum. This enabled members to visit their society's Palmetum and see the progress being made there.

European Palm Society (U.K.) News

The European Palm Society, based in the U.K. but with members throughout Europe, is planning a Rome summer meeting for four days (August 30–September 2). Participants should plan to arrive on or before Thursday, August 29, and depart on or after Tuesday, September 3, leaving the full four days for the various planned activities. Included will be a visit to the Rome Botanic Garden, one of the best in Europe, full of unusual palms and other exotic plants. A day coach will take participants to the Naples Botanic Gardens, not open to the general public, but offering a wonderful cycad collection. There will be a coach visit to the nursery of Tor San Lorenzo, one of the largest palm nurseries in Europe, where palms can be purchased (subject to space on the bus). There will be an optional tour of the City of Rome, lunch at the garden of Dario Peso, one of our Roman members, and visits to additional gardens, parks, and squares—each with its own character and, of course, palms. For additional information, contact Martin Gibbons, European Palm Society, % The Palm Centre, 563 Upper Richmond Road West, London SW14 7ED, United Kingdom or call at 44-181-876-3223.

News from Southern California

The May 18 meeting of the Southern California Chapter of the IPS featured tours of four gardens in San Clemente. Included were the gardens of Ricardo Luna, Bill Taylor, Jerry Anderson, and Robert De Jong. Following the tours and lunch, Ralph Velez gave a slide presentation on the "Palms of Florida" at the nearby San Clemente Community Center. The day was topped off with a raffle and auction.

The July 13 meeting featured gardens in El Cajon and Poway. Two gardens were featured that have never been toured by the Southern California Chapter. The first garden was at the home of Greg and Debbie Hamann in El Cajon. The second garden was at the 19-acre estate of Dr. Lyle and Helen Arnold in Poway.

The March, 1996, issue of *The Palm Journal* published by the Southern California Chapter was devoted to the genus *Hyophorbe* and the May issue focused on *Caryota*. In addition to the focus articles, each journal featured an excellent article on a specific cycad for Southern California and several other short articles.

Pritchardia munroi. Jay Hersker of Kaunakakai has sent us this photograph of the last fruiting individual of this very rare palm, growing in the wild on the island of Molokai in the Hawaiian Islands, at Puakoolau, Kainolo, 650 m elevation. Although there are some cultivated individuals in botanic gardens, it is unlikely that any of these produce seed yet. This wild specimen is thus probably the only source of seed of what is probably one of the most endangered palms in the world.

News from the Hawaii Island Chapter

The Hawaii Island Palm Society held their annual BBQ and chapter elections on February 16 at Pavilion 3 at Wailoa Park. The meeting featured a palm auction, with stellar auctioneer Gaila Vidunas calling the prices. There were also palm giveaways and T-shirts for sale—and, of course, the BBQ dinner.

The group got together in April for a work party at the chapter's Panaewa Zoo palm planting. The zoo planting has become one of the most successful long-term undertakings of the Hawaii island chapter. Less strenuous spring activities of the chapter included a Cinco de Mayo Blast and garden tour at Roger Fischer and Grace Kissell's home and a June tour of Norm Bezona's extensive palm garden.

The Cinco de Mayo event was attended by more than 40 people.

There was great food, Mexican beer, and endless Margaritas (recipe to be published in our upcoming newsletter sometime later this year). Roger led us on a tour of his densely planted property, and his palms are really starting to acquire some stature, an inspiration to those just getting started, because the oldest of them have been in the ground only about 10 years. The tour was in two phases. The first was the upper area, nearer the house, and the second was down into an old railroad cut dating from early in the sugar plantation era. The later area is much more wild. Roger had arranged for at least two of his *Chambeyronia* to have impressive red flushes for the occasion. His *Bismarckia nobilis*, a dramatic planting, are considered to be among the bluest in the Pacific region by some, although this is subject to some intense, not to say acrimonious, dispute.

HORACE HOBBS AND KEN BANKS

News from Western Australia

The Palm & Cycad Society of Western Australia (PACSOWA) met on April 15 at the Leederville Town Hall. George Sevastos put together a palm and cycad quiz for this meeting—designed to give everyone a chance of winning—not just a few experts. There was also a brief talk by Ken Lee about Stressgard, a new palm transplant aid he has researched.

The May 20 meeting featured the main annual palm and cycad auction. There was a very wide variety of plants from which to choose. The auctioneer was Russell Dyer, with Peter Skinner there to give a brief description of each lot prior to it being auctioned. The main raffle prize for this meeting was a nice specimen of *Cycas wadei.*

Gascoyne Park workdays were held on March 24, April 21, and June 1. The first two busy bees were mainly designed in cleanup and readying the park for the official opening and for the major palm planting, which took place on June 1, along with a free BBQ and special sauce.

The Annual Display and Plant Sale at Roy Edinger Hall will be held on September 7 and 8, 1996. There will also be another display and plant sale by the Society at the Dianella Shopping Centre on November 14–16.

News from Northern California 1995

It was a very good year. The winter rains began early last fall and by February, Northern California was approaching a record rainfall season. The rainfall was almost of Biblical proportions. In the month of January 1995 San Francisco recorded 30 days of measurable precipitation. With all the rain there was almost no freezing weather and only a few isolated occurrences of frost recorded in the Bay Area. The palms loved it.

Fortunately for the Northern California Chapter, February 4th was a beautiful sunny day. Our first meeting of 1995 was held at the home and palm garden of Bob and Angelina Archer in the hills above Hayward overlooking the south end of San Francisco Bay. The Archer estate covers seven acres and is forested with approximately 400 mature *Washingtonia robusta*, along with *Syagrus romanzoffiana*, *Trachycarpus fortunei*, groves of Golden Bamboo, and a lake large enough to attract migratory water fowl each winter. The Archer home is a beautiful Polynesian-style long house; the entire Northern California Chapter membership in attendance (approximately 65) had no problem finding a place to sit in the main living room for our business meeting. The weather on the 4th was perfect for an afternoon in a beautiful palm garden with a spectacular view of most of the San Francisco Bay and the cities beyond.

Our next meeting was on April 29th at the palm and rhododendron garden of Dr. Herbert Weber in Greenbrae (in Marin County, just north of San Francisco). Herb selected the late April date because his rhododendrons would normally be in full bloom. They were, due to some very warm weather, two weeks earlier in the month. On the 29th the weather was more typical of the Olympic Peninsula in Washington. The meeting was one of the only Palm Society gatherings I have attended in 15 years when umbrellas were necessary. Maybe it was appropriate. Dr. Weber was leaving right after the Palm Society meeting for a tour of the rhododendron gardens of the Pacific Northwest. It was a damp meeting in a beautiful garden. The late spring rain really made the garden look its best. The weather did not dampen the spirits of the 40 members who attended the meeting. The Chapter raised $325 from the palm auction. Maybe all the fine wine and food contributed for the potluck lunch helped.

The late summer meeting was held on September 17th at Richard Douglas' garden in Walnut Creek. This meeting was a vintage Northern California Palm Society gathering. The weather was hot but not unbearable, there was plenty of time to socialize and stroll around Dick's mature garden, the members contributed a great potluck luncheon, and Dick supplied the Lowenbrau and the ambiance. The Douglas garden is now 23 years old and has one of the largest collections of palms in Northern California. The *Nannorrhops ritchiana* may be the largest in California. Late in the afternoon our palm auction netted $614 for our treasury. We all reluctantly left Dick's garden as the sun went behind the palms and the ancient valley oaks.

The Northern California Chapter traditionally holds its last meeting of the year at the Lakeside Garden Center in Oakland where our Palmetum is located. This year the meeting was held on November 18th. Mid-November in Northern California is still "late Summer" with temperatures in the 70's. Fifty-five members toured our palm garden at Lakeside on a beautiful sunny afternoon. Our Palmetum is now 14 years old and has many mature fruiting palms. After the palm tour we met in the Vista room at the Lakeside Garden Center for a slide presentation given by Inge Hoffmann, our peripatetic palm seed lady. Inge took us on a whirlwind tour through most of the palm lands of three continents. After Inge's presentation our palm auction raised $640 for the treasury.

Last year, I mentioned that our Chapter had made some major capital improvements to the Lakeside Palmetum (the new pathways). This expenditure depleted our treasury's bank balance. In our February meeting announcement, I made a special appeal to our members for financial assistance. At the meeting at the Archer estate the special appeal raised $900. I would like to personally thank all our members who generously contributed to the Chapter. Your contributions brought us back into a state of financial solvency. I would also like to thank all the members who contributed their time (at the Palmetum work parties), contributions (palms for our auctions), ongoing financial contributions (at the palm auctions), and continued support. I would especially like to thank Bob and Angelina Archer, Dr. Herbert Weber, and Richard Douglas for opening their gardens and homes for our meetings in 1995.

DANIEL SEKELLA, PRESIDENT
Northern California Chapter

Principes, 40(3), 1996, pp. 168–170

PALM LITERATURE

THE FIELD GUIDE TO THE PALMS OF THE AMERICAS. By Andrew Henderson, Gloria Galeano, & Rodrigo Bernal. viii + 352 pp, 256 color illus. Princeton University Press, Princeton, New Jersey, USA. 1995. ISBN 0-691-08537-4. Price: US$75.00.

This book is most valuable, single-volume resource for information on the palms of the Americas. At 23.5 × 16 cm it is too big to go in a pocket, but not too big to be wrapped in a polyethylene bag and carried in a field rucksack. Within its more than 350 pages can be found a general introduction to palms and to the palms of the Americas, including an important discussion of species concepts, a key to genera (made more useful than most other available keys by the presence of thumbnail sketches at crucial dichotomies), accounts of all 550 species (yes, 550, a much lower number than usually recognized), genus by genus, the genera arranged according to the system in *Genera Palmarum*, individual maps for each species, geographical listings of species, country by country, a complete listing of species with their synonyms (arranged alphabetically), an extensive bibliography, and two indexes, one to local names, and one to scientific names. At the end of the book is a block of 64 color plates, with four images to a plate, a glorious selection of fine palm photographs.

This is intended as a field guide. It is not a monograph (it does not have carefully documented arguments justifying taxonomic decisions, it does not cite specimens, and the maps may give only an approximate idea of the range of the species). Neither is it a guide to cultivated palms of New World origin. It is very clearly intended to be used in the field to aid identification and to lead the reader to primary sources of information relevant to the species identified. It relies quite heavily on geography as an aid to identification (and of course it is this that makes it inappropriate though probably nevertheless useful, for trying to identify species of unknown origin in cultivation). For example, if you have established the correct genus of a palm in the field, and you know which country you are in, then it is usually easy by elimination to reach an answer. However, there is a curious quirk about the book that I find unfortunate. Keys are provided to the really big genera, but for the smaller genera with less than ten species, no key is provided. The authors direct you instead to compare the key characters italicized in the species descriptions in these smaller genera. However, sometimes (for example, in *Ceroxylon*) the only tangible difference between the descriptions of two species lies not in the italicized characters but in the geographical range—as I have said, no problem if you know where you are, but of little value for comparing cultivated plants or herbarium specimens of unknown origin.

I have not been in the field in the New World since I acquired my copy so I haven't really been able to test the keys properly; I have only been able to test them mentally, in an armchair in Britain. However, they seem to work well and I have no doubt that the book will be a really splendid guide and aide memoir, an essential vade mecum for field workers in the Americas. I did note a few points where I thought the keys might break down. A specimen of *Polyandrococos caudescens* in Kew Herbarium has clear spine-like teeth on its petioles so would not key out properly in the generic key (I continue to maintain that the full range of variation in this genus has not been fully documented and appreciated). Similarly *Syagrus vagans* and *S. schizophylla* with their spiny petioles would not key out properly. I suppose you could argue that these are not real spines, but most field workers will immediately observe and interpret them as such.

There are some important changes in generic delimitation that have been adopted in the Field Guide. *Catoblastus* is included in *Wettinia*; *Maximiliana*, *Orbignya*, and *Scheelea* are included in *Attalea*; and *Jessenia* in *Oenocarpus*; all are improvements to generic delimitation in New World palms that are well justified, either in the volume or elsewhere.

I do have some criticisms. The first relates to the use of unpublished binomials. The authors have been privileged to have access to monographs that have recently been completed by other workers but that have not yet been published. In some instances new combinations that have not yet been validly published according to the International Code of Botanical Nomenclature have been used in the Guide. They are not validly published in the Field Guide; validation will have to wait for the final publication of the monographs. This is untidy but will only annoy conscientious nomenclaturalists and perhaps the poor researchers whose

names have been used before they should have been. Possibly more serious from a nomenclatural point of view is the inclusion in the lists of synonymy of nomina nuda such as those published by O.F. Cook. For example, *Neanthe bella* is a nomen nudum that, although occurring in a published article by Cook, was never published according to the rules of nomenclature. It thus has absolutely no botanical standing. The authors, however, have included *Neanthe bella* as a formal synonym of *Chamaedorea elegans*, which, by virtue of its never having been validly published, is totally wrong. One might just as well include *Parlor palm* as a formal synonym of *Chamaedorea elegans*.

There are also some rather oblique allusions to biogeographic theory (tracks, etc.) that are not explained. In one instance the allusion is based on completely incorrect fact. *Ceroxylon* with 12 species is described as being the terminal and most speciose genus of a chain of genera stretching from Madagascar, Australia, and the Juan Fernandez to the Andes. In fact, of the genera in the Ceroxyleae it is *Ravenea* with 17 species in Madagascar and the Comores that is the most speciose (or, perhaps, the authors have decided not to recognize all the species of *Ravenea*). Without a proper discussion of the biogeographic theory, I feel that this comment in the Guide is specious and, being based on incorrect facts, should have been left out.

In the introduction the authors stress that the book is intended to be a field guide. It is not a monograph of the palms of the Americas; the reader will not find detailed justification for the many new taxonomic concepts of species that appear here. For some of that the reader will need to consult Henderson's *Palms of the Amazon* and other recent taxonomic monographs (all clearly referred to). Nevertheless, there are examples of new synonymizing in the Field Guide that are not supported by taxonomic argument—and I suppose it is in relation to this that I have my most serious reservations about the book. In any group of taxonomists one will find a wide range of opinion on how to classify the range of variation that one finds in nature. Some will distinguish species where others would regard the same entities as fitting within the range of variation of more broadly conceived species. If disjunctions in variation exist, taxonomists usually give some sort of nomenclatural recognition to separate entities. Recent collecting and field observations have shown that in many instances species poorly represented in herbaria and scarcely known in the field in the past are in fact connected to each other by a whole range of intermediates, and so historically recognized species are sunk into synonymy. The three authors together know the palms of the Americas as well as any other living palm taxonomists. I respect their judgement for the most part, but on reading the guide I found that the authors have gone on to sink species almost willy-nilly, in some instances rather sweepingly. It is interesting to compare treatments of predominantly Amazonian genera with predominantly Andean genera. In Amazonia, many historically recognized local endemics have been shown to be mere forms of widespread, variable species—perhaps not surprising given the huge area of contiguous similar habitats throughout the basin. In contrast, genera such as *Ceroxylon* and *Wettinia*, predominantly Andean in distribution, seem to consist of geographically much more narrowly confined taxa—again, not surprising, given the disjunction of habitats in the Andes. Using their broad species concepts and the degree of synonymization that they have applied in the Americas, the authors have extrapolated from the Americas to the rest of the World and suggest, in the introduction, that the world palm flora consists of approximately 1 500 species. Compare this figure with the estimate of 2 600+ species usually quoted for the family, and subtract the number of species sunk in the present volume and you will begin to realize some of the implications of the authors' species concepts—they have assumed that there will be comparable lumping elsewhere. I, however, feel it is premature to make such extrapolations. Speciation patterns seem to vary considerably. Large blocks of contiguous rain forests, such as Amazonia, may well have far fewer local endemic species than the great eastern rain forest block of Malesia that is fragmented by geology and geography into separate units, admittedly each with widespread species that occur on several of the islands, but also with what we currently interpret as large numbers of local endemics.

This leads me to comment on a dilemma that we now face. Who should we follow? Should we accept the mostly broadly based species of Henderson, Galeano, and Bernal or should we follow the narrow species concepts of other workers. In many cases I instinctively want to follow Henderson et al. With their very wide experience they have been able to make well-informed judgements, which, where documented, sound right. However,

there are some areas where it is not so easy, areas where the three authors are at variance with contemporary workers such as Hodel and Kahn whose work, being based on extensive experience and detailed field study I also respect and value highly. Hodel, for example, recognizes more than 100 species of *Chamaedorea* in his recent monograph and subsequent papers in contrast to the 77 species recognized by Henderson et al. To some extent it doesn't really matter who one follows; given the index in the Field Guide it is easy to find where the three authors have placed a synonym. However, at one level, it matters a great deal. Conservationists use lists of species as major arguments for developing conservation strategy with political consequences. If Hodel's account is followed then there are many more species requiring conservation action than if Henderson et al.'s account is followed, and who is to adjudicate between the two approaches? Clearly it would be better to follow Hodel if we wish to conserve the maximum range of variation within the genus, but such a position would be open to argument. In short, the use of the Field Guide for purposes for which it was not intended could have unfortunate results. I suspect that the authors themselves would be the first to recognize this dilemma.

All in all this is a most exciting and invaluable book that will be widely used and quoted. With two guides to the palms of Madagascar and Africa recently published we are now left with one major gap in coverage of the world's palms, the Southeast Asian, Malesian, and west Pacific region, perhaps the most diverse palm flora of all. How wonderful if we could also have similar guides to areas such as Borneo, Sumatra, and New Guinea, but for some of these areas I believe we have as yet insufficient basic information to allow us to decide on what should be included. *The Field Guide to the Palms of the Americas* provides a splendid challenge to the team of palm researchers working on the account of palms for Flora Malesiana to provide an identification tool that is as portable and as attractive. The authors are to be congratulated for what is a most attractive volume that all palm lovers will wish to obtain and use.

JOHN DRANSFIELD

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Root spines of *Cryosophila guagara* in Gamalotillo, Costa Rica. Photo by R. Evans. See pp. 129–147.