J. Ethnobiol. 14(2):161–172 Winter 1994

PALM ETHNOECOLOGY IN THE SARIPIQUI REGION OF COSTA RICA

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ABSTRACT.—Palms are an important natural resource in the lowland tropical rainforest in the Saripiqui region of Costa Rica. An ethnoecological study of palms therefore was conducted at La Selva Biological Station and nearby Puerto Viejo during July 1990. The study consisted of interviews with local residents knowledgeable of the palm flora and a survey of palm populations occurring on primary forest alluvium, the soil type most often occupied by local inhabitants.

Seventeen of 30 native palm species were identified as economically useful; nine species have not previously been reported as used in this region. Major uses cited were for *palmito* (edible palm heart), thatch, and wood. The single most important palm species was *Iriartea deltoidea*, which has the best (native) *palmito* and is also a source of wood for construction. *Welfia georgii* was considered the most important source of thatch by all informants. It was the only palm which has been "actively" managed and, along with *Euterpe macrospadix* and *Iriartea deltoidea*, was believed to be over-harvested.

Sixteen of 30 native species were present in transects through primary forest alluvium; 10 were reported as useful. The subcanopy species *Welfia georgii* was the most abundant palm in transects overall (36.1% of stems). Understory clonal species such as *Asterogyne martiana* and *Geonoma congesta* had proportionally greater numbers of the larger size-class individuals. Information on harvesting techniques and levels were combined with data from population transects to estimate resource capacity. *Welfia georgii* leaves appear to be the limiting resource in thatch roof construction.

RESUMEN.—Las palmas son un recurso natural importante en el bosque tropical lluvioso de zona baja en la región de Saripiqui en Costa Rica. Por ello se realizó un estudio etnoecológico de las palmas en la Estación Biológica de La Selva y el pueblo vecino de Puerto Viejo en julio de 1990. El estudio consistió en entrevistas con residentes locales que conocen la flora de palmas, y un reconocimiento de las poblaciones de palmas en el bosque primario sobre aluvión, el tipo de suelo ocupado más frecuentemente por los habitantes locales.

Diecisiete de las treinta especies nativas fueron identificadas como plantas economicamente útiles; nueve de ellas no han sido reportadas previamente como especies usadas en esta región. Los principales usos citados fueron como palmito (corazón comestible), para techado y como madera. La especie más importante de todas fue *Iriartea deltoidea*, que tiene el mejor palmito (local) y es también fuente de madera para construcción. *Welfia georgii* fue considerada por todos los informantes como la palma más importante para techar. Fue la única palma que ha sido manejada "activamente", y junto con *Euterpe macrospadix* y *Iriartea deltoidea* se consideró que ha sido sobre-explotada.

Dieciseis de las treinta especies nativas estuvieron presentes en transectos a través del bosque primario sobre aluvión; diez de ellas fueron reportadas como plantas útiles. La especie del subdosel *Welfia georgii* fue la palma más abundante en los transectos en total (36.1% de los tallos). Las especies clonales del sotobosque como *Asterogyne martiana* y *Geonoma congesta* tuvieron números proporcionalmente mayores de individuos de la clase de talla superior. Se combinó la información sobre técnicas y niveles de recolección con los datos de los transectos de poblaciones para estimar la capacidad de los recursos. Las hojas de *Welfia georgii* parecen ser el recurso limitante en la construcción de techos de palma.

RÉSUMÉ.—Les palmiers représentent une ressource naturelle importante de la forêt tropicale basse de la région Saripiqui (Costa Rica). Une étude ethnoécologique des palmiers a été effectuée à la station biologique de La Selva et à Puerto Viejo, ville voisinante, en Juillet 1990. Cette étude a consistée d'entrevues avec des habitants locaux bien informés sur la flore, ainsi que d'un examen des populations de palmiers poussant sur alluvions de forêt primaire, où habitent le plus souvent les habitants locaux.

Dix-sept des trentes espèces indigènes ont été identifiées comme étant utiles; l'utilization de neuf espèces n'avait pas été reportée auparavant dans cette région. Les emplois principaux cités consistent en *palmito* (le coeur de palmier comestible), en chaume, et en bois. L'espèce de palmier la plus importante est *Iriartea deltoidea*, qui produit le meilleur *palmito* indigène et apporte également une source de bois pour la construction. *Welfia georgii* a été désignée à l'unanimité comme étant la source de chaume de choix. De fait, c'est le seul palmier à subir un control actif, et le seul, avec *Euterpe macrospadix* et *Iriartea deltoidea* à être trop récolté, selon les informateurs.

Seize des trentes espèces indigènes ont été retrouvées dans les quadrants effectués à travers la forêt primaire alluviale; dix ont été identifiées comme étant utiles. L'espèce sous-canopy *Welfia georgii* est le palmier le plus abondant dans tous les quadrants (36.1% de toutes les tiges récoltées). Les espèces clonales de sous-bois, telles que *Asterogyne martiana* et *Geonoma congesta* présentent une proportion plus élevée d'individus de grande taille. Des renseignements sur les techniques et niveaux de récolte sont alliés aux données provenant de l'étude des quadrants, à fin de pouvoir estimer la capacité des ressources. Les feuilles de *Welfia georgii* semblent être la ressource limitative pour la construction des toits de chaume.

INTRODUCTION

Ethnobiologists generally agree that indigenous people have a keen understanding of the natural world around them and that they have developed effective management (e.g., sustainable yield) for important wild plant resources (e.g., Anderson 1991; Posey et al. 1984). Although an increasing number of studies quantify the value of wild plant resources or indigenous knowledge about them (e.g., Prance et al. 1987), few *quantitatively* evaluate traditional resource management (e.g., Anderson 1991). An important first step to understanding the impact of harvesting on wild-collected plant species is to study their population size-class structure (Pinard and Putz 1992). The results presented here are from a pilot study that combined ethnographic and ecological methods to investigate the relationship between use and population structure in native palms, an important natural resource throughout much of the tropics.

La Selva Biological Station, located in the lowland tropical rainforest of the Saripiqui region of Costa Rica, has one of the most diverse palm floras in the world (Chazdon 1985). The area has been largely undisturbed since the 1950s. La Selva was established as a biological preserve in the 1960s, but present palm distribution may reflect prepreserve activity (Deborah Clark, personal communication, 1991). Thirty indigenous and two exotic palm species, *Bactris gasipaes* H.B.K. and *Cocos nucifera* L., have been reported from La Selva (unpublished checklist, 1989, in possession of the author and the station director). Only the two introduced and eight of the native species have been documented as economically useful in the region (Murphy 1983). An ethnographic survey was therefore conducted at La Selva to improve documentation of local knowledge of native palms. Information gathered included which species were known and what informants knew about the use, management, and natural history (distribution, abundance, and so on) of each. Standard ecological methods were used to establish baseline population data for palm species growing in primary alluvial forest, the forest type most often occupied by local residents.

METHODS

Ethnography—Interviews were conducted at La Selva Biological Station and in the nearby town of Puerto Viejo during July 1990. Hector Gonzalez, director of La Selva's community education program, arranged interviews with local residents. Orlando Vargas, the station naturalist, was interviewed first. His knowledge is a combination of local information and what he has learned from assisting field station biologists. During the interview we walked through the reserve; the route (Sendero Oriental and Camino Circular Lejano) included most local palm species and all those with prior recorded use. Vargas identified palms by both local and scientific names, and provided information on distinguishing characters, local uses, natural history, abundance, distribution, and management and conservation practices. Species were identified using available palm keys (Chazdon and Marquis 1985; Moore and Chazdon 1985). Identifications were verified by field station biologists David and Deborah Clark and by comparison with vouchers deposited in La Selva's herbarium. Subsequent interviews were conducted at each informant's home or work place. Vargas assisted in translation during all but one interview. Using local name(s) and palm morphological and ecological descriptions to identify the palms being discussed, informants were asked which palms they knew, and what they knew about their use, management, and natural history.

Palm population surveys.—Eight 2 × 50 m (100 m^2) transects were established at 100 m intervals along the Camino Experimental Sur (CES). The CES runs through primary forest overlaying alluvial terraces comprised of the soil type most often occupied by local residents (Bette Loiselle, personal communication, 1990). The forest has been undisturbed, except for scientific study, for more than 25 years. A general habitat description for each transect was recorded. All size-class individuals of all palm species were counted in one half (50 m^2) of each transect. In the second half of the transect, only subcanopy species were counted in order to increase sample size for large species. Voucher specimens were not collected. Instead, species were identified as described above. For each palm present I noted species, size-class, crown height, reproductive status, and numbers of stems and green leaves. The size-classes were seedling, juvenile, immature, and adult (after Vandermeer 1983). Seedlings have no more than two leaflets per leaf. Juveniles are trunkless individuals with intermediate to mature leaf morphology. Immature palms resemble adults in leaf morphology but have short trunks and are sexually nonreproductive. Adults have mature leaf morphology, tall trunks, and fresh or old inflorescences present.

RESULTS

Ethnography.—Five male, lifetime residents of the Saripiqui region were interviewed. All except one are employed as workmen or guards at La Selva Biological Station. Informants recognized between 11 and 19 palms each. They identified a total of 18 of the 30 native species by common name, cited them as used, or both. The two introduced species included by Murphy (1983) were not discussed during these interviews. Table 1 summarizes local name(s) and reported use(s) of the palms discussed (for full species accounts see Joyal 1990).

Thirteen palms had one common name, two had two local names, and three had three names. There were two designations at the generic level, *biscoylillo* for *Bactris* spp. and *palmilla* for *Geonoma* (Table 1). The names *cola de gallo* and *pacaya* were applied to different species than those reported by Murphy (1983) by the informants in this study. Murphy identified *Asterogyne martiana* as *cola de gallo* whereas my informants called it *suita*. She did not identify any plant as *suita* nor did she note any uses for *Calyptrogyne sarapiquensis*, a palm identified as *cola de gallo* in this study. Robin Chazdon (personal communication, 1994) says that local knowledgeable people have always applied *suita* to *A. martiana* whereas *cola de gallo* refers either to *Calyptrogyne saripiquensis* or *Geonoma* species. This is in agreement with the present survey. Murphy identified *pacaya* as an undescribed *Chamaedorea* sp. while Vargas and I identified it as *Prestoea decurrens. Chamaedorea tepejilote* Liebm. is called *pacaya* in Guatemala, where it has been domesticated primarily for its edible male inflorescence, and secondarily for its *palmito* (Castillo Mont et al. 1994). Robin Chazdon (personal communication, 1994) reports that *pacaya* has always referred to *Chamaedorea* species in the Saripiqui region and that the inflorescence buds are roasted and eaten. She could not recall a common name for *P. decurrens* nor could she remember its flowers being eaten. It appears, therefore, that Vargas and I may have misidentified this palm. Clarification will have to await further field work. There was only one instance in which the same common name was used by the same informant for two species: *chonta* for *Socratea exorrhiza* and *Iriartea deltoidea.*

Major palm uses reported were leaves for thatch, trunks for wood, and edible palm heart *(palmito)* (Table 1). Murphy (1983) reported three species that were used exclusively for fiber, one species each that had edible fruit or *palmito*, and three that were used for a combination of fiber, fruit, or *palmito*. She listed only one species, *Chamaedorea* sp., as useful that was not reported during the course of my interviews. This is a species of doubtful identity, as discussed above. A total of

TABLE 1.—Palm species with reported use in the Saripiqui region of Costa Rica. Observations are based on original field work and Murphy (1983). * indicates introduced species, not covered in 1990 interviews. Informants are identified by their initials.

Species	Local name(s)	Use(s)
Asterogyne martiana H. A. Wendl. ex Burret	*suita* (FM, GM, EP, OV); *cola de gallo* (HM)	thatch (FM, GM, HM, EP, OV); edible fruit (FM); ornamental (FM)
Astrocaryum alatum Loomis	*coquito* (FM, GM, HM, EP, OV)	fruit for wildlife (FM, HM, EP, OV); thatch (HM, EP); wood (GM)
A. standleyanum Bailey (*A. confertum* H. A. Wendl. ex Burret)	*pejibaye del monte* (IA, GM, EP)	*palmito* (IA, GM, EP, OV); wood (EP)
**Bactris gasipaes* H.B.K.	*pejibaye* (HM)	edible fruit (HM)
Bactris porschiana Burret	*biscoyol* (IA, FM, GM, EP, OV)	wood (IA, FM, GM, EP, OV); *palmito* (OV); edible fruit (OV)
Bactris sp.	*pejibayito* (IA)	—
Bactris spp.	*biscoyolillo* (OV)	wood (OV); *palmito* (OV)
Calyptrogyne saripiquensis H. A. Wendl. ex Burret	*cola de gallo* (IA, FM, GM, EP, OV)	thatch (IA, FM, GM, EP, OV); edible fruit (OV); ornamental (FM)
Chamaedorea sp.	*pacaya* (HM)	*palmito* (HM)
**Cocos nucifera* L.	*coco, pipa* (HM)	medicinal fruit (HM)
Cryosophila albida Bartlett	*escobon* (all)	thatch (all); fruit for wildlife (GM)
Desmoncus costaricensis (Kuntze) Burret	*batamba* (IA, EP, OV)	lance/prod (IA, EP, OV)
Euterpe macrospadix Oersted	*palmito de mantequilla* (IA, FM, GM, OV)	*palmito* (IA, FM, GM, OV); ornamental (FM)
Geonoma congesta H. A. Wendl. ex Spruce	*caña de danta* (all)	thatch (all); lance (FM, EP, OV); wood (FM, GM, OV)
Geonoma cuneata H. A. Wendl.	not known	thatch (OV)
Geonoma interrupta (Ruiz & Pavón) C. Martius	*surtuba* (IA, GM)	*palmito* (IA, GM)
Geonoma spp.	*palmilla* (OV)	—
Iriartea deltoidea Ruíz & Pavón (*I. gigantea* H. A. Wendl. ex Burret)	*palmito dulce* (IA, FM, GM, EP, OV); *chonta* (IA, EP, OV); *palmilera* (IA, GM, HM, EP)	*palmito* (all); wood (all)

TABLE 1.—Palm species with reported use in the Saripiqui region of Costa Rica. Observations are based on original field work and Murphy (1983). * indicates introduced species, not covered in 1990 interviews. Informants are identified by their initials. (continued)

Species	Local name(s)	Use(s)
Prestoea decurrens (H. A. Wendl.) H. Moore	*pacaya* (FM, GM, EP, OV); *pacayita* (IA); *pacaya de danta* (IA)	*palmito* (FM, GM, EP, OV); ornamental (FM); edible flower bud (IA)
Reinhardtia cf. *simplex* (H. A. Wendl.) Burret	not known	ornamental (OV)
Socratea exorrhiza (C. Martius) H. A. Wendl. (*S. durissima* (Oersted) H. A. Wendl.)	*palmito amargo* (all); *maquenque* (IA, FM, HM); *chonta* (GM)	*palmito* (IA, FM, GM, EP); wood (IA, FM, EP, OV); edible fruit (HM, OV); medicinal palmito (GM)
Welfia georgii H. A. Wendl. ex Burret	*corozo* (all)	thatch (all); wood (GM, EP, OV); *palmito* (GM, HM, EP)

17 of the 30 native palm species were reported as used in the study presented here, with 12 cited by four or all five informants. Several species were used interchangeably while a few were preferred for specific uses. For example, nine native species can be used for palmito but *Euterpe macrospadix* is considered the best flavored. Its small size makes it relatively unpopular, however, and the larger *palmito* of *Iriartea deltoidea* was the most commonly used until recently (the introduced *Bactris gasipaes* is replacing it). The large leaves of *Welfia georgii* are preferred for covering flat sections of roofs whereas the small leaves of *Asterogyne martiana* and *Geonoma congesta* are used to finish the peaks. Some uses have disappeared entirely or were more common in the past. For example, *Geonoma congesta* stems were frequently used as lances for hunting tapir (*caña de danta*, tapir's cane) in the past. This use is now restricted to the most remote jungle areas, hunting lances having been largely replaced by rifles.

Harvest practices for several species were discussed. Three of the five subcanopy palms, *Euterpe macrospadix, Iriartea deltoidea,* and *Welfia georgii,* were reported to be over-harvested for *palmito,* thatch, or wood. In contrast, *Cryosophila albida* is valued for its beauty and some farmers are reluctant to allow harvesting of leaves for broom-making. *I. deltoidea* was considered to be the single most important palm, being a major source of *palmito* and an important source of wood. *W. georgii,* cited by all five informants as the most important palm for thatch, is the only native palm that is or has been "actively" managed. Active management is defined here as activities consciously done to enhance plant populations for economic exploitation. For example, when clearing forest for pasture, *W. georgii* palms are left standing and only five leaves per palm are cut for thatch. The palms do not grow as tall in open pasture and they produce larger leaves at a faster rate. Whereas it takes about 500 forest-grown *W. georgii* leaves to thatch a roof, only 300-350 pasture-grown leaves are needed. Lunar cycles play a critical role in harvesting palm fiber. *Welfia georgii* leaves not collected during *la luna menguante* (the first few days of the waning moon) will be "wet" or destroyed by insects within a few years, whereas a roof made from properly-harvested leaves may last 25 years (a 10–50 year range was given by informants). Special harvesting practices were used for *Cryosophila albida* and *Geonoma congesta* for reasons of safety. The first has sharp spines on the trunk and the latter leaves sharp, persistent stumps after cutting.

Informants provided information about palm natural history and conservation issues 24 times. Habitat was given for several species: virgin forest for *Bactris* sp., *Pholidostachys pulchra*, and *Reinhardtia* cf. *simplex;* secondary forest for *Prestoea decurrens;* higher elevation forests for *Geonoma interrupta*. In addition, informants noted that *Prestoea decurrens* grows near rivers, *Astrocaryum alatum* and *Calyptrogyne saripiquensis* in swamps, and *A. standleyanum* and *Pholidostachys pulchra* are restricted to hilltops. Discussion of abundance and distribution of palm species was limited by time constraints. Three species *(Euterpe macrospadix, Prestoea decurrens* and *Welfia georgii)* were cited as common, five *(Bactris wendlandiana, Bactris* sp., *Geonoma interrupta, G. longevaginata, Reinhardtia* cf. *simplex)* as uncommon, and six *(Astrocaryum alatum, A. standleyanum, E. macrospadix, Iriartea deltoidea, Socratea exorrhiza,* and *W. georgii)* as decreasing in numbers. Some *Geonoma* species, recognized as the folk genus *caña de danta*, were characterized as rare.

Palm population surveys. —A total of 489 individual palms (296 seedlings, 91 juveniles, 45 immature, and 56 adults) were present in eight transects established through primary forest on alluvium. Sixteen palm species, approximately half of the species known from La Selva, were encountered. *Welfia georgii* was the single most abundant species, accounting for 36.1% of all individuals. The six most frequent species, which accounted for 92.0% of individuals present *(Asterogyne martiana, Geonoma congesta, G. cuneata, Prestoea decurrens, Socratea exorrhiza, Welfia georgii)* (Fig. 1), were all reported as economically important (Table 1). Four additional useful palm species *(Bactris porschiana, Calyptrogyne saripiquensis, Cryosophila albida, Geonoma interrupta)* that were present but infrequent (< 1% presence) in the transects brought the total number of useful species in the transects to ten and the percentage to 94.9% of all palm stems. Size-class distribution for the four most frequent species (> 20 individuals) are presented in Fig. 2. Plot size for subcanopy species was twice as large as those for understory species and numbers were therefore halved to give an accurate proportion for *W. georgii* and *Socratea exorrhiza*. Three of the five economically-important subcanopy species, *Astrocaryum standleyanum, Euterpe macrospadix,* and *Iriartea deltoidea*, are restricted to habitats other than alluvium (Hartshorn and Poveda 1983; Chazdon 1985; Deborah Clark, personal communication, 1990) and thus did not occur in the transects.

Combined ethnographic and palm population survey data—Although sufficient time was not available during the course of this survey to determine annual stem and leaf productivity, it was possible to estimate resource capacity from the data collected. *Welfia georgii* and *Socratea exorrhiza*, both important sources of wood, had an average standing crop of 137.5 and 25 useable stems per hectare, respec-

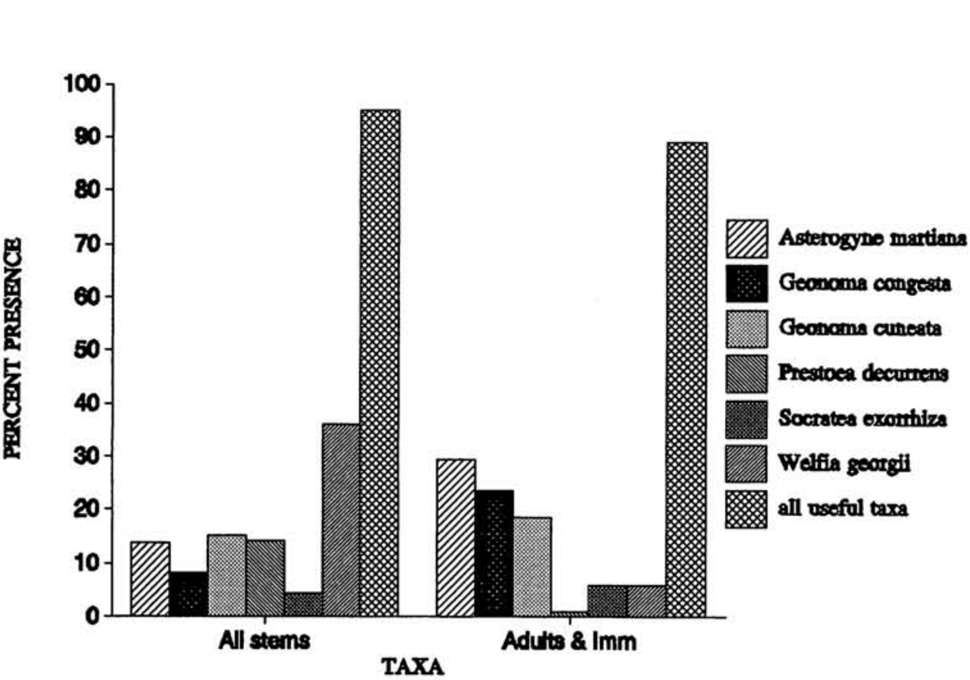

FIG. 1.—Palm species with > 3% presence in transects through primary forest alluvium and percentage of stems represented by adult and immature stems. All six species shown have economic value. Ten species were represented by < 1% presence: *Bactris porschiana**, 0.29%; *B. wendlandiana* Burret, 0.57%; *Bactris* sp. 0.86%; *Calyptrogyne saripiquensis**, 0.57%; *Chamaedorea warscewiczii*, 0.29%; *Cryosophila albida**, 1.15%; *Geonoma interrupta**, 0.86%; *G. oxycarpa* Martius, 0.29%; *Pholidostachys pulchra* H. A. Wendl. ex Hemsl., 2.59%; and *Synecanthus warscewiczianus* H. A. Wendl., 0.57% (* indicates species with reported economic use). The category "all useful taxa" is the sum of all palm species reported as economically useful.

tively (Fig. 2). Both adult and immature stems are considered useable. *Geonoma congesta* is a clonal species that is used occasionally for wood. There was an average of 600 clones per hectare and 8.4 utilizable stems per clone, or a standing crop of 5,040 stems per hectare (Fig. 2). Given that the average stem height was 3.4 m, a total of 17,136 m of stem are available per hectare.

The average standing crop of leaves for the three common thatch palms (adult and immature only) occurring in the alluvial transects, *Welfia georgii*, *Asterogyne martiana*, and *Geonoma congesta*, was calculated at 11.5, 14.7, and 65.9 leaves per palm, respectively. *W. georgii* leaves are employed for the large, flat areas of thatched roofs. An average forested hectare contains 137.5 harvestable *W. georgii* palms (Fig. 2) for a total of 1,581 useable leaves per hectare (Joyal 1990). Given that 500 forest-grown *W. georgii* leaves are needed to thatch one roof, 43 palms are required if the entire leaf standing crop is removed. (550 lvs/roof ÷ 11.5 lvs/palm = 43.5 palms/roof). Thus 3.2 roofs could be thatched per hectare if all leaves are cut. Only five leaves per palm are cut if the trees are to be maintained, that is if traditional management is practiced. In this case 100 palms are needed per roof, and the number of roofs that can be thatched from each hectare drops to 1.4. If the

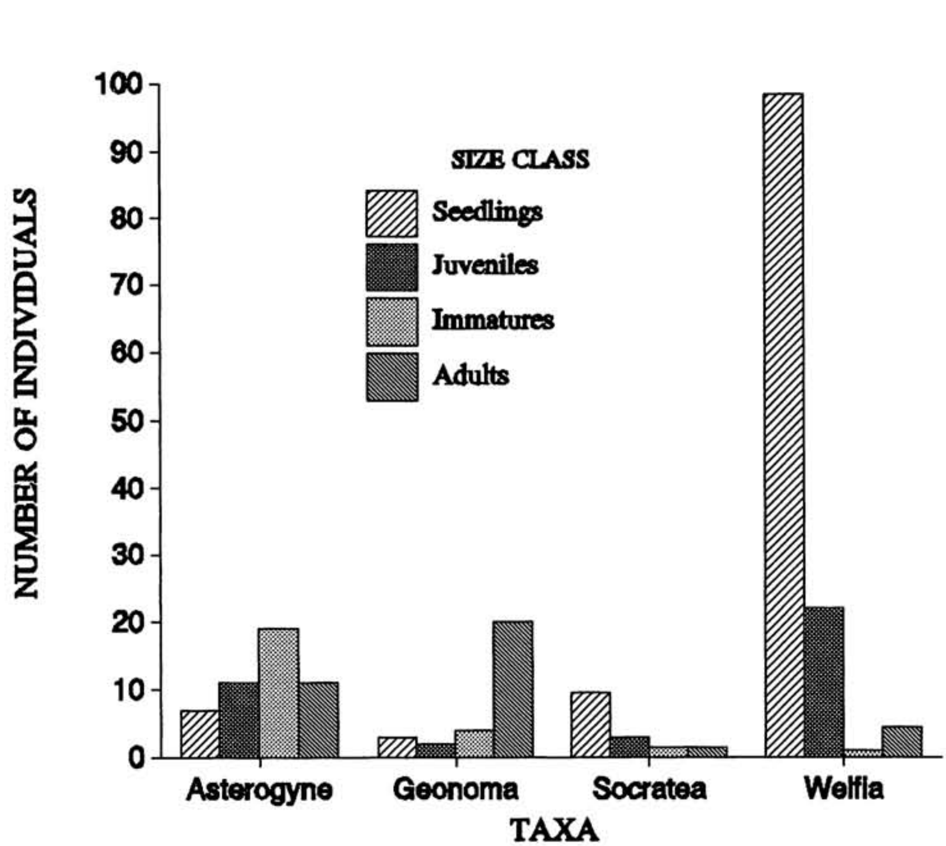

FIG. 2.—Size-class distribution for four economically important palm species at La Selva Biological Station, Costa Rica.

larger leaves of pasture-grown *W. georgii* are used, only 300–350 leaves, or 60–70 palms (5 lvs/palm/harvest), are needed to thatch a roof. Orlando Vargas (personal communication, 1990) thought that forest-grown *W. georgii* produces about one leaf per palm per year; he felt that annual leaf production for pasture-grown *W. georgii* was higher (no estimate is available). Using a production rate of 1 leaf per palm per year, one forested hectare will produce enough *W. georgii* leaves to thatch a new roof every 3.6 years. The small leaves of *Asterogyne martiana* and *Geonoma congesta* are used solely for finishing roof peaks. The amount needed per roof was not reported. However, the standing crop of these palms was calculated as 225 stems and 600 clones, or 3,308 and 39,540 leaves, per hectare, respectively. *Welfia georgii* leaves, while much larger, are less abundant (1,581 versus 42,848 combined *A. martiana* and *G. congesta* leaves) and, given their low numbers per hectare and high demand, are likely to be the limiting resource in thatched roof construction.

DISCUSSION AND CONCLUSIONS

Results obtained from the present study indicate that all palm species that are common at La Selva are economically useful (Hartshorn and Poveda 1983; Chazdon 1985; Deborah Clark, personal communication, 1990; Joyal 1990). Only three small understory species (*Bactris longiseta, Chamaedorea exorrhiza, Pholidostachys pulchra*) that were cited as frequent in distribution in previous studies have no documented use.

Determining the size-class structure of relatively undisturbed populations is an important first step toward assessing the status of harvested populations. For example, the size-class distributions for *Welfia georgii* and *Socratea exorrhiza* at La Selva (Fig. 2) are characteristic of long-lived individuals reproducing from seed. There are many seedlings and the number of individuals present in each subsequent life stage is progressively smaller (Sarukhán 1978). *Geonoma congesta* exhibits a size-class distribution typical of clonal species, i.e., there are many older individuals with relatively few seedlings and juveniles present (DeSteven 1986). The size-class distribution of *Asterogyne martiana* is not easily explained by either of the preceding patterns. The establishment of large cohorts of individuals at irregular intervals in years of abundant flower production followed by high seed set, dispersal, and establishment, can produce a size-class distribution other than those typically exhibited by woody species. This "episodic recruitment" (Harper 1977) is a possible explanation for the observed pattern in *Asterogyne martiana*. This baseline data can now be used for comparisons with harvested populations. For example, if the economically-important size-classes (adult and immature) of *W. georgii* populations outside the preserve were found to be greatly reduced, it would suggest over-harvest. However, if the seedling or juvenile size-classes were significantly decreased, an alternative explanation should be sought (e.g., biological phenomena or other changes in land-use management).

How might harvesting affect the abundance of economically important plant species? Some species increase and others decrease in abundance, depending upon what part is harvested, harvesting pressure, and the individual species' response to stress (Harper 1977). The use of a plant resource can be destructive to the entire plant or require only the limited harvest of a plant part. Destructive uses of palms include harvesting of stems for wood, edible *palmitos*, and whole plants as ornamentals. These uses have immediate demographic consequences to a palm population. Palm parts harvested nondestructively include leaves for thatch, edible flower buds and fruit (some fruit are also used medicinally), and seeds for growing palms as ornamentals. While more subtle, these practices can have long-term impacts on a palm population (Mendoza et al. 1987). Present harvesting practices for wood, *palmito* and thatch are creating conservation concerns for three subcanopy palm species (*Euterpe macrospadix, Iriartea deltoidea, Welfia georgii*) among some local residents (Joyal 1990).

Welfia georgii, a slow-growing subcanopy species (Chazdon 1985), is among the most economically important palms in this region. It is reported as uncommon through much of its range but is locally abundant in the La Selva area (Vandermeer 1983). Use of *Welfia georgii* is primarily nondestructive (leaves for thatch) but it is also harvested destructively (for wood and *palmito*). It is the only palm reported as "actively" managed. In the past complete harvest occured only when *W. georgii* was cleared for conversion of forest to pasture. Many people now harvest the entire standing crop of leaves, which is reported to kill the palm because it only produces one leaf per year (Orlando Vargas, personal communication, 1990). Traditional cultures often have practices which serve to regulate the harvest of important wild-collected resources. For example, in Sonora, Mexico, only the emerging leaves from large-leaved juvenile palms (*Sabal uresana* Trelease) are used for weaving. A leaf is not harvested until its petiole is visible, and its' specific use (for hats, baskets, or mats) depends upon the developmental stage of the fibers. Harvest is restricted to the time of the full moon during the summer monsoon season. As a result of these practices, individuals rarely have more than one leaf harvested per year, an important consideration when harvesting from young, slow-growing palms that produce an average of three leaves each per year (unpublished field notes, 1990–1994, in possession of the author).

The absence of appreciable "active" palm management, except for *W. georgii*, the single most useful species, has several possible explanations. It may be that more species were previously managed but that the traditional knowledge associated with them has been lost and the practices abandoned ("cultural erosion"). Alternatively, the need for active management may be recent if it can be assumed that active management becomes necessary only when a resource is both important and limited. For example, the *palmitos* of both *Euterpe macrospadix* and *Iriartea deltoidea* are destructively harvested as the *comida tipica* (traditional food) of Costa Rican holy days (Joyal 1990). Both were cited as overharvested but neither was reported as managed in any way. Did active management for these species exist in the past in Costa Rica? Or is a rapidly expanding human population that is changing from a subsistence to a market economy placing a greater demand on the *palmito* resource? Fortunately, the increased popularity of the domesticated *Bactris gasipaes* as a new source of *palmito* for local and export markets is reducing pressure on native *palmito* species. Like the native palms of the Saripiqui, many of our wild plant resources are dwindling under the pressure of increasing world populations. By documenting traditional ecological knowledge and resource management for wild plant resources now, we hopefully can manage them better in the future.

ACKNOWLEDGEMENTS

I wish to thank the staff of La Selva Biological Reserve, especially Orlando Vargas, for sharing their time and knowledge, and OTS 90-3, including Beverly Humphrey, Michelle Pinard, and Bette Loiselle, for their valuable criticism. Javier Caballero, Hermilo Quero, and Deborah M. Pearsall reviewed the manuscript and provided helpful comments. Humberto Suzán and Suzanne Hendrickson read the Spanish and French abstracts, respectively.

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