 J Hum Ecol, 42(1): 69-93 (2013)

Use, Production and Conservation of Palm Fiber in South America: A Review

Carolina Isaza[1], Rodrigo Bernal[2] and Patricia Howard[1]

[1]Anthropology Department, University of Kent at Canterbury
[2]Instituto de Ciencias Naturales, Universidad Nacional de Colombia (Current Address)
Apartado 7495, Bogotá, Colombia (Actual)
E-mail: [1]<caisazaar@unal.edu.co>; [2]<rgbernalg@unal.edu.co; [1]<P.Howard@kent.ac.uk>

KEYWORDS Arecaceae. Fiber. Conservation. Forest Extraction. Forest Products. Palms. South America. Sustainable Use

ABSTRACT South American ethnic groups traditionally use palm fiber, which provides materials for domestic, commercial, and ceremonial purposes. A literature review of 185 references was carried out in order to identify and understand the extent of palm fiber production and the sustainability of harvesting and use in South America. The reports recorded 111 palm species and 37 genera used for fiber in the region; the genera *Attalea*, *Astrocaryum* and *Syagrus* had the highest diversity of fiber-producing species. *Mauritia flexuosa* and *Astrocaryum chambira* were the species mostly reported and with the largest number of object types manufactured with their fibers. The geographical distribution of the species use nearly overlaps the natural distribution of palms in South America, reaching its highest diversity in northern Amazonia, where palms are used mostly by indigenous people and peasants. The techniques used for extraction, harvesting and processing are usually basic and minimal. Most species are represented by wild populations found on common lands, the little detailed information available suggests that when use is intensive it is mosly unsustainable, and those with a greater market demand usually become locally extinct. Market demand, ecosystem conservation, and management practices used to boost fiber production are the major variables determining the sustainability of fiber extraction.

INTRODUCTION

Palms are an important part of everyday life for many South American peoples because of their abundance, diversity, and utility. This is particularly true for Amerindian groups and rural colonists, for whom palms provide raw materials to fulfill basic needs such as food, medicines, oils, waxes, fuel, fibers, and materials for construction and for producing ornaments and many other kinds of artifacts for domestic use, subsistence, or ceremonial purposes (see, for example, Lévi-Strauss 1952; Macía 2004; Paniagua-Zambrana et al. 2007; Macía et al. 2011). Neotropical palms have been known worldwide as a source of fiber since at least the mid 19th century, especially the *piassabas Attalea funifera* and *Leopoldina piassaba*), which are used to make brooms both for domestic use and for international markets (Wallace 1853; Spruce 1860; Crizón 2001). But in many of the world's tropical areas, palm fiber use may date back to hunter-gatherer societies (Baleé 1988). According to Bellwood (2005), species with technological uses, such as fiber-producing plants, might have been the first to be managed or domesticated. In spite of this, palm fibers are poorly documented in the archaeobotanical record (Morcote and Bernal 2001), probably as a consequence of their poor preservation. The oldest palm fiber item recorded by these authors is a mat that was found in Minas Gerais, Brazil, dating from 3420 ±120 yr before present (Morcote and Bernal 2001).

Recently, the extraction of palm fiber has increased in many areas of South America to produce handicrafts and brooms for local and regional markets (Borgtoft Pedersen 1996; Vormisto 2002; Coomes 2004). This new trend can be explained in part by the promotion of non-timber forest products (NTFPs) by governments and non-governmental organizations over the past few decades (Peters et al. 1989). The market value for some of these products, especially handicrafts, has increased, and various indigenous and rural communities have exploited the opportunity to increase their incomes, which has

Address for correspondence:
Dr. Carolina Isaza
Instituto de Ciencias Naturales,
Universidad Nacional de Colombia
Sede Bogotá, Apartado 7495, Bogotá,
Colombia (Actual)
E-mail: caisazaar@unal.edu.co

led to growing pressure on the species that provide the raw materials. Whereas some researchers consider that the extraction and use of palm fiber for commercial purposes could improve the living conditions of local communities while conserving the species involved (Nepstad and Schwartzman 1992; Macía 2006), most studies actually show that populations of useful palms are decreasing due to over-harvesting, inadequate management techniques, and ecosystem conversion (Borgtoft Pedersen and Balslev 1990; Cárdenas and López 2000; Fadiman 2003). In some cases, the use of practices that increase fiber extraction is causing a decrease in the number of palms and is threatening both palm populations and trade (Cárdenas and López 2000; Vormisto 2002). Therefore, in order to design management and conservation strategies and thus ensure the sustainable use of palms, it is necessary to identify the useful species and the ecological impacts of palm fiber extraction (Peters 1996; Dalle and Potvin 2004).

Most studies of palm fiber use in South America are restricted to lists of species in a particular area, case studies on the use of palms by an ethnic group, or in-depth studies of a single species in a given location (for example, Lévi-Strauss 1952; Schultes 1977; Anderson 1978; Pinheiro and Balick 1987; Balick 1988; Borgtoft Pedersen 1994; Hiraoka 1999). In this paper, the researchers review the published literature on palm fibers from South America, and analyze the trends in palm fiber use, extraction, management, and conservation in order to assess the sustainability of palm fiber use in South America, and to point out needs for further research.

METHODOLOGY

This study is based on a literature review, on a study of the ethno-botanical collection of the Royal Botanic Gardens, Kew, and on unpublished field data gathered by one of us (RB). The researchers define fibers as those items whose mechanical features are due to a wide array of anatomical structures, ranging from hard aggregates of vascular bundles to long and fine strands, capable of being threaded, twisted, or pleated (Dodge 1897; Esau 1972; Tomlinson 1990). Thus, this study includes cordage and other kinds of palm-derived strings, and also various items such as brooms, hats, and clothes whose nature is ultimately based on the resistance of palm tissues. Palm thatching was not included in the review as most authors consider that this use is subsumed under the general category of construction materials. The use of palm for thatch is so widely reported that it deserves a study on its own.

The literature review was carried out based on collections in the following libraries (and within their respective online resources) located in the United Kingdom (UK) and Colombia (COL): Royal Botanic Gardens, Kew (UK), The British Library (UK), Templeman Library at the University of Kent at Canterbury (UK), Natural History Museum-Botany Library (UK), Biblioteca del Instituto de Ciencias Naturales – Universidad Nacional de Colombia (COL), Biblioteca General "Ramón de Zubiría" - Universidad de Los Andes (COL), Biblioteca del Banco de la República - Luis Angel Arango (COL), Centro de Documentación del Intituto Amazónico de Investigaciones Científicas – SINCHI (COL). Bibliographical information was also collected using the online scientific databases in the areas of life sciences and natural sciences, such as BioOne, CAB Abstracts, EBSCOhost, Elsevier, IngentaConnect, JSTOR, SciElo, SciendeDirect, Springer Link, Wiley Online Library, among others.

The documents for the general analysis were selected if they met two key conditions: 1) they named (scientific name or a sufficient botanical description) a palm species used for fibre and 2) they recorded use within South America. The review comprised 185 literary references, centered in the areas of botany and ethnobotany, composed of: journal articles (98), books (57), taxonomic guides (8), country and continental floras (1), ethnographies and ethnographic monographs (4), dissertations and grey literature (reports, unpublished documents, booklets and others) (6). The information was entered into one Excel table and two word documents. To process the data collected, tables were compiled and frequencies were calculated, depending on the objective or section analysed.

The fields included in the Excel table are: 1) species, 2) common names, 3) ethnic group of the users, 4) language spoken by the users, 4) country of the record, 5) region of the record, 6) locality of the record, 7) geographic coordinates (latitude and longitude), 8) altitude, 9) palm abundance in the locality of the record/study, 10) use status: wild, semi-cultivated and cultivated, 11) reproductive stage of the harvested palms, 12)

conservation status (IUCN classification), 13) sustainability of harvest according to the conclusions and perceptions of the researcher, 14) part of the palm employed: leaves, stem, inflorescences, roots, bark, etc., 15) type of fibre extracted: description of the fibre characteristics and quality, 16) extractive and productive process: description of fibre extraction techniques and the process used to manufacture fibre items, 17) type of objects manufactured, 18) quantity of fibre collected/fibre products produced in the locality or in the country, 19) type of use: domestic, local markets, national markets and international markets, 20) prices of the fibre or fibre objects (if commercialized), 21) whether the use is current or has been abandoned, 22) substitution by other plant fibres or synthetic materials, 23) literature references or records, and 24) notes relating to synonyms, and important information to complement the information gathered.

Objects made with palm fiber that were reported in the literature were assigned to one of the following 16 categories: bags, baskets, brooms, clothes, cordage, fans, filling, furniture, hammocks, hats, mats, necklaces, nets, screens, strainers, and traps. Information about the structural features of palm fibers was obtained from the direct observation of raw fibers and fiber items in the Economic Botany Collection of the Royal Botanic Gardens, Kew. The researchers followed Dodge's (1897) economic classification, which is still the most comprehensive, but incorporated modifications made by Hill (1965). Names of the species were updated in accordance with current use, mostly following Pintaud et al. (2008), Govaerts and Dransfield (2005) and Henderson et al. (1995).

The review covered roughly 85% of the literature available for palm fibre use cited in on-line catalogs, covering literature since the 1800´s to 2009. However, three sources of bias could have affected the results here presented: First, due to the requirement of a scientific name or botanical description, a considerable amount of ethnographic and economic reports was left out of the analysis; however, those sources were reviewed, and helped to find gaps in knowlegde. Second, because it was not possible to physically access each relevant library in South America, many documents, such as thesis or grey literature that did not appear in online catalogs were not included in the review. And, last, there are a number of species that are only mentioned as a fiber source in ethnobotanical lists, but in depth research about their use has not been done yet, in spite of field observations suggesting that their use is extensive and important.

RESULTS AND DISCUSSION

Species Used

One hundred and eleven palm species in 37 genera were recorded as sources of fiber in South America (Appendix 1). This accounts for 24 % of the 457 palm species known in the subcontinent (Pintaud et al. 2008). The genera *Attalea*, *Astrocaryum*, and *Syagrus* had the highest number of useful species, with 15, 14, and 10 species, respectively (Appendix 1). Fibers of *Mauritia flexuosa* and *Astrocaryum chambira* were those used for the greatest variety of purposes, with 14 and 13 different object types, respectively.

Kinds of Fiber

The fibers obtained from palms in South America come from the entire leaves, stems, spear leaves, petioles, leaf blades, leaf sheaths and spathes (Appendix 1). All of them are structural fibers. No record of uses of coconut coir fiber was recorded from South America, even from those areas where this species is widely cultivated.

South American palm fibers fall into five of Dodge's (1897) and Hill's (1965) major groups, (Fig. 1):

***Spinning Fibers*:** Fibers mainly from leaves (leaf sheaths, petioles, and blades), stems, and roots. This category comprises fibers derived from palm leaves in different stages of development and which are not a part of the leaf's vascular system (Dodge 1897; Tomlinson 1990). The fibers are used for spinning and weaving into fine and coarse textures that can be used in clothes, home decorations, or for different industries (sails, tents, etc.), lace fibers, coarse netting fibers (such as those used for bags and hammocks), and cordage fibers (used to make strings, fishing lines, ropes and cables) (Dodge 1897).*Tie Material*: Very coarse material such as striped leaves, stems, or other coarse material without preparation. These are used as emergency cordage or construction rope.*Natural*

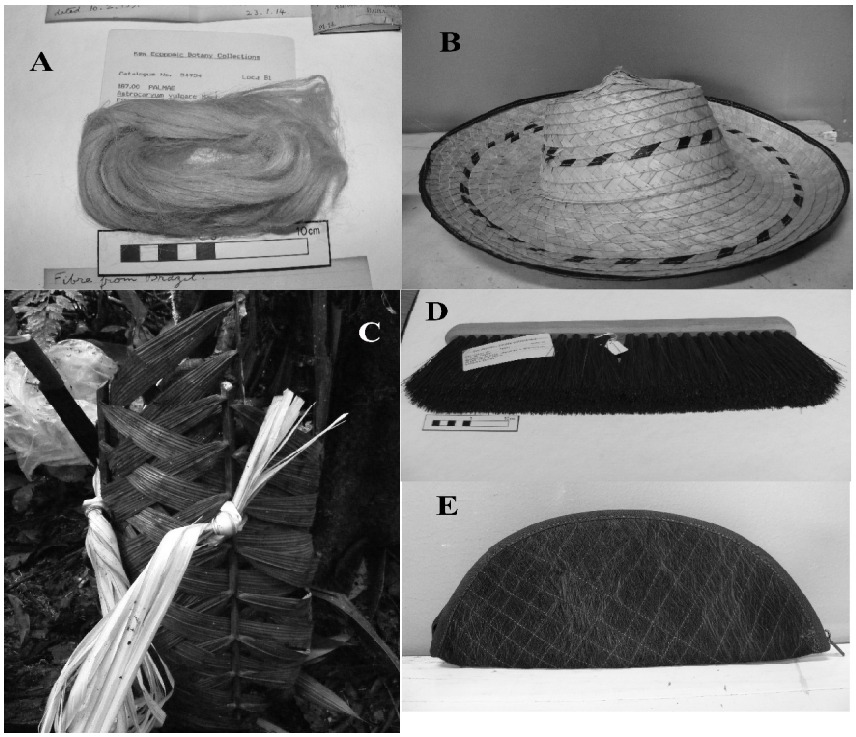

Fig. 1. Kinds of palm fibers: A. Spinning fiber from *Astrocaryum vulgare*, B. Plaiting material from *Copernicia tectorum* C. Tie material from *Oenocarpus bataua*, D. Brush fibres from *Aphandra natalia*, E. Natural textures from *Manicaria saccifera*.

Textures: A fabric-like structure produced by naturally interwoven fibers.*Brush Fibers*: Most South American fibers in this group come from the leaf sheaths, which are shredded structural fibrous vascular bundles that persist on the plant. This group includes fibers for soft brushes (grass-like), and for hard brushes (bass fibers).

Plaiting Fibers: This group is the most heterogeneous, stemming from different sources such as stems, spear leaves, expanded leaves, and petioles. The plaits, made from split leaves, can be used to make hats, sandals, sleeping mats, and screens. For basketry in general, the fibers comes from split stems or other rigid organs, such as petioles.

Useful Species and Objects

At least 16 different kinds of objects are produced that involve the use of palm fibers. This figure is not exact, as it is sometimes difficult to establish from the written source whether two objects represent different items or just variants of a single item. For example, cordage made with various *Astrocaryum* species is woven into necklaces and is also used for fish lines or to manufacture nets. Each of these objects was assigned to one of the 16 object types in our gross classification of fiber use (Table 1). Object types produced from multiple palm species include baskets (67 species), hats (39 species), and cordage (strings and ropes) (31 species) (Table 1). For some object types, the use of a few species that yield a specific kind of fiber is prevalent, such as *Attalea funifera* and *Leopoldinia piassaba* for brooms and brushes, or *Desmoncus polyacanthos* and *Ammandra descasperma* for baskets.

Human Groups and Palm Fiber

The researchers found records of at least 69 ethnic groups belonging to 31 linguistic families that use palms for fiber. This represents just a fraction of the several hundred ethnic groups that inhabit South America. The distribution of palm fiber use roughly corresponds to the geo-

Table 1: Objects manufactured with palm fibers in South America, and the involved species

Object type	*Objects included*	*Reports*	*No. of species*	*Most used species*
Bags		81	26	*Astrocaryum chambira, Mauritia flexuosa, Manicaria saccifera*
Baskets	Temporary baskets, mortuary baskets	221	67	*Desmoncus polyacanthos, Oenocarpus minor, Attalea phalerata, Attalea speciosa*
Brooms	Brooms, brushes	115	34	*Aphandra natalia, Attalea funifera, Leopoldinia piassaba*
Clothes	Straps, textiles	60	26	*Astrocaryum vulgare, Mauritia flexuosa, Astrocaryum chambira*
Cordage	Strings, lines, ropes	161	31	*Mauritia flexuosa, Astrocaryum chambira, Astrocaryum vulgare*
Fans	Fans,fly brushes	60	27	*Attalea speciosa, Parajubea sunkha, Astrocaryum aculeatum*
Filling		2	2	*Attalea tessmanii, Chelyocarpus ulei*
Furniture		14	9	*Desmoncus polyacanthos, Astrocaryum standleyanum*
Hammocks		113	16	*Mauritia flexuosa, Astrocaryum chambira, Astrocaryum vulgare*
Hats		99	39	*Copernicia prunifera, Mauritia flexuosa, Manicaria saccifera*
Mats		100	36	*Mauritia flexuosa, Attalea maripa, Copernicia prunifera*
Necklaces		16	4	*Astrocaryum chambira, Mauritia flexuosa*
Nets		62	15	*Astrocaryum chambira, Mauritia flexuosa, Astrocaryum aculeatum*
Screens		7	6	*Attalea maripa*
Strainers	Manioc strainers, sieves	17	14	
Traps		13	8	*Desmoncus cirrhifer, Raphia taedigera, Attalea speciosa*

Fig. 2. Types of objects made with fibers of *Astrocaryum chambira* (A. Bag, B. Basket) and *Mauritia flexuosa* (C. Bag, D. Basket).

graphical and altitudinal distribution of palms across South America. Most of the fiber palm species found in the literature were distributed in the Amazon, which reflects both the high palm diversity and the high cultural diversity of the area. Most ethnic groups that were recorded as using palms as a source of fiber live also in the Amazon, with a predominance of Tukanoan, Guarani-Tupi, Chibchan and Panoan speakers. The ethnic groups with the largest recorded numbers of palm fiber uses are the Huaorani, the Cashinahua, and the Shuar, all from Ecuador. However, this result may be biased due to the greater number of detailed ethnobotanical studies done on these groups compared with other ethnic groups in South America (Bennett et al. 2002; Byg 2002; Byg and Balslev 2004). The species with most records of use within indigenous communities were *Mauritia flexuosa* and *Astrocaryum chambira* (Fig. 2). On the other hand, the use of *Astrocaryum standleyanum* and *Aphandra natalia* was remarkable for Afro-descendants inhabiting the Pacific lowlands of Colombia and Ecuador. Interaction between the numerous indigenous groups, and between them and *mestizos* or *caboclos*, has possibly increased the transfer of knowledge and the repertoire of palms species used among these groups.

Fiber Palm Harvest, Management and Conservation

Harvest and Management

Detailed information about palm fiber harvest and management, as well as about the sustainability of such practices and the local conservation status of the involved species is scarce. Nearly all of the references provide only lists of palm species used by an ethnic group or within a region, and offer just a brief description of the use, parts used, and current abundance status. About 14% of the studies reviewed (27 out of 185) provided more detailed accounts, giving information on two or more aspects related to harvest, management, and sustainability. Each study generally covers different topics, leading, in most cases, to incomparable results. Consequently, the information that is useful for determining the trends in fiber production and species conservation is limited. A common feature of most fiber use cases is that functional parts such as expanded leaves, spear leaves, petioles, stems (in climbing palms) and leaf spathes are selectively harvested. However, when extractors are in urgent need of fiber, palms may be massively cut down to supply market demand; as a consequence, the palms are killed and sometimes the surrounding habitat is also heavily disturbed. This has been reported as early as the 19th century for the extraction of fibers from *Attalea funifera* (Voeks 1988), and more recently for *Aphandra natalia* (Kronborg et al. 2008; Balslev et al. 2010), *Astrocaryum chambira* (Vormisto 2002; Guel and Penn 2009), *A. standleyanum* (Borgtoft Pedersen 1994), *Leopoldinia piassaba* (Crizón 2001), and *Parajubaea torallyi* (Vargas 1994). The predominant tool used to harvest and collect palm parts is the machete. It is employed in versatile ways to cut parts, process fiber, and make objects (Jensen and Balslev 1995; Borgtoft Pedersen and Skov 2001). Ladders as well as ropes are used to reach and harvest tall palms (Fejos 1943; Borgtoft Pedersen and Balslev 1990; von Andel 2000). A simpler technique is to harvest the shedding petioles of *Copernicia prunifera* and *Aphandra natalia*, which involves manual dislodging (Dodge 1897; Demers 1909; Kirby 1950; Borgtoft Pedersen and Skov 2001).

In most cases, wild palm populations are used for fiber (97% of the species), whereas in a few cases a combination of wild and semi-cultivated populations were harvested (18% of the species); only in one case each were fibers exclusively obtained from a semi-cultivated population, or from a cultivated population. For most species, there was no information about the stage or age of plants harvested. Where information was available (ten species) it indicated that palms are harvested mostly in juvenile and mature stages (seven species); only *Mauritiella aculeata* was reported as used only in juvenile stages, and one species, *Astrocaryum vulgare*, was harvested only in the mature stage.

Social and Economic Aspects

Fiber extraction, processing, and transforming is labor-intensive, employing mostly peasants and indigenous communities (Hübschmann et al. 2007; Crizón 2001; Fadiman 2003) (Fig. 3). Usually, fiber collectors and manufacturers live in rural areas where roads are poor or nonexist-

Fig. 3. Stripping leaflets of *Astrocaryum chambira* in the Colombian Amazon

ent and, as a consequence, traveling to the nearest market place requires much time and is expensive. Furthermore, there is market competition between products made by different social groups, as is reported for products made of *chambira* (*Astrocaryum chambira*) in Peru (Vormisto 2002) and *mócora* (*Astrocaryum standleyanum*) in Ecuador (Borgtoft Pedersen 1994). Where such competition is evident, there is great variation in prices so that, at the end, manufacturers and harvesters who can access markets tend to earn little from the commercialization of fiber and fiber objects.

Despite this, fiber collecting and processing may constitute a very important part of the cash income of artisan and extractor communities and households (Lescure et al. 1992; Jensen and Balslev 1995; Crepaldi et al. 2007; Balslev et al. 2010). Fiber harvesters can earn from $0.15 to $19.16 USD per day with an average of more than $1.25 USD per day, which is considered to place them above the poverty line for underdeveloped nations (Ravallion et al. 2008). Such income may be complemented with other activities such as cattle husbandry, agriculture, and the extraction of other NTFPs (Mayer 2006). Due to the importance of fibers, fiber extraction and artisanal production of fiber objects have been promoted as a source of income that can also serve to conserve resources in rural areas of South America (Artesanías de Colombia 1997; CENPOL 2000; Vantomme 2004; Saraiva 2009).

Currently, the major outlets for fiber and fiber objects are local markets and tourist markets in cities such as Quito, Lima, Bogotá, Leticia, Iquitos, Manaus, and Belém, and in tourist shops along some highways. However, many fiber crafters cannot access these markets and they frequently sell to tourists visiting their villages (Jensen and Balslev 1995; Coomes 2004). The market chains for fiber products are variable: it is usual to find two market chains for a species, which represents a strategy to increase sales and access more markets (Fig. 4). The most common are those in which the extractor is also the artisan, who sells the product to a middleman, who finally sells it to a shopkeeper or to the final buyer; in this case, the middleman earns most of the profit. Another common chain is one in which the extractor/artisan sells directly to the final buyer or shop, which is more profitable for the artisan (Crizón 2001; Vormisto 2002; Balslev et al. 2010).

Fiber production from South American palms has been repeatedly affected as fibers from other sources have provided substitutes. As early as the 19th century, African and Asian piassabas (mainly *Raffia ruffia* and *Borassus flabellifer*) began to compete with the American species (*Attalea funifera* and *Leopoldinia piassava*) that previously dominated the market (Dodge 1897; Kirby 1950). In the 20th century, synthetic fibers and fibers from other plants that are cultivated at a large scale, such as cotton or sisal, also

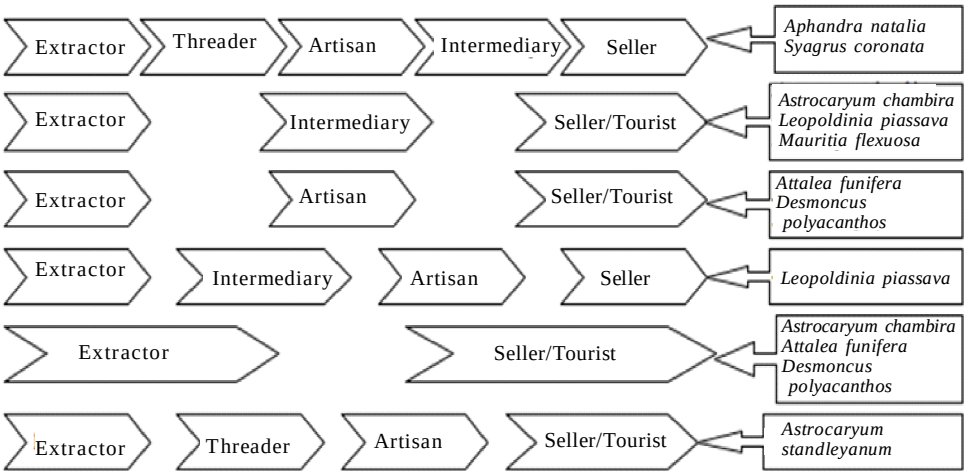

Fig. 4. Market chains for palm fiber and palm fiber objects in South America. Unless otherwise stated, the extractor is also the artisan or manufacturer

displaced South American palm fiber (Byg and Balslev 2006; Paniagua-Zambrana et al. 2007). Bags, hammocks, brooms, and fishing nets made from *Astrocaryum chambira, Attalea maripa* and *Leopoldinia piassaba*, have been substituted with cheaper plastic (bags), cotton (hammocks), monofilaments (brooms), and nylon (nets) (Wheeler 1970; Bernal 1992; Guánchez and Romero 1998). In some areas of the Venezuelan and Colombian Amazon, even the traditional *sebucán* used to squeeze cassava, usually woven from *Desmoncus polyacanthos*, is now made with packaging strip (Bernal, pers. obs.). However, the use of palm fiber is still prevalent for bags and hammocks because of its aesthetic appeal and durability (Vormisto 2002; Gallego 2005).

Most fiber harvesters in South America depend, to different degrees, on palm fiber extraction and handicraft production to earn cash. For many indigenous communities this income is not high nor is it represented in national economic statistics (Coomes 2004; Gallego 2005; Mayer 2006). Women and children play an important role in the activity and with it they contribute essential cash income to their households; fiber harvest and processing particularly provide women with better economic perspectives (Hiraoka 1999; Crepaldi et al. 2007; Guel and Penn 2009).

Conservation and Sustainable Use

Information about the conservation status of South American fiber-producing palms was usually not reported in the studies reviewed, so this information was obtained from Dransfield et al. (1988), Borchsenius and Skov (1999) for Ecuador, and Galeano and Bernal (2005) for Colombia. Thirty-six of the 111 species reported are not threatened, and eight have 'lower concern' status; several of the most used species belong to the latter group, such as *Aphandra natalia, Mauritia flexuosa, Leopoldinia piassaba, Attalea funifera, Copernicia prunifera, Desmoncus polyacanthos*, and *Syagrus coronata*. There are 17 species in the group of 'vulnerable and endangered species,' including species of *Ceroxylon* and the Bolivian endemic *Parajubaea sunkha*. For some important palm species, such as A*strocaryum chambira, A. standleyanum*, and *Leopoldinia piassaba*, conservation status is known only in Colombia. Five species are endemic to one country and have scattered populations, which may aggravate the effect of harvesting pressure and ecosystem threats, as is the case with *Parajubaea torallyi* that is classified as endangered (Vargas 1994).

The conservation status of a species, however, may not reflect the state of the populations in the areas where they are most used. Categorizations are usually made at national or continental scales and, in the assessment process, local depletion or extinction of populations as a consequence of over-exploitation may be buffered by the overall distribution of the species throughout other unexploited areas. This is the

case with some important species such as *Astrocaryum standleyanum, A. chambira, Mauritia flexuosa* and other twelve reported species, which are now decimated near some of their major centers of use (Linares et al. 2008; Guel and Penn 2009; Saraiva 2009), but that are still widespread in areas of undisturbed forest.The sustainability or non-sustainability of palm fiber extraction depends on the interaction between various factors, including ecosystem status, habitat specificity, growth rates, plant parts used, harvesting techniques and rates, and market demand. Other factors have a lower impact on sustainability and may act in combination with the major factors, or are triggered by them. In-depth information on sustainability is scarce: the researchers found 27 well-documented cases discussing extraction, harvest, management, and conservation, but there is still a substantial number of species for which information is poor or lacking, including some species that are heavily used, such as *Copernicia prunifera* and *Astrocaryum aculeatum* (Taube 1952; von Andel 2000; Campos and Ehringhaus 2003). The most crucial factor for palm conservation in general is habitat loss (Paniagua et al. 2007; Borchsenius and Skov 1999). Species that are not perceived as 'important' for a social group in a severely transformed ecosystem can be decimated, and knowledge about their use and management might be forgotten. In contrast, species considered to be 'important,' like *Aphandra natalia* in Ecuador, are likely to be maintained in agroforestry systems or in fallows (Borgtoft Pedersen 1992). Harvesting techniques, on the other hand, range from the entirely harmless cutting of leaf sheath fibers in low palms to the common malpractice of felling palms to facilitate rapid leaf extraction. Ultimately, the kind of economic development in the trade in fiber products is the strongest driver of sustainability. For example, where the activity is not mainly market-oriented, palms are of lower importance to local incomes and palm populations are less affected. On the other hand, in places where markets are expanding, palm populations are in decline, causing local extinctions (Belcher et al. 2005).For three of the 111 species recorded *(Attalea funifera, Desmoncus polyacanthos, Leopoldinia piassaba*), use, harvest, and management were considered sustainable (Putz 1979; May et al. 1985; Crizón 2001). For six species, use was considered to be sustainable but this was qualified, as some harvesters used harmful practices (Voeks 1988; Borgtoft Pedersen 1992; Vargas 1994; Fadiman 2003; Coomes 2004). For five of the species, the few reports available and field observations show that its use has a tendency to be mostly unsustainable as a result of over-harvesting and felling of palms (Dawson and Gancedo 1977; Balick 1985a; Moraes 1996; Moraes 1998; Balslev et al. 2010; Bernal et al. 2011). In most cases, the introduction of a few simple practices would make use completely sustainable. Unfortunately, for 86% of the species, the sustainability of harvesting and management practices is unknown (Bernal et al. 2011).

Relationships with other NTFPs: As is the case with many other NTFPs, large-scale markets for South American palm fibres are scarce, as transportation costs are too high and, with a few exceptions, such as piassava (*Attalea funifera*), the demand is low (Marshall et al. 2003; Belcher et al. 2005). Reduced market access, combined with deforestation, product substitution, and insecure land tenure, restrict markets for NTFPs worldwide (Geist and Lambin 2002; Marshall et al. 2003; Velásquez-Runk et al. 2004; Vantomme 2004). Nevertheless, as it is the case with other NTFPs, palm fibers are fundamental to local economies, in particular for indigenous people, farmers, and women. These are considered to be vulnerable population groups whose contributions to national economies in most cases are undervalued (Belcher et al. 2005; Mayer 2006; Paniagua-Zambrana et al. 2007). Indigenous groups and farmers who live in remote forested areas are increasingly being incorporated into markets, as is the case today with most palm fiber harvesters. It seems that such groups are intensifying management of wild populations and initiating cultivation schemes to increase income, especially around species perceived as 'important', as *Astrocaryum chambira* or *Aphandra natalia*. Other factors leading to intensified management and higher income are more secure land and tree tenure, so that the labor invested in sustainable management and use will be returned to the owner in the form of higher production rates (Marshall et al. 2003; Ruiz-Pérez et al. 2005).But as market demand for NTFPs grows, harvesting pressure also grows; three patterns can be identified: 1) extraction is intensified through over-harvesting, resulting in depletion of the resource, 2) intensified management is undertaken and harvesting limits are im-

posed to ensure species viability and availability, and 3) cultivation and enrichment programs are initiated to guarantee supplies (Velásquez-Runk et al. 2004; Ticktin 2004; Peters et al. 2007). These three proceses are evident in palm fiber extraction activity in South America. What is clear is that both management and cultivation increase production, help to protect the species, and increase household welfare. Unrestrained use, on the contrary, may be a direct path to local species extinction.

CONCLUSION

Of the palm species present in the region 24% are used in any extent for fiber, revealing the acknowledgement of the palm group as a key source of fiber materials. The palm species with the higher number or reports and most types of objects made from are *Astrocaryum chambira* and *Mauritia flexuosa*, both distributed mainly in the Amazon, where the highest number of palm species is used for fiber. The manufacture of utilitarian objects, such as baskets or cordage, is the primary use of fiber in the subcontinent, however due to substitution of industrially produced alike objects, palm fibre items in South America are increasingly made as handicrafts to satisfy a rising and thriving market. Fibre harvest and process is made mostly by indigenous gropus and peasants, for whom the selling of palm fiber object is an important source of income that requires minimum management of the species obtained, since the majority comes from wild populations, freely harvested in terms of frecuency and quantity. The harvest methods currently employed when fiber extraction is continous and intense, are destructive, affecting the conservation of population stands and therefore the sustainabitly of the activity. This scenario is specially seen when the market demand of the products is increasing and there are no regulations of the species management. There are few reported cases that detail palm fiber harvest, making it a fertile ground to research and from which many people in distress depend on.

RECOMMENDATIONS

The scarcity of in-depth information about palm fibre extraction and management in South America is remarkable - less than the 10% of the references contained this kind of information; yet, such studies, especially those related with the species' demography, are needed, in order to develop strategies for the sustainable use of fibre palms, particularly when palm fibre extraction has been promoted by governments and non-governmental organizations as a 'sustainable' means to improve welfare, as it is the case with other NTFPs. There is still a very substantial number of fibre palm species for which use, management and extraction rates are unknown, including some species that are heavily used, such as *Astrocaryum aculeatum*, *Astrocaryum standleyanum*, *Attalea butyracea*, *Bactris setosa*, *Copernicia prunifera*, *Desmoncus polyacanthos*, *Manicaria saccifera*, and *Syagrus romanzzofiana*, among others. Furthermore, there are few palm fiber studies in certain geographical areas such as the Caribbean region, the Inter-Andean Valleys, the Llanos savanna and the Great Chaco, which may harbor less palm species than other regions, but have some fiber-producing species used by local people and with a great potential but were not included in the study since formal studies of such species have not published yet.

ACKNOWLEDGEMENTS

We are grateful to the people of the Royal Botanic Gardens, Kew, especially to Mark Nesbitt, William Baker and Melinda Trudgen, and we also thank the AlBan Programme of the European Union for funding this project and Manuel Macía for support in the research design. Finally, thanks to Daniel Dávila for his reviews and support.

REFERENCES

Acosta-Solis M 1952. *Fibras y lanas vegetales en el Ecuador*. Boletín de Informaciones Científicas Nacionales no. 21. Quito: Editorial Casa de la Cultura. Ecuatoriana.

Amaral AJP 2010. Artesanato Quilombola: identidade e etnicidade na Amazonia. *Cadernos do CEOM* , 32: 62-75

Anderson AB 1978. The names and uses of palms among a tribe of Yanomama Indians. *Principes*, 22: 30-41.

Anderson ABE, Ioris M 1992. People of the fallow: The logic of extraction: Resource management and income generation by extractive producers in the Amazon. In: KH Redford, C Padoch (Eds.): *Conservation of Neotropical Forests: Working from Traditional Resource Use*. New York: Columbia University Press, pp. 175-199.

Antezana-Llanos L 1972. Palmeras nativas de Bolivia de valor económico. *Paper presented in Simposio Internacional sobre Plantas de Interés Económico*

de la Flora Amazónica. Belem, Brazil May 29 to June 2, 1972.

Antunes ML 2008. *Fibras de Licuri: Um Reforço alternativo de compósitos poliméricos.* DissertaçaÞo do Mestre em Engenharia Mecãnica. Universidade Federal do Rio Grande do Norte. Natal, Brazil.

Archer TC 1855. Note on piassaba. *Hooker's Journal of Botany,* 7: 213: 214.

Artesanias de Colombia 1997. *Censo Artesanal*. Artesanías de Colombia. Bogotá, Colombia.

Balée W 1988. Indigenous adaptation to Amazonian palm forests. *Principes,* 32: 47-54.

Baleé W 1989. The culture of Amazonian forests. *Advances in Economic Botany,* 7: 1-21.

Baleé W 1992. People of the fallow: A historical ecology of foraging lowland South America. In: KH Redford, C Padoch (Eds.): *Conservation of Neotropical Forests: Working from Traditional Resource Use*. New York: Columbia University Press, pp. 35- 57.

Balick MJ 1979. Economic Botany of the Guahibo. I. Palmae. *Economic Botany,* 33(4): 361-376.

Balick MJ 1980. *The Biology and Economics of the Oenocarpus- Jessenia (Palmae) Complex*. Ph.D. Thesis, Unpublished. Cambridge: Harvard University.

Balick MJ 1985a. Useful plants of Amazonia: A resource of global importance. In: GT Prance, TE Lovejoy (Eds.): *Key Environments: Amazonia*. New York, Pergamon Press, pp. 339-368.

Balick MJ 1985b. The indigenous palm of "Las Gaviotas" Colombia including observations on local names and uses. *Botanical Museum Leaflets, Harvard University,* 30: 1-34.

Balick MJ 1988. The use of palms by the Apinayé and Guajajara Indians of northeastern Brazil. *Advances in Economic Botany,* 3: 65-90.

Balslev H, Moraes M 1989. *Sinopsis de las palmeras de Bolivia*. University of Aarhus. Aarhus: AAU Reports.

Balslev H, Ríos M, Quezada G, Nantipa B 1997. *Palmas útiles en la Cordillera de los Huacamayos. Etnobotánica de las palmas de la comunidad Quichua de Santa Rita, provincia de Napo, Ecuador.* Colección de Manuales de Aprovechamiento Sustentable del Bosque. PROBONA, Quito.

Balslev H, Knudsen TR, Byg A, Kronborg M, Grandez C 2010. Traditional knowledge, use, and management of *Aphandra natalia* (Arecaceae) in Amazonian Peru. *Economic Botany,* 64: 55-67.

Baptista I de M 1910. *De Belém a S. Joao do Araguaya*. B. Garnier Livreiro Editor.

Barfod AS 1991. Usos pasados, presentes y futuros de las palmas Phytelephantoidées (Arecaceae). In: M Rios, H Borgtoft Pedersen (Eds.): *Las Plantas y el Hombre*. Quito: Herbario QCA y Abya Yala, pp. 23–46.

Barfod A, Balslev H 1988. The use of palms by the Cayapas and Coaiqueres on the Coastal plain of Ecuador. *Principes,* 32: 29-42.

Barfod AS, Kvist LP 1996. Comparative Ethnobotanical Studies of the Amerindian Groups in Coastal Ecuador. *Biologiske Skifer No. 46*. Copenhagen: The Royal Danish Academy of Science and Letters.

Beckerman S 1977. The use of palms by the Bari Indians of the Maracaibo basin. *Principes,* 21: 143-154.

Belcher B, Ruiz Pérez M, Achdiawan R 2005. Global patterns and trends in the use and the management of commercial NTFPs: Implications for livelihoods and conservation. *World Development,* 33: 1435-1452.

Bellwood P 2005. *First Farmers: The Origins of Agricultural Societies*. Oxford: Malden Blackwell.

Bennett BC, Baker MA, Gómez PA 2002. Ethnobotany of the Shuar of eastern Ecuador. *Advances in Economic Botany* 14: 1-304.

Bernal R 1992. Colombian palm products. In: M Plotkin, L Famalore L (Eds.): *Sustainable Harvest and Marketing of Rain Forest Products*. Washington D.C: Island Press, pp. 158-172.

Bernal R, Galeano G 1993. Las palmas del anden Pacífico. In: P Leyva (Ed.): *Colombia Pacífico*. Tomo I. Bogotá: Fondo para la Protección del Medio Ambiente FEN, pp. 220-231.

Bernal R, Galeano G 2006. Endangerment of Colombian Palms (Arecaceae): Change over 18 years. *Botanical Journal of the Linnean Society,* 151: 151-163.

Bernal R, Galeano G, García N, Olivares IL, Cocomá C 2010. Uses and commercial prospects for the wine palm, *Attalea butyracea,* in Colombia. *Ethnobotany Research and Applications,* 8: 255-268.

Bernal R, Torres MC, García N, Isaza C, Navarro J, Vallejo MI Galeano G 2011. Palm management in South America. *Botanical Review,* 77: 607- 646.

Bertoni MS 1903. Le palmier "Mbocaya" du Paraguay et son exploration. *Journal D' Agriculture Tropicale,* 23: 156.

Bodley JH, Benson FC 1979. Cultural ecology of Amazonian palms. *Reports of Investigations, No. 56*. Pullman: Laboratory of Anthropology Washington State University.

Boll T, Svenning JC, Vormisto J, Normand S, Grández C, Balslev H 2005. Spatial distribution and environmental preferences of the piassaba palm *Aphandra natalia* (Arecaceae) along the Pastaza and Urituyacu rivers in Peru. *Forest Ecology and Management,* 213: 175-183.

Bondar G 1942a. A piassaveira e outras plameiras Attaleainas na Bahia. *Boletim do Instituto Central de Fomento Economico da Bahia,* 12: 22-30, 59-70.

Bondar G 1942b. As cêras no Brasil e Lucuri *Cocos coronata* Mart. Na Bahia. *Boletim do Instituto Central de Fomento Economico da Bahia,* 11: 1-86.

Boom BM 1986. The Chacobo Indians and their Palms. *Principes,* 30: 63-70

Boom BM 1987. Ethnobotany of the Chácobo Indians, Beni, Bolivia. *Advances in Economic Botany,* 4: 1-68.

Boom BM 1988. The Chácobo Indians and their palms. *Economic Botany,* 6: 91-97.

Borchsenius F, Borgtoft Pedersen H, Balslev H 1998. *Manual to the Palms of Ecuador*. Aarhus: AAU Reports 37.

Borchsenius F, Skov F 1999. Conservation status of palms (Arecaceae) in Ecuador. *Acta Botanica Venezuelica,* 22: 221-236.

Borchsenius F, Moraes M 2006. Diversidad y usos de palmeras andinas (Arecaceae). In: M Moraes, B Øllgaard, L P Kvist, F Borchsenius, H Balslev (Eds.):

Botánica Económica de los Andes Centrales. La Paz: Universidad Mayor de San Andrés, pp. 412-433.

Borgtoft Pedersen H 1991. Management, extractivism and commercial use of wild palms in Ecuador. In: M Rios, H Borgtoft Pedersen (Eds.): *Las Plantas y el Hombre*. Quito: Herbario QCA y Abya Yala, pp. 13–22.

Borgtoft Pedersen H 1992. Uses and management of *Aphandra natalia* (Palmae) in Ecuador. *Bulletin de l'Institut Français d'Etudes Andines,* 21: 741-743.

Borgtoft Pedersen H 1994. Mocora Palm-fibers: Use and management of *Astrocaryum standleyanum* (Arecaceae) in Ecuador. *Economic Botany,* 48: 310-325.

Borgtoft Pedersen H 1996. Production and harvest of fibers from *Aphandra natalia* (Palmae) in Ecuador. *Forest Ecology and Manage*ment, 80: 155-161.

Borgtoft Pedersen H, Balslev H 1990. *Ecuadorean Palms of Agroforestry*. University of Aarhus. Aarhus: AAU Reports 23.

Borgtoft Pedersen H, Balslev H 1992. The economic botany of Ecuadorean palms. In: M Plotkin, L Famolare (Eds.): *Sustainable Harvest and Marketing of Rain Forest Products*. Washington: Island Press, pp. 173-191.

Borgtoft Pedersen H, Skov F 2001. Mapping palm extractivism in Ecuador using pair-wise comparisons and bioclimatic modeling. *Economic Botany* 55: 63-71.

Borman MB 1992. El arte Cofán en tejido de hamacas (the Cofán art of hammock weaving). *International Museum of Cultures Publication,* 43: 25-27.

Braun A 1968a. Cultivated palms of Venezuela. *Principes,* 12: 39-103.

Braun A 1968b. Cultivated palms of Venezuela Part II. *Principes,* 12: 111-136.

Byg A 2002. Las palmas útiles de Nangaritza. In: Z Aguirre, JE Madsen, E Cotton, H Balslev (Eds.): *Botánica Austroecuatoriana.* Quito: Ediciones Abya Yala, pp. 375-384.

Byg A, Balslev H 2004. Factors affecting local knowledge of palms in Nangaritza valley, southeastern Ecuador. *Journal of Ethnobiology,* 24: 255-278.

Byg A, Balslev H 2006. Palms in indigenous and settler communities in southeastern Ecuador: farmers´ perception and cultivation practices. *Agroforestry Systems,* 67: 147-158.

Campos MT, Ehringhaus C 2003. Plant virtues are in the eyes of the beholders: A comparison of known palm uses among indigenous and folk communities of southwestern Amazon. *Economic Botany,* 57: 324–344.

Cárdenas M 1969. *Manual de plantas económicas de Bolivia*. Cochabamba: Imprenta Icthus.

Cárdenas D, López R 2000. *Plantas útiles de la Amazonía Colombiana, Departamento del Amazonas. Perspectivas de los productos forestales no maderables*. Bogotá: Instituto Amazónico de Investigaciones Científicas, SINCHI, Ministerio del Medio Ambiente.

Castaño N, Cárdenas D, Otavo E 2007. Ecología, aprovechamiento y manejo de sostenible de nueve especies de plantas del departamento del Amazonas, generadoras de productos maderables y no maderables. Bogotá: Instituto Amazónico de Investigaciones Científicas – SINCHI. Corporación para el Desarrollo Sostenibles del sur de la Amazonia, CORPOAMAZONIA.

Cavalcante PB 1977. Edible palm fruits of the Brazilian Amazon. *Principes,* 21: 91-102.

CENPOL 2000. *Proyecto para la competitividad de las artesanías del Ecuador.* Costa Rica:

INCAE.

Cerón CEM 1995. Etnobiologia de Los Cofanes de Dureno: Provincia de Sucumbios, Ecuador. Museo Ecuatoriano de Ciencias Naturales. Herbario Nacional. *Monografías No. 3*. Quito: Ediciones Abya Yala.

Cerón CEM, Montalvo-Ayala C 1998. *Etnobotanica de los Huaorani de Quehueiri-Ono, Napo - Ecuador*. Herbario "Alfredo Paredes" (QAP), Escuela de Biologia, Quito: Universidad Central del Ecuador.

Chávez F 1996. Estudio preliminar de la familia Arecaceae (Palmae) en el Parque Nacional Manu (Pakitza y Cosha Cashu). In: DE Wilson, A Sandoval (Eds.): *Manu: The Biodiversity of Southeastern Peru*. Washington: National Museum of Natural History, Smithsonian Institution, pp. 141-168.

Civrieux JMS 1957. Nombres folkloricos e indígenas de algunas palmeras Amazónico-Guayanesas con apuntes etnobotánicos. *Boletín de la Sociedad Venezolana de Ciencias Naturales,* 18: 195: 233.

Coomes OT 2004. Rain forest 'conservation-through-use'? Chambira palm fiber extraction and handicraft production in a land-constrained community, Peruvian Amazon. *Biodiversity and Conservation,* 13: 351-360.

Cortés S 1897. *Flora de Colombia*. Papelería, Imprenta y Litografía de Samper Matiz, Bogotá.

Crepaldi IC, Salatino A, Rios A 2004. *Syagrus coronata* and *Syagrus vagans*: Traditional exploitation in Bahia, Brazil. *Palms,* 38: 43-48.

Crizón I (Ed.) 2001. *Por los territorios de la Marama: análisis del sistema extractivo de la fibra de Chiquichiqui en la Amazonia Colombiana*. Serie Ambiente y Desarrollo 1, Bogotá: IDEADE.

Dalle SP, Potvin C 2004. Conservation of useful plants: An evaluation of local priorities from two indigenous communities in eastern Panama. *Economic Botany,* 58: 38-57.

Dawson G, Gancedo OA 1977. La palma pindo (*Syagrus romanzoffianum*) y su importancia entre los indios Guayaqui. *Obra del Centenario del Museo de La Plata,* Tomo II (Antropología): 339-353.

Delgadillo OL 1996. *Propuesta de manejo de materias primas artesanales - Región Occidente*. Cali: Convenio Artesanías de Colombia-Fundación FES.

Demers MP 1909. L'exploitation de piassaba dans l'Etat de Bahia. *Journal d'Agriculture Tropicale,* 9: 190-191.

Dewey LH 1943. *Fiber Production in the Western Hemisphere* (1865-1944). Miscellaneous Publication, Washington: United States Department of Agriculture, No. 518.

Dodge CR 1897. A Descriptive Catalogue of Useful Fiber Plants of the World, Including the Structural and Economic Classification of Fibers. *Report No.9*. U.S. Department of Agriculture, Fiber Investigations. Washington: Government Printing Office.

Dransfield J, Johnson DV, Synge H. 1988. *The Palms of the New World: A Conservation Census*. Gland: IUCN.

Dugand A 1961. Palms of Colombia. *Principes*, 5: 135-144.

Duke JA 1977. Ethnobotanical observations on the Chocó Indians. *Economic Botany*, 24: 344-366.

Esau K 1972. *Anatomía Vegetal*. Barcelona: Ed.Omega, S. A.

Fadiman MG 2003. *Fibers from the Forest: Mestizo, Afro-Ecuadorian and Chachi Ethnobotany of Piquigua (*Heteropsis ecuadorensis, *Araceae) and Mocora (*Astrocaryum standleyanum, *Arecaceae) in Northwestern Ecuador*. Ph. D. Thesis, Unpublished. Austin: University of Texas.

Fejos P 1943. *Ethnography of the Yagua*. New York: Viking Fund Publication in Anthropology.

Ferreira MKM, Nascimento CC, Pacheco SA 2008. Estudo da viabilidad técnica da fibra do Tucumã-I (*Astrocaryum acaule*) para produção têxtil. In: *XXVIII Encontro Nacional de engenharia de produção. A integracaÞo de cadeias produtivas com a abordagem da manufatura sustentaìvel*. Rio de Janeiro 13 a 16 de outubro 2008.

Fonseca-Kruel VS, Peixoto AL 2005. Etnobotânica na Reserva Extrativista Marinha de Arraial do Cabo, RJ, Brasil. *Acta Botânica Brasileira*, 18: 177-190.

Forero Pinto LE 1980. Etnobotánica de las comunidades indígenas Cuna y Waunana, Chocó (Colombia). *Cespedesia*, 9: 115-302.

Galeano G 1992. *Las palmas de la región de Araracuara*. Bogotá: Tropenbos-Colombia.

Galeano G, Bernal R 2005. Palmas (familia Arecaceae o Palmae). In: E Calderón, G Galeano, N García (Eds.): *Libro Rojo de Plantas de Colombia, Volumen 2*. Bogotá: Ministerio de Ambiente, Vivienda y Desarrollo Territorial/ Instituto Alexander von Humboldt/Instituto de Ciencias Naturales, pp. 59-223.

Gallego LMA 2005. El tejido de chambira, una actividad que une más que sogas. *Boletín de Antropología* 19: 164-185.

García A 2001. Los índigenas Bora, Huitoto y Okaina en la Amazonía peruana. In: JF Duivenvoorden (Ed.) with H Balslev, J Cavalier, C Grandez, H Tuomisto, R Valencia: *Evaluación de recursos vegetales no maderables en la Amazonía noroccidental*. Amsterdam: Institute for Biodiversity and Ecosystem Dynamics, Universiteit van Amsterdam, pp. 58-64.

García A, Grandez C, Duivenvoorden JF 2001. El uso potencial de los bosques en la cuencas de los rios Ampiyacu y Yaguasyacu, Amazonia peruana. In: J F Duivenvoorden (Ed.) with H Balslev, J Cavalier, C Grandez, H Tuomisto, R Valencia. *Evaluación de recursos vegetales no maderables en la Amazonía noroccidental*. Amsterdam: Institute for Biodiversity and Ecosystem Dynamics, Universiteit van Amsterdam, pp. 163-176.

Geist HJ, Lambin EF 2002. Proximate causes and underlying drivers of tropical deforestation. *BioScience*, 52: 143-150.

Gentry AH 1988. New species and a new combination for plants from trans-Andean South America. *Annals Missouri Botanical Garden*, 75: 1429-1439.

Glenboski LL 1975. *Ethnobotany of the Tikuna Indians, Amazonas, Colombia*. Ph D. Thesis, Unpublished. Alabama: University of Alabama, USA.

Gómez D, Lebrun L, Paymal N, Soldi A 1996. *Palmas útiles de la provincia de Pastaza, Amazonia Ecuatoriana: Manual práctico*. Serie manaules de plantas útiles Amazonicas No. 1. Quito: Fundación Omaere.

González SEP 2011. *Productos florestais não-madereiros em terras indígenas Kayapó no estado do Pará: Diversidade e uso*. MS.C. Thesis, Unpublised. Belém: Universidade Federal Rural da Amazonia.

Goulding E 1917. *Cotton and Other Vegetable Fibers: Their Production and Utilization*. Imperial Institute Series of Handbooks to the commercial resources of the tropics, with special reference to British West Africa). London: John Murray.

Govaerts R, Dransfield J 2005. *World Checklist of Palms*. Kew: Royal Botanic Gardens, UK.

Gragson TL 1992. The use of palms by the Pume Indians of southwestern Venezuela. *Principes*, 36: 133-142.

Grau J 2006. *Palms of Chile. A Detailed Investigation of the Two Endemic Palms and a Review of Introduced Species*. Santiago de Chile: Ediciones Oikos.

Grimarães JL, Satyanarayana KG, Wypych F 2007. Availability, production, marketing and potential applications of natural fibers of Brazil. In: D Anandjiwala, L Hunter, R Kozlowski, G Zaikov (Eds.):*Textiles for Sustainable Development*. New York: Nova Publishers, pp. 21-37.

Guánchez FJ, Romero GA. 1998. Palms and Amerindian fishing in Amazonas state, Venezuela. *Principes*, 42: 125-135.

Guel A, Penn JW 2009. Use of the Chambira Palm *(Astrocaryum chambira)* in Rainforest Communities of the Peruvian Amazon. Undergraduate Research and Creative Practice - Student Summer Scholars. Grand Valley State University. Report 26 pp. From <http://scholarworks.gvsu. edu/sss/20 > (Retrieved November 20, 2010).

Guerra MS, Ayres PCF, Geis GL, Barcelos JI 2009. Recursos vegetais da Restinga de Carapebus, Rio de Janeiro, Brasil. *Revista Biología Neotropical*, 6:35-54.

Hardenburg WE 1913. *The Putumayo. The Devil's Paradise*. London:T. Fisher Unwin.

Henderson A 1995. *The Palms of the Amazon*. New York, USA: Oxford University Press.

Henderson A, Chávez F 1993. *Desmoncus* a useful palm in the western Amazon basin. *Principes*, 37: 184-186.

Henderson A, Galeano G, Bernal R 1995. *Field Guide to the Palms of the Americas*. New Jersey: Princenton University Press.

Hill AF 1965. *Botánica económica, plantas útiles y productos vegetales*. Barcelona: Ediciones Omega, S.A..

Hiraoka M 1999. Miriti (*Mauritia flexuosa*) palms and their uses and management among the ribeirinhos of the Amazon estuary. In: C Padoch, M Ayres, M Pinedo-Vasquez, A Henderson (Eds.): *Changes in Soil Formation and Vegetation on Silt Bars and Backslopes of Levees Following Intensive Produc-*

tion of Rice and Jute. New York: The New York Botanical Garden Press, pp.169-186.

Hodge WH 1947. The plant resources of Peru. *Economic Botany,* 1: 119-136.

Hodge WH 1961. The world of palms. *American Horticultural Magazine,* 40: 1-8.

Hooker WJ 1849. Piaçaba: Fiber and fruit of the coquilla nut, *Attalea funifera*. Mart. Hooker's *Journal of Botany and Kew Garden Miscellany,* 4: 121-123.

Howes FN 1940. The urucury wax palm. *Bulletin of Miscellaneous Information,* 4: 155-158.

Hoyos JF, Braun A 1984. Palmas tropicales cultivadas en Venezuela. *Monografía No. 33*. Sociedad y fundación La Salle de Ciencias Naturales, Caracas.

Hübschmann LK, Kvist LP, Grandez C, Balslev H 2007. Uses of Vara Casha- a neotropical liana palm, *Desmoncus polyacanthos* in Iquitos, Peru. *Palms,* 51: 167-176.

Im Thurn EF 1883. *Among the Indians of Guiana, Being sketches chiefly anthropologic form the interior of British Guiana*. New York: Dover Publications.

Irmay H de 1949. La palmera "cusi" y el aceite de "babassu": un gran recurso forestal de Bolivia, *Orbignya phalerata*, Martius. *Revista de Agricultura,* 6: 29-40.

Jensen OH 1997. La palma "chambira" (*Astrocaryum chambira* Burret, Arecaceae): uso y potencial económico. In: M Rios, H Borgtoft Pedersen (Eds.): *Uso y manejo de recursos vegetales*. Memorias del Segundo simposio ecuatoriano de etnobotánica y botánica económica. Abya-Yala, Quito, pp. 41-53.

Jensen OH, Balslev H 1995. Ethnobotany of the fiber palm *Astrocaryum chambira* (Arecaceae) in Amazonas Ecuador. *Economic Botany,* 49: 309-320.

Johnson DV 1982. Commercial palm products of Brazil. *Principes,* 26: 141-143.

Johnson DV 1985. Present and potential economic usages of palms in arid and semi-arid areas. In: J R Wickens, D Goodin, V Field (Eds.): Plants for Arid Lands. *Proceedings of the Kew International Conference on the Economic Plants for Arid Lands held in the Jodrell Laboratory,* Kew, Royal Botanic Gardens, 23 -27 July 1984 England, pp. 189-202.

Jordan CB 1970. A study of germination and use in twelve palms of northeastern Peru. *Principes,* 14: 26-32.

Keller HA 2009. Plantas textiles de los Guaraníes en Misiones, Argentina. *Bonplandia,* 18: 29-37.

Kirby RH 1950. Brush-making fibers. *Economic Botany,* 4: 243-252

Kirby RH 1963. *Vegetable Fibers: Botany, Cultivation and Utilization*. New York: L. Hill, London- Interscience Publishers.

Kitzke ED, Johnson DV 1975. Commercial palm products other than oils. *Principes,* 19: 3-26.

Kronborg M, Grández C, Ferreira E, Balslev H 2008. *Aphandra natalia* (Arecaceae) a little known source of piassaba fibers from the western Amazon. *Revista Peruana de Biología,* 15:103-113.

La Rotta C 1988. *Estudio etnobotánico sobre las especies utilizadas por la comunidad indigena Miraña, Amazonas, Colombia*. Bogotá: Fondo para la Proteccion del Medio Ambiente "Jose Celestino Mutis".

León J 1968. *Fundamentos botánicos de los cultivos tropicales*. San José de Costa Rica: Instituto Interamericano de Ciencias Agrícolas de la OEA.

Lescure JP, Emperaire L, Franciscon C 1992. *Lepoldinia piassaba* a few biological and economic data from Río Negro region (Brazil). *Forest Ecology and Management,* 55: 83-86.

Lévi-Strauss C 1952. The use of wild plants in tropical South America. *Economic Botany,* 6: 252-270.

Lima de MUR, Medeiros de JTC, Silva da VA, Cavalcanti L de HA 2008. Conhecimento e uso do ouricuri (*Syagrus coronata*) e do babaçu (*Orbignya phalerata*) em Buiìque, PE, Brasil. *Acta Botânica Brasileira,* 22:1141-1149.

Linares EL, Galeano G, García N, Figueroa Y 2008. *Fibras vegetales usadas en artesanías en Colombia*. Bogotá: Artesanías de Colombia S.A. – Instituto de Ciencias Naturales.

López R, Cárdenas D, Marín C 1998. *Plantas de uso potencial (no maderable) en el norte del departamento del Guaviare Amazonía Colombiana*. Bogotá: Herbario Amazónico Colombiano, Instituto Amazónico de Investigaciones Científicas.

Lorenzi GMAC 2006. *Acrocomia aculeata (Jacq.) Lodd. ex Mart. - Arecaceae: Bases para o extrativismo sustentável*. PhD, Unpublished. Curitiba: Agronomia.Universidade Federal do Parana.

Macía MJ 2004. Multiplicity in palm uses by the Huaorani of Amazonian Ecuador. *Botanical Journal of the Linnean Society,* 144: 149-159.

Macía MJ 2006. Las plantas de fibra. In: RM Moraes, B Øllgaard, LP Kvist, F Borchsenius, H Balslev (Eds.): *Botánica Económica de los Andes Centrales*. La Paz: Universidad Mayor de San Andrés, pp. 370-384.

Macía MJ, Armesilla PJ, Cámara-Leret R, Paniagua-Zambrana N, Villalba S, Balslev H, Pardo de Santayana M 2011. Palm Uses in Northwestern South America: A Quantitative Review. *Botanical Review,* 77:462–570.

Markley KS 1955. Caranday - a source of palm wax. *Economic Botany,* 9: 39-52.

Markley KS 1956. Mbocayá or Paraguay cocopalm- an important source of oil. *Economic Botany,* 10: 3-32.

Marshall E, Newton AC, Schreckenberg K 2003. Commercialization of non-timber forest products: First steps in analyzing the factors influencing success. *International Forestry Review,* 5: 128-137.

May PH, Anderson AB, Balick MJ, Frazão JMF 1985. Subsistence benefits from the Babassu palm (*Orbignya martiana*). *Economic Botany,* 39: 113-129.

Mayer WE 2006. *The Piassaba Palm: Conservation and Development in the Buffer Zone of Peru´s Cordillera Azul National Park*. Ph. D. Thesis, Unpublished. Durham: Duke University.

Mejía KC 1988. Utilization of palms in eleven Mestizo villages of the Peruvian Amazon (Ucayali river, Department of Loreto). *Advances in Economic Botany,* 3: 130-135.

Milliken W, Miller RP, Pollard SR, Wandelli EV 1992. *Ethnobotany of the Waimiri Atroari Indians of Brazil*. London: Royal Botanic Gardens, Kew.

Moody S 1864. *The Palm Tree*. London: Nelson.

Moraes RM 1996. Novelties of the genera *Parajubaea* and *Syagrus* (Palmeae) from interandean Valleys of Bolivia. *Novon,* 6: 85-92.

Moraes RM 1998. Richness and utilization of palms in Bolivia. Some essential criteria for their management. In: W Barthlott, M Winiger (Eds.): *Biodiversity a Challenge for Development Research and Policy*. New York: Springer-Verlag, pp. 269-278.

Moraes RM 2004. *Flora de palmeras de Bolivia*. La Paz: Herbario Nacional de Bolivia, Instituto de Ecología, Universidad Mayor de San Andrés.

Morcote G, Bernal R 2001. Remains of palms (Palmae) at archaeological sites in the New World –A review. *Botanical Review,* 67: 309-350

Mors WB, Rizzini CT 1966. *Useful Plants of Brazil*. San Francisco: Holden-Day.

Moses T 1962. Palms of Brazil. *Principes,* 6: 26-37.

Mueller von F 1895. *Select Extra- Tropical Plants, Readily Eligible for Industrial Culture Naturalization*. 9th Edition. Melbourne: R. S. Brain Government Printer.

Nepstad DC, Schwartzman S (Eds.) 1992. Non-timber products from tropical forests: Evaluation of a conservation and development strategy. *Advances in Economic Botany,* 9: 1-164.

Oenning da SRC. 2010. Saberes e misteìrios Saìliba. Relato de uma viagem iconograìfica entre os Saìliba, grupo ameriìndio equatorial de Orocueì, Casanare, Colombia. From <http://www.shinealight.org/Texts/saliba.pdf > (Retrieved March 14, 2011).

Oliveira J, Soares de Almeida S, Vilhena-Potyguara R, Batista-Lobato LC 1991. Espécies vegetais produtoras de fibras uitilizadas por comunidades Amazônicas. *Boletim do Museu Paraense Emílio Goeldi* 7: 393-428.

Oliveira J, Potiguara RCV, Batista LCL 2006. Fibra vegetais utilizadas na pesca artesanal na microrregiaÞo do salgado, Paraì. *Museu Paraense Emiìlio Goeldi,* 1: 113 - 127.

Padoch C, Chota Inuma J, De Jong W, Unruh J 1985. Amazonian agroforestry: A market oriented system in Peru. *Agroforesty Systems,* 3: 47-58.

Padoch C 1998. Aguaje (*Mauritia flexuosa* L. f.) in the economy of Iquitos, Peru. *Advances in Economic Botany,* 3: 214–224.

Paniagua-Zambrana NY, Byg A, Svenning JC, Moraes M, Grandez C, Balslev H 2007. Diversity of palm uses in the Western Amazon. *Biodiversity Conservation,* 16: 2771-2787.

Patiño VM 1967. *Plantas cultivadas y animales domésticos en America Equinoccial*. Tomo III. Cali: Imprenta departamental.

Patiño VM 1975. *Historia de la vegetación natural y de sus componentes en la América Equinoccial*. Imprensa Departamental, Cali.

Patiño VM 1997. Datos etnobotánicos sobre algunas palmeras de la America Intertropical. *Revista de la Academia Colombiana* de *Ciencias Exactas, Físicas y Naturales,* 21: 7-23.

Peckolt T, Peckolt G 1889. *História das plantas, medicinaes e úteis do Brasil, contendo a descripçao botânica, cultura, partes usadas, composição chimica, seu emprego em diversas molestias, doses, usos industriaes, etc. Familia das palmaceas.* Rio de Janeiro: 2o Fasciculo.

Pérez Arbelaez E 1956. *Plantas útiles de Colombia*. Tercera Edición. Bogotá: Librería Colombiana.

Pesce C 1985. *Oil Palms and Other Oilseeds of the Amazon*. Alcognac, Michigan: Reference Publications, Inc.

Peters CM, Gentry AH, Mendelsohn RO 1989. Valuation of an Amazonian rainforest. *Nature,* 339: 655-656.

Peters CM 1996. The Ecology and Management of Non-timber Tropical Forest Resources. Washington, *World Bank Technical Paper No. 322,* The World Bank.

Peters CM, Henderson A, Maung UM, Lwin US, Ohn UTM, Lwin UK, Shaung UT 2007. The rattan trade of northern Myanmar: Species, supplies and sustainability. *Economic Botany,* 61: 3-13.

Pinheiro CUB, Balick MJ (Eds.) 1987. Brazilian palms: Notes on their uses and vernacular names, compiled and translated from Pio Correa. *Contributions from the New York Botanical Garden,* 17: 1-50.

Pintaud JC, Galeano G, Balslev H, Bernal R, Borchsenius F, Ferreira E, Granville de JJ, Mejía K, Millán B, Moraes M, Noblick L, Stauffer FW, Kahn F 2008. Las palmeras de América del Sur: diversidad, distribución e historia evolutiva. *Revista Peruana de Biología,* 15: 7-29.

Pittier H 1926. *Manual de las plantas usuales de Venezuela*. Fundación Eugenio Mendoza. Plotkin MJ 1988. The outlook for new agricultural and industrial products from the tropics. In: EO Wilson (Ed.): *Biodiversity*. Washington: National Academy Press, P. 106.

Prance GT, Silva MF 1975. *Arvores de Manaus*. Manaus: INPA.

Prance GT 1998. *Manual de botânica econômica do Maranhão*. Maranhão: Universidade Federal de Maranhão.

Putz FE 1979. Biology and human use of Leopoldinia piassaba. *Principes,* 23: 149-156.

Ramia M 1962. Datos etnobotánicos sobre los indios Yaruros. *Acta Biologica Venezuelica* 3: 141-147.

Ravallion M, Chen S, Sangraula P 2009. Dollar a day revisited. *World Bank Economic Review,* 23: 163-184.

Rendle AB 1917. A list of economic plants native or suitable for cultivation in the British Empire. *Kew Bulletin of Miscellaneous Notes,* 7-8: 241-285.

Rondón JAR 2005. Especies vegetales utilizadas en la cestería por la etnia Piaroa del estado de Amazonas, Venezuela. *Revista Chapingo Serie de Ciencias Forestales y el Ambiente,* 11: 131-138.

Sampaio, BM, Belloni IS, Figueiredo IB 2008. Harvesting effects and population ecology of the Buriti palm (*Mauritia flexuosa* L.f., Arecaceae) in the Jalapáo region, Central Brazil. *Economic Botany,* 62: 171-181.

Sánchez M 2001. El pueblo Miraña del medio Caquetá. In: JF Duivenvoorden (Ed.) with H Balslev, J Cavalier, C Grandez, H Tuomisto, R Valencia: *Evaluación de recursos vegetales no maderables en la Amazonía noroccidental*. Amsterdam: Institute for Biodiversity and Ecosystem Dynamics, Universiteit van Amsterdam, pp. 47-52.

Sánchez M, Duivenvoorden JF, Duque A, Miraña P, Cavelier J 2005. A stem-based ethnobotanical quan-

tification of potential rain forest use by Mirañas in NM Amazonia. *Ethnobotany Research and Applications,* 3: 215-229.

Santana RF, Ochoa RV, Salazar AAV, Ximenes MP 2008. Manejo de Aguaje (buriti) na Comunidade de Parinari – Reserva Nacional Pacaya Samiria na RegiaÞo de Loreto no Peru: uma proposta de pagamento por servicio ambiental carbono. Brasília: Paper presented in *IV Encontro Nacional da Anppas Brasiìlia, 4,5 e 6 de junho 2008.*

Saraiva N 2009. *Análise do potencial econômico e socioambiental do artesanato do buriti em comunidades tradicionais nos Lençóis Maranhenses*. Centro de Desenvolvimento Sustentaìvel. Universidade Brasília, Brazil.

Schultes RE 1974. Palms and religion in northwest Amazon. *Principes,* 18: 3-21.

Schultes RE 1977. Promising structural fiber palms of the Colombian Amazon. *Principes,* 21: 72-82.

Silva da PAD 2008. *Ecologia populacional e botânica econômica de Butia capitata (Mart.) Beccari no Cerrado no Norte de Minas Gerais*. Ms. C. Thesis in Ecology, Unpublished. DissertacaÞo do Mestre. Brasília: Universidade de Brasília.

Sosnowska J, Ramirez D, Millán B 2009. Palmeras usadas por los indiìgenas Ashaìninkas en la Amazoniìa Peruana. *Revista Peruana de Biología,* 17: 347-352.

Sousa MRS, Sousa AJ 2007. Vestigios artesanais na biodiversidade e plasticidade do buriti. Paraíba: Paper presented in *II Congresso de Pesquisa e InovaçaÞo da Rede Norte Nordeste de EducaçaÞo Tecnoloìgica JoaÞo Pessoa*, June 30, 2008.

Spruce R 1855. Botanical objects communicated to the Kew museum to the Kew Museum from the Amazon or its tributaries in 1853. *Hooker's Journal of Botany,* 7: 273-278

Spruce R 1860. On *Leopoldinia piassaba*, Wallace. *Proceedings of the Linnean Society* 4: 58-63.

Squier EG 1863. *Tropical fibers: their production*. London: James Madden; New York: Scribner & Co.

Suárez MM 1966. Les utilizations du palmier "Moriche" (*Mauritia flexuosa* L.f.) chez les Warao du delta de L'Orénoque, territoire delta Amacuro, Venezuela. *Journal d'Agriculture Tropicale et de Botanique Appliquée,* 13: 33-43.

Suárez MM 1968. *Los Warao, indígenas del delta del Orinoco*. Departamento de Antropología, Caracas: Instituto Venezolano de Investigaciones Científicas.

Taube E 1952. Carnauba wax- product of a Brazilian palm. *Economic Botany,* 6: 379-401.

Thompson NLB, Moraes MR, Baudoin MW 2009. Estructura poblacional de la palmera endeìmica *Parajubaea torallyi* (Mart.) Burret en zonas aprovechadas del Aìrea Natural de Manejo Integrado El Palmar (Chuquisaca, Bolivia). *Ecología en Bolivia,* 44: 17-35.

Ticktin T 2004. The ecological implications of harvesting non-timber forest products. *Journal of Applied Ecology,* 41: 11-21.

Tomlinson PB 1990. *The Structural Biology of Palms*. Oxford: Clarendon Press.

van den Eynden, V, Cueva E, Cabrera O 2004. Edible palms of southern Ecuador. *Palms,* 48: 141-147.

Vantomme P 2004. Extracción de productos silvícolas no madereros. In: B Vinceti, W Amaral, B Meilleur (Eds.): *Desafíos de la ordenación de los recursos genéticos silvícolas para contribuir a la subsistencia: ejemplos de Argentina y Brasil*. Rome: Instituto Internacional de Recursos Fitogenéticos, pp. 57-77.

Vargas I 1994. Ecology and uses of *Parajubaea torallyi* in Bolivia. *Principes,* 38: 146-152.

Vargas I, Jordán CG 2003. *Principales planta útiles del Bajo Paraguá, Santa Cruz-Bolivia. Guía de campo.* La Paz: Editorial FAN, Bolivia.

Vásquez MR, Baluarte JV 1998. La extracción de productos forestales diferentes de la madera en el ámbito de Iquitos - Perú. *Folia Amazónica,* 9: 69 - 92.

Velásquez-Runk J 2001. Wounnan and Emberá use of the fiber palm *Astrocaryum standleyanum* (Arecaceae) for basketry in Eastern Panamá. *Economic Botany,* 55: 72-82.

Velásquez-Runk J, Peña F, Mepaquito P 2004. Artisanal non-timber forest products in Darién Province, Panamá: The importance of context. *Conservation and Society,* 2: 217-234.

Voeks RA 1988. The Brazilian fiber belt: Hervest and management of Piassaba palm (*Attalea funifera* Mart.). *Advances in Economic Botany,* 3: 254-271.

Vormisto J 2002. Making and marketing chambira hammocks and bags in the village of Brillo Nuevo, Northeastern Peru. *Economic Botany,* 56: 27-40.

von Andel TR 2000. Non-Timber Forest Products of the Northwest District of Guyana. Part 2. *Field Guide.* Tropenbos-Guyana Series 8a/b. Georgetown: Tropenbos-Guyana Programme.

Wallace AR 1853. *Palm Trees of the Amazon and Their Uses*. London: John Van Voorst, Coronado Press.

Wessels Boer JG 1988. Palmas indígenas de Venezuela. *Pittieria,* 17: 1-332.

Wheeler MA 1970. Siona use of chambira palm fiber. *Economic Botany,* 24: 180-181.

Wilbert J 1980. The Temiche Cap. *Principes,* 24: 105-109.

APPENDIX

Appendix 1. Palm species used for fibres in South America, with the geographical record of use, parts employed, fiber types, objects manufactured and references of the reports. A. Geographic region according with ecosystem units: 1. Pacific lowlands, 2. Andes, 3. Amazonas, 4.Llanos savanna, 5. Cerrado, 6. Caatinga, 7. Mata Atlantica, 8. Great Chaco, 9. Caribbean. B. Fiber classification after Dodge (1897) 1. Spinning material, 2. Tie material, 3. Natural textures, 4. Brush fibers, 5. Plaiting, 6. Filling material and 7. Paper material. C. Types of objects manufactured: 1. Bags, 2. Baskets, 3. Brooms , 4. Clothes, 5.Cordage, 6. Fans, 7. Filling, 8. Furniture, 9. Hammocks, 10. Hats, 11. Mats, 12. Necklaces, 13. Nets, 14. Screens, 15. Strainers, 16. Traps.

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Acrocomia aculeata (Jacq.) Lodd. ex Mart.	Argentina, Brazil, Bolivia, Paraguay	Amazonas, Cerrado, Mata Atlantica	Leaves	1	1, 2, 4, 5, 9, 10, 11, 13	Dodge 1897, Peckolt and Peckolt 1889, Bertoni 1903, Markley 1956, Cárdenas 1969, Pinheiro and Balick 1987, Lorenzi 2006
Allagoptera arenaria (Gomes) Kuntze	Brazil	ND	Leaves	5	2	Peckolt and Peckolt 1889, Pinheiro and Balick 1987
Allagoptera campestris (Mart.) Kuntze	Brazil	Mata Atlantica	Leaves	5	2	Peckolt and Peckolt 1889
Ammandra decasperma O.F.Cook	Colombia, Ecuador	Amazonas, pacific	Leaves, petioles	5	1, 2, 6	Bernal and Galeano 1993, Henderson et al. 1995, Macía 2004, Linares et al. 2008
Aphandra natalia (Balslev and A.J.Hend.) Barfod	Brazil,Ecuador, Peru	Amazonas	Leaves, leave sheath, petioles	4	3	Borgtoft Pedersen and Balslev 1990, Barfod 1991, Borgtoft Pedersen 1991, 1992, Borgtoft Pedersen and Balslev 1992, Henderson et al. 1995, Borgtoft Pedersen 1996, Borchsenius et al. 1998, Vásquez and Baluarte 1998, Borgtoft and Skov 2001, Macía 2004, Boll et al. 2005, Meyer 2006
Astrocaryum acaule Mart.	Brazil, Colombia, Venezuela	Amazonas	Leaves, petioles,	5	2, 4	Wallace 1853, Dodge 1897, Peckolt and Peckolt 1889, Henderson et al. 1995, Ferreira 2008
Astrocaryum aculeatissimum (Schott) Burret	Brazil	spathe, spear leaves Amazonas, Mata Atlantica	caatinga, Leaves Leaves	1	3, 5, 10, 13	Mors and Rizzini 1966, Kitzkeand Johnson 1975, Johnson 1982, Pinheiro and Balick 1987, Henderson et al. 1995
Astrocaryum aculeatum G.Mey. Jordan	Bolivia, Brazil, Colombia, Guyana	Amazonas, Cerrado	Leaves, spear leaves	1, 5	2, 4, 5, 6, 9, 10, 13	Peckolt and Peckolt 1889, Dodge 1897, Schultes 1977,Johnson 1982, Pesce 1985, Boom 1986, Boom 1987, Balslev and Moraes 1989, Vormisto 2002, Campos and Ehringhaus 2003, Vargas and 2003, Amaral 2010, González 2011
Astrocaryum campestre Mart.	Brazil	Cerrado	Leaves	1, 5	13	Balick 1988, Henderson et al. 1995

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Astrocaryum chambira	Brazil, Colombia, Ecuador, Peru, Venezuela	Amazonas, Llanos savanna	Spear leaves	1	1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 15, 16	Cortés 1897, Hardenburg 1913, Hodge 1947, Fejos 1943, Dugand 1961, Patiño 1967, Jordan 1970, Wheeler 1970, Schultes 1974, Patiño 1975, Glenboski 1983, Padoch et al. 1985, La Rotta 1988, Mejía 1988, Wessels Boer 1988, Borman 1992 Borgtoft Pedersen and Balslev 1992, Cerón 1995, Jensen and Balslev 1995, Gómez et al. 1996, Jensen 1997, Borchsenius et al. 1998, Cerón and Montalvo-Ayala 1998, López et al. 1998, Vásquez and Baluarte 1998, Borgtoft and Skov 2001, García 2001, Sánchez 2001, Bennett et al. 2002, Coomes 2004, Macía 2004, Gallego 2005, Castaño et al. 2007, Guel and Penn 2008
Astrocaryum gynacanthum Mart.	Brazil	ND	Leaves	ND	ND	Peckolt and Peckolt 1889
Astrocaryum huaimi Mart.	Brazil	Amazonas	Leaves	1	4	Peckolt and Peckolt 1889, Pinheiro and Balick 1987
Astrocaryum jauari Mart.	Brazil, Colombia, Ecuador, Peru, Venezuela	Amazonas	Leaves, petioles, spear leaves		1, 2, 6, 9, 10, 11, 14	Peckolt and Peckolt 1889, Schultes 1977, Pinheiro and Balick 1987, Mejía 1988, Borgtoft Pedersen and Balslev 1990, Gragson 1992, Henderson et al. 1995
Astrocaryum malybo H.Karst.	Colombia	Andes	Leaves, spear leaves	5	2, 3, 11	Cortés 1897, Pérez Arbelaez 1956, Dugand1961, Patiño 1975, Henderson et al. 1995, Patiño 1997
Astrocaryum murumuru Mart.	Brazil, Peru	Amazonas, Cerrado	Leaves, spear leaves	5	2, 6, 10, 11	Peckolt and Peckolt 1889, Dodge 1897, Lévi-Strauss 1952, Schultes 1977, Bodley and Benson 1979, Mejia 1988, Campos and Ehringhaus 2003
Astrocaryum perangustatum F. Kahn and B.Millán	Peru	Amazon	Leaf raquis	3		Sonowska et al. 2009
Astrocaryum sciophilum (Miq.) Pulle		Brazil	Amazonas Leaves	5	10, 11	Peckolt and Peckolt 1889, Pinheiro and Balick 1987
Astrocaryum standleyanum L.H.Bailey	Colombia, Ecuador	Pacific	Spear leaves	5	2, 5, 8, 9, 10, 11, 13	Patiño 1975, Forero-Pinto 1980, Barfod and Balslev 1988, Borgtoft Pedersen 1994, Henderson et al. 1995, Barfod and Kvist 1996, Patiño 1997, Borchsenius et al. 1998, Borgtoft and Skov 2001, Velásquez-Runk 2001, Fadiman 2006

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Astrocaryum vulgare Mart.	Brazil, French Guiana, Surinam	Amazonas, Cerrado, Mata Atlantica, Llanos savanna	Leaves, spear leaves	1	1, 2,5, 6, 9, 10, 11, 13	Wallace 1853, Peckolt and Peckolt 1889, Civrieux 1957, Balick 1985a, Pinheiro and Balick 1987, Baleé 1989, Oliveira et al. 1991
Attalea butyracea (Mutis ex L.f.) Wess.Boer	Brazil, Colombia, Peru	Amazonas, Andes, Caribean, Llanos savanna	Spear leaves, leaves, spathe, inflore-scence	5	1, 2, 3, 5, 6, 10, 11	Peckolt and Peckolt 1889, Pérez Arbelaez 1956, Bodley and Benson 1979, Campos and Ehringhaus 2003, Bernal et al. 2010
Attalea colenda (O.F.Cook) Balslev and A.J.Hend.	Ecuador	Pacific	Leaves, petioles	1	5	Acosta-Solis 1952, Borchsenius et al. 1998
Attalea dubia (Mart.) Burret	Brazil	Mata Atlantica	Leaves	5	2	Peckolt and Peckolt 1889
Attalea eichleri (Drude) A.J.Hend.	Brazil	Caatinga, Cerrado, Mata Atlantica	Leaves	1	1, 5	Peckolt and Peckolt 1889
Attalea exigua Drude	Brazil	Cerrado	Petiole	5	2	Peckolt and Peckolt 1889
Attalea funifera Mart.	Brazil	Mata Atlantica	Petiole	4	2, 3, 5, 10, 11	Hooker 1849, Archer 1855, Squier 1863, Moody 1863, Dodge 1897, Peckolt and Peckolt 1889, Demers 1909, Goulding 1917, Rendle 1917, Bondar 1942a, Dewey 1943, Kirby 1950, Lévi-Strauss 1952, Hodge 1961, Moses 1962, Kirby 1963, Mors and Rizzini 1966, León 1968, Kitzke and Johnson 1975, Johnson 1982, Pesce 1985, Pinheiro and Balick 1987, Voeks 1988, Prance Henderson et al. 1995, Grimarães et al. 2007
Attalea insignis (Mart.) Drude	Ecuador	Amazonas	Petiole	5	11	Macía 2004
Attalea maripa (Aubl.) Mart.	Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, Venezuela	Amazonas, Llanos savanna	Leaves, petioles, spear leaves	1, 2, 5	1, 2, 5, 6, 11, 14, 16	Peckolt and Peckolt 1889, Lévi-Strauss 1952, Civrieux 1957, Moses 1962, Braun 1968b, Anderson 1978, Balick 1979, Bodley and Benson 1979, Hoyos and Braun 1984, Balick 1985b, Guánchez and Romero 1998, Vargas y Jordan 2003, Macía 2004, Rondón 2005, Oliveira et al. 2006
Attalea microcarpa Mart.	Brazil	Amazonas Mata Atlantica	Leaves	ND	ND,	Peckolt and Peckolt 1889
Attalea oleifera Barb.Rodr.	Brazil	Cerrado, Mata Atlantica	Leaves, spear leaves	5	2	Peckolt and Peckolt 1889, Pinheiro and Balick 1987

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Attalea phalerata Mart. ex Spreng.	Brazil, Bolivia	Amazonas, Cerrado, Great Chaco	Leaves, spear leaves	4,5	1, 2, 3, 6, 10, 11	Peckolt and Peckolt 1889, Boom 1986, Boom 1987, Boom 1988, Balslev and Moraes 1989, Campos and Ehringhaus 2003, Vargas y Jordan 2003, Moraes 2004, Borchsenius and Moraes 2006
Attalea racemosa Spruce	Brazil, Venezuela	Amazonas	Leaves, stem	1	4	Peckolt and Peckolt 1889
Attalea speciosa Mart.	Brazil, Bolivia	Cerrado, Great Chaco,	Leaves, spear leaves	1, 5	1, 2, 3, 5, 6, 10, 11, 15, 16	Irmay 1949, Lévi-Strauss 1952, May et al. 1985, Pinheiro and Balick 1987, Balick 1988, Balslev and Moraes 1989, Prance 1998, Campos and Ehringhaus 2003, Vargas and Jordan 2003, Moraes 2004
Attalea spectabilis Mart.	Brazil	Amazonas	Leaves	1	5, 13	Peckolt and Peckolt 1889
Attalea tessmannii Burret	Brazil, Peru	Amazonas	Leaves, spear leaves	4, 5, 6	2, 3, 6, 7, 10	Bodley and Benson 1979, Campos and Ehringhaus 2003
Bactris acanthocarpa Mart.	Brazil	Mata Atlantica	Leaves	1	5, 13	Peckolt and Peckolt 1889
Bactris brongniartii Mart.	Brazil	Amazonas	Leaves	1	5	Peckolt and Peckolt 1889
Bactris cuspidata Mart.	Brazil	ND	Leaves	1	4, 5, 13	Pinheiro and Balick 1987
Bactris gasipaes Kunth	Colombia, Ecuador, Peru	Amazonas, Llanos savanna	Leaves	1	1, 4, 6, 11	López et al. 1998, Byg and Balslev 2004, Sonowska et al. 2009
Bactris glaucescens Drude	Brazil	Matto Grosso	Leaves	1	1, 5	Peckolt and Peckolt 1889
Bactris hirta Mart.	Brazil	Amazonas	ND	1	4	Peckolt and Peckolt 1889
Bactris major Jacq.	Bolivia	Amazonas, Andes, Great Chaco	Stem	5	3	Moraes 2004
Bactris riparia Mart.	Brazil, Ecuador	Amazonas, Cerrado, Matto Grosso	Leaves, stem	1, 4	3, 4	Peckolt and Peckolt 1889, Macía 2004 Peckolt and Peckolt 1889, Macía 2004
Bactris setosa Mart.	Brazil	Mata Atlantica	Leaves	1	1, 4, 5, 9, 10, 13	Peckolt and Peckolt 1889, Dodge 1897, Lévi-Strauss 1952, Kirby 1963, Pinheiro and Balick 1987, Fonseca-Kruel and Peixoto 2005
Barcella odora (Trail) Drude	Brazil	Amazonas	Leaves	ND	ND	Peckolt and Peckolt 1889
Butia capitata (Mart.) Becc.	Brazil	Cerrado	Leaves	4	3	DaSilva 2008
Ceroxylon alpinum Bonpl. ex DC.	Venezuela	Andes	Spear leaves	5	10	Pittier 1978

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Ceroxylon echinulatum Galeano	Ecuador	Andes	Spear leaves	5	2	Borchsenius and Skov 1999
Ceroxylon ventricosum Burret	Ecuador	Andes	Spear leaves	5	4, 10, 11	Borchsenius et al. 1998, Macía 2006
Chelyocarpus chuco (Mart.) H.E.Moore	Brazil, Bolivia	Amazonas, Cerrado	Leaves, petioles	5	2, 10, 15	Peckolt and Peckolt 1889, Balslev and Moraes 1989, Henderson et al. 1995, Campos and Ehringhaus 2003
Chelyocarpus ulei Dammer	Brazil, Peru	Amazonas	Leaves	5, 6	2, 3, 6, 7, 9, 10, 12	Bodley and Benson 1979, Campos and Ehringhaus 2003
Coccothrinax barbadensis (Lodd. ex Mart.) Becc.	Venezuela	Caribbean	Spear leaves	5	1, 11	Hoyos and Braun 1984
Copernicia alba Morong	Argentina, Brazil, Bolivia, Paraguay	Great Chaco	Leaves	1	1, 5, 8, 9, 10	Markley 1955, Pinheiro and Balick 1987, Henderson et al. 1995
Copernicia prunifera (Mill.) H.E.Moore	Argentina, Brazil, Bolivia	Caatinga, Mata Atlantica	Leaves, petioles	1, 5	1, 2, 3, 6, 10, 11, 13	Moody 1863, Mueller 1895, Dodge 1897, Taube 1956, Mors and Rizzini 1966, Johnson 1982, Johnson 1985, Pinheiro and Balick 1987
Copernicia tectorum (Kunth) Mart.	Colombia, Venezuela	Llanos savanna	Leaves, spear leaves	5	2, 10	Pittier 1978, Henderson et al. 1995
Cryosophila kalbreyeri (Dammer ex Burret) Dahlgren	Colombia	Andes	Leaves	4	3	Borchsenius and Moraes 2006
Desmoncus cirrhifer A.H. Gentry and	Colombia, Ecuador Amazonas,	Pacific	Stem	2, 5	2, 8, 13, 16	Gentry 1988, Bernal snd Galeano 1993, Henderson et al. 1995, Barfod snd Kvist 1996, Zardini Borchsenius et al.1998
Desmoncus giganteus A.J.Hend.	Brazil, Colombia, Ecuador, Peru	Amazonas, Llanos savanna	Stem	2, 5	2, 8	Henderson 1995, Henderson et al. 1995, Cerón and Montalvo-Ayala 1998
Desmoncus horridus Splitg. ex Mart.	Brazil, Bolivia, Colombia, Ecuador, Guyanas, Venezuela	Amazonas, Llanos savanna, Mata Atlantica	Stem	2, 5	1, 2, 6, 8, 11, 15	Civrieux 1957, Pinheiro and Balick 1987, Oliveira et al. 1991, Henderson et al. 1995, Balslev et al. 1997, Cerón and Montalvo-Ayala 1998, Oliveira et al. 2066, Guerra et al. 2008
Desmoncus mitis Mart.	Brazil, Colombia, Peru	Amazonas	Stem	2, 5	2	Peckolt and Peckolt 1889, Galeano 1992, Henderson et al. 1995
Desmoncus polyacanthos Mart.	Brazil, Bolivia, Colombia, Guyana, Peru, Suriname	Amazonas, Andes	Stem	2, 5	2, 8, 15	Wallace 1853, Moody 1863, Peckolt and Peckolt 1889, Dodge 1897, Pinheiro and Balick 1987, Galeano 1992, Henderson and Chávez 1993, Henderson et al. 1995, von Andel 2000, Moraes 2004, Hübschmann et al. 2007
Elaeis oleifera (Kunth) Cortés	Venezuela	Caribbean	Leaves	1	5	Pittier 1978

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Euterpe precatoria Mart.	Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Surinam, Venezuela	Amazonas	Leaves, spear leaves	1,4,5	1, 2, 3, 4, 6, 11, 15	Balslev and Moraes 1989, Cerón and Montalvo-Ayala 1998, Henderson 1995, von Andel 2000, Campos and Ehringhaus 2003, Vargas and Jordan 2003, Byg and Balslev 2004 Oliveira et al. 2006
Euterpe oleracea Mart.	Brazil	Amazon	Leaves		2	
Geonoma baculifera (Poit.) Kunth	Brazil	Amazonas	Leaves	5	2	Anderson 1978
Geonoma deversa (Poit.) Kunth	Bolivia, Brazil, Ecuador, Colombia, Ecuador, Guyana, Peru, Venezuela	Amazonas	Leaves	5	2	Anderson 1978, Henderson 1995, Borchsenius et al. 1998
Geonoma macrostachys Mart.	Ecuador	Amazonas	Stem	4	3	Macía 2004
Geonoma pohliana Mart.	Brazil	Mata Atlantica	Leaves, petioles	1, 5	2, 5, 14	Peckolt and Peckolt 1889, Pinheiro and Balick 1987
Geonoma leptospadix Trail	Brazil	Amazonas, Cerrado	Petiole	5	2	Peckolt and Peckolt 1889
Geonoma schottiana Mart.	Brazil	Caatinga, Cerrado, Mata Atlantica	Petiole, stem	1, 5	1, 2	Peckolt and Peckolt 1889, Pinheiro and Balick 1987
Hyospathe elegans Mart.	Brazil	Amazonas	Stem	5	2	Peckolt and Peckolt 1889
Iriartea deltoidea Ruiz and Pav.	Brazil, Bolivia, Colombia, Ecuador, Peru, Venezuela	Amazonas	Leaves, spear leaves	1, 4, 5	2, 3, 5, 11	Henderson 1995, Borchsenius et al. 1998, Byg 2002, Byg and Balslev 2004, Sonowska et al. 2009
Iriartella setigera (Mart.) H.Wendl.	Venezuela	Amazonas	Stem	5	2, 16	Guánchez and Romero 1998
Jubaea chilensis (Molina) Baill.	Chile	Great Chaco	Leaves	4, 5	2, 3, 11	Grau 2006
Leopoldinia major Wallace	Brazil	ND	Leaves	1	4	Pinheiro and Balick 1987
Leopoldinia piassaba Wallace	Brazil, Colombia, Venezuela	Amazonas, Llanos savanna	Leaves, petioles	2, 4	2, 3, 5, 10	Wallace 1853, Spruce 1855, Spruce 1860, Moody 1863, Peckolt and Peckolt 1889, Cortés 1897, Dodge 1897, Goulding 1917, Rendle 1917, Dewey 1943, Kirby 1950, Lévi-Strauss 1952, Civrieux 1957, Dugand 1961, Kirby 1963, Mors and Rizzini 1966, Braun 1968a, León 1968, Schultes 1974, Kitzke and Johnson 1975, Patiño 1975, Pittier 1978, Putz 1979, Johnson 1982, Pesce 1985, Pinheiro and Balick 1987, Wessels Boer 1988, Oliveira et al.1991, Anderson and Ioris 1992, 1992, Lescure et al. 1992, Henderson 1995,

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
						Henderson et al. 1995, Guanchez and Romero 1998, Prance 1998, Crizón 2001
Leopoldinia pulcra Mart.	Brazil	Amazonas	Stem	5	2	Peckolt and Peckolt 1889
Lepidocaryum tenue Mart.	Colombia	Amazonas	Stem	5	2	Henderson 1995
Manicaria saccifera Gaertn.	Brazil, Colombia, Venezuela	Amazonas, Llanos savanna, Pacific	Spathe	3	1, 4, 10, 11	Wallace 1853, Moody 1863, Dodge 1897, Dugand 1961, Braun 1968b, Patiño 1975, Duke 1977, Wilbert 1980, Oliveira et al. 1991, Henderson 1995
Mauritia carana Wallace	Brazil, Colombia, Peru, Venezuela	Amazonas	Leaves		3	Henderson et al. 1995
Mauritia flexuosa L.f.	Brazil, Colombia, Ecuador, Guyana, Peru, Surinam, Venezuela	Amazonas, Cerrado, Llanos savanna, Pacific	Leaves, petioles, spear leaves	1, 2	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15	Wallace 1853, Moody 1863, Squier 1863, Im Thurn 1883, Peckolt and Peckolt 1889, Dodge 1897, Fejos 1943, Acosta-Solis 1952, Lévi-Strauss 1952, Perez Arbelaez 1956, Dugand 1961, Moses 1962, Ramia 1962, Mors and Rizzini 1966, Suárez 1966, Braun 1968b, Suárez 1968, Calvacante 1977, Schultes 1977, Balick 1979, Bodley and Benson 1979, Johnson 1982, Hoyos and Braun 1984, Pesce 1985, Pinheiro and Balick 1987, Balick 1988, Mejía 1988, Oliveira et al. 1991, Anderson and Ioris 1992, Galeano 1992, Gragson 1992, Milliken et al. 1992, Henderson et al. 1995, Chávez 1996, Guánchez and Romero 1998, López et al. 1998, Prance 1998, Hiraoka 1999, von Andel 2000, Macía 2004, Oliveira et al. 2006, Sousa and Sousa 2007, Sampaio et al. 2008, Santana et al. 2008, Saraiva 2009, Oening 2010, González 2011
Mauritiella aculeata (Kunth) Burret	Brazil, Venezuela	Llanos savanna	Leaves	1, 2	5, 6, 9, 10, 11	Pinheiro and Balick 1987, Gragson 1992
Mauritiella armata (Mart.) Burret	Bolivia, Brazil, Colombia, Ecuador, Peru, Venezuela	Amazonas	Leaves	1, 5	2, 4	Pinheiro and Balick 1987, Henderson 1995
Oenocarpus bacaba Mart.	Brazil	Amazonas, Llanos savanna	Leaves	1, 2	1, 5, 6	Dodge 1897, Prance and Silva 1975, Pinheiro and Balick 1987
Oenocarpus bataua Mart.	Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, Venezuela	Amazonas, Andes, Llanos savanna	Leaves, petioles, spear leaves	1, 5	1, 2, 3, 4, 6, 11, 14	Beckerman 1977, Anderson 1978, Balick 1980, Hoyos and Braun 1984, Galeano 1992, Milliken et al. 1992, Borchsenius et al. 1998, Cerón and Montalvo-Ayala 1998, von Andel 2000, Byg 2002, Campos and Ehringhaus 2003, Byg and Balslev 2004, Macía 2004, Sánchez et al. 2005, Borchsenius and Moraes 2006, Sonowska et al. 2009

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Oenocarpus distichus Mart.	Brazil	Cerrado	Leaves, spear leaves	1, 2	1, 2, 6	Pinheiro and Balick 1987, Balick 1988
Oenocarpus minor Mart.	Brazil, Bolivia, Colombia, Ecuador, Peru, Venezuela	Amazonas, Pacific	Leaves, petioles, spear leaves	2, 5	2, 10, 11, 15	Barfod and Balslev 1988, Mejía 1988, Balslev and Moraes 1989, Henderson et al. 1995, Barfod and Kvist 1996, Borchsenius et al. 1998, García et al. 2001, Byg 2002, Campos and Ehringhaus 2003, Macía 2004
Parajubaea sunkha M.Moraes	Bolivia, Ecuador	Andes	Leaves, spear leaves	1, 5	2, 5, 6, 11	Moraes 1996, Moraes 1998, Moraes 2004, Borchsenius and Moraes 2006, Macía 2006
Parajubaea torallyi (Mart.) Burret	Bolivia	Andes	Leaves, spear leaves, stem	1, 2, 5	2, 5, 6, 8, 11, 15	Balslev and Moraes 1989, Vargas 1994, Henderson et al. 1995, Moraes 1996, Macía 2006, Thompson et al. 2009
Pholidostachys synanthera (Mart.) H.E.Moore	Brazil	Amazonas	Leaves	5	2	Peckolt and Peckolt 1889
Phytelephas aequatorialis Spruce	Ecuador	Amazonas, Pacific	Petiole, spear leaves	4, 5	2, 3, 4	Acosta-Solis 1952, Barfod 1991, Borgtofot Pedersen and Balslev 1992, van den Eynden et al. 2004
Phytelephas macrocarpa Ruiz and Pav.	Brazil, Bolivia, Peru	Amazon	Leaves, petioles	4, 5	2, 3, 6, 11	Spruce 1860, Campos and Ehringhaus 2003, Moraes 2004, Sonowska et al. 2009
Phytelephas tenuicaulis (Barfod) A.J.Hend.	Ecuador	Amazonas	Leaves	5	2	Macía 2004
Prestoea acuminata (Willd.) H.E.Moore	Ecuador	Andes	Spear leaves		54, 10, 11	Acosta-Solis 1952
Prestoea ensiformis (Ruiz and Pav.) H.E.Moore	Ecuador	Amazonas	Petiole	1, 5	2, 4	Byg 2002, Byg and Balslev 2004
Prestoea schultzeana (Burret) H.E.Moore	Ecuador	Amazonas	Leaves	1, 4	3, 5, 16	Bennett et al. 2002
Raphia taedigera (Mart.) Mart.	Brazil, Colombia	Amazonas, Pacific	Petiole	2, 5	1, 2, 5, 8, 10, 13, 16	Wallace 1853, Dodge 1897, Patiño 1975, Oliveira et al. 1991, Henderson 1995, Henderson et al. 1995
Roystonea oleracea (Jacq.) O.F.Cook	Colombia, Guyanas, Venezuela	Llanos savanna	Leaves	1	5	Patiño 1975
Syagrus botryophora (Mart.) Mart.	Brazil	ND	Leaves	1, 5	2	Peckolt and Peckolt 1889, Pinheiro and Balick 1987

Appendix 1: Contd...

Species	*Countries*	*Geographic region*	*Fiber origin*	*Fiber type*	*Objects manufactured*	*References*
Syagrus coronata (Mart.) Becc.	Brazil	Mata Atlantica	Leaves, Spear leaves	1, 2, 5	1, 2, 3, 4, 5, 9, 10, 11, 15	Peckolt and Peckolt 1889, Howes 1940, Bondar 1942b, Pinheiro and Balick 1987, Crepaldi et al. 2004, Antunes 2006, Lima et al. 2008
Syagrus inajai (Spruce) Becc.	Brazil	ND	Leaves	1	9, 11	Peckolt and Peckolt 1889
Syagrus petraea (Mart.) Becc.	Brazil, Bolivia, Paraguay	Caatinga, Cerrado, Mata Atlantica	Leaves	5	2, 3, 9	Peckolt and Peckolt 1889, Pinheiro and Balick 1987, Henderson et al. 1995
Syagrus pleioclada Burret	Brazil	Mata Atlantica	Leaves	4	3	Henderson et al. 1995
Syagrus pseudococos (Raddi) Glassman	Brazil	ND	Spear leaves		1, 2 10	Pinheiro and Balick 1987
Syagrus romanzoffiana (Cham.) Glassman	Argentina, Brazil, Paraguay, Uruguay	Great Chaco	Leaves, spear leaves	1, 2, 5	2, 4, 5, 6, 11	Peckolt and Peckolt 1889, Dawson and Gancedo 1977, Pinheiro and Balick 1987, Baleé 1992, Keller 2009
Syagrus vagans (Bondar) A.D.Hawkes	Brazil	Mata Atlantica	Leaves	5	10	Henderson et al. 1995
Syagrus werder-mannii Burret	Brazil	Mata Atlantica	Leaves	4, 5	3, 15	Henderson et al. 1995
Syagrus yatay (Mart.) Glassman	Brazil, Argentina, Paraguay	Great Chaco	Leaves	2, 5	2, 10	Pinheiro and Balick 1987
Trithrinax brasiliensis Mart.	Argentina, Brazil, Bolivia, Uruguay	Great Chaco, Mata Atlantica	Leaves, petiole, spear leaves	1, 4, 5	3, 4, 5, 6, 10	Peckolt and Peckolt 1889, Dodge 1897, Pinheiro and Balick 1987, Balslev and Moraes 1989, Henderson et al. 1995
Trithrinax campestris (Burmeist.) Drude and Griseb.	Argentina, Brazil, Bolivia, Paraguay,	Andes, Great Chaco	Leaves, spear leaves	5	1, 2, 6, 10	Dodge 1897, Henderson et al. 1995, Moraes 2004
Welfia regia H.Wendl.	Colombia	Pacific	Spear leaves	4	3	Bernal and Galeano 1993
Wettinia maynensis Spruce	Ecuador	Amazonas	Leaves	4	3	Byg 2002, Byg and Balslev 2004