PLANT VIRTUES ARE IN THE EYES OF THE BEHOLDERS: A COMPARISON OF KNOWN PALM USES AMONG INDIGENOUS AND FOLK COMMUNITIES OF SOUTHWESTERN AMAZONIA[1]

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Campos, Marina Thereza and Christiane Ehringhaus *(School of Forestry and Environmental Studies, Yale University, 205 Prospect St., New Haven, CT 06511, Parque Zoobotânico, Universidade Federal do Acre, Rio Branco, Acre, Brazil, and Institute of Economic Botany, The New York Botanical Garden, Bronx, NY 10458. E-mail contact: marina.campos@yale.edu).* PLANT VIRTUES ARE IN THE EYES OF THE BEHOLDERS: A COMPARISON OF KNOWN PALM USES AMONG INDIGENOUS AND FOLK COMMUNITIES OF SOUTHWESTERN AMAZONIA. *Economic Botany 57(3):324–344, 2003.* *Despite its central importance to tropical forest conservation, the understanding of patterns in traditional resource use still is incipient. To address this deficiency, we compared known palm uses among two indigenous (Yawanawá and Kaxinawá) and two folk (rubber tapper and ribeirinho) communities in Southwestern Amazonia (Acre, Brazil). We conducted one-hundred-and -forty semi-structured "checklist" interviews about palm uses with male and female adults in the four communities. The knowledge of each community about the uses of the 17 palm species common to all communities was compared by testing for significant differences in the mean number of uses cited per informant and by calculating the Jaccard similarity index of known uses of palm species among the four communities. The following three hypotheses were confirmed: 1) the use of palms differs according to the cultural preferences of each community; 2) indigenous communities know significantly more about palm uses than folk communities; and 3) part of the indigenous knowledge was acquired through contact with Amazonian folk communities.*

Apesar de sua importância central para a conservação de florestas tropicais, o entedimento dos padrões do conhecimento tradicional sobre recursos naturais ainda é incipiente. Para atenuar esta deficiência comparamos o conhecimento dos usos de palmeiras entre duas comunidades indígenas (Yawanawá e Kaxinawá) e duas comunidades não-indígenas (seringueiros e ribeirinhos), na Amazônia Ocidental (Acre, Brasil). Foram feitas 140 entrevistas semiestruturadas do tipo "checklist" sobre o uso de palmeiras com homens e mulheres em cada comunidade. O conhecimento de cada comunidade sobre usos das 17 espécies de palmeiras encontradas em comum, foi comparado através do teste das diferenças significativas entre a média de usos conhecidos por informante e através do cálculo do índice de similaridade Jaccard dos usos conhecidos de palmeiras entre as quatro comunidades. As seguintes três hipóteses foram confirmadas: 1) os usos conhecidos de palmeiras diferem de acordo com as preferências culturais de cada comunidade, 2) as comunidades indígenas possuem um maior conhecimento sobre os usos de palmeiras do que as comunidades tradicionais não indígenas, e 3) grande parte do conhecimento indígena sobre utilização de palmeiras foi adquirido no último século com a convivência de outros povos amazônicos.

Key Words: indigenous knowledge; ethnobotany; palm uses; Yawanawá; Kaxinawá; folk communities; rubber tapper; *ribeirinho*; Southwestern Amazonia; Acre; Brazil.

The value of indigenous and folk knowledge on resource use has long been recognized, but despite its central importance to tropical forest conservation, our understanding of the patterns by which forest peoples know and use their plant resources is in its infancy. Attempts to promote rural development that reconciliates improvements in the quality of life and conservation of natural resources have had more success when based on the local knowledge and current patterns of resource use within the involved communities (IES 1995). Therefore, information on these use patterns in indigenous and folk communities is the base for successful community development strategies, particularly where it

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concerns the management of natural resources by these communities.

By asking how different cultures used the same plant resources, we tested three principal hypotheses about the knowledge of natural resource use by traditional people in tropical forests. The first hypothesis holds that the same resources, accessible to all groups, are used and valued in different ways by different communities. In each cultural context, the use of a certain resource fits into a specific cultural niche. The choices of resources for certain purposes depend on cultural preferences, variety characteristics and abundance of the resource, the specific mechanisms of use, and the access to alternative resources and materials that could replace that resource.

The second hypothesis holds that indigenous communities retain a larger body of knowledge about a natural resource use as compared to Amazonian immigrants and folk communities (Balée and Posey 1984; Hecht and Cockburn 1989). This premise is based on the notion that knowledge about plant use is accumulated over time, passed from generation to generation and is therefore greatest in those groups with the longest histories in a particular habitat.

The third hypothesis holds that traditional knowledge about plant use is dynamic, and continuously built through contact with other indigenous and folk people, as conditions change and groups interact. Indigenous communities have shown great adaptability to alter their culture by incorporating new resources and technology originating from other Amazonian people (Alexiades 1999; Milliken and Albert 1997a,b). Also, folk communities have had to adapt to Amazonian conditions in the course of their immigration and miscegenation with native Amazonians. Moran (1990) points out that the diffusion of new practices is facilitated in any population though exogamy and economic interaction between populations. These processes result in a continual incorporation of new ideas, know-how and values. Hence, cultural interchange is a fundamental element in the course of adaptation to environmental, social and economic change. This behavior is based on general human curiosity, and the interest to improve the economic base through the newly acquired knowledge.

Formal tests of these premises are virtually impossible using already published data, because of the differences in interview methods and differences in available natural resources. In this article, we test these hypotheses by comparing the known uses of palms by two indigenous groups, the Yawanawá and Kaxinawá, with centuries of experience in the same region and by two folk communities, the *seringueiros* (rubber tappers) and *ribeirinhos* (river dwelling people), with less than a century of experience in the area.

The approach we chose is suited to test these hypotheses, because 1) palms are perhaps the most important plant group in the lives of forest people (e.g., Anderson 1977; Balick 1986, 1988; Boom 1988, Mejia 1988; just to list a few), are very diverse in the region (Evandro Ferreira pers. comm. 1999) and represent a relatively large set of species occurring throughout the study area that we can use as a model system to test our hypotheses; 2) the study area, Acre, Southwestern Amazonia, also holds significant cultural diversity in a relatively small area with similar forest types and resources; and 3) the ethnobotanical information was gathered using the same interview methodologies, offering the opportunity to gather comparative data on the knowledge about palm utilization in the four communities.

Study Area

This study was carried out in four Southwestern Amazonian communities in the state of Acre, Brazil (Fig. 1): two indigenous groups, the Yawanawá and the Kaxinawá who live in the Western region of the state, and two folk groups, a *seringueiros* (rubber tapper) and a *ribeirinhos* (river swelling) community, who live in the Eastern part of the state.

The history and cultural characters of Acre were indelibly marked by the rubber boom at the end of the last century and its resurgence during the Second World War, which brought thousands of people from other Amazonian regions and particularly the arid Brazilian Northeast to the state. The western Acre area is very sparsely populated, with an average of 0.1–2 persons/km^2 (IMAC 1991), the majority of which lives along the rivers. The population consists of a variety of indigenous groups, rubber tappers, a few *ribeirinhos*, farmers and cattle ranchers near the small urban centers. Access to the region is difficult; one needs airplanes to get to the areas and boats to travel along the rivers. The eastern study area is closer to the urban center and cap-

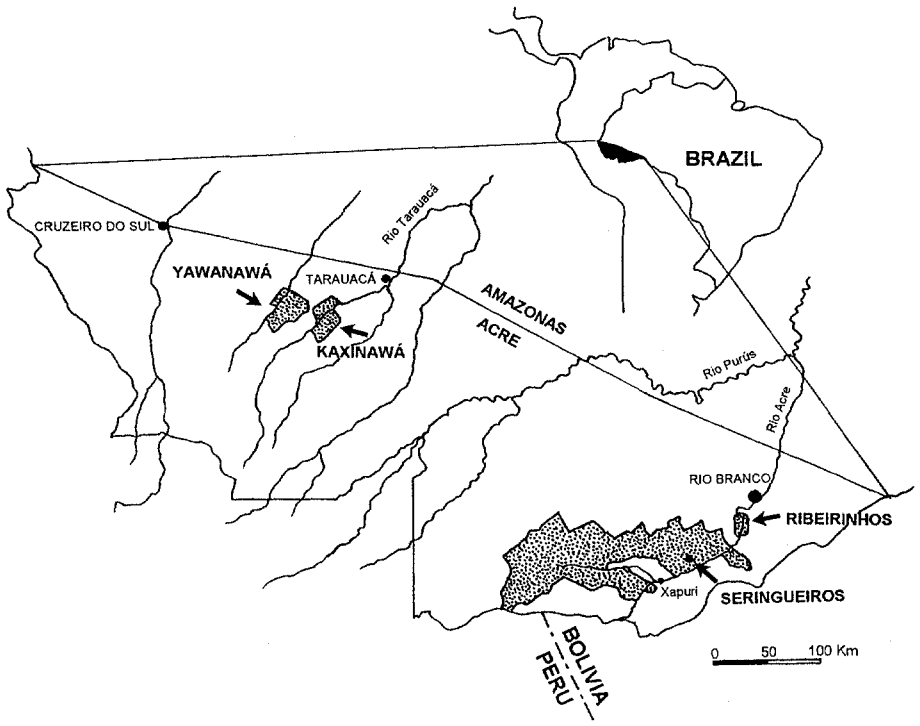

Fig. 1. Location of the four study sites, state of Acre. Southwestern Brazoian Amazonia.

ital of Rio Branco, and to the roads and airport that connect the state to the rest of the country. The region has been marked by the clashes between forest dwelling people and the development frontier along settlement projects and cattle farms. The rural population ranges from 0.75–3 persons/km^2, of which the majority are *ribeirinhos* and rubber tappers, as well as settlers in the settlement projects and some large cattle ranchers.

The vegetation in the area is generally characterized as humid moist tropical forest (Holdridge 1978). Characteristic forest types in Acre are dense and open evergreen tropical rainforest on terra firme, as well as seasonally flooded and poorly drained soils. The forests in Acre are mixed with bamboo forests that cover a considerable part of the state and constitute a characteristic disturbance element in the Southwestern Amazon region. The forests in these areas have been postulated to be extremely diverse (Daly and Mitchell 2000), and confirming data has been collected concerning the families Moraceae, Sapotaceae, Leguminosae, Euphorbiaceae, Piperaceae, Annonaceae, and others. In addition, the state is very rich in palms, with 80 species in a relatively small area (Evandro Ferreira pers. comm. 1999), which constitute characteristic elements in the different forest types.

Characterization of the Communities

Indigenous Communities: The Yawanawá and Kaxinawá

The Yawanawá and Kaxinawá indigenous groups both belong to the Panoan linguistic group, a major group in Southwestern Amazonia (Kensinger 1995). The Yawanawá have lived at the headwaters of the Rio Gregório since ancestral times. Currently, they consist of about 450 individuals who reside in the Rio Gregório Indigenous Area (8°23′51″ S and 71°46′53″ W) of 92 959 ha (Iglesias and Aquino 1996), demarcated and declared in 1977. The population resides in three villages, the most recent being Nova Esperança ("New Hope"), constructed in an attempt to take up traditional values of the culture.

The Kaxinawá indigenous group is the largest

in the state of Acre with about 2000 members in several indigenous areas. The Kaxinawá community Praia do Carapanã ("Mosquito beach"), with which we worked, is located on the Tarauacá river, a tributary of the Juruá River. Except for one family, the Kaxinawá resettled in these ancestral lands since 1991 and the area was declared an indigenous territory in 1998. The area comprises about 66 000 ha, with a population of about 300 people (Aquino and Iglesias 1994).

Originally, the Yawanawá and Kaxinawá were semi-nomadic, living in communal houses in villages. Today, both groups live in family-sized houses on stilts, the Yawanawá in villages and the Kaxinawá in family nuclei along the river, in rubber tapper fashion. Both groups practice swidden agriculture for subsistence, the Kaxinawá holding a stronger agricultural tradition than the Yawanawá. The main staples are cassava (*Manihot esculenta* Crantz, cultivars, Euphorbiaceae), banana (*Musa* X *paradisiaca* L., cultivars, Musaceae) and corn (*Zea mays* L., Poaceae). In both communities they also hunt, fish and meet other needs with extraction of forest products. The communities commercialize a few agricultural and extractive products, such as rubber, in the small urban centers. Both groups still hold a diverse material culture; the Kaxinawá have maintained their rich weaving craft alive, despite the erosion of many other traditional customs.

For a long time, the Yawanawá and Kaxinawá have interacted with each other and other indigenous groups of the area, particularly the Katukina and Ashaninka. At the end of last century, indigenous territories were first invaded with the emergence of the 'rubber boom' (Tastevin 1925a,b). Since then, the Yawanawá and Kaxinawá were continuously exposed to rubber tappers and missionaries, often working in semi-slavery for rubber barons, or *seringalistas*. The interaction with rubber tappers had a great influence on the indigenous societies, bringing about changes in the traditional customs, religious concepts, style of living, and mode of resource utilization with them. Both groups have absorbed many of the rubber tapping customs and their economic activities.

Folk Communities: The Seringueiros and Ribeirinhos

During the "rubber boom" at the beginning of the century thousands of people migrated to Acre to earn their living with rubber. A last resurgence occurred during the Second World War, when access to the rubber supplies from South East Asia was cut off. Most people came from the arid Brazilian Northeast, in the hope for better conditions; some came from other areas of the Amazon region (Dean 1987). Rubber lords allocated the *seringueiros* (rubber tappers) to *seringais* (rubber tapping areas), where they lived in family nuclei and worked on the *estradas de seringa* (rubber tapping trails) in almost feudal conditions for the rubber lords. Rubber extraction was the main source of income, other activities were limited to cassava planting and hunting. Additional goods only were available through barter systems that kept the rubber tappers in constant debt to the rubber lords. With the decline of the rubber prices, the Brazilian rubber system collapsed and the *seringueiros* started to diversify their spectrum of resource use toward agriculture and other forest products, such as Brazil Nuts (*Bertholletia excelsa* Bonpl., Lecythidaceae). Today, despite the search for other non-timber forest products as economically viable alternatives in a forest setting, the *seringueiro* identity remains focused on rubber extraction, although it does not yield their main income anymore. During the last century, rubber tappers have acquired a diverse body of folk lore about resources in their forests, initially learning from the local indigenous peoples and adapting from their own knowledge of other systems.

In the late 1980s, the rubber tapper union leader, Chico Mendes, who was assassinated ten years ago, championed territorial rights of rubber tappers against large scale cattle ranching and settlement projects. In this context, the first extractive reserve "Reserva Extrativista Chico Mendes" was founded, with almost 1 000 000 ha the largest of its kind in the Amazon region. It is known as the first model attempt to reconcile community development and forest conservation (Allegretti 1990, 1994; Anderson 1994; Murrietta and Rueda 1995) and is administered by the Federal Environmental Protection Agency (Conselho Nacional Populações Tradicionais-CNPT/IBAMA) and the rubber tapper organizations within the reserve. The rubber tapper community we worked with lives in the Seringal Dois Irmãos of the "Reserva Extrativista Chico Mendes." The families live in "colocações" (family nuclei) in houses made of palm products or timber. Today, most people in the area extract

Brazil Nuts, practice agriculture, hunt, and sometimes raise a few cattle.

The *ribeirinhos* (river dwelling people) are the most "acculturated" community we studied. *Ribeirinhos* come from a variety of racial, cultural and geographic backgrounds, and live along the rivers near the urban centers of Acre. They generally represent people or descendants of people that came to Acre more recently, colonists that gave up settlement projects, or former rubber tappers and people formerly involved with the rubber trade. Access to these areas generally is relatively easy by road and by river, and they often produce goods that are sold in the regional market such as agricultural products or the fruits of the açai palm (*Euterpe precatoria* Mart.). Many of the families also raise cattle, or are caretakers for cattle ranchers in the region.

METHODOLOGY

We compared the known uses of palms in the four Southwestern Amazonian communities as a measure of cultural variation of traditional knowledge about natural resources. We used palms as a model system for this case study because of their great spectrum of utility, their diversity in the area, and the relatively large set of species common to the study areas.

To determine the species known by each community, we used a free listing method (Weller and Rommey 1988) with some older informants in each community. This procedure resulted in a checklist of the known species in each area and their common and indigenous names. The indigenous names were pronounced and written with help of the indigenous school teachers in the communities. We obtained complementary information about the species occurring in the area by consulting the relevant literature (Henderson 1994).

We gathered data about palm use in each community in 140 semi-structured interviews with men and women above 18 years old (n = 50 Yawanawá, n = 20 Kaxinawá, n = 35 seringueiros and n = 35 ribeirinhos). Using the "checklist-interview" technique (Alexiades 1996), we asked informants about all the known uses about each palm species documented in each community. Moreover, we collected botanical material from all native species mentioned by the communities, following standard botanical procedures and deposited voucher specimens at the Parque Zoobotânico/Universidade Federal do Acre Herbarium (HPZ) and the New York Botanical Garden (NY). The material was identified by Evandro Ferreira and Andrew Henderson, both from the New York Botanical Garden. Appendix 1 lists of all the voucher specimens.

To test the hypothesis that indigenous peoples know more about palm uses than folk communities, we used only data concerning the 17 shared palm species to the four communities. All the uses mentioned by the informants were recorded and grouped in seven use categories: food, medicine, construction, ritual, technology/crafts, not known and not used. We calculated the proportions of uses in each established category as well as the proportions of uses of different plant parts, such as roots, spines, trunks, palm hearts, leaves, flowers and fruits. We classified uses at three levels: (1) **general uses,** to designate the possible types of different uses of palm resources in general, regardless of the species; (2) **species-specific uses,** to designate all uses possible associated with each specific palm species, and (3) **cited uses,** to determine the number of times a determined use is mentioned by the informants for each palm species. For example, in the case of three mentions of the same use for two different species, we considered it one general use, two species-specific uses and three cited uses.

To compare the four communities in terms of specificity of knowledge about the palms they use, we calculated the average number of uses cited per informant per species in each community. We compared the averages for the 17 shared species in the four communities using the Tukey Multiple Comparisons test (Sokal and Rolf 1981). Using the similarity index of Jaccard (Brower and Zar 1978) based on the number of general and species-specific uses for the 17 shared palm species, we calculated the similarity between communities and compared use specificity of a certain resource.

To test the hypothesis that a large part of the uses known in the indigenous communities were acquired during the last century from folk cultures, older informants in the indigenous communities classified the species-specific uses as indigenous or folk. We compared the proportions of traditional vs. acquired uses within each indigenous community.

RESULTS

THE PALMS AND THEIR USES

During our work with the four communities, we documented 31 palm species distributed in 19 genera, of which 26 are native and 5 are exotics or cultivated (Table 1). *Carludovica palmata* Ruiz & Pav. (Cyclanthaceae) was considered to be a palm by the indigenous communities. The cases of 'marajá' (3 *Bactris* spp.) and 'ubin' (4 *Geonoma* spp.) represent a classic case of underdifferentiation (Berlin et al. 1974) by the communities and we treated them as one, according to the traditional classification. The most species-rich genera were *Attalea* (5 species), *Bactris* (4), *Astrocaryum* and *Oenocarpus* (3 each), *Cheylocarpus* (2) and the remaining genera had one species each.

Considering all 31 species, we encountered the total of 143 distinct general uses in all communities. Although the Yawanawá have fewer palm species in their community, they shared the highest number of general and species-specific uses (Table 2), followed by the Kaxinawá. *Seringueiros* and *ribeirinhos* know more species, some of them cultivated, but the number of general and species-specific uses is lower than that in the indigenous communities.

Of the 31 encountered palm species, 17 species are common to the four communities (Tables 1 and 3). Overall, the species with the most known species-specific uses are: *Euterpe precatoria, Mauritia flexuosa, Attalea phalerata, Attalea butyracea* and *Phytelephas macrocarpa,* although the different communities use the species for different purposes (Table 3). The indigenous communities know more uses about the native *Attalea* spp, particularly *A. tessmannii,* the *Astrocaryum* species and *Phytelephas macrocarpa.* The folk communities know most uses about *Euterpe precatoria, Attalea phalerata, Mauritia flexuosa* and *Cocos nucifera.* The number of species-specific uses known for all palms is higher in the Yawanawá and the Kaxinawá community than in the *seringueiro* and *ribeirinho* communities (Table 3). Exceptions are the palms *Euterpe precatoria, Mauritia flexuosa, Attalea phalerata, Cocos nucifera, Geonoma* spp, *Chamaeodora anguistisecta,* for which the seringueiros and ribeirinhos know as many or more uses than the indigenous groups. The *seringueiros* and *ribeirinhos* know more uses about the cultivated palms from other Brazilian regions.

We classified the cited uses for the 17 shared palms in use categories and plant part categories (Tables 4 and 5, respectively). The proportions in which all uses occur in these categories give an indication of the main needs that are covered by the use of palms and the principal palm parts used for these purposes. In all the communities, the proportions of uses, measured by the number of cited uses, were highest for food, construction and technology/crafts, food being most important (Table 4). In indigenous communities, technology/crafts, then construction, and to a small extent ritual uses are of importance, whereas in folk communities the palm uses are more associated with construction of houses and less with technology/crafts and rituals. Very rarely indigenous informants did not know a palm or did not cite uses for a palm. Folk communities, particularly the more acculturated *ribeirinhos,* mentioned unknown palms or palms with no uses more often than the indigenous groups.

The four communities also use the parts of palms in similar proportions (Table 5). All communities cited fruits most frequently, which is directly associated with their importance as a source of food (Table 4). The fruits of primarily *Euterpe, Oenocarpus* spp. (Fig. 2), *Attalea* spp., and *Astrocaryum* spp., are consumed raw, as "wine," boiled, roasted, mixed in with other foods or processed to oil. The trunks, primarily of *Iriartea* and *Socratea,* as well as *Euterpe* and *Oenocarpus mapora,* are used as structural elements in house construction. Leaves are very important as thatching material, the species employed including *Attalea* spp (Fig. 3), *Phytelephas, Cheylocarpus* spp. to *Geonoma* spp. In addition, leaves of *Attalea* spp. and *Astrocaryum* spp. are important materials for the manufacture of indigenous crafts and domestic tools. The main difference in palm part use is the more frequent consumption of palm hearts by the folk communities. Only indigenous communities mentioned spines of *Astrocaryum* spp. as a traditional painting tool, a practice abandoned today. Flowers and roots are little used by all communities, roots being used primarily for medicines or grating tools and flowers as perfuming agent.

SPECIFICITY AND DIFFERENCES IN RESOURCE USE

We calculated the average number of cited uses per species and informant to examine the

TABLE 1. SCIENTIFIC, COMMON AND INDIGENOUS NAMES OF ALL PALMS CITED IN THE FOUR COMMUNITIES.

Scientific name	Common name	Yawanawá	Kaxinawá	Community[a]
Aiphanes aculeata Willd.	pupunha xicaxica	—	nena	K, S, R
Astrocaryum aculeatum G. Meyer	tucum/tucumã	paniwã	panimã	Y, K, S, R
Astrocaryum jauari Mart.	joari	—	—	K, S, R
Astrocaryum murumuru Mart.	murmuru	pani peshku	pani	Y, K, S, R
Attalea butyracea (Mutis ex L.f.) Wess. Boer	jaci	kuti	kuti	Y, K, S, R
Attalea maripa (Aubl.) Mart.	najá	—	—	S, R
Attalea phalerata Mart. ex Spreng.	auricuri	miriari	xebun	Y, K, S, R
Attalea speciosa Mart. ex Spreng.*	babaçu	—	—	S, R
Attalea tessmannii Burret	cocão	kuta	kunta	Y, K
Bactris acanthocarpa Mart.	pupunha brava	—	—	S
				Y, K, S, R
Bactris gasipaes Kunth*	pupunha	vaná nená	bani bana	Y, K, S, R
Bactris macana (Mart.) Pittier	pupunha da mata	niimera nená	bani	Y, K, S, R
Bactris spp.†	marajá	xini	xii	Y
Carludovica palmata Ruiz & Pav.	xila	hume	txaxu bume	Y, K, S
Chamaedorea angustisecta Burret	palmeirinha	—	sinkabin	
Chelyocarpus chuco (Mart.) H. E. Moore	xila	—	bume	K
Chelyocarpus ulei Dammer	carnaubinha	humewã	bumeuã	Y, K, S, R
Cocos nucifera L.*	coco da praia	—	—	K, S, R
Copernicia prunifera (Miller) H. E. Moore*	caranúba	—	—	R
Desmoncus mitis Mart.	jacitara	—	—	K, S, R
Elaeis guineense Jacq.*	dendé	—	—	S, R
Euterpe precatoria Mart.	açai	panã isã	pana isã	Y, K, S, R
Geonoma spp.*	ubim	tatoumi	tana	Y, K, S, R
Iriartea deltoidea Ruiz & Pav.	paxiubão	tau	tau	Y, K, S, R
Mauritia flexuosa L. f.	buriti	vinu	binu	Y, K, S, R
Oenocarpus mapora H. Karst.	bacaba	kehu isã	purisã	Y, K, S, R
Oenocarpus bataua Mart.	patoá	isã	isã	Y, K, S, R
Oenocarpus sp.	bacabão	isã newá	purisã ewapa	Y, K, S, R
Phytelephas macrocarpa Ruiz & Pav.	jarina	epevi	hepe	Y, K, S, R
Socratea exorrhiza (Mart.) H. Wendl.	paxiubinha	uxtá	nixte	Y, K, S, R
Syagrus sancona H. Karst.	açairana, catolé	—	—	K, S, R

[a] Y = Yawanawá, K = Kaxinawá, S = seringueiros, R = ribeirinhos.
* Cultivated.
† Collected species are listed in Appendix 1.

TABLE 2. COMPARISON OF ALL PALMS KNOWN AND THEIR KNOWN USES IN THE FOUR COMMUNITIES.

Community	Ni	Known palms	Native palms	Total GU	Total SU
Yawanawá	50	20	18	94	247
Kaxinawá	20	24	21	82	191
Seringueiros	35	26	23	64	146
Ribeirinhos	35	25	21	60	164

Ni = number of informants; GU = general uses; SU = species-specific uses.

different use patterns among the communities (Table 6). For most native species more uses are mentioned on average in indigenous communities than in folk communities. In both indigenous communities, the species with highest averages of use citations was *Attalea tessmannii* (Fig. 4). This species does not occur in the eastern region of Acre, but plays an important role as a source of food, construction and craft materials in the indigenous communities. Apart from this species, the Yawanawá mentioned many uses for *Phytelephas macrocarpa* and *Bactris macana* and the Kaxinawá mentioned many uses for the other local *Attalea* species and *Astrocaryum murumuru,* an important craft material.

The focus in folk communities is on other palm resources. In most cases, the *seringueiros* mentioned more uses per species than did the *ribeirinhos.* In both communities, *E. precatoria* had the highest average of known uses, although the *seringueiros* mentioned more uses for this palm than the *ribeirinhos* (Table 6). In both communities also *Attalea phalerata* and the exotic *Cocos nuc*ifera play an important role. The *seringueiros* also frequently mention *Socratea exorrhiza* and *Oenocarpus* spp.

All the communities studied showed a great specificity in the utilization of palm resources (Table 6), having a distinct emphasis on one or two species. For example, the Yawanawá and the *seringueiros,* mentioned uses of *Attalea tessmannii* (8.80) and *Euterpe precatoria* (5.43), respectively, to a much higher degree than other species, highlighting the cultural importance of these species within their communities.

To test whether the level of knowledge about palm use is higher in indigenous communities than in folk communities, as the results about the use of all species indicate, we compared the uses of only the shared species. One way to do this is comparing the number of general, species-specific and cited uses of the common species in each community (Table 7). The indigenous communities cited more general, species-specific and use citations than the folk communities, although the cited uses as such depend on the sample size, which is largest in the Yawanawá community and smallest in the Kaxinawá community. The average number of species-specific uses per palm also shows that the indigenous communities, as a whole, know more uses per species than the folk communities. We also tested this hypothesis though a statistical comparison of the average number of cited uses (ACU) per palm and informant. The ACU of the 17 shared palms was significantly higher in the indigenous communities than in the folk communities ($P < 0.05$, Tukey Multiple Comparisons test, Table 7).

In general, indigenous communities knew and cited more uses of palms per species than did folk communities, supporting the second hypothesis of this paper. The Kaxinawá ACU was significantly higher than that of the folk societies. The Yawanawá ACU was also higher than that of the folk societies, but this difference was not significant (Table 7). The mean number of uses cited per species for 6 of the 17 shared species (*Bactris macana, Bactris maraja, Mauritia flexuosa, Oenocarpus mapora* and *Phytelephas macrocarpa*) was significantly higher in the indigenous communities than in the folk communities, while the inverse was true for only one species (*Euterpe precatoria*). The mean number of uses cited for *Attalea butyracea* was significantly different in each of the four communities. It is interesting to note that the mean number of uses cited for *Bactris gasipaes,* a cultivated species, was the same for the four communities (Table 6).

The number of uses cited per species is not only similar in indigenous communities, but also tends to be similar in the two folk communities. According to Tukey's Multiple Comparison Test (Table 6), the mean number of uses per species was not significantly different for 10 species in the two indigenous communities, and for 12 species in the folk communities (Table 8).

SIMILARITY OF KNOWLEDGE OF PALM USE IN THE FOUR COMMUNITIES

The number of cited uses in the different communities gives a quantitative indication of how

TABLE 3. COMPARISON OF MAIN USES OF PALM SPECIES THAT ARE COMMON AND NOT COMMON TO THE FOUR COMMUNITIES.

Palm species	Uses[a]	Number of species-specific uses[a]				Traditional [%]	
		Y	K	S	R	Y	K
Species in common							
Astrocaryum aculeatum	The fruits and seeds are eaten raw or roasted, and the oil from the fruits is used in cooking (all groups). Rarely the palm heart is eaten (S). The endocarp also is used to make rings and necklaces (S). The fruits sometimes contain beetle larvae that are roasted and eaten or used as fish bait (Y). The young leaves are used to make string, hammocks, fishing nets, baskets and has (Y, K). The young leaves also are used to make ritual clothing (K), the spines are used in traditional painting (Y, K) and the trunk to make bows (Y).	9	11	9	7	87	100
Astrocaryum murumuru	The fruits and seeds are eaten raw, boiled or roasted and the extracted oil is used for hair care (all groups). The endocarp is used to make rings and buttons (S). The palm heart is popular among seringueiros. The young leaves are used to make fans, baskets and hats (all groups); toy animals, ritual garments (K) and sieves (Y). The spines are used in traditional indigenous painting (Y, K). The trunks serve as supporting house element (Y).	13	19	5	8	77	98
Attalea butyracea	The fruits and seeds are eaten raw (S, R), or boiled, roasted, mixed with other foods and processed as beverage and cooking oil (Y, K). The hard endocarp was used as fuel for the rubber smoking process (Y). Very rarely the palm heart is eaten (Y, K); The young leaves are used to make fans, mats and carrying baskets (Y, K). The leaves are used as thatching material in all communities and the trunk serves as compost (R, Y).	13	15	4	10	85	83
Attalea phalerata	The fruits and seeds are eaten raw and roasted or as cake, a beetle larvae in the seed is eaten and used as fish bait (all groups). The endocarp is used as fuel in the rubber smoking (Y). The extracted oil is used for cooking (S, Y, K) and hair care (Y, K). The palm heart also is eaten (S, R). The young leaves are used to make fans and mats; baskets and hatching bags (Y, K) and to treat boils; the mature leaves are used as thatching material (all groups) and carrying baskets (Y, K). The stem is used as compost (R).	20	14	12	15	80	66
Bactris gasipaes	The fruits are eaten boiled and processed to flour and cooking oil (all groups). The palm heart also is eaten. The trunks are used as wall boards; spits (Y) and to make compost (R).	8	6	4	6	0	6
Bactris macana	The fruits and seeds rarely are eaten, but used to extract oil for cooking and hair care (all groups). The palm heart is eaten (S). The stem is the favorite material to produce bows, arrows, war clubs, spears and weaving instruments (Y, K).	10	8	2	7	90	87
Bactris maraja	The fruits are snack foods (all groups). The stem is used to make bows, arrows, spears, and waving material (Y, K); grated it is used as stuffing material for cartridges (S, R, K).	5	5	4	5	100	100
Chamaedorea angustisecta	The fragrant inflorescences are used as "perfume" for clothes, bags and rooms (all groups) and the plant planted for ornamental purposes (S, K).	2	3	2	3	100	100

TABLE 3. CONTINUED.

Palm species	Uses[a]	Number of species-specific uses[a]				Traditional [%]	
		Y	K	S	R	Y	K
Euterpe precatoria	The fruits are processed into the local "wine" (S, R), the oil is extracted for cooking and hair care (all groups). The seeds are used to make necklaces and produce salt (S). The palm heart also is eaten (S, R). The young leaves are used to treat snake bites (all groups), ant bites and cough remedy, as well as for mats, basketry, sieves and ritual garments (Y). The mature leaves are used for emergency thatching and in the press for the cassava flour processing (all groups). The stem is used to make floors, walls, lattice, fences and gutters (mostly S, R). The roots are used as a remedy for anemia and hepatitis (S, R, K).	24	11	19	15	46	60
Geonoma spp.	The leaves are used for thatching (S, R) and used to wrap materials (Y, K). The stem is used for traps and spits (S, R). The fruits are snack food (Y, K) and hunting remedy (K).	2		6	4	100	91
Iriartea deltoidea	The trunks are favorite construction material to make floors, walls and fences (all groups). They also serve as a canoe bottom (Y, K), as a ritual corn wine barrel (K) and are used as support beams of the house, to make bows (Y) and a musical instrument (K). The palm heart is rarely eaten (K). The water in young fruits and palm hearts is consumed (Y, K) and the fruits are used to make necklaces and as cattle food (S, Y).	14	10	6	9	64	42
Mauritia flexuosa	The fruits are eaten raw and processed into the local "wine," sweets and cooking oil. The petiole is used to make bottle cork, (S, R), kite sticks (R), bird cages (S, R), and traps (S, K). The young leaves are twined into string to wrap tobacco (all groups) and used to make baskets, hats, and toy animals (Y, K), as well as ritual garments and bracelets (Y). The trunk serves as bridges and as weight in the cassava flour press (K).	10	16	12	13	70	82
Oenocarpus mapora	The fruits are processed into "wine" and oil for cooking, hair care (all groups), to treat asthma (R) or rashes (Y). The palm heart can be consumed (S, R) and the leaves are used for thatching, in the cassava flower press (all groups) and as carrying baskets (Y). The trunk is used to make floors, walls, lattice (all groups) as well as bows and arrows (Y).	17	13	8	9	53	43
Oenocarpus bataua	The fruits are processed into "wine" and oil for cooking, hair care, gun lubrication (all groups), to treat asthma (R) or rashes (Y). Fruits are also used to make curtains (S, Y). The petiole is used to make kite sticks and spits (S, R). The leaves are used to make rooftops, provisional thatching (all groups), carrying baskets, bridges, (K, Y), tobacco wrapping, brooms and lashing material (Y).	15	13	9	9	80	89
Oenocarpus sp.	The fruits are processed into "wine" and oil for cooking hair care (all groups), and to treat asthma (R). The palm heart can be consumed (S, R). The leaves are used for provisional thatching, rooftops (all groups), as carrying baskets and mats (Y, K). The trunk can be used to make bridges, supporting house structure and lattice (Y, K).	10	4	6	6	50	95

TABLE 3. CONTINUED.

Palm species	Uses[a]	Number of species-specific uses[a]				Traditional [%]	
		Y	K	S	R	Y	K
Phytelephas macrocarpa	The fruits and seeds are eaten raw or roasted (all groups) and the water from the immature fruits is drunk (S, Y, K). The mature hard seeds are used to make buttons (S, R), rings and necklaces (S, Y), as pipe heads and for polishing pottery (Y, K). The young leaves are used as snake bite and head ache remedy (all groups), sting ray and fever remedy (K), epilepsy, allergy and crying remedy (Y) and kidney remedy (S). The mature leaves are used as thatching material (all groups), roof tops, carrying baskets; mats (Y, K), sieves, lashing material and tree climbing strings (Y).	25	16	9	8	88	65
Socratea exorrhiza	The trunks are a favorite material for flooring, walls, lattice, fences (all groups), gutters (S, R) and bows (Y). Rarely, the palm heart is eaten (Y). The spiny adventitious roots are the traditional indigenous cassava and corn grater (Y, K). The leaf sap is used to coagulate *Hevea* spp. latex (S, K) and serves as a tonic (Y). The fruits are used as sling shot ammunition (Y).	11	11	8	8	55	27
Species not in common							
Alphanes aculeata	The fruits are eaten raw and sometimes processed to "wine" (S, R, K). The stem is used to manufacture weaving and hunting gear (K).	—	5	2	—	—	100
Astrocaryum jauari	The fruits are used as fish bait and the tree is a good hunting tree (S, R, K).	—	1	1	2	—	0
Attalea maripa	The fruits are rarely eaten (S), but serve as game attractant (S, R). The leaves are used as substitute thatching materials (S, R) and the petiole as lattice (S).	—	—	4	4	—	—
Attalea speciosa	The fruits can be eaten raw or cooked (S, R), processed to oil or flour (R) and used as necklaces (S). The leaves are used for thatching (R), for fans and hats (R).	—	—	6	5	—	—
Attalea tessmannii	The fruits and seeds are eaten raw, boiled, roasted, as cakes, mixed with other foods (Y, K), processed to "wine", "milk"; and oil used in cooking, hair care, rash remedy, gun lubrication, and fuel for lighting (Y). The endocarp is used as fuel in the rubber smoking process (Y, K) and to make pipe heads (Y). Beetle larvae from the seeds are eaten and used as fish bait (Y, K). The palm heart is occasionally eaten (Y). The young leaves are used to make fans, baskets; hats and toy animals (Y). The mature leaves are used for thatching (Y, K).	29	22	—	—	86	85
Bactris acanthocarpa	This palm is not used: "not even animals eat the fruit" (S).	—	—	1	—	—	—
Carludovica palmata	The leaves are used for thatching, to make sieves; baskets and ritual garments (Y).	10	—	—	—	75	—
Chelyocarpus chuco	The fruits are eaten as snack food. The leaves are used for thatching and to make hats, baskets, and in the cassava flour press (Y, K).	3	6	—	—	10	70
Chelyocarpus ulei	The fruits are eaten as snack food (K). The leaves are used in hatching (S, K), cassava flour press, to make fans, baskets; hats, brooms, hammocks; toy animals, and ritual bracelets (K).	—	13	4	5	—	50

TABLE 3. CONTINUED.

Palm species	Uses[a]	Number of species-specific uses[a]				Traditional [%]	
		Y	K	S	R	Y	K
Cocos nucifera	The coconut water is drunk as a remedy for diarrhea and hepatitis. The seed and its sweet derivatives are eaten and the coconut "milk" and oil used to spice food (S, R). The pericarp is used as a remedy for anemia, bleeding and tooth ache and used as a cleaning scrubber (S, R). The endocarp is used as an ashtray and to make salt (S, R). The leaves are used for provisional thatching (R), and the petiole to make bird cages (S).	—	8	10	18	—	0
Copernicia prunifera	The leaves are used to make hats and baskets and to extract the cutical wax (R/S).	—	—	1	5	—	—
Desmoncus mitis	The stem is used as tobacco wrapping (S, R, K), and for latching, clothes lines and basketry (K). The roots are used for treating boils, bleeding and fever (S, K).	—	6	3	2	—	5
Elaeis guineense	The fruits yield a oil, popular in NE Brazil, used in food preparation and used in wound healing.	—	—	1	7	—	—
Syagrus sancona	The fruits are rarely eaten and are hunting attractants (S, K).	—	1	2	2	—	100

[a] Y = Yawanawá, K = Kaxinawá, S = *Seringueiros*, R = *Ribeirinhos*.

much knowledge exists within the communities, but it does not yield information about the similar quality of this knowledge. We used the Jaccard similarity index, based on general uses to determine the similarity of general knowledge on how to use palm resource. Using similarity indices based on species-specific uses, we tried to determine whether the know-how on palm use is similarly applied to the different palms in the four communities. In general, similarities between groups are low, ranging between 0.326 and 0.588 for general uses and between 0.189 and 0.341 for species-specific uses (Table 9). The general dissimilarity points to distinct patterns of palm use within each of the communities. The fact that similarities based on general uses are higher than those based on species-specific uses supports the hypothesis that each community uses different palms of their preference to satisfy the same general needs and purposes. The four communities share knowledge and know-how about palm use in general, but use different palms to fill these purposes, each making different choices on how to satisfy their needs.

As expected, the similarity analysis shows that the most similar communities in terms of palm uses were the seringueiros and ribeirinhos and the Yawanawá and Kaxinawá respectively (Table 9). The most dissimilar communities were ribeirinhos and Yawanawá. Surprisingly, the seringueiros and the Kaxinawá showed a relatively high similarity, possibly due to the construction style that these indigenous peoples have adopted from rubber tappers.

CHANGES IN TRADITIONAL PLANT LORE: ACQUISITION OF NEW PRACTICES

To investigate the incorporation of new plant knowledge into traditional knowledge systems, we compared the proportions of traditional and acquired uses in the two indigenous communities (Table 10). Although the number of known uses is higher in the indigenous communities, we identified part of this knowledge as acquired from folk Amazonian populations. The origins of these acquired uses are probably in *seringueiros* and *ribeirinhos* communities, who in return have brought these practices from other Amazonian regions and the Brazilian Northeast. The traditional uses mentioned by both communities are mainly related to the technology/craft category, including baskets, mats, ham-

TABLE 4. PROPORTION OF CITED PALM USES IN DIFFERENT USE CATEGORIES, BASED ON THE 17 SHARED PALM SPECIES.

Community	Food	Technology/ crafts	Construction	Medicinal	Ritual	No use	Unknown	Total
Yawanawá	36.0	34.3	21.3	1.5	3.8	1.5	1.6	100
Kaxinawá	40.5	33.5	17.0	2.3	4.2	1.7	0.8	100
Seringueiros	39.9	15.5	34.9	1.4	1.6	4.6	2.0	100
Ribeirinhos	39.7	12.4	33.1	1.8	0.5	5.7	6.7	100

mocks, weapons (Fig. 5), domestic tools and medicines. Acquired uses are mostly associated with the construction of houses in the rubber tapper style with floor panels, walls, thatching, and structural elements.

About a fourth to a third of the uses encountered were acquired in recent times during contact with folk populations, and this holds true for all use levels (GU, SU, and CU, Table 10). The Kaxinawá cited a slightly higher proportion of traditional uses than the Yawanawá, which probably is due to the higher number of uses related to crafts, especially the rich weaving tradition. Thus, the current stock of truly 'indigenous' plant uses is about the same as the folk knowledge, if one subtracts the acquired uses of the indigenous general and species-specific uses (e.g., Yawanawá 62% of 87 is 53, about the same as the *seringueiros* [56] or *ribeirinhos* [54].

DISCUSSION

THE ROLE OF PALMS AND THEIR USES

The bulk of species used by the communities is native to the region, although also a few exotic species are known, particularly in the folk communities. Due to their great variety and usefulness, palms play a central role in the daily lives of the four communities we studied. The main uses of palms in the communities are associated with basic necessities such as food, house construction, as well as technology and craft implements. Despite the differences in the uses known about each palm, the proportions of uses in the different categories and of the palm parts used in the different communities are very similar. Food is the most important category, mostly fruits and less frequently palm hearts. In indigenous communities also the varied technology/craft category is important, using all palm parts, particularly leaves, trunks and fruits. In folk communities the construction category is more important using trunks and leaves.

CULTURAL DIFFERENCES

The spectra of palms used within each community differ slightly, but the uses attributed to each species differ considerably among the cultural groups. We detected that indigenous and folk communities use different palm resources to satisfy their various needs and show a high degree of specificity, focussing on key palm species. The Kaxinawá and, particularly, the Yawanawá have a strong cultural focus on *Attalea tessmanii* and other *Attalea* species. In the case of *Attalea tessmanni,* this may be due to the great usefulness of the species, and to the great abundance of the species in the area, although many other useful palms are present. The *seringueiros* and *ribeirinhos* both focus on *Euterpe precatoria,* which occurs abundantly in all areas. This shows that the mere existence of a natural resource in an area does not necessarily imply that all communities would exploit this resource to a large extent.

The low similarities in species-specific uses of

TABLE 5. PROPORTIONS OF USE CITATIONS OF PALM PARTS, BASED ON THE 17 SHARED PALM SPECIES.

	Roots	Trunk	Spines	Palm heart	Leaves	Flowers	Fruits	Total
Yawanawá	1.0	27.9	0.2	0.9	28.2	1.7	40.2	100
Kaxinawá	1.5	22.0	1.1	4.5	29.2	1.2	42.5	100
Seringueiros	0.4	27.1	0.0	7.4	17.2	1.3	46.6	100
Ribeirinhos	0.7	25.7	0.0	5.6	23.7	0.6	43.8	100

Fig. 2. Preparation of açaí (Euterpe precatoria) wine (non-fermented): **a.** harvest of fruits, **b.** mashing of fruits, and **c.** wine.

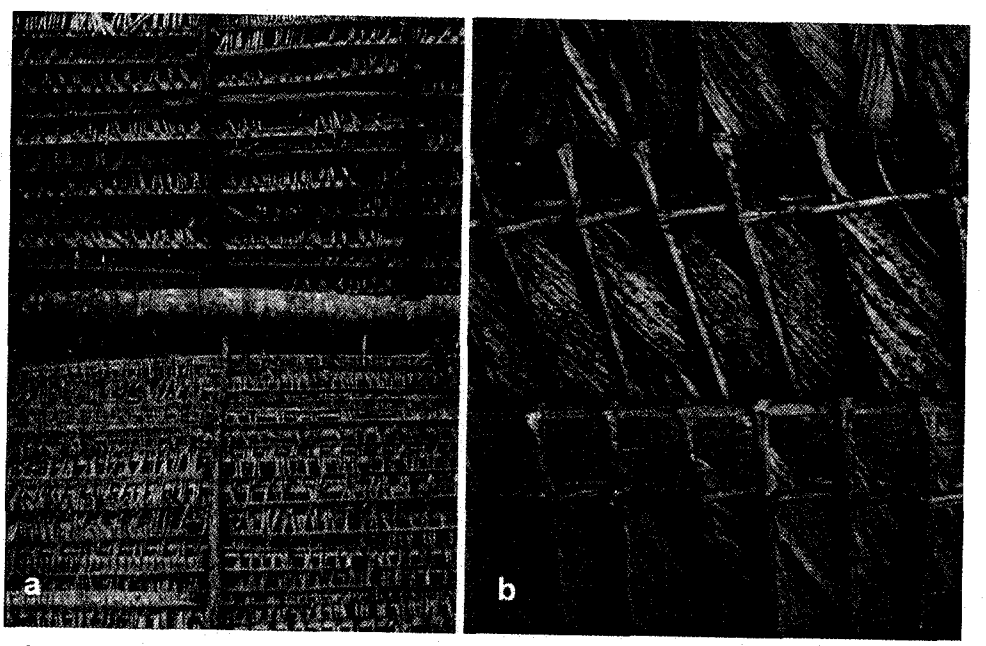

Fig. 3. Thatching in different cultures: **a.** Yawanawá thatching with cocão (*Attalea tessmannii*), **b.** Seringueiro thatching with ubim (*Geonoma deversa*).

TABLE 6. AVERAGE NUMBER AND STANDARD ERROR OF TOTAL USE CITATIONS CITED PER INFORMANT PER PALM.

Palm species	Yawanawá		Kaxinawá		Seringueiros		Ribeirinhos	
	Average	StEr	Average	StEr	Average	StEr	Average	StEr
Species in common								
Astrocaryum aculeatum	1.50[a]	±0.43	2.95[b]	±0.61	1.80[a]	±0.20	1.22[a]	±0.17
Astrocaryum murumuru	2.14[a]	±0.33	5.55[b]	±0.63	1.51[a,c]	±0.29	0.97[c]	±0.26
Attalea butyracea	2.84[a]	±0.28	7.50[b]	±0.43	0.80sc	±0.26	1.80[d]	±0.20
Attalea phalerata	3.42[a]	±0.38	5.80[b]	±0.55	2.63[b]	±0.24	2.97[b]	±0.25
Bactris gasipaes	1.32[a]	±0.17	1.75[a]	±0.29	1.71[a]	±0.20	1.43[a]	±0.19
Bactris spp.	3.28[a]	±0.18	2.55[a]	±0.30	1.26[b]	±0.18	1.03[b]	±0.27
Bactris macana	4.70[a]	±0.30	4.35[a]	±0.38	0.43[b]	±0.14	0.40[b]	±0.21
Chameodora angustisecta	0.76[a]	±0.12	1.10[a]	±0.07	0.57[b]	±0.17	0.20[c]	±0.10
Euterpe precatoria	3.24[a]	±0.25	2.45[a]	±0.29	5.43[b]	±0.53	3.77[a]	±0.38
Geonoma spp.	0.32[a]	±0.11	1.20[b]	±0.23	1.69[b]	±0.15	0.97[a]	±0.12
Iriartea deltoidea	2.46[a]	±0.25	3.65[b]	±0.34	2.49[a]	±0.15	1.80[a]	±0.24
Mauritia flexuosa	3.68[a]	±0.27	4.70[a]	±0.51	1.75[b]	±0.22	2.17[b]	±0.27
Oenocarpus bataua	2.88[a,b]	±0.33	3.75[a]	±0.30	2.83[a,b]	±0.31	1.97[b]	±0.31
Oenocarpus mapora	2.78[a]	±0.21	3.00[a]	±0.29	1.94[b]	±0.30	1.43[b]	±0.21
Oenocarpus sp.	1.66[a]	±0.23	1.00[b]	±0.14	1.11[b]	±0.15	0.57[b]	±0.23
Phytelephas macrocarpa	5.14[a]	±0.41	5.85[a]	±0.43	2.31[b]	±0.24	1.34[b]	±0.22
Socratea exorrhiza	2.84[a,b]	±0.25	3.50[a]	±0.23	2.97[a]	±0.31	1.89[b]	±0.34
Species not in common								
Aiphanes aculeata	—	—	2.10	±0.16	0.40	±0.10	—	—
Astrocaryum jauari	—	—	0.25	±0.09	0.10	±0.05	0.09	±0.05
Attalea maripa	—	—	—	—	0.40	±0.15	0.30	±0.09
Attalea speciosa	—	—	—	—	0.30	±0.13	±0.40	±0.16
Attalea tessmannii	8.80	±0.36	8.60	±0.65	—	—	—	—
Bactris acanthocarpa	—	—	—	—	0.1	±0.05	—	—
Carludovica palmata	1.94	±0.13	—	—	—	—	—	—
Cheylocarpus chuco	0.64	±0.08	2.55	±0.27	—	—	—	—
Cheyocarpus ulei	—	—	3.35	±0.41	0.40	±0.10	0.54	±0.11
Cocos nucifera	—	—	2.10	±0.31	2.90	±0.20	2.97	±0.21
Copernicia prunifera	—	—	—	—	0.10	±0.05	0.23	±0.16
Desmoncus mitis	—	—	1.05	±0.23	0.20	±0.08	0.06	±0.04
Elaeis guineense	—	—	—	—	0.10	±0.05	0.05	±0.11
Syagrus sancona	—	—	0.10	±0.07	0.10	±0.05	0.06	±0.09

[a,b,c,d] Grouping according to Tukey's Multiple Comparison Test.

palms among communities suggest that each culture has its distinct way of using these resources. It also suggests that, although communities share knowledge and know-how on how to use palms in general, the resources employed to fill these purposes, are not the same, depending on the choices of each community. In each culture, other resources fill in specific cultural niches, e.g., in the indigenous cultures *Attalea* spp is used for many cultural thatching and food needs, *Phytelephas macrocarpa* for thatching, and *Astrocaryum murumru* for crafts. Whereas in the seringueiros use *Geonoma* spp. and *Phytelephas macrocarpa* for thatching and *Euterpe oleracea, Oenocarpus* spp., *Attalea phalerata,* and *Astrocaryum aculeatum* as a food resource. Hence, one species can replace the use of another in a different cultural context, depending on the cultural preferences and history, the varietal characteristics of that species, its abundance, the specific technology used to process that resource, the access to new materials, and the insertion of each community in the market economy.

Similarly, Alcorn (1981), studying Huastec Mayan resource perception concluded that the use of a determined plant as a resource is a result of the interplay of several dynamic factors, which she classified as biological and physical; cultural; economic; and personal and social. It is

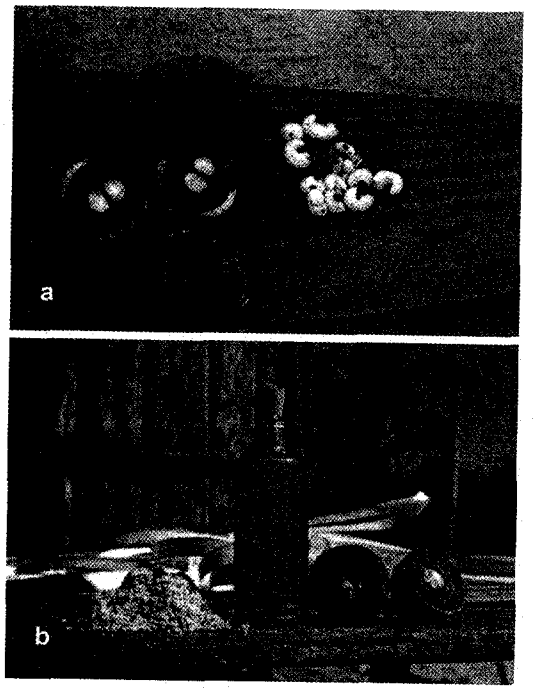

Fig. 4. Uses of cocão (*A. tessmannii*) fruits by indigenous communities: **a.** Parasitic beetle larvae are eaten, **b.** oil extracted from seed is used for cooking and as skin medicine.

the interrelation of all these dynamic factors that shape resource utilization. She states (1981) that plant "use" must be analyzed as a text that derives part of its meaning from the cultural, natural, and social context in which it occurs and serves its function." Moreover, she mentions that "uses" and "behavior responses" to plants are not as simple as they have been understood by many ethnobotanical investigators, because changes in the personal and social lives of people as well as variations and changes in the natural environment (e.g., due to absence of the resource) can influence the resource perception and use. Thus, the differences in palm use by the studied communities are not merely reducible to "cultural" differences but to a more complex set of influences from both the social and natural realm.

Levels of Knowledge about Natural Resource Use

Our data fully supports the hypothesis that indigenous communities have more knowledge about palm uses compared to the folk communities we studied. This holds true for general uses known about palms, species-specific uses on how to use each of the palms, and also for the average number of cited uses, that reflects the level of knowledge within the community. We believe that the larger indigenous knowledge about palm use stems from the longer history in the area, during which they could accumulate more knowledge, most of which survived the periods of semi-slavery and acculturation. In contrast, the folk communities have started learning about the local resources less than a century ago.

However, a high number of known uses does not necessarily mean that they are mentioned frequently, i.e., that the uses are known throughout the community. Although the Yawanawá, as a community, cited more general and species-specific palm uses than the Kaxinawá, the distribution of the existing plant lore seems to be distributed more evenly within the Kaxinawá community, as they mention more uses on average. It seems that the Yawanawá have a greater breadth of knowledge, held by different individuals within their community, whereas the Kaxinawá have a narrower, but a more homogenous distribution of that knowledge. A similar, less pronounced, pattern can be detected with the *seringueiros* and *ribeirinhos*.

Table 7. Comparison of known uses of the 17 palms species shared by the four communities.

Community	GU	SU	CU	ASU	ACU	TMC-Test ($P < 0.05$)
Yawanawá	87	208	2295	12.11 ± 1.63	2.64 ± 0.31	a,b
Kaxinawá	72	177	1208	10.58 ± 1.16	3.75 ± 0.45	a
Seringueiros	56	119	1167	7.35 ± 1.03	1.95 ± 0.28	b
Ribeirinhos	54	144	928	8.47 ± 0.84	1.53 ± 0.22	b

GU = general uses; SP = species-specific uses; CU = cited uses; ASU = average species-specific use per palm; ACU = average cited use per informant and palm; TMC-Test based on ACU.

TABLE 8. NUMBER OF TIMES THAT THE AVERAGE NUMBER OF CITED USES WERE SIMILAR (NOT SIGNIFICANTLY DIFFERENT) AMONG THE FOUR STUDIED GROUPS (TMC-TEST, SEE TABLE 6).

	Yawanawá	Kaxinawá	Seringueiros	Ribeirinhos
Yawanawá	—	10	7	7
Kaxinawá	10	—	5	3
Serigueiros	7	5	—	12
Ribeirinhos	7	3	12	—

CHANGES IN THE USE PATTERNS AND THE ACQUISITION OF NEW KNOWLEDGE

We were able to show that part of the uses mentioned by the studied indigenous communities is not "traditional" to their culture. According to elders in both indigenous groups, even before the contact with rubber tappers, indigenous groups interacted through intermarriage, kidnapping of women and slaves as well as warfare and sorcery with other groups. The coexistence with folk groups after the rubber boom has largely influenced both the Yawanawá and the Kaxinawá cultures. During this period, they were forced to drastically modify their traditional lifestyle and consequently incorporated new knowledge, but also lost traditional practices. Interaction with missionaries has also brought changes in the traditional customs, religious concepts, family structure, life style and resource use.

In the past, palms might have had an even more important role in indigenous communities, due to the existence of more traditional customs and the lack of commercial substitutes for forest products. A few species, such as the wild peach palm (*Bactris macana*) and *B. maraja* were widely used in the manufacture of weaponry, such as bows, arrows, spears and clubs (Fig. 5), used for hunting, fishing, and also in the warfare among groups. The palm heart also was an important source of food in indigenous communities, but they abandoned this practice with access to new crops. Therefore, acquisitions as well as losses have largely shaped the knowledge encountered at a particular moment.

Not only indigenous peoples have incorporated and lost ecological knowledge. We also can observe the incorporation of new uses in the *seringueiro* and *ribeirinho* communities. Since their arrival in Acre, less than a hundred years ago, they have not only learned about local resources but also have incorporated exotic palms from other regions of Brazil and even other continents into their plant lore (e.g., *Cocos nucifera* and *Elaeis guineense*).

The discovery and incorporation of uses originating in other cultural groups is a phenomenon also documented for Amazonian people elsewhere. The acquisition of recent knowledge about new, often exotic, medicinal plants in the treatment of old and new diseases has been documented for a number indigenous and folk groups (Alexiades 1999; Bennett and Prance 2000; Milliken and Albert 1996, 1997a; Prance

TABLE 9. JACCARD SIMILARITY INDICES BETWEEN EACH INDIGENOUS AND FOLK COMMUNITY, BASED ON THE GENERAL AND SPECIES-SPECIFIC USES OF THE COMMON SPECIES.

	Yawanawá	Kaxinawá	Seringueiros	Ribeirinhos
General Uses				
Yawanawá	—	0.495	0.348	0.326
Kaxinawá	0.495	—	0.422	0.392
Seringueiros	0.348	0.422	—	0.588
Ribeirinhos	0.326	0.392	0.588	—
Species-specific Uses				
Yawanawá	—	0.332	0.211	0.189
Kaxinawá	0.318	—	0.327	0.249
Seringueiros	0.211	0.327	—	0.341
Ribeirinhos	0.189	0.249	0.341	—

TABLE 10. PROPORTIONS OF TRADITIONAL AND ACQUIRED USES (GU, SU, AND CU) FOR THE COMMON PALM SPECIES.

Uses	Yawanawá		Kaxinawá	
	Traditional	Acquired	Traditional	Acquired
Cited Uses (CU)	62%	38%	77%	23%
Species-specific Uses (US)	64%	36%	73%	27%
General Uses (UG)	64%	36%	69%	31%

and Plana 1998). Milliken and Albert (1997b) also point out that adaptive changes in house construction are a common phenomenon amongst tribal peoples entering sustained contact with outside societies. The changes of circumstances, faced especially by indigenous people, might result in the incorporation of new habits that might be beneficial in a new set of conditions. The exchange of know-how between cultures can result in an increased repertoire of resource uses, which is an advantage if you depend on natural resources for survival. We therefore believe that today's "indigenous" knowledge is a mixture of two non-exclusive processes: the accumulation of knowledge along the course of many centuries in the process of trial and error experimentation, and the acquisition and loss of knowledge in contact with other Amazonian populations.

A number of authors have recently revealed concrete evidence that the so-called indigenous knowledge is not so "purely indigenous" and actually is of hybrid origins. These studies show that indigenous knowledge is dynamic and eclectic, as well as unevenly distributed within populations. Most importantly, these studies demonstrate that indigenous knowledge is not isolated and inert, but subject to change and constant incorporation of outside knowledge. As result of this "new" view of indigenous and traditional knowledge the call for a more "realistic" and less idealized and romanticized view of traditional communities, traditional knowledge and traditional practices (Ellen and Harris 2000).

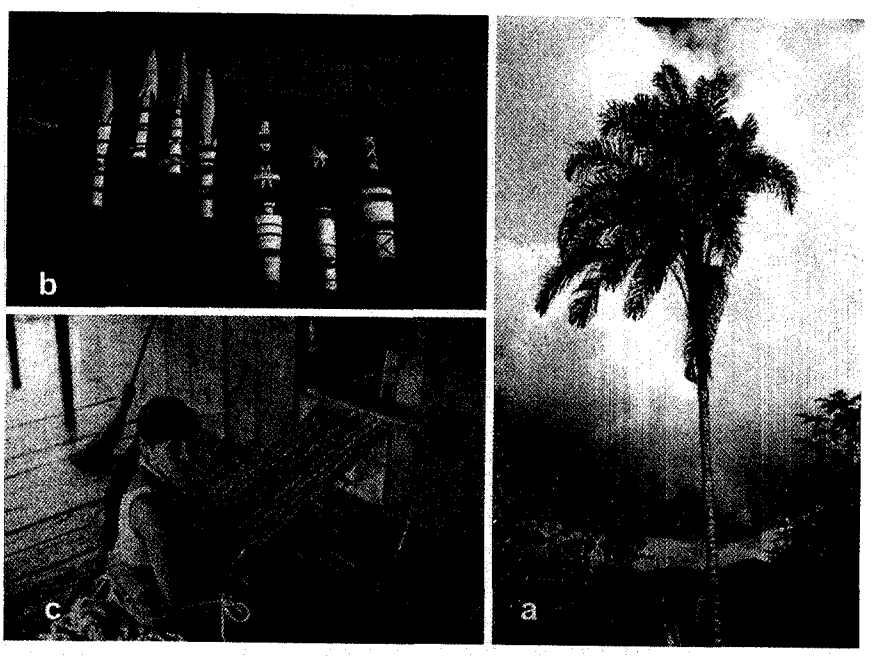

Fig. 5. Traditional uses of pupunha (*Bactris* spp.): **a.** *Bactris gasipaes,* **b.** spears made from *Bactris* trunk wood by Yawanawá Indians, white arrow tips are made from bamboo, *Guadua* sp., **c.** Kaxinawá girl weaving, using Bactris wood for loom and leaf petioles from *Attalea* spp. and *Oenocarpus bataua* as guiding help.

A number of authors argue that the strong focus on indigenous knowledge in opposition to non-indigenous or western knowledge systems creates artificial dichotomies. Agrawal (1995), for instance, tries to uncover contradictions and conceptual weakness in the concept and literature related to indigenous knowledge and scientific knowledge and argues "this distinction of knowledge between indigenous and western is flawed because of the heterogeneity among their elements and because of the status of knowledge as a transferable, flowing entity." The blurring of the boundaries between indigenous, folk and other knowledge systems is also supported by Sillitoe (1998), who argues for a continuum of knowledge in which the indigenous knowledge and scientific knowledge represent the extremes. The results of our research support an understanding of heterogeneity in traditional knowledge systems and the notion of a continuum. Therefore, while the indigenous communities we worked with definitely hold more knowledge about palms than folk communities, the mixed origin of this knowledge does not justify a "purist" understanding of that knowledge.

The State of the Art of Palm Uses: Known vs. Practiced Uses

In light of this dynamic, constantly changing knowledge system, it is important to distinguish between known uses of plants and those uses that are actually practiced in daily life. Our study is based on the known uses and not on the observed uses that are truly practiced today within the communities. This would require an extensive study with monitoring of actual uses over time. An example of this knowledge/actual use distinction is the indigenous abandonment of their traditional housing style in the last century, to adopt the rubber tapper house based on a different use of palm resources, although they still know the species used for the traditional housing style. Similarly, *seringueiros* today are gradually replacing the traditional rubber tapper houses usually made with different palm species, in favor of houses built with timber species boards (e.g., *Swietenia macrophylla* King. and *Cedrela odorata* L.) and aluminum roofs. As more and more families adopt the new housing style information about this type of plant use is increasingly incorporated into the knowledge of the *seringueiro* community, while know-how of traditional house construction becomes an increasingly theoretical knowledge. Therefore, the body of knowledge within a given culture includes three different levels: 1) known uses that are currently practiced, 2) known uses that are no longer practiced, and 3) formerly known or forgotten uses that have been extinct from a cultural group.

The loss of traditional knowledge is one of the biggest problems in Amazonia and elsewhere, as many rural populations have not yet learned the skills necessary for survival in a developed setting, but are losing the traditional knowledge that equips them with know-how to exploit the resources in their forest. Repeatedly, older people complain about the youth's lack of interest in learning the traditional customs of their culture. In this light, the participation of community members of all generations and the incorporation of traditional knowledge systems into resource management projects are crucial for its success (IES 1995, Davis 1993). Thus, the understanding of the dynamic nature of indigenous and folk knowledge about natural resource use is of fundamental importance in the planning of development and natural resource management programs and the active participation of the communities in these processes (Borrini-Feyerabend 1996). Furthermore, the recognition of the hybridity, flexibility and creativity within traditional knowledge systems should provide support for local response mechanisms and decision-making (Kaplan and Kopische 1992).

Conclusions

Our research on differences in palm use by indigenous and folk communities of South Western Amazonia leads us to four conclusions. First, palm resources are used differently in the indigenous and folk communities we studied, although the same basic necessities for food, housing and tools are covered. Second, dissimilarities between communities exist not only on a general level for different types of uses, but the communities also use different species to satisfy their specific needs. The choices on how to use a resource depend on the cultural preferences and history, the variety characteristics and abundance of the resource, the processing technology, access to new materials that substitute that resource, and to the market economy. Third, as expected, the indigenous communities know more about the uses of palms than the folk communities, although a larger breadth of knowledge does not imply a homogeneous distribution of this knowledge within

a community. Fourth, part of today's indigenous knowledge includes elements of folk lore that were recently incorporated in the course of adaptations to changed conditions. Therefore, current indigenous knowledge is a mixture of two non-exclusive processes: the accumulation of knowledge over many generations and the acquisition of new know-how originating from the contact with other Amazonian populations. Traditional indigenous and folk plant lore is in a dynamic state where acquisition of knowledge and loss of traditional practices interplay and the boundary between traditional 'indigenous' and 'folk' knowledge becomes blurred.

The changing nature of traditional plant lore is particularly important for natural resource management, regarding not only the management of traditional forest resources but also the introduction and adoption of new crops, uses and technologies. A better grasp of the hybrid and dynamic nature of traditional knowledge systems becomes particularly important in the planning and implementation of development and resource management programs in which the active participation of the communities is imperative, and local people decide which practices to adopt or to reject.

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APPENDIX 1

LIST OF VOUCHER SPECIMENS COLLECTED IN THE FOUR STUDY AREAS

Aiphanes aculeata Willd. (pupunha xicaxica) *Ehringhaus 931*; *Astrocaryum murumuru* Mart. (murmuru), *Campos & Lima 931*; *Attalea butyracea* (Mutis) Wess. Boer (jaci), *Campos & Lima 939*; *Attalea phalerata* Mart. (aricuri), *Campos & Lima 962*; *Attalea tesmannii* Burret (cocão), *Campos & Lima 957*; *Bactris acanthocarpa* var. *acanthocarpa* Mart. (pupunha brava) *Ehringhaus 936*; *Bactris bifida* Mart. *Ehringhaus 957; Bactris macana* (Mart.) Pittier (pupunha da mata) *Campos & Lima 938, Ehringhaus 906*; *Bactris maraja* Mart. (marajá), *Campos & Lima 936*; *Ehringhaus 932, 935; Bactris concinna* Mart (marajá), *Ehringhaus 933*; *Chamaedora angustisecta* Burret (palmeirinha), *Campos & Lima 914*; *Campos & Lima 915*; *Desmoncus mitis* var. *mitis* Mart. (jacitara) *Ehringhaus 934*; *Euterpe precatoria* Mart. (açaí), *Campos & Lima 926*; *Geonoma deversa* (Poit.) Kunth (ubim) *Ehringhaus 954*; *Geonoma macrostachys* var. *acaulis* Skov (ubin sem hasta) *Ehringhaus 955*; *Geonoma stricta* (Poit.) Kunth (ubim), *Campos & Lima 940*; *Iriartea deltoidea* Ruiz & Pav. (paxiubinha), *Campos & Lima 953*; *Mauritia flexuosa* L. f. (buriti), *Campos & Lima 961*; *Oenocarpus bataua* Mart. (patoá), *Campos & Lima 960*; *Oenocarpus mapora* H. Karst. (bacaba) *Campos & Lima 967* and *Ehringhaus 937*; *Oenocarpus* sp. (bacabão) *Ehringhaus 904*; *Phytelephas macrocarpa* Ruiz & Pav. (jarina), *Campos & Lima 958*; *Socratea exorrhiza* (Mart.) H.Wendl. (paxiubão) *Campos & Lima 952*; *Syagrus sancona* Karst (açairana) *Ehringhaus 905.*