Geobotany Studies
Basics, Methods and Case Studies

Nigel Smith

Palms and People in the Amazon

Springer

Geobotany Studies

Basics, Methods and Case Studies

More information about this series at
http://www.springer.com/series/10526

About the Series

The series includes outstanding monographs and collections of papers on a given topic in the following fields: Phytogeography, Phytosociology, Plant Community Ecology, Biocoenology, Vegetation Science, Eco-informatics, Landscape Ecology, Vegetation Mapping, Plant Conservation Biology and Plant Diversity. Contributions are expected to reflect the latest theoretical and methodological developments or to present new applications at large spatial or temporal scales that could reinforce our understanding of ecological processes acting at the phytocoenosis and vegetation landscape level. Case studies based on large data sets are also considered, provided they support habitat classification refinement, plant diversity conservation or vegetation change prediction. Geobotany Studies: Basics, Methods and Case Studies is the successor to Braun-Blanquetia published by the University of Camerino between 1984 and 2011 with cooperation of Station Internationale de Phytosociologie (Bailleul-France) and Dipartimento di Botanica ed Ecologia (Université de Camerino - Italia) and under the aegis of Societé Amicale Francophone de Phytosociologie, Societé Francaise de Phytosociologie, Rheinold Tuexen Gesellschaft and the Eastern Alpine and Dinaric Society for Vegetation Ecology. This series aims to promote the expansion, evolution and application of the invaluable scientific legacy of the Braun-Blanquetia school.

Nigel Smith

Palms and People in the Amazon

Springer

Nigel Smith
Department of Geography
University of Florida
Gainesville, FL
USA

ISSN 2198-2562 ISSN 2198-2570 (electronic)
ISBN 978-3-319-05508-4 ISBN 978-3-319-05509-1 (eBook)
DOI 10.1007/978-3-319-05509-1
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014948187

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

To the memory of Hilgard O'Reilly Sternberg (1915–2011)
Brazilian geographer, mentor, and inspiring teacher who introduced me to the Amazon in 1970 during a summer field course

Preface

I have undertaken field work in the Amazon since 1970. Most of the field work has been conducted in the Brazilian portion of the basin, but I have also visited parts of Amazonia in Peru, Bolivia, and Venezuela. The Amazon Basin is vast, so this ethnobotanical survey of palms is by no means exhaustive. And my field work has been mostly with rural people of mixed ancestry, or who no longer speak any native language. I have only visited a few indigenous groups – the Assurini at Posto Trocara along the lower Tocantins, a few families of Saterê-Maué living outside their reserve in the watershed of the Maués, Shipibo villages at San Francisco and Nueva Cajamarca along the Ucayali visits to several Tukano and Tuyuka communities along the Uaupés and Tiquié Rivers, and a couple of Kichwa communities along the Alto Pastaza in Ecuador – and then only for brief periods. For information on the use of palms by indigenous peoples, I have therefore relied heavily on published sources. Appendix 2 lists indigenous groups mentioned in the text and summarizes their locations.

I have not had a research project to specifically study the ethnobotany of palms. Rather I have made field notes and taken photographs of palms during the course of other research endeavors stretching over four decades. A large number of organizations have funded my field work in Amazonia or provided logistical support since 1970 which enabled me to gain an appreciation for the importance of palms in the lives of rural people. The list of organizations that have funded or provided logistical support for my field work in Amazonia includes, in chronological order: The Center for Latin American Studies, University of California, Berkeley; Museu Paraense Emílio Goeldi, Belém; Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus; Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Belém, Macapá, and Manaus; World Bank Research Committee; the John D. and Catherine T. MacArthur Foundation; the Gordon and Betty Moore Foundation; the National Geographic Research Committee; ProNaturaleza, Lima and Iquitos, Peru; Instituto Mamirauá in Tefé; Instituto Socioambiental in São Paulo and São Gabriel da Cachoeira; and the Fulbright Council for International Exchange of Scholars. My findings and opinions expressed in this book are my own, however, and are not necessarily endorsed by any of the above organizations.

For years, Andrew Henderson of the Institute for Economic Botany at the New York Botanical Garden has helped me sort out the identity of some Amazonian palms based on my photographs as well as to better understand their distributions and habitats. Voucher specimens were collected for only a few of the palms examined here because it can be difficult and very time consuming to obtain authorizations to obtain biological specimens. I did, however, receive authorization to obtain plant specimens in the Peruvian Amazon with the collaboration of Rodolfo Vásquez (Appendix 1). Rodolfo Vásquez, a Peruvian plant taxonomist, accompanied me in the field and sent one of his assistants on several trips I made to the Pacaya-Samiria National Reserve in Loreto, Peru, and his help was indispensable in identifying of some of the lesser known palms of the region.

The taxonomy of palms, as with many other botanical families, is periodically revised and some genera of palms I was familiar with during the early days of my field work, such as *Orbygnia* and *Scheelea*, are no longer recognized. Plant taxonomists usually make few if any ethnobotanical observations when they gather specimens for herbaria, and few ethnobotanists or ethnographers working in Amazonia systematically gather voucher specimens. While reading informative ethnographies I was often frustrated when turning to a page with a spectacular photograph of a communal house (*maloca*) thatched with palm fronds only to discover that the authors do not even mention the common name of the palm used for thatch, let alone give the scientific name.

Several individuals have helped me arrange field trips in Amazonia, or have taken the trouble to read parts of this manuscript. In Brazil, Eduardo Neves at the Museum of Archaeology and Ethnography at the University of São Paulo was a valued colleague and counterpart during my four month Fulbright Award in Brazil in 2012. Dr. Neves kindly invited me to visit the archaeology field school near Tefé which was ably administered by one of his students, Jacqueline Belletti. Jacqueline helped me organize several field excursions in the Tefé area. Angela Steward and her husband Rafael Santos at the Instituto Mamirauá did the same for me in the Tefé region in 2012. Helena Lima of the Museu Paraense Emilio Goeldi and her husband Bruno Moraes introduced me to the fascinating prehistory of the Urubu River where I visited various archaeological sites with them in 2010 and 2012. Carlos Durigan of the Fundação Vitoria Regia in Manaus kindly organized and accompanied me on a field trip to the Jaú National Park along the lower Rio Negro in 2012. Pieter van der Veld of the Instituto Socioambiental invited me to spend 3 weeks in the Upper Rio Negro region, mainly along the Tiquié River, a wonderful opportunity for me to learn some of the culture of the Tuyuka and Tukano. Charles Clement of the Instituto Nacional de Pesquisas da Amazonia (INPA) in Manaus kindly commented on a draft of the peach palm chapter.

In Peru, Walter Wust, a Peruvian naturalist and superb photographer helped organize numerous field trips to the Andes and Amazon region during the 2003–2006 period. I learned much from his photographic expertise. Professor Augusto Oyuela-Caycedo of the Anthropology Department at the University of Florida graciously invited me to participate in a reconnaissance of the northern part of the Pacaya-Samiria National Reserve in Loreto in 2010 and also allowed me to borrow many books from his extensive collection of ethnographic literature on Amazonia.

In Bolivia, Lois "Lucho" Jammes, a French bush pilot, flew me several thousand kilometers over many parts of the Bolivian Amazon in 2005 in his canvas-bodied, single-engined plane that had a window I could open for unobstructed shots. His many contacts at landing strips and towns in the region were enormously helpful.

In Ecuador, I am particularly grateful to Stéphen Rostain of the Instituto Francés de Estudios Andinos for helping arrange a field trip for me in September 2013 to the Alto Pastaza where I was ably assisted by his Ecuadorian colleague Carlos Duche.

I would also like to thank Cicero Cardoso Augusto, Coordinator of the Geoprocessing Department at the Instituto Sociambiental (ISA) in São Paulo, Brazil, for providing the map of the Amazon Basin.

Gainesville, FL, USA — Nigel Smith

Contents

Palms and Cultural Landscapes

1

Palms are ubiquitous in Amazonia, in both upland and floodplain environments. Approximately 150 palm species are native to the region, and palm diversity increases as one approaches the Andes (Balslev et al. 2011; Kahn et al. 1988; Kristiansen et al. 2011). However, new palms species have recently been discovered and described, especially in the genus *Geonoma*, a diminutive palm used extensively to thatch buildings, so the total is likely to be much higher.

The cultural uses of 56 palm species are reviewed here, but this survey is by no means exhaustive. In the rainforests of northwestern South America, at least 194 palm species are used (Macía et al. 2011). Of the 98 palms native to the American tropics that are found in the Colombian Amazon, 77 have at least one recorded use (Mesa 2011: 18). And in just two watersheds in the foothills of the Andes in western Amazonia, the Pastaza and Madidi, some 38 palms have 38 different uses (Paniagua-Zambrana et al. 2007). At least half of the palms found in Amazonia are probably exploited to varying degrees. Although I focus on Amazonia, mention is also made of the uses of palms that also occur in the Orinoco Basin and the Guianas.

Of all the plant families represented in the diverse habitats of the Amazon, palms are arguably the most important economically and culturally. Indeed, in the Uaupés watershed in northwestern Amazonia, palm fruits are second only to manioc as a source of food for indigenous people (Reichel-Dolmatoff 1997: 281). In addition, many other palms provide materials for construction, handicrafts, hunting gear, and folk medicines. Several palms in Amazonia have more than a dozen uses. The fruits of several dozen palm species are consumed regularly in rural areas and some of them are also sold in urban markets, regionally, nationally, and even internationally.

Palms are a conspicuous feature of Amazonian landscapes, whether one is traveling along rivers, highways, or traversing immense savannas. Palms are among the most common trees found in many environments in Amazonia and the Guianas (Steege et al. 2013). Indeed, palms are so numerous that outside visitors to the region have often remarked on their beauty and bounty. During the

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_1

mid-eighteenth century, João Daniel, a Jesuit missionary and a keen observer of natural history and people's customs, was impressed with the splendor of palms he observed during his 16 year sojourn in the Brazilian Amazon:

> Among the most admirable trees in the vast forests of the Amazon, and indeed in all of the Americas, are the palms and for this reason merit the applause of us all (Daniel 2004: 513)

The American naturalist, Herbert Smith, a student of the renowned geologist C. F. Hartt, made two trips to the Brazilian Amazon in the 1870s and was particularly impressed with the quantity, diversity, and splendor of palms in the Amazon estuary:

> straight up from the water the forest rises like a wall–dense, dark, impenetrable, a hundred feet of leafy splendor. And breaking out everywhere from the heaped up masses are the palm-trees by thousands. For here the palms hold court; nowhere else on the broad earth is their glory unveiled as we see it (Smith 1879: 81).

Nikolai Vavilov, the boundless Russian plant explorer, crop breeder and biogeographer, was so impressed with the abundance of palms during his visit to the eastern Amazon in 1933 that he remarked "But most amazing are the banks of the Amazon with their splendid vegetation and, most of all, the variety of palms. This is, in the fullest sense of the word, a kingdom of palms" (Vavilov 1997: 142).

Nineteenth century explorers and naturalists noticed not only the prominence of palms but their cultural significance as well. For example, Clements Markham, a geographer who explored the headwaters of several affluents of the Amazon, made the following observation in the Tambopata river valley, an affluent of the Upper Purus: "There is a great variety of palm-trees some useful from the hardness and excellence of their timber, others from their leaves, others from their edible fruits, and all remarkable for their grace and beauty" (Markham 1861). Alfred Russel Wallace, a Victorian naturalist who was hot on the trail of Darwin regarding ideas about the origin of species, also remarked on the prominence of palms in the natural history and lifeways of the Amazon. Best known for his classic works *The Malay Archipelago* and *A Narrative of Travels on the Amazon and Rio Negro,* Wallace also devoted an entire book to Amazonian palms and their cultural importance: *Palm Trees of the Amazon and Their Uses*. In this rare work in which several new species are described, Wallace captures eloquently the intimate relationship between people and palms in the Amazon:

> Suppose then we visit an Indian cottage on the banks of the Rio Negro, a great tributary of the river Amazon in South America. The main supports of the building are trunks of some forest tree of heavy and durable wood, but the light rafters are formed by the straight cylindrical and uniform stems of the Jará palm. The roof is thatched with large triangular leaves, neatly arranged in regular alternate rows, and bound to the rafters with sipós or forest creepers; the leaves are those of the Caraná palm. The door of the house is a framework of thin hard strips of wood neatly thatched over; it is made of the split stems of the Pashiúba palm. In one corner stands a heavy harpoon for catching the cow-fish; it is formed of the black wood of the Pashiúba barriguda. (Wallace 1853: 9–10).

Wallace goes on to describe uses of ten other palm species for such items as blowguns, presses for manioc dough, drinks, and fresh fruit for eating. And today, it is still common to find the products of half a dozen wetland palms in the homes of river dwellers.

Mauritia palm (*Mauritia flexuosa*) and açaí (*Euterpe oleracea*) are the two most valuable species of wild fruits in Amazonia with respect to nutrition and trade. Mauritia palm stands out as the single most important wild fruit in western Amazonia both in terms of food and the creation of jobs, whereas açaí is the most valuable palm at the mouth of the Amazon. But many other palms, although not so prominent in commerce, still play a vital role in the lives of millions of people in the Amazon and other parts of northern South America, both in rural areas and in towns and cities (Balslev 2011). Palm fruits also contribute indirectly to the diet of rural and urban folk through fish and game animals that eat the fruits. For example, collared peccaries (*Pecari tajacu*) and white-lipped peccaries (*Tayassu pecari*), among the most important game animals in Amazonia, feed on 25 and 37 palm species, respectively (Beck 2006).

Wetland palms with edible fruits, such as Mauritia palm, açaí, and yarina (*Phytelephas macrocarpa*), frequently form extensive groves, thus providing abundant harvests. Locals have even coined terms for these productive palm swamps. In Peru, for example, aguaje (*Mauritia flexuosa*) groves are called *aguajal*, whereas in Brazil, stands of the palm are known as *buritizal* or *miritizal*. Açaí groves are called *açaízal* in Brazil, whereas yarina stands in Peru are called *yarinales*. Some of these immense "orchards" owe their existence in whole or part to human agency. Of the 500 or so palm species in South America, locals manage at least 96 of them (Bernal et al. 2011). How many palms species are managed by rural people in the Amazon is not known, but it must be in the dozens. Many of the species profiled here are under some degree of management by rural inhabitants.

People have been rearranging the biological furniture in Amazonia for a very long time (Balée 2010a, 2013). When people first entered the region is not known, but the first human footprints were surely made at least 20,000 years ago. Foraging bands probably began dispersing across South America during the late Pleistocene between 23,000 and 12,000 years ago (Ab'Sáber 2001). Groups of hunters and gatherers likely penetrated Amazonia from various directions, both along water courses, through the forest, and by walking across savannas because the climate was drier during the Pleistocene. It is possible that humans were in the Amazon Basin even before 23,000 years ago; C14 dates from caves in Chile and Northeastern Brazil suggest people had spread widely in South America some 33,000 years ago (Dillehay and Collins 1988). Although some contest those earlier dates, it is quite possible that people had settled in Amazonia tens of thousands of years ago. And palms were surely useful to those early hunters and gatherers as a source of food, weapons, and fronds for creating lean-to shelters.

Many of early inhabitants of the Amazon arrived when sea levels were lower because so much water was tied up in giant ice sheets in more northerly and southerly latitudes. Some, if not most, of their camps and shell mounds were downed when the ice sheets retreated at the close of the last ice age. Sea level off the coast of Brazil only reached its present level some 5,000 years ago (Ab'Sáber 2001). As the sea level began rising at the close of the Pleistocene, the Amazon was backed up forming a vast floodplain, and the same happened to the lower courses of its tributaries. So evidence of settlement by hunters and gatherers along the rivers of Amazonia has been largely lost.

These early inhabitants may have been small in numbers, but they nevertheless began altering the landscape by enriching campsites and trails with useful species, especially fruit and nut trees. And hunters and gatherers torched savannas to facilitate hunting. Then as people started cultivating crops, landscape changes were even more dramatic as large areas were transformed into a mosaic of secondary forest in various stages of succession. Many of the fallows were managed to obtain useful products long after annual crops were harvested.

The fingerprints of such activity often persevere, even when the cultural group that wrought such changes has since moved on or disappeared. Palms are particularly conspicuous in this regard (Balée 1988; Goulding and Smith 2007). Stands of several palms, such as *Euterpe oleracea*, *Astrocaryum vulgare* and *Mauritia flexuosa* are often indicators of abandoned settlements (Lisboa 1997). Dramatic evidence of such changes can be seen in the extensive patches of anthropogenic soils, ridged fields, and orchards of economic plants. Amazonian Dark Earths (ADE), known as *terra preta do índio* in Brazil, are the former sites of indigenous settlements and typically contain pottery or potsherds and often lithic materials as well (Balée 1993: 148; Lehmann et al. 2003; Smith 1980; Woods et al. 2009). Many such sites are located in the Central Amazon, along the Amazon River and its tributaries (Heckenberger et al. 1999; Heckenberger and Neves 2009; Neves 2007; Neves and Peterson 2006), but they are also found in inland areas all over the basin (Kern et al. 2003; Schmidt et al. 2014).

As the forest is peeled back by the expanding agricultural frontier in Amazonia and more archaeologists are fanning out into hitherto remote areas, increasing numbers of ADE sites are being unmasked. ADE sites contain soil darkened with charcoal from house fires and are rich in nutrients, particularly phosphorus, through the disposal of kitchen and human waste. Several economic plants are considered indicator species of ADE sites, including such palms as bacaba (*Oenocarpus bacaba*), caiaué (*Elaeis oleifera*), mucajá (*Acrocomia aculeata*), inajá (*Attalea maripa*), murumuru (*Astrocaryum murumuru*), patauá (*Oenocarpus bataua*), tucumã (*Astrocaryum aculeatum*, *A. vulgare*), and urucuri (*Attalea phalerata*).

In addition to dark earth, other vestiges of Amerindian occupation are found in many parts of the Amazon, including raised fields and geoglyphs (Rostain 2013: 6; Saunaluoma 2012; Saunaluoma and Schaan 2012; Schaan 2010; Schaan et al. 2012). Some of the engineered landscapes are occupied by useful palms. The Amazon, then, is far from virgin.

At the mouth of the Amazon, palms are also prominent on mounds in the savannas that cover much of the eastern half of Marajó Island. Some of these mounds are relic sand dunes, or have formed by other natural means such as the banks of abandoned water courses. Others, though, are artificial, made by indigenous peoples in the past. Tucumã (*Astrocaryum vulgare*), marajá (*Bactris major*), jacitara (*Desmoncus polyacanthos*), and urucuri (*Attalea phalerata*), are among the palms found on mounds (*tesos*) on Marajó, and all of them have economic uses from fruit to fiber (Miranda 1903). It thus seems likely that the woods on such mounds are at least partially anthropogenic. Another clue to the man-made origins of the vegetation on such mounds is that they contain other fruit-bearing plants that are useful to rural inhabitants of the island today (Smith 2002).

Landscape transformation is brought about deliberately and inadvertently. Deliberate re-arranging of the vegetation includes planting the seeds of useful wild plants around settlements and in cultivated fields. As those fields, villages, and home sites are abandoned the forest returns, but it is not the same as before. It has been enriched with useful species. Palms are prominent in this process, particularly *Mauritia flexuosa*, *Euterpe oleracea*, and *E. precatoria*.

Another way that humans have increased the abundance of palms in some areas is through fire. Several palms, including babaçu (*Attalea speciosa*), tucumã (*Astrocaryum aculeatum* and *A. vulgare*), and mucajá (*Acrocomia aculeata*) tolerate fire and because many rural people practice slash-and-burn agriculture such species often proliferate. It so happens that fire-tolerant palms also provide a variety of useful products from fruit or nuts to twine and thatch. So although they are "weedy", they are not necessarily a nuisance. When Amazonia experienced a drier climate during the mid-Holocene (8,000–4,000 years ago), some of the forest was replaced by sun-loving species of *Cecropia*, suggesting that people cleared patches of remnant forests to plant crops and torched savannas to drive game (Mayle and Power 2008).

Many areas of the Amazon may appear "pristine", but they are actually old regrowth forests or mosaics of orchards within a forest matrix. Diseases introduced by Europeans wiped out at least 95 % of the indigenous population of the lowland Neotropics by 1650; the recovering forests acted as a significant carbon sink, contributing to the Little Ice Age that struck Europe between 1550 and 1750 (Dull et al. 2010).

Forest islands found in some savannas in Amazonia have been created by people in pre-Columbian times and this process continues today. In the Llanos de Moxos in Bolivia, for example, indigenous cultures created extensive earthworks such as causeways and mounds for planting crops and to provide dry land for their villages which have subsequently been colonized by forest (Mayle et al. 2007). And in the transition zone between forest and savanna in the Upper Xingu and Tocantins, the Kayapó are still creating patches of forest in grasslands that are stocked with useful trees and bushes (Anderson and Posey 1985; Posey 1983). Forests in other parts of the American tropics have also been re-assembled by different groups of people over an extended period of time. In the Sierra Nevada de Santa Marta in northern Colombia, for example, the woods cloaking some of the slopes and ridges have been characterized as an "archaeological forest" (Oyuela-Caycedo 2010). And a Venezuelan anthropologist considers indigenous peoples of the Orinoco and Guiana highlands as "agents for creative disturbance", rather than destroyers of the environment (Zent and Zent 2004).

For some time, the prevailing idea among ecologists has been that people degrade the rainforest whenever they start living there, reducing its biodiversity and even driving some plants and animals to the brink of extinction (Terborgh

2004). Few would deny that some of today's land use activities in the region, such as clearing forest for large-scale cattle and soybean operations and the construction of hydro-electric dams on major rivers, have destroyed vast tracts of forest. And the setting aside of some parts of the Amazon Basin for ecological or biological reserves is certainly warranted. Yet the earlier inhabitants of the region did not trigger such large-scale destruction; rather they enhanced biodiversity, as has been documented in eastern Amazonia (Balée 1993, 1998; Posey 1998). Many of today's megaprojects are actually riding roughshod over revamped landscapes crafted to enhance the sustainability of food producing systems. And these are not just relict landscapes, an echo of the past creativity of long-disappeared chiefdoms. The sculpturing of nature is still going on, and Amazonian palms are testament to that creative process.

How much of Amazonia's forests are anthropogenic is not known. But judging by the large number of chiefdoms in the region at the time of contact with Europeans, it is large (Cleary 2001). And people, both indigenous and mestizos, continue to alter the forest and other vegetation in the region. The archaeologist Michael Heckenberger, who has helped elucidate the prehistory of the Upper Xingu, captures this idea succinctly: "The Xinguano landscape is a fully "saturated" anthropogenic landscape, with virtually no place that is not touched and molded by human hands" (Heckenberger 2005: 251). A growing number of scholars familiar with the historical ecology of Amazonia consider many of the landscapes in Amazonia as domesticated (Clement and Junqueira 2010; Erickson 2006). One archaeologist has coined the expression "domestication of landscape" when speaking of Amazonia (Erickson 2008), while another has posited the question "Pristine forests or cultural parkland?" (Heckenberger et al. 2003).

The notion that large areas of Amazonia are cultural artifacts of past and present human activities may seem a little odd, but it is by no means unique. Landscapes in other regions, both temperate and tropical, have been shaped to varying degrees by people. Aborigines in Australia managed landscapes through the selective use of fire and transplanting in tropical, subtropical, and temperate parts of the country (Gammage 2011: 3). When I was a college student at Berkeley, I was awestruck by Ansel Adams' stunning photographs of Yosemite Valley in California which he took in 1924. I thought they were the very epitome of what wilderness was, or should be. I was influenced no doubt by the writings also of John Muir describing his forays into the Sierra Nevada Mountains, including Yosemite. But then I learned that native peoples had been setting fires on the floor of Yosemite Valley for a long time and that the landscapes that Adams had photographed were in fact partly cultural.

Research on cultural forests and engineered landscapes in Amazonia has revealed the hand of man on the region's vegetation in a wide array of habitats from upland forests to seasonally flooded savannas all across the region from Ecuador (Rival 1998), to the Rio Negro watershed (Alarcón and Peixoto 2008; Guix 2005), the Upper Xingu (Posey 1998; Heckenberger 2005), the Amazon estuary (Anderson et al. 1995; Muñiz-Miret et al. 1996; Weinstein and Moegenburg 2004), to the eastern fringes of the Amazon rainforest (Balée 1989, 1993; Balée and

Gély 1989). Palms are found in most upland and wetland environments, and their numbers, densities, and distributions have often been altered by human agency.

Palms are so useful in Amazonia that several species are in various stages of recruitment as cultivated crops. Peach palm (*Bactris gasipaes*) emerged as a fully-fledged crop long before the arrival of Europeans in the New World, but others are well on their way to becoming crops, including *Mauritia flexuosa* and *Euterpe oleracea*. Plant domestication is a process that may start with the sparing of trees during land clearing and progress to the care of spontaneous seedlings in home gardens and fields, and ultimately the deliberate planting of seeds and selection of desirable varieties. Then there are "camp followers" that arise, often in groves, as a result of fire; such plants are not deliberately cared for, but thrive on their own because of the altered conditions created by humans.

A number of different frameworks for analyzing plant domestication have been proposed with varying degrees of complexity (Pickersgill 1969; Rindos 1984; Ucko and Dimbleby 1969). Some classifications only consider a plant as domesticated when deliberate breeding has occurred, that is altering the genotype as well as the phenotype. Others consider a plant domesticated if it is simply cultivated. Furthermore, plant domestication is often seen as a linear progression from a wild plant to a fully domesticated crop with various stages in between.

In many parts of Amazonia, however, some fruit trees, including several palms, appear to have fallen in and out of "domestication" as settlement sites have been abandoned. The late Claude Lévi-Strauss captured this state of affairs in his usual eloquent prose: "It is not always easy to distinguish between wild and cultivated plants in South America, for there are many intermediate stages between the utilization of plants in their wild state and their true cultivation" (Lévi-Strauss 1952). And a century ago, the Swiss-Brazilian Jacques Huber, a botanists who worked out of the Goeldi Museum in Belém, declared that in Amazonia especially it can be hard to designate a fruit tree as truly wild since so many are at various points along a transition from wild to domesticated (Huber 1904).

Many of the early classifications of plant domestication were based on research on temperate crops, particularly cereals. Two classifications have been developed by scientists working in tropical America. In his studies of plants in Mexico, Robert Bye (1993) considers three broad categories: *gathering* (plant products that are simply collected in the wild), *incipient domestication (*minor tending to plants that arise spontaneously as a result of human activity), and a*gricultural domestication* (farming that involves the creation of fields and selection of varieties). Charles Clement and collaborators (Clement 1999; Clement et al. 2010), working out of the central Amazon, propose a more fine-tuned classification: *wild*; *incidentally co-evolved* (which encompasses plants that exploit areas disturbed by humans); *incipiently domesticated* (modest selection but phenotypes still within the range found in wild populations); *semi-domesticated* (significant modification by human selection through management); and *domesticated* (crop with reduced genetic variability which can only survive in human-created environments).

However, the term "domestication" can be problematic. Charles Clement, an agronomist who works at the National Institute for Amazonian Research (INPA) in

Manus splits the hair into incipient domestication, semi-domesticated, and domesticated. Peter Bellwood, an Australian archaeologist, argues that domesticated plants that are found at archaeological sites have some recognizable degree of phenotypic change from the wild type, but that does not imply that the plant cannot survive without human intervention (Bellwood 2005: 13).

While the work of Bellwood, Bye, and Clement has helped sharpen thinking on the manner in which people incorporate plants into their cultures, I am going to adopt a different, perhaps more flexible taxonomy of plant domestication. *Wild* palms are those in which little or no human intervention in their location or density is obvious. Palms that are *spontaneous in cultural settings* include species that are favored by fire, or whose seeds are dispersed by animals or humans. In the latter case, people often toss seeds on the ground after eating the fruit, and some of them sprout. Birds and mammals often disperse certain palms seeds into clearings in the forest where crops are grown, either in fields or home gardens. The final category I am going to use is simply *planted*. Palms that are planted include those for which large fruit forms have been selected over time, such as peach palm (*Bactris gasipaes*) and those that are simply planted with no apparent selection of varieties. Interestingly, the Achuar of the Ecuadorian Amazon classify all plants, other than weeds, growing in their fields as *aramu* (that which is planted in the earth). That encompasses seeds and seedlings, including palms, brought from the forest (Descola 2013: 15).

The fruits of some palms in the Amazon are gathered in the wild, from trees that have arisen spontaneously in fields, as well as from trees planted in home gardens. I have discarded the term incipient domestication because it implies that a plant is on course to full domestication when many of the fruit trees in Amazonia never seem to proceed to planting and selection of new genotypes. I also avoid the term domestication because it can mean different things to different people; for some it implies selection of varieties and many mean that the plant has become wholly dependent on people for propagation.

Carl Sauer (1952) was one of the first scholars to suggest that crop domestication occurred in the tropics earlier than temperate regions. In the humid tropics, fruit and nut trees have played an important role in people's diet for a long time, and many of them have entered the domestication process at various times. The significance of tree domestication has tended to be overlooked, even in the tropics. However almost a century ago, Wilson Popenoe (1920) recognized that fruit and nut trees in the Neotropics have had their distributions and characteristics changed by human agency for millennia, and these ideas reverberated in the mid to late twentieth century in the works of Seibert (1948) on rubber and its near relatives (*Hevea* spp.), and Johannessen (1966a) and Clement (1988, 1989, 1992) on peach palm (*Bactris gasipaes*).

Acrocomia aculeata

2

English: Macaw palm, grugru palm
Bolivia: Totaí; korondía (Sirionó)
Brazil: Mucajá, macaúba, coco babão, bocaiúva, côco de catarro; maka-djiup (Kayabí), roi (Kayapó), roy rak (Krahò), pinawa (Tapirapé)
Colombia: Corozo, tamaco
Paraguay: Mbocayá, coqueiro de catarro; pikáde (Ayoreo)
Venezuela: Corozo

Status: Spontaneous in cultural settings

Fig. 2.1 *Acrocomia aculeata* palm in fruit. Clusters may contain as many as 400 fruits. Santa Rosa de Yacuma, Beni, Bolivia, 5-28-05

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_2

Acrocomia aculeata has a strong affinity with humans. It is found mostly in disturbed habitats, such as second growth in forested areas or savannas that are periodically burned to promote forage for cattle. Mucajá, as the upland palm is known in the Brazilian Amazon, tolerates fire and thus often proliferates in the vicinity of villages and in abandoned fields. Also referred to as macaúba in Amazonas and Mato Grosso, *A. aculeata* is never found in mature forest. This begs the question: where is it found "naturally"? My guess is that its numbers and range expanded during dry climatic cycles in the Amazon and diminished when more humid conditions returned. And when the forest re-occupied formerly more open, drier areas, such as savannas, it was humans who opened up more space for the fire-resistant palm. Mucajá prefers areas with a pronounced dry season, such as central, eastern and southern Amazonia and its numbers have certainly increased over the last several thousand years.

This decorative palm is one of the more widespread Neotropical palms, ranging from Mexico, where it is known as coyol, south to Argentina, as well as the Antilles (Henderson 1995: 162, Zona et al. 2003). Coyol is thought to have been cultivated 7,000 years ago in the vicinity of Teotihuacan, a vast ceremonial and administrative complex in the central valley of Mexico (Tapia 1992). I saw the palm in fruit in the rain shadow area of northwestern Dominica in December 2012. Some authorities suggest that people introduced the palm into Central American from South America in precontact times (Morcote-Rios and Bernal 2001). It has been suggested that the Mayans may have been responsible for introducing the palm to various parts of Mexico and Central America (Scariot 1998), but an earlier civilization in Mexico, the Olmecs, were using the fruits at least 4,700 years BP as evidenced by the discovery of *Acrocomia aculeata* nuts in an archaeological site (Pool 2007: 74).

Fig. 2.2 Mucajá singed but not killed by a fire set on the perimeter of a village. Fire-tolerant tucumã (*Astrocaryum vulgare*) palms can be seen in second growth in the background. These palms are growing on an archaeological site. Pontão, Lake Canaçari, near Silves, Amazonas, Brazil, 9-21-10

The solitary palm has distinctive feathery fronds emanating in radial fashion. On occasion, however, the palm occurs in dense stands, such as at km 82 of the Belém-Paragominas highway, likely an artifact of human occupation of the area. Indeed, the Munduruku of the Upper Tapajós believe that groves of the palm on patches of scrub savanna in interfluvial areas of their territory were planted by their ancestors (Frikel 1978). The Munduruku were allies of the Portuguese during the colonial period and once had widely scattered settlements, such as along the Maués River where one of their villages was named Mucajá-tuba, which means the place of the mucajá palm (Agassiz and Agassiz 1896: 306). Also in the nineteenth century, the Yorkshire botanist Richard Spruce observed that mucajá palms in the interior of Pará State, Brazil, were only found in open situations near dwellings, and he considered them to have been planted (Spruce 1871). Although most *Acrocomia aculeata* are not planted, they are nevertheless “social” palms, whose lives are tightly bound to human affairs. Over a century ago, the American botanist Orator Fuller Cook considered the palm an indicator of human disturbance in Central America (Cook 1909: 12).

Fig. 2.3 Girl gathering mucajá fruits in her village. Pontão, Urubu River near Silves, Amazonas, Brazil, 10-11-12

The palm is typically spared when clearing sites for home gardens or fields, and even pasture, because cattle also relish the fruits, as near Figueirópolis in Mato Grosso, Brazil. Cattle ingest the entire fruit, later defecating the seeds and thus serving as dispersal agents for the palm (Yamashita 1997). Another reason why the palm is typically spared is because the fruits are fed to pigs, such as in the community of Lontra along the Pedreira River some 60 km northeast of Macapá, Amapá. *Acrocomia aculeata* also arises spontaneously in home gardens. When a farmer on the outskirts of San Ignacio in the Llanos de Moxos region of the Bolivian Amazon was asked how totaí (as the palm is known in Bolivia) turned up in his home garden he responded "*nasce, no mas*" (it just comes up by itself).

The round fruits, the size of small plums, are generally gathered from the ground because the trunk is adorned with slender spines. The spines of *Acrocomia aculeata* command respect, and with good reason: they can penetrate deeply into the body and break off. One 11 year-old boy in Paraguay lived for 7 years with a 6.3 cm piece of spine from the palm that had penetrated his heart; surgeons removed it successfully after he began to develop symptoms of cardiac distress (Lugones et al. 2009).

Rather than wait for the fruits to fall, boys will sometimes use catapults to dislodge the fruits which are born in clusters some 5–10 m above ground. Fruits brought down in this manner may not be fully ripe, so they are smacked together to soften the pulp. Although most of the fruits are consumed locally, they turn up occasionally in markets, such as in Alenquer, Pará. In central, southern, and eastern Amazonia, several indigenous groups also relish the pulp, including the Jurúna of the Upper Xingu (Oliveira 1970) and the Kamayurá in Mato Gross (Oberg 1953: 17).

Fig. 2.4 Girl eating a mucajá fruit that she has gathered from the ground. Pontão, Urubu River near Silves, Amazonas, Brazil, 10-11-12

Yellow-green when ripe, the fruits are not damaged when they fall to the ground because the skin is tough and there is only a thin layer of mesocarp surrounding the single seed. Although mucajá fruits contain rather paltry amounts of pulp, they are nevertheless relished, especially by youngsters, who peel the fruits to ingest the oily pulp. Furthermore, mucajá fruits during the dry season when few other wild fruits are available. The slippery texture of *Acrocomia aculeata* fruits accounts for the common name for the palm in the eastern part of the Bragantina zone along the coast of Pará: coco babão (the drooling coconut). In some areas, such as near

Itapiranga, a small town on the north bank of the Amazon River downstream from Itacoatiara, locals make juice from the fruits. Called *vinho de mucajá*, the juice is unfermented despite its name (*vinho*), which translates as wine. In the Brazilian Amazon, many fruit juices are dubbed *vinho* even though they are not alcoholic. The Tapirapé who live in the Araguaia watershed in eastern Amazonia boil the fruits to soften the pulp which is then cooked in water to make a refreshing nut-flavored drink (Baldus 1970: 193). The Kayabí of the Upper Xingu mix the pulp with honey to make porridge (Ribeiro 1979: 122). The nut casing also finds uses in some areas. The Kayapó, for example, string the endocarps on to necklaces (González-Pérez et al. 2013).

Oil is extracted from the nut in some parts of the Amazon, and occasionally sold in markets, such as the Mercado Campesino in Trinidad, Bolivia. The kernel oil is reputed to be especially good for making soap and has properties similar to African oil palm (*Elaeis guineensis*), the latter widely planted in tropical forest regions and a cause of major deforestation in some areas (Balick 1979; Cavalcante and Johnson 1977). Large African oil plantations are found in several parts of Amazonia, including Pará state in Brazil and on the outskirts of Coca along the Napo River in Ecuador. Perhaps it might make more sense to investigate the feasibility of planting a native palm in the region to produce vegetable oil for biodiesel and other purposes. Locals in the community of Murumuru at the edge of the Amazon floodplain a few kilometers downstream from Santarém mix the oily pulp with rice to make a creamy porridge (*mingau de mucajá*).

Much of the Murumuru community is located on sizeable anthropogenic black earth (*terra preta do índio*), and mucajá palms are common on that site, formerly occupied by indigenous people. Mucajá is often associated with Amazon Dark Earth (ADE) sites in the Brazilian Amazon (Balée 1988; Hiraoka et al. 2003). I have seen the palm on numerous ADE sites particularly in villages and small towns near Santarém, such as Belterra, Juriti, and Arapixuna. The palm is also a conspicuous fixture of vegetation on ADE sites near Caxiuanã along the lower Anapú River in Pará. Mucajá is also a prominent feature of abandoned Xinguano settlements on ADE sites in the Upper Xingu (Heckenberger et al. 2007) and is a "camp follower" par excellence,

This widespread palm plays an important role in the survival of the rare blue-throated macaw (*Ara glaucogularis*). This endangered macaw eats the fruits of *Acrocomia aculeata* on forest islands in seasonally-flooded savannas on the Llanos de Moxos in the Bolivian Amazon, thereby possibly dispersing the seeds. These colorful macaws, once the target of illicit pet traders, also excavate cavities in dead *A. aculeata* palms to raise their broods (Jordan and Munn 1993). The bill of the world's largest parrot, the hyacinth macaw (*Anodorhynchus hyacinthinus*) is powerful enough to crush the endocarp and eat the nut (Bates 1863a: 133).

This useful palm surfaces occasionally in indigenous mythology. The Waurá, who inhabit an affluent of the Upper Xingu, tell the story of a tapir who lives in a lake and eats the fruits of the palm, as well as a porridge made with the cooked fruits of another palm, *Mauritia flexuosa*. The tapir eats a repast of these palm fruits before making love, including to a woman of the Mató tribe. One day, a little boy catches them in flagrante and reports his observation to the husband of the Mató woman. The cuckolded husband then ambushes the tapir to exact revenge (Schultz and Chiara 1971). Tapirs sometimes feature in amorous encounters in indigenous legends because the males have an enormous penis.

Aiphanes aculeata

3

English: Ruffle palm, coyure palm
Bolivia: Cocos rura; cajna (Tsimané)
Brazil: Pupunha, pupunha brava, chica-chica
Colombia: Mararay, corozo, cubarro
Peru: Shicashica, quindio
Venezuela: Macaguita, marará, corozo

Status: Wild, planted

Fig. 3.1 *Aiphanes aculeata* in fruit in a home garden. Puente Cumbaza, Tarapoto, San Martin, Peru, 9-1-04

This spiny palm which furnishes an edible pulp as well as savory nuts, thrives in forest along the Andean foothills from Bolivia north to the mountainous coast of

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_3

Venezuela and outlying Trinidad. The palm also occurs in the Parima highlands in the Upper Orinoco Basin in Venezuela. Outlying populations of the spiny palm can also be found in Acre and in the southwestern portion of Amazonas state, Brazil (Borchsenius and Bernal 1996; Lorenzi et al. 2010: 28). *Aiphanes aculeata* does not occur wild in the Ecuadorian Amazon most likely because it is wetter there than other parts of the Amazon Basin (Henderson et al. 1995: 171). This elegant palm is widely cultivated throughout its range, particularly in home gardens. Although occasionally found close to sea level, *A. aculeata* is more common between 500 and 1,500 m.

Fig. 3.2 Fruits of shicashica (*Aiphanes aculeata*) gathered in a home garden. San Pedro de Cumbaza near Tarapoto, San Martin, Peru, 8-23-04

Aiphanes aculeata can reach 10 m and produces fruits in generous bunches, each containing some 50 fruits. The bright red fruits are a little over 2 cm in diameter and are used to make juice (*refresco*) in San Martin province in Peru. The fruits also serve as a snack, such as among the Yanomama in the border area between Brazil and Venezuela (Smole 1976: 161). The fruits are also sold in markets in the Magdalena and Cauca valleys in Colombia, and in the plains (*llanos*) of eastern Colombia children use the endocarps to play games (Borchsenius and Bernal 1996: 47).

Fig. 3.3 Villager cracking open endocarps of *Aiphanes aculeata* to obtain the kernels for a snack. San Pedro de Cumbaza near Tarapoto, San Martin, Peru, 8-23-04

To access the savory kernels, the hard endocarps are cracked open, typically between two stones. The nuts, which taste like coconut, are about the size and shape of a hazelnut. Bags of shicashica nuts appear occasionally in street markets in the Andean foothills in Peru, such as in Tarapoto.

In Panama the has escaped cultivation and invaded secondary forests in the Canal Zone (Svenning 2002). But far from being considered a “weed”, the palm is generally regarded as an asset. Indeed, *Aiphanes aculeata* is an attractive palm and it is planted as an ornamental outside its native range.

4 Aphandra natalia

English: Piassaba palm
Brazil: Piaçaba, piaçava
Ecuador: Fibra, escoba, piassaba; kinchuk (Achuar), chiri'si (Cofán), chili (Kichwa), tintiuk, tindiuqui (Shuar), wamowe (Waorani)
Peru: Piassaba; tintuki (Aguaruna)

Status: Wild, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_4

Fig. 4.1 Fibra (*Aphandra natalia*) palms in secondary forest adjacent to a slash-and-burn field. The Kichwa have enriched the vegetation in this area with economic plants, including fibra palm. Canelos, Alto Pastaza, Ecuador 9-21-13

Aphandra natalia is one of only two Amazonian palms harvested for the long fibers extending down the trunk for use in making brooms and brushes for regional trade. The other species, *Leopoldinia piassaba*, also has a relatively restricted distribution, but it occupies a completely different habitat: lowland areas of the upper Rio Negro watershed subject to occasional flooding.

Fig. 4.2 Piassaba (*Aphandra natalia*) palm with fibers ready for harvesting. Andean foothills at 628 m, Sauce, Laguna Azul, near Tarapoto, Peru, 8-24-04

The only representative of its genus, *Aphandra natalia* is an understory palm of montane forests on the eastern slopes of the Andes from Ecuador south to Peru and into the lowlands of Acre in the southwestern part of the Brazilian Amazon. The palm is a denizen of upland forest, though it sometimes occupies high, well-drained terraces near streams that may flood after exceptionally heavy rains (Kronborg et al. 2008). In the Andean foothills, piassaba occupies a rather narrow altitudinal range between 300 and 800 m (Henderson 1995: 295). In the Ecuadorian Amazon, however, fibra is occasionally cultivated up to 1,000 m (Borgtoft 1992). In Pastaza province, Kichwa communities establish small enclaves of the palm by removing surrounding vegetation in forest and by planting the palm in their home gardens. Farmers plant seeds of the palm in their home gardens obtained from the edible fruit (Sirén 2007). One reason that people plant the palm around their houses is that fiber production improves with increasing light levels (Pedersen 1996). The Shuar along the Nangaritza River in the Zamora-Chinchipe Province valley of southeastern Ecuador also cultivate the palm (Byg and Balslev 2006). Most piassaba fibers, though, are gathered in the wild, especially in the Peruvian Amazon (Balslev et al. 2010a).

Fig. 4.3 Vendor with brooms made with the fibers of *Aphandra natalia*. Yurimaguas, Loreto, Peru, 8-26-04

The fibers that hang down the trunk of *Aphandra natalia* are parts of the leaf sheath with elongate ligules and old petioles that fray (Henderson 1995: 296). The fibers are cut by hand and are then taken to work stations where they are cleaned and tied into bundles. Women and children are often involved in the domestic processing of piassaba fibers and some households make the brooms without the handles which they sell to middlemen (Kronborg et al. 2008). In some areas, though, the entire palm may be cut down to obtain the fibers, which has not surprisingly led to a decline in fiber production (Balslev et al. 2010a).

In the Peruvian Amazon, bundles of piassaba fibers are sold to middlemen who dispatch them to several urban centers, such as Iquitos and Yurimaguas. Dozens of small factories in Iquitos produce piassaba brooms, often using scrap wood from local sawmills (Penn 2008). Piassaba bundles reach towns by road, boats, or rafts (*balsas*). In the Ecuadorian Amazon, trucks and aircraft are also used to transport the fibers to market. Piassaba fibers were used for making rope to tie cattle before they were employed commercially to make brooms (Kronborg et al. 2008).

Fig. 4.4 Raft with a cargo of *Aphandra natalia* fiber and plantains. The family has been drifting down the Ucayali River towards Iquitos for several days. The oars are for steering rather than paddling. Loreto, Peru, 4-29-06

In the Ecuadorian Amazon, various indigenous groups extract grubs of the palm beetle (*Rhynchophorus palmarum*) from the trunks of piassaba (Borgtoft 1992). This beetle lays eggs on the decaying trunks of several species of palm in the Amazon, and in Peru rural folk prefer the grubs obtained from the trunks of aguaje (*Mauritia flexuosa*) palm. Apparently the diet of the curculionid larvae affects their taste. Groves of wild and cultivated piassaba are good hunting grounds because the palm fruits attract game (Borgtoft 1996). In the Cordillera Azul in the Andean foothills of Peru, piassaba gatherers set traps for paca (*Agouti paca*), a succulent, bulldog-sized rodent (Mayer 2006: 5).

Fig. 4.5 Roof of a Kichwa house made with fronds of two palms, including *Aphandra natalia*, that serve as the frame for a covering of paja toquilla (*Carludovica palmata*) leaves. Canelos, Alto Pastaza, Ecuador, 9-21-13

Fronds of *Aphandra natalia* are occasionally used for thatch, such as in the watershed of the Pastaza. The Kichwa often employ fibra fronds as the framework for intertwining fronds of other palms or the fan-shaped leaves of paja toquilla (*Carludovica palmata*, Cyclanthaceae) when making roofs for their houses or work spaces. In some areas, the fronds are also fashioned into carrying baskets and the heart-of-palm is eaten locally (Balslev et al. 2010a). In addition, the male inflorescence is fed to cattle and the fiber is used to stuff the inside of blowgun dart holders (Boll et al. 2005; Pedersen 1992).

Fig. 4.6 Fibra palm grove planted by a Kichwa family in their home garden. The girl has had her face painted with dye obtained from the fruits of *Genipa americana*. Canelos, Alto Pastaza, Ecuador 9-21-13

In both Peru and Ecuador, rural folk savor the yellow mesocarp of piassaba as well as the endocarp when it is still liquid (Balslev et al. 1997: 10). Along the Pastaza River and its affluents in the Peruvian Amazon, the mesocarp is eaten after it is boiled (Balslev et al. 2010a). In the Ecuadorian Amazon, piassaba fruits reach some markets, whereas in Peru they are only consumed locally (Kronborg et al. 2008).

Astrocaryum acaule

5

Brazil: Tucumaí; mumú (Wayana)
Colombia: Cocorito, espina, tucum; mataukuri (Piapoco)
Venezuela: Corozo

Status: Wild, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_5

Fig. 5.1 *Astrocaryum acaule* in a home garden at the mouth of the Jaú River, Amazonas, Brazil, 10-2-12

Tucumaí (the small tucumã) is a denizen of floodplain forests along black water courses, such as the Rio Negro and many of its affluents, as well as the Urubu River which flows into the middle Amazon. The short palm also occurs along the sandy shores of clear water rivers, such as the Tapajós. The stemless palm is festooned with black spines, as is typical of the genus, and ranges widely in Amazonia including the Guianas (Henderson 1995: 236). The tightly packed fronds arch outwards, fountain like, and the young petioles are a distinctive reddish-brown.

Fig. 5.2 Tucumaí palm in fruit in a home garden. Sitio da Dona Rita, a few km upstream from Seringalzinho, Rio Jaú, Amazonas, Brazil, 10-3-12

This diminutive palm has been recruited by river dwellers into their home gardens, such as along the black water Jaú, an affluent of the lower Negro. The yellow fruits, measuring 4 cm by 3 cm, contain a layer of vitamin A-rich pulp surrounding a single seed. The seed itself is used to carve rings and other ornaments for the handicraft trade. In home gardens, tucumaí is typically planted in the outskirts of the yard in order to avoid accidents with the spines, especially with children. Because riverine areas in the Amazon Basin were often densely settled in precontact times, it can be hard to differentiate truly wild *Astrocaryum acaule* populations from those that are descendants of the bushy palm planted long ago. Indeed, the palm often occurs in areas disturbed by human activity (Lorenzi et al. 1996).

Fig. 5.3 *Astrocaryum acaule* fruit with its vitamin A-rich mesocarp. Lower Jaú River, Amazonas, Brazil, 10-3-12

Astrocaryum aculeatum

6

Bolivia: Chonta; panima (Chácobo)
Brazil: Tucumã, tucumã-açu, tucum; cumare (Baniwa), tukumá (Parintintin), i'tcha (Ticuna), beta (Tuyuka), ëri si (Yanomama)
Colombia: Cumare, tucum; wamni (Nukak), toke?iba (Witoto)
Guyana: Akyau (Patamuna)
Venezuela: Tucuma, cumare

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_6

Fig. 6.1 *Astrocaryum aculeatum* in fruit. Near Anori, Solimões River, Amazonas, Brazil, 6-22-07

Tucumã is found in the uplands of central Amazonia, from Bolivia north to the Guianas and Trinidad (Henderson et al. 1995: 203). Its range does not extend as far west as Peru, and east of the Tapajós and Trombetas Rivers in Pará, Brazil, it is replaced by a near relative, *Astrocaryum vulgare* (Miranda and Faria 2008: 73).

Fig. 6.2 *Astrocaryum aculeatum* in old secondary forest that has undergone repeated slash-and-burn cycles for crop production. Near an extensive archaeological site, Vila Valente, lower Tefé River a few km downstream from Tefé, Amazonas, Brazil, 8-15-12

A quintessential "weed", *Astrocaryum aculeatum* flourishes in second growth and thus proliferates when people cut the forest to establish settlements and carve out their fields (Kahn and Granville 1992: 109). Although present in some mature forests, the palm is much more common in disturbed habitats (Miller and Proctor 1998). While cattle ranchers may consider the spiny palm a nuisance, most rural folk regard it is an asset on account of the fruits that contain a vitamin A-rich pulp. Known as tucumã in Brazil, the solitary palm can form sizeable stands after repeated clearing and burning. Tucumã sprouts after fires and it is typically spared because the ensuing spontaneous orchards provide an abundant fruit harvest. Tucumã is thus a component of some agroforestry fields established by small farmers, such as on the outskirts of Itacoatiara in Amazonas, Brazil.

Fig. 6.3 Tucumã palms in a cattle pasture. The palms were spared when the secondary forest was cleared. Anori-Mato Grosso road, Amazonas, Brazil, 6-22-07

The Saterê-Maué, who occupy parts of the Maués watershed in Amazonas, Brazil, interplant tucumã as well as several other wild and domesticated plants in their fields of guaraná (*Paullinia cupana*). For the most part, though, tucumã arises spontaneously in fields and home gardens. This prickly palm is often found on patches of Amazonian Dark Earths (ADE) in the vicinity of Itacoatiara and Silves (Hiraoka et al. 2003), further evidence of the palm's strong affinity with people. Tucumã is common in home gardens along the middle Madeira River (Fraser et al. 2011a).

Green when ripe, tucumã fruits can be found virtually year round, but production peaks at the beginning of the rainy season (Schroth et al. 2004). Fruits are gathered from the ground in home gardens and fields, though in secondary forests wild animals tend to abscond with the fruits before people can find them. Seed dispersal is carried out by terrestrial rodents, such as agoutis and acouchies (Jorge and Howe 2009). To circumvent wild animals and pigs, various means are employed to obtain the fruits before they fall to the ground. The fruit stalk is cut with a specialized hooked knife (*foice*) tied to the end of a pole, or a long pole without an attached knife is used to dislodge a few of the fruits. Boys and girls fire slingshots to knock down the fruits.

Fig. 6.4 A 7 year-old girl knocking down tucumã fruits with a slingshot. She is using charred tucumã fruits as ammunition. The palm is growing at the edge of field that has just been burned. Taperebatuba, Urubu River, Amazonas, Brazil, 10-12-12

Tucumã can reach 20 m, so the fruits are too high to pick. Long black spines, arranged in concentric rings along the entire trunk, discourage any thought of climbing the tree to access the fruits. Only senile tucumã palms lose their spines at the base of the trunk; enough of the formidable spines remain further up the bole, however, to thwart would be fruit pickers. The formidable spines have long caught the attention of indigenous peoples. Baniwa shamans, for example, sometimes "extract" the spines shot into patients by sorcerers (Robin Wright, pers. comm.). And the Yanomama use the spines to pick out skin parasites (Gertsch et al. 2002).

Fig. 6.5 Tucumã palm festooned with spines along its trunk. Boa Esperança, outskirts of Itacoatiara, Amazonas, Brazil, 12-9-06

The globular fruits are about the size of a golf ball, though slightly elongated (obovoid). They are peeled to access the firm orange pulp which is typically gnawed off the single black seed (endocarp). In several urban centers in Amazonas, Brazil, such as Manaus and Tefé, the oily mesocarp is scraped off the hard seed with a knife and added to sandwiches or manioc dough when making pancakes (*beijú*). In the main market of Tefé, a rapidly growing town of some 40,000 inhabitants at the juncture of the Tefé and Solimões Rivers, a popular snack stand sells *X-caboclino* which consists of a bread roll cut in half and filled with slices of rubbery farm cheese (*queijo coalho*) and crunchy tucumã pulp. *X-caboclino* sandwiches can also be purchased at some snack stands in Manaus. A taxi driver in Tefé recalled how he used to eat tucumã fruits as a kid growing up on a small farm (*sitio*) near the town. In those days, bread was a rare luxury so for breakfast he would cut up pieces of tucumã fruit and put them in black coffee along with some yellow manioc flour.

Although relatively thin, the mesocarp contains up to 30 % oil and is therefore high in calories (Arkcoll 1990; Leitão 2008). Along the middle Rio Negro near its confluence with the Branco, villagers also cook the fruits (Alarcón and Peixoto 2008). The fruits are highly esteemed among the Chácobo in the Bolivian Amazon and they also extract white beetle grubs from the seed cavities for fish bait (Boom 1988, 1989).

Fig. 6.6 Villager peeling tucumã fruits gathered in her home garden. Lago do Limão, near Cacau-Pereira, Amazonas, Brazil, 9-18-10

Tucumã fruits are often encountered in street markets in Amazonas, Brazil, such as in Manaus and Rio Preto da Eva. People who have migrated from rural areas to cities in search of employment and better schooling for their children are eager customers for tucumã fruits. Regional fruits are typically not found in supermarkets which tend to focus more on "prestige" fruits, such as apples from Argentina or grapes from southern Brazil.

Fig. 6.7 Lady eating a peeled tucumã fruit that she has bought from a street stall. The 75 year-old farmer is from Acre and she is in Manaus for medical treatment. The flavor of tucumã reminds her of her ancestral land. Avenida Eduardo Ribeiro, Manaus, Amazonas, Brazil, 9-12-10

Unripe fruits are also knocked down in order to drink the liquid endosperm as well as eat the soft white endosperm that remains. The immature fruits are cut open with a machete and the "milk" is drunk directly from the opened fruit, similar to coconut. Then the remaining soft, creamy endosperm is scooped out with a finger and eaten. A river dweller along the lower Tefé River claims that the liquid endosperm makes good drops for irritated eyes. The drinking of tucumã "milk" is an ancient practice; indigenous people have long relished the fluid, including the Nukak (Cárdenas and Politis 2000: 43) and the Yanomama (Gertsch et al. 2002).

Once the endosperm hardens it is sometimes ground up and fed to chickens, such as along the Anebá, an affluent of the Lower Urubu in Amazonas, Brazil. The hard endocarp is sometimes hollowed out and polished for the trade in ornaments, a practice that can be traced to indigenous groups. Parintintin women and children, who inhabit several affluents along the right bank of the middle Madeira, use the nut shells to adorn necklaces (Nimuendajú 1924). Similarly both men and women belonging to the Ticuna tribe make astonishingly beautiful figurines carved from the endocarps of both *Astrocaryum aculeatum* as well as another palm, inajá (*Attalea maripa*). The figurines represent a wide variety of animals, from insects to mammals and birds, as well as men firing shotguns, women with children, girls in the costume worn for the puberty ceremony, and adults dancing. The Ticuna also wear rings made from the hard endocarps (Nimuendajú 1952: 41, 109). And Yanomama children like to make spinning tops from the endocarps (Gertsch et al. 2002).

Fig. 6.8 Cutting open an unripe tucumã fruit to access the liquid endosperm. Bom Jesus, mouth of Rio Bauanas, Lago de Tefé, Amazonas, Brazil, 8-29-12

Fig. 6.9 A young Ticuna woman drinking the liquid endosperm of an unripe tucumã fruit. Bom Jesus, mouth of Rio Bauanas, Lago de Tefé, Amazonas, Brazil, 8-29-12

Fiber extracted from the young fronds is used to make hats and baskets along the Amazon, such as in the vicinity of Itacoatiara and Tefé. Tucumã hats are not as common as they were in the 1970s, however, since hats made in the Brazilian northeast from carnaúba (*Copernicia cerifera*) palm fronds have become widely available in the Brazilian Amazon. Also, rural people, especially younger men and women, often prefer baseball hats or other machine-made hats that do not brand the wearer as a "peasant" (*caboclo* in Brazil and *campesino* in Spanish-speaking countries). Similarly, Bora men in the Colombian Amazon sometimes wear bonnet caps woven with fibers of the palm, although the younger generation apparently eschews that custom (Guyot 1972). I recall an expression from the early 1970s in the Brazilian Amazon regarding humble folk who turned up to ask for a favor; those in charge would say that the supplicants had come "*chapeu no mão*" (hat in hand). That saying has largely lost its meaning now days.

Fig. 6.10 Hat made from the tucumã fiber. Bom Socorro, Paraná Tambaqui, near Lago Amanã, Amazonas, Brazil, 9-22-12

Indigenous people have long used tucumã fiber to make hammocks. The Witoto once made hammocks with the fiber, but they now purchase cotton hammocks (Gasché 1972). In the first half of the twentieth century, the Ticuna along the Solimões made their hammocks with tucumã twine, which was sometimes dyed with various colors. Ticuna women wove the hammocks using a shuttle of paxiúba (*Socratea exorrhiza*) palm wood or a piece of the petiole of buriti (*Mauritia flexuosa*) palm (Nimuendajú 1952: 13). A century ago, the Pareci who inhabit scrub savanna in northwestern Mato Grosso, made some of their hammocks from the palm fiber but even then cotton was used more frequently for that purpose (Roquette-Pinto 1950: 142). According to the Victorian naturalist Henry Walter Bates, the now extinct Passé, who once lived in the vicinity of Tefé, used to make their hammocks with tucumã fiber (Bates 1863b: 234).

Tucumã fiber has traditionally been put to many other uses. In the early twentieth century, the Baniwa, who live along the Içana, an affluent of the Upper Negro, used the fiber to make bowstrings from the palm fiber (Koch-Grünberg 1995: 130) and the Nukak still do (Politis 2007: 206). The Tukano along the Tiquié River, an affluent of the Uaupés, still make string from tucum fiber which is used for variety of purposes including fishing lines and to make dip nets to scoop up fish (Cabalzar 2012: 105).

Tucum fiber is also used to make body ornaments. The Pirahã who inhabit the Maici River (a tributary of the Marmelos which in turn flows into the Madeira) make necklace string from the palm from which they suspend ornaments, such as the seeds of various plants (Gonçalves 2001: 114). Anklets of *A. aculeatum* fibers are worn by both sexes among the Nukak of the Colombian Amazon; men and women also wear a band of the fiber below each knee (Politis 2007: 219). Babies are also fitted with bracelets of the palm fiber a few days after birth, whereas only men wear tucum wristbands. Nukak color the palm fiber used in their body ornaments with the red dye obtained from the leaves of *Arrabidaea chica*, a vine native to

Amazonia which is sometimes cultivated in backyards of indigenous villages in the Upper Rio Negro region. The Nukak also fashion necklaces of tucum fiber strung with mammal teeth, especially from the howler monkey (*Alouatta* sp.), or more rarely the jaguar (Politis 2007: 221).

Fig. 6.11 Tucum fiber drying on a line. A Tukano woman will use the fiber to make string. Some bowls made from calabash (*Crescentia cujete*) are drying on a nearby platform. São Paulo, Tiquié River, affluent of the Uaupés, Amazonas, Brazil, 10-30-12

The resilient wood of *Astrocaryum aculeatum* is used by various indigenous groups. The Yanomama fashion clubs from the stems (Gertsch et al. 2002). The Chácobo employ the hard, black wood of *A. aculeatum* to make bows and arrow heads (Boom 1989). For the Chácobo of the Bolivian Amazon, tucumã leaves are the most important material for making a variety of baskets; the pinnae (leaflets) are split longitudinally and woven tightly (Boom 1988).

Plants that figure prominently in the economic life of indigenous people sometimes turn up in mythology and are incorporated in rituals. Tukano speakers of the Upper Rio Negro, for example, believe in a supernatural entity called Béxtáwaxti, a malevolent spirit that dwells in the tucumã palm and can allegedly eat people (Oliveira 1995: 85). And the Kawaliyana, nomadic hunters and gatherers who once inhabited the Yawong Valley in Guyana near the border with Brazil, worshipped the palm and performed dances in a circle around the tree to give thanks for its bounteous fruits (Whitehead 2003).

7 Astrocaryum chambira

Brazil: Tucumã, piranga
Colombia: Chambira, cumare, ariará, tucuma, macora; chambira (Kichwa), nìhímúhè (Miraña), na i (Ticuna), ñekɨna (Witoto), tátëči (Yagua)
Ecuador: Chambira; tuinfa (Cofán), sapsi chamwira, ushahua, (Kichwa), kumái (Shuar), ñukwa (Siona-Secoya), opongengkawe (Waorani)
Peru: Chambira; nɨɨjɨhe (Bora), kutáma (Candoshi), cumari (Cashibo), čambira (Lama), beto ñi, ñuaca ni (Maijuna), ní (Mayna), di (Mayoruna), načitsáku (Sápara), lekēmatosó (Yagua)
Venezuela: Cumare

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_7

Fig. 7.1 Chambira (*Astrocaryum chambira*) fruits. Iquitos, Loreto, Peru, 3-5-04

Although the principal use of this tall, solitary palm is to obtain a fiber from the fronds for weaving and to make cordage, the fruits are also gathered in the rainy season. Green when ripe, the endocarp is opened to drink the liquid endosperm. The "milk" of chambira is similar in taste and texture to coconut milk. When the endosperm begins to harden, the creamy, semi-soft tissue is also eaten in Loreto, Peru, as well as the Ecuadorian Amazon (Jensen and Balslev 1995). The white pulp (mesocarp) surrounding the endocarp is generally not eaten. The Siona-Secoya relish both the liquid and coconut-like "meat" of chambira endosperms (Vickers 1994), as do the Maijuna who also toast the nuts (Gilmore et al. 2013). Ambulant vendors ply the streets of Iquitos to sell the fruit: in March 2004, six fruits were fetching the equivalent of U.S. 7 cents each, well within the purchasing power of even the poorest inhabitants. In Nauta along the lower Marañón, the fruits were even cheaper in March 2003: 20 of the fruits could be obtained for the same price (20 fruits for 50 centimos; exchange rate 3.45 soles = US$ 1).

Fig. 7.2 Chambira fruits in a street market. The red fruits are Malay apple (*Syzygium malaccense*), an exotic. Mercado Belén, Iquitos, Loreto, Peru, 5-9-03

This spiny palm is confined to western Amazonia from Acre in Brazil north through the western portions of Amazonas into the lowlands of Peru, Ecuador, Colombia, and southwestern Venezuela (Henderson 1995: 239; Lorenzi et al. 2010: 45; Reynel et al. 2003: 432). Chambira is found in upland forests up to 500 m, but is more common in second growth. Terrestrial rodents, particularly paca (*Agouti paca*), agouti (*Dasyprocta*) and acouchy (*Myopracta*) are the main dispersal agents (Ramirez et al. 2009). These esteemed game animals bury chambira fruits, not all of which are retrieved. Humans are also involved in dispersing the palm. The Waorani in the Ecuadorian Amazon, for example, plant chambira seeds along their trails, part of their strategy to domesticate landscapes (Rival 1998) and Kichwa deliberately scatter chambira seeds in their home gardens (Pedersen and Balslev 1992). The Ticuna cultivate chambira in some of their fields as do mestizos along the Amazon River near Iquitos (Coomes 2004a).

In the vicinity of Iquitos, twine from the young leaves of chambira is used to make various handicrafts, including handbags (Pinedo-Vasquez et al. 1990). The manufacture of bags with chambira twine is an ancient practice as noted by William Hardenburg among the Siona along the Upper Putumayo while he was uncovering atrocities committed against indigenous groups during the rubber boom (Hardenburg 1913: 81). At that time, the Witoto fashioned hand nets with chambira twine for fishing (Whiffen 1915: 97, 99). Yagua women make small bags or pouches, some of which are used by men to store items such as matches and shotgun shells (Chaumeil 1987: 114). Mayoruna women weave slings with chambira twine for carrying their infants and make bags which are used for a variety of purposes, such as for their children to carry school books and for their husbands to safeguard their shotgun shells when hunting. Mayoruna women wear skirts of chambira or cotton fiber, although in the past they did not wear any clothes (Romanoff et al. 2004: 51, 78).

In the nineteenth century, various indigenous groups in western Amazonia wove hammocks using twine obtained from the young fronds of *Astrocaryum chambira*. At that time, most of the hammocks produced in the Ecuadorian Amazon were made by the Sápara, then known as the Zaparo, who lived along the Napo River. Now almost extinct, the Sápara obtained the fibers for weaving from chambira palm (Orton 1870: 171; Osculati 1854: 166). In the early twentieth century, the Sápara were still making chambira hammocks (Izaguirre 1927). Witoto women in the Colombian Amazon also wove hammocks with chambira twine; they obtained the fiber by folding leaflets at their broadest part and then rubbing them against their thighs. Yagua women in the vicinity of Pebas on the Amazon River in Peru were also recorded rubbing the fibers on their thighs to make string for hammocks (Herndon and Gibbon 1853: 226). Indigenous craftsmen in Pebas along the Amazon in Peru were known for making particularly fine hammocks with chambira twine (Poeppig 2003: 402), and that tradition continues today (Vormisto 2002a). The Ticuna in the Colombian Amazon still make hammocks with chambira twine; to prepare the twine strips are torn from young fronds which are then boiled in water and dried in the sun. Some chambira string may be colored with a red dye obtained from the seeds of annatto (*Bixa orellana*) as well as dyed black with an extract from genipap (*Genipa americana*) fruits (Glenboski 1983: 23). The Siona who occupy parts of the Putumayo River also weave hammocks with chambira twine (Wheeler 1970).

Chambira twine is also used for fishing line, such as among the Siona (Wheeler 1970), although this custom is declining as more people fish with multifilament or monofilament line. Indigenous groups along the lower Huallaga in the Peruvian Amazon made fishing line from chambira twine in the middle of the nineteenth century (Herndon and Gibbon 1853: 175), but now most river dwellers use synthetic twine. The Lama used chambira twine for their bowstrings in the early twentieth century (Tessmann 1999: 131), although they have likely switched to shotguns now for hunting. The Achuar in the southern part of the Ecuadorian Amazon use chambira twine for their harpoons (Descola 1994: 275).

Chambira palm is also used for medicinal purposes by at least one indigenous group. The Yagua squeeze juice from the heart-of-palm and stir it into water which is taken in small doses to treat colds. The medicine is swallowed at regular intervals, depending on the age of the patient. The liquid is also rubbed on the head to treat the same condition (Chaumeil 1998: 315).

Chambira is such a prominent feature of some landscapes and cultures that a major tributary of the Marañón River is named after the palm (Maroni 1988: 109). The Miraña who inhabit the middle Caquetá River name their clans after plants or animals; one such lineage is called "people of the cumare palm" (Karadimas 2005: 45). According to Miraña, white-lipped peccaries (*Tayassu pecari*), which are important game animals, arose from fallen fruits of *Astrocaryum chambira* (Karadimas 2005: 50).

8 Astrocaryum gynacanthum

Brazil: Mumbaca, marajá-açu; yɨara'i (Araweté), yu (Guajá), yu-ɨ (Ka'apor), ñetenõ (Tuyuka), xoo mosi (Yanomama)
Colombia: Cubarro; máam, weí (Nukak), tuiri (Piapoco), ruirɨyɨ (Witoto)
Venezuela: Uli ba ji (Jodï), moshihawë (Yanomami)

Status: Wild, spontaneous in cultural settings

Fig. 8.1 *Astrocaryum gynacanthum* with stingless bees visiting the flowers in upland forest. Igarapé Açu, affluent of the Upper Tiquié, Amazonas, Brazil, 11-4-12

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_8

This relatively short palm is found in upland forests in central and eastern Amazonia, including the Guianas and the Upper Orinoco (Henderson 1995: 240). Although it does not feature much in the ethnobotanical literature, the Tuyuka of the Upper Tiquié in the northwest part of the Brazilian Amazon pointed out the understory palm to me and indicated that they consume the fruits. Great care has to be taken when gathering the fruits, however, because of the numerous, punishing spines. The Yanomama who inhabit the forest straddling the border between Brazil and Venezuela eat the fruits after toasting them and they also consume the heart-of-palm (Albert and Milliken 2009: 49).

Although relatively small, measuring some 3.5 cm by 1.5 cm, the fruits are rich in vitamin A, as is typical for this genus. In the Upper Orinoco in Venezuela close to the border with Colombia, the Jodï allow several spontaneous plants, including *A. gynacanthum*, to grow in the their fields because they are useful (Zent and Zent 2012).

Some indigenous groups in Amazonia, especially in the northwest, burn various plants to obtain ash salts. The Witoto used to add small amounts of salt obtained by burning wood from *A. gynacanthum* to their food (Escheverri and Román 2011). However, the main use of ash salts among the Witoto is for ritual purposes.

Yɨara'i ñã is the Master of Mumbaca palm according to the Araweté who live along the Ipixuna, a right bank tributary of the middle Xingu. This spirit trembles and stinks. Women must not make love anywhere near the palm, otherwise their children will suffer convulsions (Viveiros de Castro 1992a: 81).

Astrocaryum jauari

9

Brazil: Jauari; yawar-'ɨ (Ka'apor), roy ti (Krahò), dyó-dyok (Kuruaya), dia behta (Tukano), dia beta (Tuyuka)
Colombia: Yavarí; pe'dana (Andoque), korɨna (Witoto), úmase (Yagua)
Ecuador: Huiririma (Kichwa), oko bëto (Siona)
Peru: Huiririma; jahuarhuanqui (Shipibo)
Venezuela: Macanilla, albarico; bai to (Pumé), moshoha (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_9

Fig. 9.1 Jauari (*Astrocaryum jauari*) palms in fruit on the Amazon floodplain. Paraná Nhamundá near Terra Santa, Pará, Brazil, 6-22-94

Jauari is a floodplain palm that grows singly, in small clumps, or large stands. It thrives in all water types, from black and clear rivers to water courses laden with sediment eroded from the Andes. It is more common, however, along black and clear water courses. This tall palm is found along the Amazon and its lower tributaries in Brazil and Peru, as well as much of the Amazon lowlands in Colombia and Venezuela. The palm's range also extends into the Guianas. Jauari is absent from the Amazon estuary, most likely due to excessive turbidity resulting from the daily tides (Goulding and Smith 2007: 151).

People do not usually eat the fruits of *Astrocaryum jauari* although residents of Iquitos eat the endosperm while it is still soft (Mejía 1992). The fruits are nevertheless important economically and ecologically. The round fruits, which measure some 2–3 cm in diameter, are fed to pigs. Jauari fruits during the annual flood and once the fruits fall into the water they sink. To obtain jauari fruits for their pigs, river dwellers must paddle into floodplain forest and cut off fruit bunches from the spiny palms with a knife tied to the end of a pole. A mature jauari palm produces 4 fruit bunches a year with about 100 fruits per stalk (Kahn and Granville 1992: 141; Piedade et al. 2006). Some river dwellers create stores of the fruit for their pigs on platforms that either float or are secured by stilts. Rural folk living on an upland bluff overlooking the Amazon floodplain along Igarapé do Jari a few kilometers upstream from Santarém carry jauari fruits up to their home gardens to feed their pigs.

Fig. 9.2 River dweller with jauari fruits on a floating dock by his home. Paraná Nhamundá near Terra Santa, Pará, Brazil, 6-21-94

Jauari fruits also feed people indirectly because they are consumed by several fish important in commerce and subsistence. Tambaqui (*Colossoma macropomum*), one of the most prized fishes of the Amazon, eats large quantities of jauari fruits and disperses some of the seeds (Araújo-Lima and Goulding 1997: 83; Goulding 1980: 86; Silva et al. 2003). Other fish eaten locally and sold in markets that consume jauari fruits include pirapitinga (*Piaractus brachypomus*), several species of catfish including bacu pedra (*Lithodoras dorsalis*), and aracu (*Leporinus* and *Schizodon*) (Kubitzki and Ziburski 1994; Parolin et al. 2010; Piedade et al. 2006).

Fruits of *Astrocaryum jauari* are used for fish bait throughout the Amazon, such as in Amazonas, Venezuela (Narváez and Stauffer 1999). The Siona of the Ecuadorian Amazon use the endosperm, which they obtain by breaking open the nut, for fish bait (Balslev and Barford 1987). Fishermen along Paraná Nhamundá near Terra Santa, Pará, catch tambaqui by placing the entire fruit on the hook. To snag smaller frugivorous fish such as aracu, the pulp is scraped off and rolled into a ball before being placed on the hook. Along the Tefé River in Amazonas, fishermen collect jauari fruits and put them in a small basket, measuring some 20 cm by 20 cm, and place it in about 2 m of water in flooded forest. The fruits attract a variety of fish including jaraqui (*Semaprochilodus*), pacu, jaraqui, cará roxo, and cará disco. A few hours later the fisherman returns in a canoe, taking care not to scare off any fish that have come to feed on the fruits. The fisherman then rolls up a ball of jauari pulp, puts it on a hook, and then lowers it into the water near the basket using a pole. Fruit-eating fish that have gathered at the spot are thus primed to take the bait.

In Vila Franca, a village and former Jesuit Mission at the confluence of the Tapajós and Arapiuns Rivers in the Brazilian Amazon, men employ the pulp of jauari fruits in a fishing method called *roedeira* (the “gnawer”). A line is attached to a piece of Styrofoam with a ball of jauari or tucumã (*Astrocaryum vulgare*) fruit pulp at the other end. When the flotation device bobs, signaling that fish are feeding, the fisherman lowers a baited hook attached to a pole by the *roedeira*. This method is employed at high water in lakes.

Jauari fruits deposited on floodplains as the annual flood subsides are sometimes consumed by terrestrial game animals. By the time the land dries out under jauari palms, the pulp surrounding the fruits has long since disappeared. Nevertheless, white-lipped peccaries (*Tayassu pecari*) are fond of the endosperms and easily crunch up the endocarps with their powerful jaws. Near the margins of Amanã Lake in Amazonas, Brazil, three hunters who killed five white-lipped peccaries after they were caught raiding a field planted to bitter manioc found that the stomachs of the prized game animals contained masticated seeds of jauari in addition to manioc.

Fig. 9.3 *Astrocaryum jauari* palms along a river bank. The women are steering a raft of logs destined for Iquitos. Nanay River, Loreto, Peru, 1-8-06

Settlers along water courses typically spare stands of jauari palm when establishing their home sites, such as along the Tefé River. One river dweller a little below the town of Tefé has protected a grove of jauari palms at the foot of the scarp upon which he has his home. The palms help protect the escarpment during storms, thus helping prevent further erosion of his property. And he noted that fishing is good among the jauari palms during the annual flood. Jauari palms have sprouted in low lying areas in front of the village of Piraruaia along the middle Tefé; many of the palms allegedly arose from fisherman discarding the seeds after removing the pulp for fish bait.

Fig. 9.4 Basket made with strips torn from the petioles of *Astrocaryum jauari*. San Carlos, Rio Puinahua (a branch of the Ucayali), Pacaya-Samiria, Loreto, Peru, 1-11-06

Jauari has several other uses in addition to fruit. In the middle of the nineteenth century, Alfred Russel Wallace noted that the hard endocarps of *A. jauari* were used to make bobbins (Wallace 1853: 109). Although lace making with bobbins is less common these days, some elderly ladies still practice this dying craft. Fiber from young jauari leaves has long been used to make hammocks and textiles (Souza 1873: 239), a craft still practiced by the Pumé in the Apure savannas of Venezuela (Gragson 1992). The Pumé also use the woody seeds of the palm to fashion snuff inhalers to for taking yopo, an hallucinogenic powder made by grinding the seeds of *Anadenanthera peregrina*. And in the Peruvian Amazon, baskets are crafted from strips cut from the leaf stems, after first slicing off the spines.

Fig. 9.5 A species of stingless bee called arapuá has built a nest on the trunk of a jauari palm and the honey will gathered for its medicinal properties. The jauari palms along the shores of this lake (on *left*) were spared when the family settled here. Açaí (*Euterpe precatoria*) palms have been planted in the home garden. Lago do Jacu, near Bella Vista do Sapá, Tefé River, Amazonas, Brazil, 9-9-12

Given jauari's prominence in some aquatic landscapes, it is not surprising that several places are named after the palm. The Jauari district of Itacoatiara, Amazonas, Brazil, is so named because of the large numbers of the palm that once lined the margins of a lake just inland from the high upland bluff that overlooks the Amazon. In the mid-1970s, old timers recalled seeing canoe races on the lake when they were boys. Alas, the shallow lake has been filled and occupied by the rapidly growing town. And along the Trombetas River, a clear-water tributary of the Amazon that drains the Brazilian shield, Tabuleiro Jauari is an important nesting beach for the endangered South American river turtle (*Podocnemis expansa*) (Alfinito 1975).

10 Astrocaryum murumuru

Bolivia: Chonta, chonta loro; pani (Chácobo), shibó (Tsimané)
Brazil: Murumuru; muru-ɨ (Ka'apor), mry kok (Kayapó), darachicho (Matis), maha si (Yanomama)
Colombia: Chuchana; kɨkɨyɨ (Witoto), totose (Yagua), mahã (Yanomama)
Ecuador: Chuchana; e'tso (Cofán), ramus (Quichua), si'ra (Siona-Secoya)
Peru: Huicungo; uwan (Aguarana), pandi (Amahuaca), dsúhsába (Bora), pisin (Mayoruna)
Venezuela: Orocori

Status: Wild, spontaneous in cultural settings

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_10

Fig. 10.1 Fruits of *Astrocaryum murumuru*. The fruits are covered by fine spines (spinules) and rachillae are protruding between the fruits bearing the remains of male (staminate) flowers. When the fruits mature, the skin turns pale orange and they fall to the ground. Lower Rio Tigre, near Miraflores, Loreto, Peru, 4-26-06

Murumuru (*Astrocaryum murumuru*) is an understory palm that inhabits forest on uplands as well as the floodplains of black, clear, and sediment-rich rivers. The palm is more common, however, on the rich alluvial soils of "white water" rivers and is considered an indicator of fertile soils (Vormisto 2002b; Vormisto et al. 2004). On uplands as well as floodplains, murumuru is often associated with Amazonian Dark Earth (ADE), an anthropogenic soil created by indigenous settlements (Fraser et al. 2011a; Hiraoka et al. 2003; Junqueira et al. 2010a, b). A river dweller living on an ADE site that extends for at least 1.3 km along an upland bluff overlooking the lower Tefé River told me that when his Father established the homestead in 1912, "it was the land of murumuru" (*era terra de murumuru*).

In the territory of the Sirionó in the Bolivian Amazon, the palm is particularly common in cultural forests cloaking artificial mounds in seasonally-flooded savannas (Erickson and Balée 2006). Likewise, in the reserve of the Chácobo in another part of the Bolivian Amazon, the palm is only found in abandoned fields and along trails in second growth (Boom 1988). Murumuru, then, is another Amazonian palm whose distribution and density has been greatly influenced by human activities.

Murumuru is confined to Amazonia and is found from the river's mouth west to the foothills of the Andes in Bolivia, Peru, Ecuador, and Colombia. It is absent, however from the middle and upper courses of affluents of the Amazon in the central and eastern part of the basin (Henderson et al. 1995: 205). The palm can occur singly or in groups, and reaches densities of up to 30 adult trees per hectare in floodplain forests, such as in the Manu National Park in the Peruvian Amazon (Cintra 1998; Cintra and Horna 1997). This understory palm fruits in the rainy season and produces up to 3 fruit bunches, each containing as many as 300 fruits.

Fig. 10.2 Spine on the trunk of *Astrocaryum murumuru*. The spines can reach 48 cm in length. Near Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 7-24-10

Murumuru is arguably the most heavily armed tree in the Amazon for it is covered from top to bottom with punishing, black spines that can reach almost half a meter in length. The flattened, spear-like thorns inflict punishing wounds. One hunting dog on Ilha dos Porcos in the Amazon estuary lost an eye to a murumuru spine while chasing a spiny rat (*Proechimys*), and many other dogs have probably suffered a similar fate. Rural women sometimes use the spines of this pincushion palm for sewing, such as in the vicinity of Itacoatiara, Amazonas. At Marapanim along the brackish coast of Pará and Arapixuna near Santarém, folk healers burn the spines of murumuru in ritual smokings (*defumações*) to purge evil influences. As the palm ages, however, most of the downward pointing spines that cover the trunk drop off, but they still festoon the base and underside of the fronds, thus providing a formidable defense against herbivores that might be tempted to browse on the leaves or abscond with immature fruit.

Fig. 10.3 Kit box of a village healer (*curandero*) containing spines of *Astrocaryum murumuru*. Arapixuna, Igarapé do Jari, Santarém Municipality, Pará, Brazil, 7-22-96

In spite of its formidable spines, *Astrocaryum murumuru* provides several foods: nuts, livestock feed, the pulpy mesocarp, grubs that feed on decaying trunks, and heart-of-palm. The wood-encased nuts are cracked open to eat the white, coconut-like flesh, especially in the Peruvian Amazon. Across the border in western Amazonas, Brazil, Matis women extract the endosperm while sitting near the doorway of their communal homes (Erikson 1996: 183). When the fruits are maturing, the embryo is still jelly-like and is relished as a snack. The fruits are gathered from the ground or harvested by fashioning a hooked pole in the forest to pull down the fruit bunches within striking range of a machete. In the vicinity of Afuá on Marajó Island at the mouth of the Amazon, farmers gather the nuts to feed pigs which have powerful enough jaws to crush the hard endocarp. Cowboys on Marajó near Chaves also crack open murumuru nuts and mash them with rice or manioc flour to feed their ducks and pigs. Sometimes cowboys on the island build a fenced pen (*paiol* or *paió*) with sticks lashed together with a forest vine, cipó imbé (*Philodendron imbe*), to store murumuru fruits for their livestock.

Fig. 10.4 River dweller pulling down an *Astrocaryum murumuru* fruit bunch in a floodplain forest. He is using a pole obtained by cutting a nearby tree sapling. Lower Rio Tigre, near Miraflores, Loreto, Peru, 4-26-06

In the vicinity of Cinco de Mayo, a village along the Huallaga River near Yurimaguas in Peru, youngsters keep an eye open for seedlings of huicungo, as the palm is known in Peru. If the seedling is small, there is a good chance that some of the endosperm is still present in the nuts, so they dig up the seedling to check.

Fig. 10.5 Cracking open endocarps of *Astrocaryum murumuru* with a machete at the entrance of a village home. The children are snacking on the soft, coconut-like endosperms. Miraflores, lower Tigre River, Loreto, Peru, 4-27-06

As the fruits mature, a creamy pale orange pulp develops around the wood-encased nut. The thin, but tasty mesocarp evolved to attract seed dispersal agents, including monkeys, peccaries, and terrestrial rodents. In the Manu National Park, for example, dexterous capuchin monkeys (*Cebus apella*) manage to feed on the pulp of the fruits without getting pricked and then drop the seeds, sometimes at an appreciable distance from the parent tree. Some of the seeds dropped by the nimble monkeys are then scatter horded by squirrels and agoutis (Cintra and Horna 1997). Ground dwelling mammals and tortoises do not have to rely on monkeys to drop the fruits, however. When fully ripe, some fruits fall to the ground without being dislodged by monkeys or birds. According to gatherers of aguaje (*Mauritia flexuosa*) palm fruits who live in San Pedro, a village along the lower Marañón, paca (*Agouti paca*) are also fond of huicungo pulp. A cowboy on the Campo Limpo ranch in central Marajó reported seeing agouti, paca, white-lipped peccary (*Tayassu pecari*) and perema (*Rhinoclemys punctularia*) turtles feeding on murumuru fruits. The jaws of peccaries are powerful enough to crack the wooden seed case (endocarp) and thus destroy the embryo. Nevertheless, some of the seeds may be swallowed entire and later defecated in another location where they can sprout in a fertile setting.

Fig. 10.6 When murumuru fruits mature they fall to the ground and are eaten by dispersal agents, such as cattle. Lower Tefé River, Amazonas, Brazil, 8-15-12

In Panama, spiny rats (*Proechimys semispinosus*) are likely dispersal agents for a related palm, *Astrocaryum standleyanum* (Hoch and Adler 1997). Various species of spiny rats, which people hunt for food, inhabit upland and floodplain forests in Amazonia and they may also disperse seeds of *Astrocaryum murumuru*. Some fish are also fond of murumuru fruits which they can access at high water, and they may also disperse some of the seeds. In the vicinity of Vigia at the mouth of the Amazon, for example, men use fruits of murumuru to bait hooks when fishing for bacu pedra (*Lithodoras dorsalis*), a tasty armor-plated catfish. Murumuru thus contributes to the diet of rural folk indirectly through game animals and fish.

Small farmers who live in Marinheiro, a village in the Bailique archipelago in the northern part of the Amazon estuary, do not have the resources to create extensive pastures for their cattle. So their cattle must fend for themselves much of the time in floodplain forest and patches of native grasses in isolated clearings. Cattle are fond of murumuru fruits and pass the endocarps intact. Small-scale cattle owners perceive the value of floodplain forest as a source of food for their livestock, whereas larger operators tend to clear-cut large areas and plant African pasture grasses for their cattle herds. One hundred and fifty years ago, Alfred Russel Wallace noted how fond cattle were of the palm fruits:

> On the Upper Amazon cattle eat the fruits of the Murumurú, wandering about for days in the forest to procure it. The hard stony seeds pass through their bodies undigested and become thickly scattered over the pastures adjoining the houses (Wallace 1853: 101).

Wallace also noticed that pigs sought out fruits of the palm along the Upper Amazon in Brazil. In the Amazon estuary, pigs continue to eat the fruits of murumuru and other trees in floodplain forests (Anderson et al. 1985).

The sweet, tasty pulp is rich in calories, and judging by the color, likely a good source of carotene as well. Although the layer of pulp is thin, people snack on the mesocarp as they encounter fruits while in the forest, such as in the vicinity of Yarina, a village on the Yanayacu River in the Pacaya-Samiria Reserve in Loreto, Peru. Although fruits of *Astrocaryum murumuru* do not reach markets, the pulp is highly esteemed. In the Bolivian Amazon, the Chácobo are particularly fond of this palm's fruits (Boom 1988).

Palm weevils (*Rhyncophorus palmarum*) lay their eggs on the decaying trunks of the palm which hatch into thumb-sized grubs, known as suri in the Peruvian Amazon. The pale yellow grubs are removed from trunks that have fallen in the forest or from palms that have been killed by intense fires when preparing fields. Suri grubs cut out of huicungo trunks do not taste as good as those taken from *Mauritia flexuosa*, but they are nevertheless a welcome snack.

In the first half of the twentieth century, several small factories sprung up in the Amazon estuary to process oils from several nuts, including murumuru, in order to make soap. The nuts of *Astrocaryum murumuru* have an exceptionally high oil content, around 40–44 %, and were thus of interest to the vegetable oil industry. Belém had the largest number of factories processing murumuru nuts for their oil, but smaller towns at the mouth of the Amazon also had small-scale enterprises devoted to pressing the nuts for oil (Lleras and Coradin 1988). Youngsters along the Pedreira River in Amapá, for example, used to gather the nuts for sale to itinerant merchants who would take them by boat to Macapá for processing. Murumuru nuts were also shipped from Pará state in the Brazilian Amazon to São Paulo, the United States, and Europe for processing into oil for soaps and margarine; in 1954, alone, 323,000 t of the nuts were exported from Pará. By the early 1940s, however, the extraction of murumuru nuts for vegetable oil was already in decline as the price that European importers were willing to pay for the nuts plummeted and the Federal government in Brazil imposed a tax on vegetable oils, further depressing demand.

A factory in Chaves, a small town on the northern coast of Marajó Island, once processed vegetable oils from murumuru as well as andiroba (*Carapa guianensis*) and pracaxi (*Pentaclethra filamentosa*) before closing in 1960. Usina Uruãs, named after an extinct tribe that once inhabited the northern coast of Marajó and adjacent islands, used to dispatch the oils by to boat to Belém where murumuru oil was used to make soap and the pressed seed cake was fed to pigs. Another vegetable oil factory on Marajó Island, Óleos Industriais Cachoeira do Arari (OLEICA) that once processed nuts of murumuru, pracaxi, and andiroba, also closed its doors in the 1960s. Rubber tappers, river dwellers, and some indigenous groups still extract oil from murumuru nuts for cooking and to massage into their hair.

Murumuru oil is receiving renewed attention by some cosmetic firms. Natura, a Brazilian company based in São Paulo, incorporates murumuru oil in one of its hair conditioners. And Murumuru butter can be purchased online from U.S.-based companies selling natural products for skin care.

During the rubber boom of the late nineteenth century and early twentieth century, rubber tappers in the lower Amazon used to burn the woody endocarps along with the encased nuts (endosperms) of the palm for smoking latex (Bates 1863a: 144; Lange 1914: 59, 67; Le Cointe 1922a: 321). And because murumuru endocarps have such a high calorific value, they were used as fuel by small steamships plying the waters of the Amazon during the rubber boom (Gates 1927: 72).

Fig. 10.7 River dweller cracking open an *Astrocaryum murumuru* endocarp to see whether it contains a beetle grub. Called muchuã, the larvae are used for fish bait. Lower Tefé River, Amazonas, Brazil, 8-15-12

In the vicinity of Tefé in Amazonas, Brazil, river dwellers sometimes crack open the endocarps looking for beetle grubs. Known locally as muchuã, the bruchid beetle larvae are sought after bait for catching various species of fish including sardinha (*Triportheus*), pacu (several genera), and aracu (*Leporinus* and *Schizodon*). One old timer who lives along the lower Tefé reported that the oil (*banha*) of the muchuã grubs is good for treating rheumatism and other aches and pains ("*dor de corpo*").

Fig. 10.8 Bruchid beetle grub consuming a murumuru endosperm. The larvae are used for fish bait. Lower Tefé River, Amazonas, Brazil, 8-15-12

In addition to the fruits and nuts, other parts of *Astrocaryum murumuru* are used for food or for building materials, brooms, handicrafts, weaving, sewing, and for casting spells. The Sirionó in the Bolivian Amazon extract heart-of-palm from juvenile chonta, as the palm is called there (Erickson and Balée 2006). The Siona-Secoya in the Ecuadorian Amazon also fell the palm to extract palmito (Vickers 1994) as do the Amahuaca in the Peruvian Amazon (Tessmann 1999: 94). Mayoruna women use the young fronds of the palm to make hand-held fans for stirring up flames while cooking, or to brighten up fires on cold nights. Leaflets of the palm are also used to make head bands which are worn by men and boys; the head band is pinned in place with a spine obtained from the palm and then painted red with annatto (*Bixa orellana*). Various patterns representing wild animals are drawn with the vegetable dye. The leaflets are also used to make belts worn by men and boys (Romanoff et al. 2004: 57, 79). The Maijuna (Orejón, Coto) who live in scattered villages in the Putumayo watershed use the spines to tattoo their bodies with a red color obtained from *Bixa orellana* seeds and blue-black dye from *Genipa americana* fruits (Tessmann 1999: 111).

In the southern part of the Peruvian Amazon, the trunks are used in house construction because the wood resists termites. The Bora of the Peruvian Amazon employ the fronds for thatch. Murumuru fronds do not appear to be widely used for thatch in the Brazilian Amazon, but Dona Dica, a 66 year old farmer who lives along Igarapé Ubim on the margins of Amanã lake along the lower Japurá remembers that when she was a girl her father used to lay down the heavy leaves of murumuru to keep the ubim (*Geonoma* sp.) thatch from being blown off by strong winds during storms. In the vicinity of Iquitos in the Peruvian Amazon, young fronds of the palm are fashioned into handbags (Pinedo-Vasquez et al. 1990).

In various parts of the Amazon Basin, rural folk make rings, buttons, and pendants for necklaces from the endocarps. The Suruí in Rondônia employ murumuru endocarps to decorate necklaces and bracelets (Coimbra 1985). In adjacent Acre, rubber tappers employ the wooden endocarps to fashion rings and buttons as do the Kayapó in eastern Amazonia (González-Pérez et al. 2013).

As in the case of jauari (*Astrocaryum jauari*), murumuru features in several place names in the Brazilian Amazon. One such place, the village of Murumuru, is nestled at the scarp of the Santarém plateau along the Maicá River and supplies Santarém with fruits of the açaí palm (*Euterpe oleracea*). Another settlement called Murumuru, 8 km from Marabá along the PA 150 highway in Pará, supplies the city with milk. Ramal Murumuru is a side-road leading off the Santarém to Curuá-Una Highway in Pará. And Lago Murumuru along the Amazon a little above its confluence with the Negro in Amazonas State, Brazil, is heavily fished to supply the nearby city of Manaus.

11 Astrocaryum vulgare

Brazil: Tucumã, tucumã-piranga; takamã (Guajá, Ka'apor), woti (Kayapó), roy ti (Krahò), rojti (Mebêngôkre-Kayapó), hatátsu (Nambicuara), chavana (Tapirapé), roïti (Xikrin)
French Guiana: Aroira, awara
Suriname: Awara

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_11

Fig. 11.1 Tucumã (*Astrocaryum vulgare*) palm in fruit. Fazenda Oriente, Marajó Island, Pará, Brazil, 12-15-01

The tucumã (*Astrocaryum vulgare*) palm of eastern Amazonia grows under similar ecological conditions and fulfills a similar cultural role as its cousin in the central Amazon: *A. aculeatum*. Their ranges brush up against each other in the Tapajós watershed, and both abound in second growth. But they are easy to distinguish: *A. vulgare* has orange fruits when ripe, whereas those of *A. aculeatum* are green. And *A. vulgare* grows in clumps, whereas *A. aculeatum* is solitary. Furthermore, the latter is a little taller and has a thicker trunk with darker spines. In the literature, *A. vulgare* is sometimes referred to as tucumã-do-Pará and *A. aculeatum* as tucumã-do-Amazonas (Cavalcante 2010). But locals in both states simply call the palms tucumã or tucum.

Tucumã is found in the Brazilian states of Pará, neighboring Maranhão, and ranges north to Amapá, French Guiana, and Surinam (Henderson 1995: 250). The palm occurs as far south as Tocantins and Mato Grosso states in Brazil, in the transition zone between rainforest and scrub savanna. *Astrocaryum vulgare* has been introduced to rural areas surrounding Silves, about 300 km east of Manaus, Amazonas. Specifically, it is found in second growth, cultivated fields and pastures, and some home gardens from Itapiranga on the banks of the Amazon west to the lower Anebá River, an affluent of the lower Urubu, a distance of some 50 km. The palm was likely brought to those parts in pre-Columbian times since the Silves area has numerous archaeological sites some of which suggest, through shared pottery styles, ancient cultural contacts with the Santarém area further down the Amazon (Helen Lima, pers. comm.). In this isolated pocket, the palm is known as tucum-ã-piranga, which means the red tucumã in *nheengatu*, an ancient regional dialect which is also known as *lingua geral*. Locals in the vicinity of Silves recognize intermediate forms between the native tucumã (*Astrocaryum aculeatum*), which they call tucumã-açu (the big tucumã) and tucumã-piranga, suggesting that the two palms may have hybridized.

Fig. 11.2 *Astrocaryum vulgare* proliferating in second growth at the edge of a village that occupies an archaeological site. Known locally as tucumã piranga, the palm was introduced to this area in precontact times. Pontão, Urubu River, near Silves, Amazonas, Brazil, 10-11-12

A classic indicator of disturbance on upland sites and higher parts of floodplains, tucumã is particularly common on sandy soils, such as on relic dunes on Marajó Island where the palm sometimes forms dense stands. The very name of the species, *vulgare*, suggests that the palm is common. Tucumã is an indicator species for Amazonian Dark Earth, an anthropogenic soil created by indigenous groups (Balée 1988). And the Ka’apor who farm and gather fruits in the forests of Maranhão consider several palms, including tucumã, as an indicator of cultural forests (Balée

2010a). Groups of tucumã palm are sometimes found on indigenous mounds in northeastern Marajó Island and carbonized seeds of the palm have been uncovered in the cultural layers of the raised mounds, such as at Teso do Bacuri Alto on Fazenda Silva (Nimuendajú 2004: 50, 57).

Fig. 11.3 *Astrocaryum vulgare* proliferating in a pasture on an archaeological site. Irmandade São José, Urubu River, Amazonas, Brazil, 10-13-12

Fire-tolerant tucumã has undoubtedly been increasing in eastern Amazonia for thousands of years as a result of farming activities. The Gorotirê Kayapó of the Fresco River, an affluent of the Xingu, set fires to promote groves of the palm, a practice that has most likely endured for generations (Hecht 2003). The Gorotirê Kayapó recognize that *Astrocaryum vulgare* "likes" fire (Posey 1985). Cattle ranchers began burning savannas during the colonial period. When farmers clear second growth to plant crops today, tucumã palms are typically spared and then become part of agroforestry plots, such as on the outskirts of Murumuru near Santarém. Even when *A. vulgare* is cut back, it soon resprouts. In spite of the spines, tucumã is also spared in home gardens, such as in the village of Santana do Ituqui downstream from Santarém, because the fruits are a welcome addition to the diet. Tucumã is even planted in home gardens, such as in Urucurituba, a community on the Amazon floodplain near Alenquer, Pará, and on the island of Combú opposite Belém in the southern part of the Amazon estuary. For at least one indigenous group, the spines are an asset: the Nambicuara in Mato Grosso traditionally embedded the spines in wooden boards to grate manioc (Oberg 1953: 94).

Fig. 11.4 Tucumã piranga (*Astrocaryum vulgare*) sprouting after having been cut back in a field planted to West Indian gherkin (*Cucumis anguria*). The field has been cleared on an archaeological site with Amazonian Dark Earth. Sitio Tauaquera, Anebá River, an affluent of the lower Urubu, Amazonas, Brazil, 10-20-12

Shiny orange tucumã fruits are born in generous clusters during the latter part of the rainy season (May) and throughout the dry season (June-December). The rounded to slightly ellipsoid fruits are approximately 5 cm long and 3.5 cm in diameter and are often gathered from the ground on account of the spines that are particularly numerous along the upper trunk and the underside of the fronds. People use their teeth to peel the fruit and then gnaw the orange mesocarp surrounding the single dark endocarp.

As the color suggests, tucumã fruits are high in vitamin A (52,000 international units per 100 g), three times the amount found in carrots (Cavalcante and Johnson 1977; Chaves and Pechnik 1947; Pechnik et al. 1947). Tucumã is another example of how fruits substitute for vegetables as major sources of vitamins in the regional diet. Tucumã pulp is 22 % oil, with a high proportion of oleic fatty acid which helps reduce levels of cholesterol in the blood (Oboh 2009; Oboh and Oderine 1988). The pulp also contains 6 % protein, so the fruits are a healthy snack.

Fig. 11.5 Boys picking up tucumã fruits that have fallen to the ground in a home garden. Santana do Ituqui, Santarem Municipality, Pará, Brazil, 10-5-92

Tucumã fruits have been providing valuable nutrition to people in Amazonia for a long time. Seeds of *Astrocaryum vulgare* are abundant in middens of the now extinct Marajoara culture at the mouth of the Amazon and in a cave at Serra do Pilão near Monte Alegre that was occupied by hunters and gatherers over 10,000 years ago (Roosevelt 1991: 375; Roosevelt et al. 1996). Indigenous groups continue to gather tucumã fruits, such as the Tapirapé in eastern Amazonia (Baldus 1970) and the Jurúna along the Upper Xingu (Oliveira 1970). In the 1930s, the Tapirapé gathered tucumã fruits to obtain the kernel oil which they mixed with annatto (*Bixa orellana*) for painting their bodies and to rub into their hair to make it shine (Wagley 1977: 65). Most fruits are consumed in rural areas by children and adults alike, but some reach markets, such as at Vigia in the southern part of the Amazon estuary.

Fig. 11.6 Farmer snacking on a tucumã fruit. He spared the palm when he cleared secondary forest for his field. Rio Maracá, Amapá, Brazil, 5-3-96

A special dish is prepared with tucumã fruits in Cachoeira do Arari and vicinity on Marajó Island. Called *canhapira*, the dish is prepared by mashing tucumã fruits and sieving them to drain off the juice. The juice is left to settle in a pan for a while before boiling slowly for 3 days. The resulting soup is served with savory meats, such as strips of dried beef (*carne de sol*), a fatty kind of beef jerky (*charque*), pork, or locally-produced sausages (*choriço*). A similar dish, called bouillon d'awara, is prepared at Easter time in French Guiana (Granville 1999). *Canhapira* has its origins in indigenous cuisine, although the ingredients have changed over time because there were no cattle or pigs in the New World in Pre-Columbian times. Along the Tiquié River, an affluent of the Uaupés, for example, Tukano and Tuyuka villagers serve a communal *canhapira* breakfast consisting of fish stew heavily spiced with chili peppers.

As is the case with several other species of *Astrocaryum* palms, rural folk use fibers pulled from young fronds to make baskets and other handicrafts. In the village of Carariacá in the Municipality of Santarém, for example, women fashion colorful hats with tucumã fibers for local use and for sale in nearby Santarém. The Guajá (sometimes referred to as the Awá) who inhabit the rapidly shrinking forests of eastern Amazonia in Maranhão make hammocks, rope, skirts, and bowstrings from tucumã fiber (Balée 1988; Salgado and Shoumatoff 2013). Similarly, the Guajajara in western Maranhão and the Gaviões, who inhabit the fast-disappearing forests inland from the right bank of the middle Tocantins, make their bowstrings from tucumã fiber (Arnaud 1964; Balick 1988) as do the Nambicuara in Mato Grosso (Oberg 1953: 93). In a legend recounted by the Baciarí of the Upper Xingu, Kamuschiní goes into the forest to search for tucum fronds to obtain twine for making bowstrings (Oberg 1953: 77). The Xavante who inhabit the Rio das Mortes, an affluent of the Upper Araguaia in Tocantins State, use the palm fiber to attach a stone to the shaft of a plane for making their bows and clubs (Maybury-Lewis 1967: 60).

Fig. 11.7 Villager weaving a hat with fibers obtained from petioles of *Astrocaryum vulgare*. Carariacá, Santarém Municipality, Pará, Brazil, 5-15-96

The hard endocarps of *Astrocaryum vulgare* are used for the ornamental trade, following an indigenous tradition. The Asuriní make thin disks from the dark brown endocarps then drill a hole in the middle to thread them on to a necklace (Lukesch 1976a: 92). Women who belong to the Urubu tribe in western Maranhão make rings and ornaments from the dense hard endocarps for necklaces and ear rings (Ribeiro 1976: 54) as do the Jurúna of the Upper Xingu (Oliveira 1970) and the Nambicuara in Mato Grosso (Oberg 1953: 94, 95). The Jurúna use the endocarps to make blunt points for some of their arrows. The endocarp, which has had the endosperm removed, has a hole drilled into the side so that it makes a whistling sound when in flight. Such "whistling" arrows are occasionally mentioned by other ethnographers, but their purpose is unclear. It would seem counter-intuitive to warn the prey that a missive is on its way. Arrows with blunt points may be used to bring down birds so that their feathers are untainted with blood. The Apinajé fashion spinning tops from tucumã endocarps. A hole is drilled into one side of the hard seed case so that it hums when spinning. The small, slightly ellipsoid tops serve as toys (Nimuendajú 1939: 108).

The sturdy wood of tucumã palm is occasionally used for a variety of purposes. The Jurúna of the Upper Xingu, for example, fashion some of their bows from the palm stems. They also make combs from the dark wood for weaving (Oliveira 1970).

Several companies have recently begun offering Tucuma Seed Butter or Astrocaryum Vulgare Kernel Oil for cooking oil and for making soap due to its high lauric acid content (Bora et al. 2001). Similarly, oil from tucumã pulp is available online as a skin conditioner. In the early part of the twentieth century, farmers in Pará used the mesocarp oil for cooking (Pesce 1985: 35).

The prominence of tucumã in the lives of people in eastern Amazonia accounts for several places and a manioc variety being named after the palm. A variety of bitter manioc cultivated in the vicinity of Corre Água de Piriri near Cutias in Amapá, for example, is called Tucumã on account of the deep yellow color of the tubers. Yellow manioc flour fetches a premium in local and regional markets.

Attalea butyracea

12

Bolivia: Cusi; bitire' (Tsimané)
Brazil: Jací, aricuri
Colombia: Canambo, chapaya, guayo, palma de ramo, palma real, palma de vino; sapohe (Cofán); mabai (Piapoco); kurua (Ticuna), yarina (Witoto), tamjo (Yagua)
Ecuador: Canambó; canambó, lucata, chapaya (Kichwa), pa'pa, papa'o (Siona)
Peru: Shebón, shapaja; kontá (Amahuaca), kuakish (Aguarana), tsigaro (Machiguenga), budëd (Mayoruna)
Venezuela: Yagua, coroba; yei (Yanomama)

Status: Wild, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_12

Fig. 12.1 *Attalea butyracea* in a botanical garden. Roseau, Dominica, 12-21-12

Attalea palms tend to be conspicuous because of their massive fronds and propensity for thriving in disturbed habitats, both in uplands and wetlands. Shebón, as *Attalea butyracea* is known in Peru, stands out along river banks in western Amazonia on account of its long, arching fronds that reach 10 m in length. Shebón dominates the vegetation along some river banks, such as in floodplain forests along the lower Ucayali (Nebel et al. 2001). The palm has an extensive distribution from Mexico south through Central America and into northern South America in Colombia and Venezuela, as well as western Amazonia (Henderson 1995: 142). The widespread palm is found on uplands, but is more common in wetlands because it prefers moist soils (Normand et al. 2006).

Shebón looks much like shapaja (*Attalea phalerata*) except that the leaflets are regular, rather than alternate. Also, river dwellers in the Pacaya-Samira wetlands of the Peruvian Amazon report that the fruits are slightly larger and rounder than those of shapaja. The endocarp of *A. butyracea* is also harder and the leaf bases persist longer than those of its close relative, *A. phalerata*. Some farmers distinguish between the two species, whereas other locals conflate them and call them both shapaja. The ranges of the two palms overlap in the Peruvian Amazon and hybrids may well have formed.

Fig. 12.2 River dweller chopping open the endocarp of *Attalea butyracea* to access the white beetle grubs that are eating the endosperms. Near Nueva Esperanza, Marañón River, Pacaya-Samiria, Loreto, Peru, 11-10-03

In the Peruvian Amazon, river dwellers gather the fallen fruits and chop open the dense endocarp to check for grubs of bruchid beetles that may occupy one or all of the nut cavities. The macaroni-like white grubs are eaten raw, fried, or skewered with a thin sliver of wood and roasted over a fire. The beetle larvae have a nutty taste, similar to that of fresh Brazil nut (*Bertholletia excelsa*). The uncooked grubs are also used as fish bait, such as in the vicinity of Nueva Esperanza along the Marañón River.

Fig. 12.3 Cooking larvae of bruchid beetles extracted from endocarps of *Attalea butyracea*. Some of the grubs are being fried while others are roasting on a skewer. Nueva Esperanza, Marañón River, Pacaya-Samiria, Loreto, Peru, 11-10-03

In the Ecuadorian Amazon, the Waorani extract thumb-sized grubs of the palm weevil (*Rhyncophorus palmarum*) from decaying trunks of *Attalea butyracea* and the Yukuna do the same in the Caquetá watershed in the Colombian Amazon (Bernal et al. 2010; Macía 2004). In the Peruvian Amazon, however, river dwellers prefer to obtain the fatty grubs of *Rhyncophorus palmarum* from aguaje (*Mauritia flexuosa*) palms because they allegedly taste better.

Each shebón endocarp contains from one to three nuts, and the palm can produce as many as 1,400 fruits per infructescence as a means of ensuring that at least some progeny survive the onslaught of beetle attacks, as well as predation by agoutis (*Dasyprocta* spp.), spiny rats (*Proechimys* spp.), and squirrels (*Sciureus* spp.). All three rodents eat the nuts but also play an important role in dispersing fruits of the palm by scatterhoading them (Adler and Kestell 1998; Gálvez and Jansen 2007). People hunt agoutis and spiny rats in Amazonia, so the palms are an indirect source of high quality protein. Before they became extinct, giant ground sloths dispersed the seeds of *Attalea butyracea* (Janzen and Martin 1982). Giant sloths were likely present in the Amazon when the first humans arrived and may have survived well into the Holocene; they possibly served as the model for mapinguary, a mythical gorilla-like beast with a single eye in its forehead (Oren 1993).

The thin mesocarp surrounding the endocarp is rarely eaten in the Peruvian Amazon, but in southern Venezuela the fruit is boiled with salt until soft then the pulp and endosperm are eaten (Narváez and Stauffer 1999). The boiled mesocarp is also dried and then grated to make flour which can be stored for later use, such as in the preparation of *arepas* which are cooked on a *budare*. Grilled *arepas*, a favorite of Colombians and Venezuelans alike, are usually prepared with ground maize.

Fig. 12.4 Two fronds of *Attalea butyracea* woven together to form a *cumba*, used for covering the apex of thatched roofs. San Carlos, Puinahua River (a branch of the Ucayali), Pacaya-Samiria, Loreto, Peru, 1-12-06

Attalea butyracea is an important source of thatch for covering houses, boats, and rafts in the Colombian, Ecuadorian, and Peruvian Amazon. The Waorani, for example, often employ the leaves of *A. butyracea* for the outer layers of thatch for their houses in the Ecuadorian Amazon (Svenning and Macía 2002), as do the Machiguenga in the Peruvian Amazon (Johnson 2003: 74). The single family homes of the Amahuaca in southwestern Amazonia in the border area between Peru and Brazil require some 500 fronds of *A. butyracea* to form the roof of the rectangular houses that are some 6–10 m long (Dole 1998). And among the Piapoco in the Guaviare watershed in the northern part of the Colombian Amazon, the fronds of *A. butyracea* are the most importance source of thatching material for their dwellings (Mesa 2011: 108, Mesa and Galeano 2013). The Yanomama use fronds of *A. butyracea* to thatch their communal roundhouses, but they prefer the leaves of *Geonoma* palms (Gertsch et al. 2002).

Shebón fronds are wider and last longer than those of *Attalea phalerata*, and are thus transported hundreds of kilometers to supply villages and towns in the Peruvian Amazon. The palm is also used for thatch in other parts of its extensive range, such as in Panama (Aguilar and Condit 2001).

Fig. 12.5 Houses thatched with fronds of *Attalea butyracea*. Nauta, Marañón River, Loreto, Peru, 4-28-06

Along the Marañón River, rafts (*balsas*) loaded with produce, such as plantains or aguaje palm fruits, are typically covered with shebón fronds to protect the cargo and family members from the sun. When the rafts reach their destination in Nauta or Iquitos and the cargo has been off-loaded, the fronds and logs are dismantled for sale. The farmer then returns upstream on a scheduled boat with purchased goods and the two round paddles which were attached to long poles for steering.

Fig. 12.6 Raft (*balsa*) with cargo of plantains destined for Nauta. The plantains are covered with fronds of *Attalea butyracea* and plastic tarps to protect them from the sun and rain. Marañón River near Parinari, Loreto, Peru, 3-9-04

The fronds of *A. butyracea* are also used occasionally to make mats. Mayoruna women make two kinds of mats from the young fronds. Large mats are used for partitioning off portions of the long house (*maloca*) they live in, while smaller ones are placed on the ground to hold cooked game meat. The smaller mats are washed after the meal and hung inside the *maloca* (Romanoff et al. 2004: 28, 29). And the Amahuaca make brooms for domestic use from the rachis of the palm fronds, and also cut out heart-of-palm to eat (Tessmann 1999: 94).

Given its usefulness, shebón is typically spared when forest is cleared. And some farmers, such as in San Martin Tipishca on the lower Samiria River, a right bank affluent of the Marañón, and in Miraflores, a village at the confluence of the Tigre and Marañón, have planted the palm in their fields (*chacras*). The Yuracaré and Trinitario in the Bolivian Amazon also plant the palm in their fields and home gardens (Thomas and Van Damme 2010). Such plantings help create cultural forests, even when people have left the area because shebón endures for two centuries or more (Henderson 2002).

In the Sinú Valley in northern Colombia, locals fell the palm and cut a hole at the crown where sap collects. The sap is then allowed to ferment to make "wine", hence one of the names for the palm in Colombia: palma de vino (Gordon 1957: 84). Several palms are used to make "toddy" in both the New and Old Worlds, but this practice does not appear to be common in the Peruvian Amazon.

Attalea maripa

13

Bolivia: Cusi; xëbichoqui (Chácobo)
Brazil: Inajá, palha; naya'i (Araweté), awal (Canela), inaya'ɨ (Guajá, Ka'apor), karatsi (Kanamari), inata-ëp (Kaiabí), rikri (Kayapó), awara (Krahò), anayá (Parintintin), aohoe (Pirahã), ihki (Tukano), iki (Tuyuka), maripa (Wayana), rikré (Xikrin), okorasisi ãte, okolaxi (Yanomama)
Colombia: Cucurito; bojoriküríka (Makuna), kurá (Nukak), wizire (Piapoco), jarɨna (Witoto)
Ecuador: Inayu, iñayua (Achuar), inayova (Cofán), wa-hó (Siona)
Guyana: Cokerite palm
Peru: Inayuga, conta; edi ñi (Maijuna)
Suriname: Maripa
Venezuela: Cucurito, coroba; Ulu (Jodï), wasai (Makiritare), mabaco (Piapoco), wachá (Piaroa), careshi (Yanomama), wasai (Yekuana)

Status: Wild, spontaneous in cultural settings

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_13

Fig. 13.1 *Attalea maripa* in fruit in second growth at the edge of a home garden. Seringalzinho, Rio Jaú, Amazonas, Brazil, 10-3-1

Attalea maripa is yet another palm whose numbers have increased in the wake of human settlement. Called inajá in the Brazilian Amazon, a term stemming from the Tupi linguistic family, the conspicuous palm occurs as isolated individuals when it is being engulfed in forest, but it often proliferates in disturbed areas (Baar et al. 2004; Eden et al. 1994; Henderson 1995: 147; Levis et al. 2012; Salm 2005; Salm et al. 2005). The abundance of *A. maripa* in upland forest in the vicinity Ponta de Pedras on Marajó Island, for example, is likely a vestige of former cycles of slash-and-burn agriculture (Brondizio 2008: 94). And in the vicinity of Manicoré along the Madeira, the palm is an aggressive volunteer and occupies large areas of home gardens (Fraser et al. 2011a). Inajá is also considered a disturbance indicator in upland forests of the eastern portion of Maracá Island in Roraima (Milliken and Ratter 1998).

In the Brazilian Amazon, inajá is particularly conspicuous in some cattle pastures, such as on the upland plateau (*planalto*) just inland from the right bank of the lower Tapajós River and further east in the watershed of the Capim River. People raising cattle appreciate inajá palms because they are not armed with thorns and they provide shade for livestock (Santos and Mitja 2011). Smallholders also value the palm because it supplies many useful products, especially fruit. Inajá is thus typically spared when farmers clear the land to plant crops, such as in the vicinity of Aninduba and Murumuru, villages near Santarém, and near Anori along the Solimões River. A farmer along the lower Jaú River, an affluent of the lower Negro in Amazonas, spared an inajá palm when he cleared second growth for a manioc field because the fruits are sought after by white-collared peccaries, a prized game animal. Another valued game animal, the agouti, is also fond of the palm fruits (Bates 1863a: 203). This appears to be an ancient practice; the Jodï in the southwestern portion of the Orinoco watershed leave the palm standing when clearing their fields (Zent and Zent 2012). Because the palm is so useful, the Gorotirê Kayapó of the Fresco River, a tributary of the Xingu, set fires to encourage groves of inajá (Hecht 2003).

Fig. 13.2 Inajá palms in a pasture invaded by weeds. With each slash-and-burn cycle, the number of inajá palms increases. Fazenda Santa Maria da Liberdade, Urubu River, Amazonas, Brazil, 10-16-12

A denizen of secondary forest on uplands, the palm ranges widely in the Amazon and Orinoco Basins reaching north into the Guianas and Trinidad. The palm is found on mounds made by indigenous peoples in seasonally-flooded savanna, such as along the Upper Anabiju River on Marajó Island. Inajá is also common on and around ancient shell mounds lining Melgaço Bay in the Amazon estuary. Indeed, inajá is considered an indicator for Amazonian Dark Earth (ADE), associated with many archaeological sites (Balée 1988; Clement et al. 2003). The Ka'apor of western Maranhão consider *Attalea maripa* a tell-tale sign of cultural forests (Balée 2010b). Like so many other palms in Amazonia, inajá has a strong affinity with people.

In the Brazilian Amazon, inajá fruits throughout the year with production peaking in the rainy season (Stone 2007). The oily fruits are easy to harvest because the palm is not particularly tall, generally less than 20 m. The entire bunch is usually lopped off, each of which can contain over 2,000 fruits measuring some 5 cm long by 3 cm in diameter (Henderson 2002: 140). Inajá is a generous palm with up to four fruit bunches produced annually (Fragoso 1997). To access the mesocarp, the tough skin is peeled away using one's teeth. The sticky pulp is gnawed off the seed case as a snack in many parts of Amazonia, such as along the Rio Negro (Alarcón and Peixoto 2008). The pulp is also scraped off with a knife or spoon and combined with manioc flour (Cavalcante 2010: 135). In the community of Murumuru near Santarém, locals mix inajá pulp with tapioca then wrap the pancakes (*beijú*) in banana leaves before cooking them on an open fire. Inajá occasionally turns up in fruit stalls in Belém's Ver-o-Peso market, evidently to cater to those individuals who have migrated from the countryside and still retain a taste for wild fruits.

Indigenous people have long consumed the fruits of *Attalea maripa*. For example, the remains of *A. maripa* seeds are especially abundant in all layers of an archaeological site at Pedra Pintada near Monte Alegre in Pará that dates back some 11,000 years (Roosevelt 1999). And along the Caquetá in the Colombian Amazon, seeds of the palm are found in both preceramic and ceramic levels in anthropogenic earth sites (Cavelier et al. 1995).

Indigenous groups continue to eat the fruit as well as prepare concoctions with the pulp. The Saterê-Maué in the Maués watershed cook the entire fruits and serve them with manioc flour. Many other indigenous groups consume inajá fruits, including the Jurúna in the Upper Xingu (Oliveira 1970), the Nukak in the Colombian Amazon (Cárdenas and Politis 2000: 43), the Yanomama in the Upper Rio Negro and Orinoco watersheds (Cocco 1975: 147), and the Chácobo in the Bolivian Amazon (Balick 1988; Boom 1988). The Guajá, a hunting and gathering group who inhabit the eastern fringe of the Amazon forest in Maranhão, boil the mesocarp to make a porridge which is served in an inajá spathe (Balée 2013: 84). The Wapishana employ the pulp to make juice (Farabee 1918: 45) while the Waorani prepare an infusion with the fruits to treat colds (Davis and Yost 1983).

The fruits are also collected to feed pigs throughout the Brazilian Amazon. A fruit bunch is hung inside the pen so that the pigs can gnaw at will, or the individual fruits are kept in baskets in the home and tossed to the pigs.

Fig. 13.3 Pig pen with suspended inajá fruits. Comunidade Santo Afonso, Rio Xingu on floodplain of the lower Tocantins, near Abaetetuba, Pará, Brazil, 7-7-07

When the fruits fall to the ground the mesocarp eventually rots and certain beetles then seek out the endocarps to lay eggs. The resulting larvae feed on the endosperm which is protected by a hard shell. The Maijuna in the Peruvian and Colombian Amazon break the endocarps open to use the grubs for fish bait (Gilmore et al. 2013). Rural folk in the vicinity of Portel, Pará, extract beetle grubs from the seed cavities which are then fried and served with manioc flour.

Fig. 13.4 A cowboy loading inajá fruits on to a wagon. He has just gathered the fruits in a pasture and is taking them home to feed his pigs. Retiro Grande, near Cachoeira do Arari, Marajó Island, Pará, Brazil, 5-12-99

Inajá endocarps are extremely hard, so villagers along the northern coast of Marajó island crack them open to enable livestock to feed on the endosperms. The Jurúna of the Upper Xingu extract the nuts which they pound in a mortar and mix with manioc flour (Oliveira 1970). The Jurúna also snack on the raw nuts and prepare an oil from them which they mix with annatto (*Bixa orellana*) to flavor and color certain dishes. Inajá oil is also smeared on bows and then held over a fire to straighten them (Oliveira 1970). The Kaiabí of the Upper Xingu extract the oil from the nuts to rub into their hair (Ribeiro 1979: 122).

During the rubber boom, the endocarps were burned to create smoke for curing latex (Bates 1863a: 144; Herndon and Gibbon 1853: 285; Le Cointe 1922a: 321). And in the 1930s, potters in Itupanema, a village on the right bank of the lower Tocantins, used the endocarps of *A. maripa* and tucumã (*Astrocaryum vulgare*) to polish the surface of jars and bowls (Lustosa 1976: 220), a technique doubtless adopted from indigenous groups. The Maijuna, for example, use the endocarps to smooth their ceramic ware (Gilmore et al. 2013).

Fishermen in the Veracruz community near Maués, Amazonas, have an ingenious method of using inajá fruits to fish. Several peeled fruits are tied to a fishing line about 12 cm above a treble hook. When jaraqui (*Semaprochilodus* spp.) start nibbling on the pulp, the fisherman yanks the pole up to snag one of the zebra-tailed fish.

Fig. 13.5 Fisherman holding a line with peeled inajá fruits. When jaraqui nibble on the bait, the pole is pulled up sharply to snag the fish on the treble hook which is set below the bait. Veracruz, Maués River, Amazonas, Brazil, 11-17-02

A variety of mammals disperse *Attalea maripa* fruits. Tapirs (*Tapirus terrestris*) and the yellow-footed tortoise (*Chelonoidis denticulata*) pass intact endocarps in their feces (Fragoso 1998; Fragoso et al. 2003; Jerozolimski et al. 2009). Agoutis (*Dasyprocta leporina*) consume the pulp of fallen *Attalea maripa* fruits (Silvius and Fragoso 2003), and anecdotal information from hunters suggests they also bury some of the endocarps. Tapirs, yellow-footed tortoises, and agoutis are widely consumed in Amazonia, so the palm also contributes indirectly to people's diets in rural areas. And I have seen a troop of 15 squirrel monkeys (*Saimiri sciureus*) descend to the ground to eat fallen fruits of inajá in the watershed of the Croarí River in northern Marajó Island. The Pirahã in the Madeira watershed have songs that recount the habits of animals, including macaws eating inajá fruits (Gonçalves 2001: 337). Macaws may not be involved in dispersing fruits of the palm, but their spectacular feathers are highly valued by many indigenous groups for ornamentation.

Fig. 13.6 Inajá spathe used as a water bowl for chickens in the backyard of a farm house. Km 17 Estrada Safrita, near Maués, Amazonas, Brazil, 11-18-02

In addition to fruits, the ample spathes (bracts that cover the developing inflorescence) serve as basins and bowls. In the middle of the nineteenth century, the English naturalist Alfred Russel Wallace noted in regard to ubiquitous inajá:

> The great woody spathes used by hunters to cook meat in, as with water in them they stand the fire well. They are also used as baskets for carrying earth, and sometimes for cradles. (Wallace 1853: 122)

Inajá spathes coated in lacquer have turned up recently in the street fair that operates on Sundays along Avenida Eduardo Ribeiro in Manaus; they are sold as holders for magazines and household items. Known as *coratá* in the Brazilian Amazon, inajá spathes are large enough to be used by farmers in Caxiuanã, Pará, to carry manioc tubers to the flour processing hut (*casa da farinha*). The spathes are used to collect juice when squeezing manioc dough which is used to make savory tucupí sauce. Inajá spathes also serve as backyard drinking basins in rural areas for chickens, ducks, dogs, and cats.

Indigenous peoples have used the spathes for a long time. Chácobo children in the Bolivian Amazon play with the spathes (Boom 1988) while Maijuna youngsters use them for toy canoes (Gilmore et al. 2013). Along the coast of Amapá and adjacent French Guiana, the Palikur use the spathes to collect clay for making pottery (Van den Bel 2009). In northern Brazil and bordering Venezuela, the Yanomama once used the spathes for holding grated manioc (Albert and Milliken 2009: 96), while the Araweté who live along the Ipixuna, an affluent of the middle Xingu, still use the wooden spathes for bowls (Viveiros de Castro 1992b: 42).

Fig. 13.7 Sateré-Maué boy removing the orange skin from guaraná (*Paullinia cupana*) fruits. He is placing the seeds, still covered by white pulp, in an inajá spathe. Igarapé Aruã, Rio Urupadi, Maués River, Amazonas, Brazil 11-16-02

Although not common, the heart-of-palm of inajá is eaten in some areas, such as among the Yanomama (Anderson 1977). The custom of eating inajá palmito may have been more common in the past. The Brazilian botanist Frederico Carlos Hoehne, founder of the São Paulo Botanical Garden in 1938, recalled how inajá helped feed one of his plant collecting expeditions in the Upper Xingu in the early 1920s: “a very beautiful and extremely useful palm, the palmito that it produces is so large and nutritious that two were enough to feed fourteen men at each meal” (Hoehne 1923: 27).

Fig. 13.8 Basket (*côfo*) for carrying mangrove crabs (*Ucides cordatus*) to market. The specialized basket is fashioned from inajá fronds. Cametá, Tocantins River, Pará, Brazil, 7-1-07

In the Amazon estuary, locals fashion baskets from young inajá fronds to take mangrove crabs (*Ucides cordatus*) to market. The crab baskets, known locally as *côfo* or *pêra*, are sewn at the top to keep the hand-sized crabs from escaping.

Several indigenous groups also make baskets by weaving the palm’s fronds. The Wayana who inhabit the Paru de Este in the northern part of the Brazilian Amazon employ the fronds to make various kinds of baskets (Velthem 1998: 89). The Jurúna of the Upper Xingu also make a variety of baskets by weaving leaflets of the palm which they use for storing manioc flour and to carry produce and household items. The Jurúna also make mats from woven inajá leaflets to cover manioc beer while it is fermenting in a trough (Oliveira 1970). The Canela weave the palm leaflets to make mats for sleeping and to set out food (Crocker 1990: 425).

Other parts of inajá fronds are also used. At Povoação Guajará near Vigia in the Amazon estuary, frond midribs (*tala*) are used to make shrimp traps. The Wapishana who inhabit the Rupununi savannas in the border area between Brazil and Guyana have multiple uses for the frond midribs. Strips are torn from the rachis to make a squeeze press (called *tipití* in Brazil) for extracting liquid from grated manioc; they also plait the midrib strips to make sieves for removing tough, fibrous chunks from manioc dough before baking (Farabee 1918: 21). The Wapishana also make their blowgun darts from the frond midribs (Farabee 1918: 70), while the Yagua chip pieces of the palm's bark to make their darts which are sharpened using a piece of piranha jaw and carried in a container of woven *Attalea butyracea* leaflets (Chaumeil 1987: 74).

Fig. 13.9 Backyard hut thatched with inajá fronds in a village. Pontão, Urubu River, near Silves, Amazonas, Brazil, 10-11-12

Fronds of the palm are also used to thatch houses and huts, such as in the watershed of the Capim River in eastern Pará (Shanley and Rosa 2004). Inajá fronds are also used to thatch huts in the vicinity of Silves, Amazonas. Some fishermen who live by the shores of Canaçari Lake near Itacoatiara, Amazonas, cover their canoes with inajá fronds to protect them from the sun. And in Sucuriju, a village along the Urubu River in Amazonas, vegetables destined for the Manaus and Itacoatiara markets are protected from the harsh sun by erecting a framework of poles to support inajá fronds. The fronds are also used by some boat-builders to cover newly made hulls so that the sun does not crack the freshly cut wood.

Fig. 13.10 Inajá fronds provide partial shade for irrigated vegetables in a home garden. Sucuriju, Urubu River, Amazonas, Brazil, 10-17-12

Indigenous peoples have long used the palm to cover their residences, including the Piaroa in the Orinoco watershed (Rondón 2003), the Chácobo in the Bolivian Amazon (Boom 1989) and the Suruí in Rondônia, Brazil (Coimbra 1985). The Yanomama use the fronds to help secure the roofs of their communal roundhouses, which are thatched with fronds of *Geonoma baculifera*, a forest understory palm (Milliken and Albert 1999). Likewise, the Urubu in eastern Amazonia combine fronds of *Attalea maripa* and *Geonoma* sp. when thatching their homes (Ribeiro 1976: 52). The Urubu also make fans by weaving leaflets of *A. maripa*. The Macuxi and Wapixana in northern Roraima employ the fronds of *A. maripa* and *Mauritia flexuosa* when thatching their *malocas* (Hada 2010: 31). The Kaiabí of the Upper Xingu still employ the fronds to thatch their dwellings (Ribeiro 1979: 122) as do the Maijuna along the lower Napo, Algodón and Putumayo Rivers (Gilmore et al. 2013).

In the early twentieth century, the Baniwa in the Içana watershed of the Upper Rio Negro Basin used the fronds to make walls for their communal houses (Koch-Grünberg 1995: 102), while in the mid-twentieth century, the Canela in eastern Amazonia occasionally used the fronds to provide walls for their individual houses (Crocker 1990: 418). The Yanomama still make screens with *Attalea maripa* fronds to demarcate family areas within communal houses (Anderson 1978).

Fig. 13.11 Canoe covered with inajá fronds to protect it from the sun. Santo Antonio do Canaçari, Amazonas, Brazil, 10-19-12

In addition to fruits, fronds, midribs, and spathes, the palm provides other useful products. The Witoto who inhabit the forests between the Caquetá and Putumayo Rivers in the Colombian Amazon use the shoots, fruits, and bark of the palm to make an iron-rich salt that is taken by all tribal members (Echeverri and Román-Jitdutjaaño 2011). The palm ash is associated with transformative purification in Witoto spiritual beliefs. In Suriname, the Saramacca (descendants of escaped African slaves) also burn the fronds to make salt (Hoffman 2013).

The hard wood of *Attalea maripa* finds diverse uses among indigenous groups. For example, the Kaiabi who inhabit parts of the Juruena watershed in Mato Grosso fashion combs from the dense wood (Grünberg 2004). The Jurúna of the Upper Xingu make shiny, dark rings from the endocarps (Oliveira 1970) and the Kayapó drill holes into the endocarps and string them on necklaces (González-Pérez et al. 2013). The Yanomama fashion needles from the dark wood to pierce the lips of girls (Milliken and Albert 1999: 105) while the Piaroa of the middle Orinoco make a wind instrument that consists of a reed cut from a leaflet of the palm which is framed with the hard wood of the palm (Rodríguez 2011). The Canela in eastern Amazonia use the leaflets to fashion bands which they wear above their ankles and around their wrists, waist, and head (Crocker 1990: 124).

The prominence of *Attalea maripa* in so many Amazonian landscapes has prompted locals to name some crop varieties after the palm. A popular banana variety in Pará, for example, is called Inajá. A variety of bitter manioc cultivated on the Amazon floodplain in the vicinity of Flexal and Urucurituba (near Alenquer) in

Pará is also named after the palm. In upland forests around Lastancia in the Municipality of Itupiranga, Pará, farmers plant a bitter manioc variety called Inajázinho (the little inajá).

As with several other palms with widespread uses, *Attalea maripa* surfaces in regional lore. In the second half of the nineteenth century, Charles Frederick Hartt, a professor of geology at Cornell, noted down a story entitled "How a tortoise (jabutí) killed a jaguar and made a whistle of one of his bones". The tale was told to him in Santarém in *lingua geral*, also known as *nheengatu*, a lingua franca once widely used as a second language in the Brazilian Amazon to communicate with different ethnic groups and still spoken in some remote areas, such as the Upper Rio Negro:

> A monkey was high up in an inajá tree eating the fruit, when a jabutí came up underneath, and, seeing the monkey, asked:
> "What are you doing, monkey!"
> "I am eating inajá fruit," answered the monkey.
> "Throw one down for me," said the tortoise.
> "Climb up, jabutí," retorted the monkey.
> "But I cannot climb."
> "Then I will descend and fetch you."
>
> Down went the monkey and carried the tortoise up into the tree, placing him on a bunch of the fruit. He then went away, leaving the tortoise, saying that he would presently return.
> The jabutí ate until he was satisfied, and waited for the monkey, who did not return. He desired to descend, but was unable, and so he remained looking down, afraid to let himself fall, lest he might be killed.
> By and by, a jaguar came along, and, looking up into the tree, saw the jabutí.
> "U,i yautí!" said he, calling to the tortoise, "what are you doing up there?"
> "I am eating inajá fruit," answered the jabutí.
> "Throw me down one!" said the jaguar. The tortoise plucked a fruit and threw it to the jaguar, who, having eaten it, said: "Sé reté! Throw down another!" The tortoise obeyed.
> "Why don't you come down?" asked the jaguar. The tortoise answered that he was afraid lest he should be killed.
>
> Now the jaguar wanted to make a meal of the tortoise, so he said:
> "Don't be afraid! Jump! I will catch you!"
>
> The tortoise leaped down, but the jaguar missed his aim, and the tortoise, striking him on the head, killed him. The jabutí, unhurt, then went off to his hole. (Hartt 1875: 26–29)

A month later the tortoise returned to the carcass of the jaguar and removed a bone to make a flute.

The palm's generous fruit bunch also features in a myth recounted by the Parintintin who inhabit tributaries of the Madeira River in which a heavy fruit cluster is tossed on to the head of an evil supernatural entity which subsequently dies (Nimuendajú 1963b). The Pemon who live in the forest of northern Amazonia and contiguous areas of the Guianas recount a myth in which two brothers seek refuge in an *Attalea maripa* palm to escape a great flood (Sá 2004: 10). And a Kayapó myth recounts how the tribe once lived in the sky where they had abundant supplies of food, including the fruits of inajá palm (Lukesch 1976b: 9).

Attalea maripa also emerges in the mythology of Jodï who inhabit forests in Venezuela in the southwestern portion of the Orinoco basin close to the border with Colombia. According to the Jodï, godlike *jkyo malidëjka* is considered the cultivator of the ulu, as the palm is known in their culture (Zent and Zent 2012).

Attalea phalerata

14

Bolivia: Motacú; xëbini (Chácobo), mana'i (Tsimané)
Brazil: Urucuri, acuri; yoi (Yanomama)
Peru: Shapaja; cantsín (Shipibo)

Status: Wild, spontaneous in cultural settings, planted

Fig. 14.1 Shapaja (*Attalea phalerata*) in fruit in a village on an archaeological site. In forests, the palm grows taller because it has to compete for light. Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-25-06

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_14

Attalea phalerata is a widespread palm on floodplains of sediment-rich rivers along the Amazon River, its southern affluents, and the Marañón and Ucayali in Peru. It ranges from the mouth of the Amazon, where it is known as urucuri, to Peru and Bolivia, where the palm is called shapaja and motacú, respectively. The palm's distinctive arching fronds add grace to river banks and seasonally flooded savannas below 200 m. In the Bolivian Amazon, motacú often forms dense stands in transitional areas between forest and grasslands, particularly between 13° and 17° south in the Departments of Beni and Santa Cruz. Throughout its extensive range, the palm is a disturbance indicator because it is particularly common in regrowth forest. The tall palm has a wide range of uses including fruit, nuts, thatch, folk medicine, and crafts.

Fig. 14.2 River dweller gathering fruits of *Attalea phalerata* in a floodplain forest. Near Manco Capac, Rio Puinahua (a branch of the Ucayali River), Pacaya-Samiria, Loreto, Peru, 4-15-06

Attalea phalerata is a prolific fruiter. An infructescence contains from 300 to 500 fruits. When mature, the palm typically produces two to three fruit bunches a year, so fruit production can reach 150 kg annually (Moraes et al. 1996). The palm starts fruiting within 10 years, and the trunk of young specimens is short enough for people to gather the fruits while standing on the ground. After a couple of decades or so *A. phalerata* reaches 10 m when in forest or second growth and men may climb the trunk of a nearby tree to lop off a fruit bunch with a machete.

Shapaja fruits are covered by a thick, almost woody skin that must be peeled to reveal a thin layer of cream-colored pulp. Although the flesh is not particularly tasty, it is rich in oils, and thus serves as an energy-rich snack. While working along the Huallaga River almost two centuries ago, the German botanist Eduard Poeppig noted that the fruits have “the advantage of being sufficiently mealy to be toasted and serve as a substitute for manioc flour for the Indians on their long journeys” (Poeppig 2003: 263). Today, the mesocarp is still relished by campesinos and indigenous people alike, such as the Chácobo in the Bolivian Amazon (Boom 1988). Fruits of *Attalea phalerata* occasionally turn up in street markets, such as in Riberalta on the Beni River in Bolivia and in Rio Branco, Acre, Brazil.

Livestock also relish the pulp surrounding the wood-encased seed, so farmers and their families, such as on the Amazon floodplain in the vicinity of Santarém, gather the fruits to feed pigs, chickens, and ducks. Near Afuá in northwestern Marajó at the mouth of the Amazon, urucuri is often spared when clearing space around home sites because pigs, which are often allowed to roam free, feast on the fruits. Residents of Marinheiro, a small village in the Bailique archipelago in the northern part of the Amazon estuary, allow their small herds of cattle to roam in floodplain forest in search of fallen fruits, including those of urucuri.

The mesocarp of urucuri is also used for fishing in some areas. Fishermen in Juriti near Santarém, for example, scrape the pulp from the fruits and tie the oily mush into a ball on a line above several unbaited hooks. A float is then attached to the line which the fisherman yanks whenever it bobs, hoping to snag jaraqui (*Semaprochilodus* spp.) attracted to the urucuri mesocarp (Smith 1999: 65, 104).

The mesocarp of *Attalea phalerata*, as with other species in the genus, evolved to entice seed dispersal agents. As the fruits mature, they drop to the ground where animals, particularly agoutis (*Dasyprocta* spp.), are attracted by the mesocarp. Locals in Buenos Aires, a village on the lower Pucate, an affluent of the Yanayacu in the Pacaya-Samiria area of the Peruvian Amazon, report that squirrels like to nibble on the mesocarp of shapaja fruits, and they may also act as dispersal agents for the palm. Tapirs (*Tapirus terrestris*), the largest terrestrial game animal in Amazonia, swallow the fruit entire and later defecate the endocarps with their seeds still intact (Quiroga-Castro and Roldán 2001). By removing the fruits from around the parent tree, tapirs reduce the number of seeds infested with grubs of at least two species of bruchid beetles: *Pachymerus cardo* and *Speciomerus giganteus* (Visser et al. 2011). Tapir feces also serve as a physical barrier to bruchid beetles attempting to lay eggs. White-lipped peccaries (*Tayassu pecari*) and collared peccaries (*Pecari tajacu*) also eat the pulp but do not swallow the hard endocarp (Desbiez et al. 2009, 2010; Keuroghlian et al. 2009). The fruits of *A. phalerata* thus contribute indirectly to the human diet via game meat.

Fig. 14.3 River dweller eating the soft endosperm of *Attalea phalerata*. Buenos Aires, Lower Pucate, affluent of the Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-10-04

People eat shapaja nuts when they are still soft (*choclo* in Peru). Before the fruits are fully ripe the infructescence is lopped off and the endocarp is cut open transversely with a machete so that the soft, slender nuts can be pried out. Farmers at La Poza, a small settlement near the town of Victoria on the Puinahua River (a branch of the Ucayali) sometimes mix the still soft endosperms of shapaja with manioc flour to make a hearty, protein-enriched meal. The white nut tastes especially creamy because of the high oil content, the highest recorded for any palm (Moraes et al. 1996). Further, the kernels of *Attalea phalerata* are high in oleic acid, a kind of oil that can lower levels of bad cholesterol (LDL) in the blood. In the Beni region of Bolivia, locals extract oil from the nuts of motacú and sometimes sell them in glass bottles in regional markets, such as Trinidad's Mercado Campesino. The Tacana in the foothills of the Bolivian Andes use motacú oil to soothe sore muscles and to treat pulmonary conditions (Moraes et al. 1995).

If the fruits have not been eaten or taken away by game animals, the skin and mesocarp eventually decay leaving the endocarp. The nuts, from one to six per endocarp, are hard at this stage and people no longer eat them. Rather they check to see if any of them have been invaded by grubs of bruchid beetles. The palm floods the forest floor with fruits to attract seed dispersal agents and to increase the chances that at least a few of the endocarps that remain near the parent tree will escape infestation. It is not uncommon to find dozens of endocarps in various stages of decomposition in the moist forest floor underneath the palm.

Fig. 14.4 Beetle grubs removed from the endocarp of *Attalea phalerata* are eaten after they are fried or roasted on sticks. Yarina, Rio Yanayacu, Pacaya-Samiria, Loreto, Peru, 6-6-04

The bruchid beetle grubs, known as suri in Peru, are much smaller than the palm beetle (*Rhynchophorus palmarum*) larvae that fatten inside the rotting trunks of large palms. Yet the white, peanut-sized bruchid grubs are nevertheless relished for their a creamy texture and nutty taste. As in the case of the closely related *Attalea butyracea*, the bruchid larvae feed on the endosperms, eventually filling the seed cavity. After pupating, the freshly emerged beetles gnaw their way out of the endocarps leaving an exit hole the diameter of a pencil. People therefore only check those endocarps without exit holes. In the Peruvian Amazon, the grubs are also kept alive for bait to catch a variety of fish including shuyo (Erythrinidae), sardiña (*Triportheus*), palometa (*Mylossoma*), certain catfish, and sabalo (*Brycon*). In the vicinity of Altamira on the Xingu River, rural folk use grubs extracted from the endocarps of *Attalea phalerata* as bait for catching esteemed pacu (*Myleus*).

Heart-of-palm from *Attalea phalerata* is a regional delicacy in the Llanos de Moxos in the Bolivian Amazon. In the small town of San Ignacio, the site of an ancient Jesuit mission, locals cook heart-of-palm of motacú as a vegetable. Residents of San Ignacio also dice cooked motacú palmito and mix it with chopped tomatoes and the green tops of spring onions, every bit as tasty as gourmet potato salad. Palmito of *A. phalerata* has long been considered a delicacy in the Llanos de Moxos (Denevan 1966: 104). It remains an important item in the diet of the Sirionó in eastern Bolivia (Holmberg 1969: 64).

Fig. 14.5 Girl eating *Attalea phalerata* heart-of-palm that her mother boiled. San Ignacio, Beni, Bolivia, 5-27-05

The ample fronds of *Attalea phalerata* are used to thatch houses, external kitchens, temporary shelters, and pig pens when more durable palm fronds, such as those of *A. butyracea* or yarina (*Phytelephas macrocarpa*) are not available. Shapaja fronds only last for about 3 years, whereas some palm fronds, such as those of buçú (*Manicaria saccifera*), may keep out the rain for a decade. Shapaja has been used by indigenous cultures to thatch their houses for a long time. The Tacana of the Madidi watershed in the Bolivian Amazon employ leaves of the palm to cover their homes (DeWalt et al. 1999). The Sirionó in eastern Bolivia make provisional shelters in the forest while on hunting expeditions by stacking layers of the palm fronds against a rectangular frame. The lengthy fronds are placed at a 60° angle such that a gap remains at the apex through which smoke from the fire used for cooking and warmth can escape. The Sirionó also construct their communal houses (*malocas*) with the palm fronds; their *malocas* are some 20 m long and provide shelter for 60–80 people (Holmberg 1969: 34–37).

Fig. 14.6 External kitchen thatched with fronds of *Attalea phalerata*. Quebrada Huirurui near San Martin Tipishca, Samiria River, Pacaya-Samiria, Loreto, Peru, 4-25-06

Along Paraná Cachoeri on the Amazon floodplain near Oriximiná in Brazil, farmers use fronds of urucuri to shade their raised vegetable beds. Similarly, vegetable growers at São Cirico de Urucurituba on the Amazon floodplain near Santarém cover their cabbage nurseries, which they establish as floodwaters recede, with urucuri fronds.

Cumbas of shapaja, made by weaving three fronds together, are a common sight leaning against houses in the Peruvian Amazon. Once dry, the yellow *cumbas* are secured on the apex of roofs to keep out the rain. *Cumbas* are usually woven by men, and take about 20 min to complete.

Fig. 14.7 A 72 year-old river dweller fashioning a *cumba* with fronds of *Attalea phalerata* in front of his village home. The *cumba* will be used to repair the roof of his house. San Martin Tipishca, Samiria River, Pacaya-Samiria, Loreto, Peru, 7-16-10

Attalea phalerata has a wide range of other uses, from making baskets to warding off insects, maintaining embers for starting fires, as temper in pottery, and for making shrimp traps. In the vicinity of Trinidad in the Bolivian Amazon, rural folk fashion baskets from the leaf rachis of motacú for sale in town, an ancient practice as evidenced by a similar use of the rachis among the Tacana in the foothills of the Bolivian Andes (Moraes et al. 1995). The Sirionó in eastern Bolivia fashion make-shift baskets in the forest from fronds of the palm for carrying home game, fruits, and produce from their fields. They also weave more durable baskets from the palm fronds for storing household items. The Sirionó also make mats from the fronds to sit on while rolling out coils of clay for pottery making, and to wrap the deceased prior to burial (Holmberg 1969: 21, 22). Motacú mats turn up in Sirionó mythology; a child belonging to the moon (*yási*), a culture hero, is killed when a jaguar which was delousing the child bit into his head. The jaguar then hides between two motacú mats to escape the wrath of the moon (Holmberg 1969: 117). Indigenous groups in the Madidi watershed in Bolivia also make mats from the palm leaves (Paniagua-Zambrana 2005). The curved bract that covers each developing fruit bunch eventually falls to the ground and in the vicinity of Afuá, this boat-shaped structure, known locally as *coatá*, is burned to help ward off mosquitoes around homes. In the Amazon estuary, the midribs of urucuri fronds are sometimes employed to fashion traps for freshwater shrimp.

The hard endocarps of *Attalea phalerata* made them a favorite fuel for rubber tappers during the rubber boom which lasted from the 1870s to about 1910 (Fonseca

1895: 41; Herndon and Gibbon 1853: 285; Lange 1914: 59, 67). Rubber tappers in the Amazon once gathered the fruits of urucuri into piles near their huts to fuel fires for smoking latex. The fruits were either burned inside a clay or metal pot (*buião*) that funneled the thick smoke up to a small spout at the top, or in a pit dug inside the smoking hut (Le Cointe 1922a: 321; Spruce 1851; Woodroffe and Smith 1915: 198). The hard endocarp of the palm and its oily nuts produced a distinctive white smoke which made the rubber more durable and elastic. Rubber balls were produced by pouring latex on to a rotating stick or paddle held over the dense smoke.

Fig. 14.8 Rubber tapper smoking latex over a fire using fruits of *Attalea phalerata* for fuel in the second half of the nineteenth century. The tapper periodically adds a fresh layer of latex scooped from the carapace of a giant river turtle (*Podocnemis expansa*). Madeira River, Brazil (Keller 1874: 101)

The popularity of *Attalea phalerata* among rubber tappers led to the palm's enrichment around their camps. While conducting fieldwork on Marajó over a century ago, the Swiss botanist Jacques Huber speculated that some of the urucuri stands on the island were created by rubber tappers (Huber 1902). And in the latter part of the nineteenth century, the Yorkshire botanist Richard Spruce remarked that stands of urucuri palms were often found close to rubber trees near the confluence of the Maués and Amazon rivers (Spruce 1908: 182). Such clusters of the palm could have arisen by deliberately planting the seeds or seedlings, or by spontaneous sprouting from piles of the fruits left by tappers during the rainy season when they generally took a break from tapping rubber. In a few areas, the fruits of *A. phalerata* are still burned to coagulate rubber, such as among the Yawanawá of the Upper Gregório in Acre (Campos and Ehringhaus 2003).

Along the Madeira River, *Attalea phalerata* is considered an indicator species for dark soils of anthropogenic origin (Fraser et al. 2011b; Junqueira et al. 2010a, b). A century ago, cacao growers considered the palm a good indicator of fertile soils when scoping out areas to plant their crop (Le Cointe 1922b: 116). And in the Pantanal, stands of the palm called *acurizais* are typically of anthropic origin due the palm's ability to colonize burned or cleared areas (Pott et al. 2011).

Fig. 14.9 Shapaja palms planted in a home garden to provide thatch. San Carlos, Rio Puinahua (a branch of the Ucayali River), Pacaya-Samiria, Loreto, Peru, 4-17-06

Because *Attalea phalerata* is useful for such a wide variety of purposes, the palm is often spared when farmers clear forest for their fields in the Peruvian Amazon, such as along the Pucallpa-Tingo Maria highway (Vebrova et al. 2013), in the vicinity of Victoria on the Puinahua, a branch of the Ucayali, and near Yarina along the Yanayacu River in the Pacaya-Samiria National Reserve. As with several other wetland palms, farmers sometimes plant seeds or transplant sprouts of *A. phalerata* in their backyards and fields, such as in the vicinity of San Carlos, a village on the Puinahua River on the Ucayali floodplain, and in San Martin Tipishca on the lower Samiria River, an affluent of the Marañón. Urucuri is also often left alone when it sprouts spontaneously in home gardens in the Brazilian Amazon, such as in the vicinity of Afuá on Marajó Island at the mouth of the Amazon. Along the middle Madeira, urucuri is therefore common in home gardens (Fraser et al. 2011a).

Fig. 14.10 Motacú palm in fruit in a street market. Riberalta, Beni, Bolivia, 5-31-05

The majestic palm is sometimes planted in towns, or spared when urban centers sprawl into the countryside. In the Bolivian Amazon, for example, motacú is planted as a shade tree in plazas, along streets, and in backyards, such as in Riberalta on the Beni. It is not surprising, then, that *A. phalerata* is common in cultural forests that cloak artificial mounds in the seasonally-flooded savannas of the Bolivian Amazon, such as in the territory of the Sirionó (Erickson and Balée 2006).

Fig. 14.11 Indigenous mound capped with a cultural forest containing *Attalea phalerata* in a seasonally-flooded savanna. Cattle seek refuge on the mound during the rainy season as evidenced by their trails in the flooded grassland. Near Trinidad, Beni, Bolivia, 5-26-05

Urucuri is so entwined in the economic and cultural life of floodplain dwellers along the Amazon that some settlements, such as Urucurituba near Santarém and Urucuri Grande near Codajás, are named after the palm. And in the Peruvian Amazon, Shapaja is the name for a village along the Huallaga a few kilometers upstream from its confluence with the Mayo.

Crop varieties are also named after the palm. Near Santarém, one of the bitter varieties of manioc is called Urucuri, so named because the yellow tubers resemble the color of the palm's mesocarp. Some farmers along the Macacoari River in Amapá and on Caviana Island at the mouth of the Amazon interplant the Urucuri variety of banana in their fields.

Fig. 14.12 Fresco of the Garden of Eden depicting a motacú palm (*Attalea phalerata*) in fruit. Jesuit Church, San Ignacio, Beni, Bolivia, 5-27-05

The palm is such a prominent feature of landscapes in the seasonally flooded savannas of the Bolivian Amazon that motacú is featured in a fresco depicting the Garden of Eden on the walls of the Jesuit church in San Ignacio near Trinidad. This tropical version of the Old Testament garden also includes a jaguar.

The palm serves as a haven for much wildlife in wetland savannas. The rare blue-throated macaw (*Ara glaucogularis*), for example, nests in *Attalea phalerata* in seasonally-flooded grasslands in a few locations in the Llanos de Moxos in the Bolivian Amazon and also feeds on the palm's fruits (Jordan and Munn 1993). While this macaw also roosts in other palms in inundated savannas, *A. phalerata* may be the single most important plant as a source of food and nesting sites for this highly endangered bird. In the Pantanal of Brazil, the hyacinth macaw (*Anodorhynchus hyacithinus*), the world's largest parrot, feeds on fruits of *A. phalerata* that have been passed by cattle. The powerful bill of the hyacinth macaw allows it to crack open the hard endocarp to reach the nuts. And crested caracaras (*Caracara plancus*) disperse the palm when carry away the fruits in their beaks to feed on the oily mesocarp; they drop the endocarp to the ground unharmed (Galetti and Guimarães 2004).

Attalea racemosa

15

Brazil: Palha preta, curuá; pepu (Tuyuka)
Colombia: Palm de coco; uiyoyɨ (Witoto)
Peru: Shebon, catirina
Venezuela: Mavaco

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_15

Fig. 15.1 *Attalea racemosa* in old secondary forest on uplands. Near Seringalzinho, lower Rio Jaú, Amazonas, Brazil, 10-3-12

Attalea racemosa is a stemless palm of upland forest and more open vegetation on sandy soils. It grows in northwestern Amazonia including parts of the Rio Negro watershed in Brazil and contiguous areas in Venezuela and Colombia, as well as in Loreto, Peru (Henderson 1995: 151; Vásquez 1997: 760). The petioles are tinged red and the fruits, measuring 9 cm by 6.5 cm, resemble those of its larger cousin, babaçu (*Attalea speciosa*). Each endocarp contains from one to three elongated endosperms, which are crunchy and savory. River dwellers along the Jaú, an affluent of the lower Rio Negro, relish the white endosperms.

Fig. 15.2 Kitchen in a village home with walls and roof made with *Attalea racemosa* fronds. Known locally as curuá, the fronds were gathered in nearby upland forest. Sitio São Cristovam, Rio Negro near its confluence with the Jaú, Amazonas, Brazil, 10-4-12

The main use for the palm in the Rio Negro watershed, however, is the fronds which are used to thatch houses and huts. The Piaroa in the Orinoco Basin also thatch their dwellings with the fronds of this palm (Rondón 2003). The fronds are also woven into mats to serve as walls within and on the outside of rural homes. The fronds, several layers thick, are also used to cover small river boats, although plastic tarps or metal roofs are increasingly used in their place.

Fig. 15.3 River boat thatched with *Attalea racemosa* fronds and powered by a small outboard motor (*rabeta*). Confluence of the Jaú and Negro Rivers, Amazonas, Brazil, 10-4-12

Fig. 15.4 Tuyuka boy gathering fronds of pepu (*Attalea racemosa*) in old secondary forest. He will take them back to his village for thatch. He fashioned the headband from a pepu leaflet. São Pedro Antigo, Rio Tiquié, affluent of the Uaupés, Amazonas, Brazil, 11-1-12

Tuyuka youngsters who inhabit the upper Tiquié in the Upper Rio Negro region like to make toys and artifacts from the young leaflets of *Attalea racemosa*. Headbands, birds, snakes, and other ornaments are quickly fashioned by girls and boys alike. They do this out of an urge to play and be creative rather than for financial gain. The Tuyuka live far from any sizeable town, but in the future markets could be developed in São Gabriel da Cachoeira or Manaus for the beautiful ornaments made by Tuyuka youth which are light and durable and easily transported

Fig. 15.5 Bird figure fashioned with an *Attalea racemosa* leaflet. The boy is Hupda (Makú) and boards in a Tuyuka village to attend school. His face is pained with a *red dye* obtained from carajuru (*Arrabidea chica*, Bignoniaceae) to ward off evil influences. São Pedro Antigo, Rio Tiquié, affluent of the Uaupés, Amazonas, Brazil, 11-1-12

Attalea sagotii

16

Brazil: Palha branca, palha vermelha; phepuri (Tuyuka)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_16

Fig. 16.1 Palha vermelha (*Attalea sagotii*) in old secondary forest. Seringalzinho, lower Jaú River, Amazonas, Brazil, 10-3-12

Attalea sagotii is another acaulescent palm in the genus *Attalea*, formerly known as *Orbignya*. A synonym of *A. microcarpa*, this stemless palm resembles a dwarf babaçu (*Attalea speciosa*), and the taxonomy of some of these small *Attalea* palms is ripe for revision (Henderson 1995: 149). *A. sagotii* occurs north of the Amazon River reaching into the Guianas and is found as far west as Loreto in the Peru. The understory palm grows on well drained upland sites, and is especially common in patches of regrowth forest.

Fig. 16.2 External kitchen of a Tukano home. The roof is thatched with fronds of a *Geonoma* palm with an elongated frond of *Attalea sagotii* at the apex to help weigh down the other fronds in the event of a storm. São José, Rio Tiquié, affluent of the Uaupés, Amazonas, Brazil, 10-29-12

Known variously as palha branca or palha vermelha along the Jaú River, an affluent of the lower Rio Negro, the palm is used mostly for thatch. The petioles and midribs (rachis) of the fronds are a distinctive reddish brown, hence one of the palm's common names in the Brazilian Amazon: palha vermelha ("red" straw). The Tukano and Tuyuka who live in scattered villages along the Tiquié, an affluent of the Uaupés, also use the fronds to fashion roofs and walls for their homes, backyard huts, and external kitchens. Before the arrival of Catholic and protestant missionaries, both indigenous groups lived in communal long houses (*malocas*) thatched with fronds of *Mauritia carana*.

Fig. 16.3 Tukano house the outside wall composed of woven fronds of *Attalea sagotii*. The base of the wall has fronds of *Mauritia flexuosa* tucked under a lattice to act as a splash guard. São José, Rio Tiquié, affluent of the Uaupés, Amazonas, Brazil, 10-29-12

17 Attalea speciosa

Bolivia: Cusi
Brazil: Babaçu, palha branca, pindoba, uauassú; nata'i (Araweté), wã'ɨ (Guajá), yetahu-'ɨ (Ka'apor), rõe tere (Krahò), chikon poro (Matis), pindó (Parintintin), rõ (Xikrin)

Status: Wild, spontaneous in cultural settings

Fig. 17.1 *Attalea speciosa* proliferating in second growth that is colonizing a harvested manioc field. Km 40 Novo Ayrão-Manaus road, Amazonas, Brazil, 10-6-12

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_17

Babaçu (*Attalea speciosa*) palm is common in eastern and southern Amazonia, and occurs in relatively small areas of central Amazonia. In the eastern fringe of the Amazonia in Maranhão, where the dry season is more pronounced and the forest is more susceptible to fire, the palm forms extensive stands called *babaçuais* that cover some 330,000 sq km, about a third of the state (Pinheiro and Frazão 1995). In the vicinity of Itacoatiara along the middle Amazon, rural folk call the palm palha branca and designate a stand of the palm as a *palhal*. In the southwestern part of the Amazon Basin, the palm extends into lowland Bolivia on outcrops of the Precambrian Brazilian shield (Henderson 1995: 155). The palm also occurs in more arid landscapes of the Brazilian Northeast in Ceará and Piauí, and extends from southeastern Amazonia through Goiás in central Brazil as far south as Minas Gerais (Anderson et al. 1991: 9). Babaçu is a *terra firme* cousin of urucuri (*Attalea phalerata*), the latter found mostly on floodplains.

An exceedingly hard endocarp protects one to three seeds. After sprouting, the shoot first grows down into the soil up to 50 cm before differentiating into roots and a shoot tip that then heads up to the surface, a process known as cryptogeal germination (Anderson et al. 1991: 71). Seedlings are thus protected from the ravages of fire at their most delicate stage. Once established, the palm can survive most fires and is thus common in landscapes where people burn forest to create fields or torch pastures after slashing weeds.

Fig. 17.2 Babaçu seedlings that have survived a fire set by a farmer to plant crops. Travessão Norte, km 80 Altamira-Itaituba, Transamazon Highway, Pará, Brazil, 1972

The majestic palm is an indicator species for liana forests (*mata de cipó*), a late successional forest found in parts of eastern Amazonia resulting from repeated slash-and-burn farming cycles (Balée and Campbell 1990). The palm can persist as a "fingerprint" of former human activity for a long time since *Attalea speciosa* has been known to live for 230 years (Henderson 2002: 90). In 1908, Emilia Snethlage, a German-born Brazilian ornithologist, noted large patches of babaçu palm along the Iriri, an affluent of the Xingu, a sure sign that the largely depopulated river had been farmed by indigenous people in the past (Snethlage 1910).

Fig. 17.3 Babaçu seedling that has survived a fire because the sprouting tip grows down into the soil before emerging above ground. Travessão Norte, km 80 Altamira-Itaituba, Transamazon Highway, Pará, Brazil, 1972

In Pará, some farmers and ranchers regard babaçu as a nuisance, even abandoning pastures to the invasive palm (Mitja and Ferraz 2001). Yet some ranchers, including small holders who are raising a few head of cattle, regard babaçu a blessing because it provides shade for livestock. Furthermore, some farmers consider the oil-rich nuts a resource. Consequently, the palm is often spared when clearing land to plant crops in fields and home gardens. The nuts are an important food item for the some indigenous groups, such as the Guajá in western Maranhão (Balée 1987) and the Xavante who inhabit campo-cerrado and galeria forests in the Upper Araguaia (Maybury-Lewis 1967: 46). The Xavante keep a supply of the nuts on hand in baskets in their homes for snacking throughout the day and men also chew the nuts to obtain the oil which they mix with their saliva to rub into their hair and smear on their bodies. Women of the Asuriní tribe who live in the forest inland from the right bank of the lower Xingu near its confluence with the Bacajá gather the nuts to snack on them and also to extract their oil (Lukesch 1976a: 61).

The large, oblong fruits some 10 cm long and 7 cm in diameter are born clusters that can contain up to 1,000 fruits. Some *Attalea speciosa* trees are male, but those with both male and female flowers typically produce several fruit bunches a year, so fruit production is abundant. Babaçu fruits year round, but peaks during the dry season. Estimates of babaçu fruit yield range widely, with yields of 1,800 kg/ha considered typical (Lleras and Coradin 1988). Uauassú, an old name for the palm in the Brazilian Amazon, means large fruit, from *uau* (fruit), and *assú* or *açu* which means large (Wallace 1853: 118). Many fruit names in the Amazon derive from indigenous languages, as well as *lingua geral*, a lingua franca spoken widely in the Brazilian Amazon during the colonial period.

Fig. 17.4 *Attalea speciosa* in fruit in second growth. Near Silves, Amazonas, Brazil, 10-14-12

Babaçu nuts are eaten as a snack, either whole or after being crushed and mixed with manioc flour. A river dweller in the community of Sangaua along the Urubu River in Amazonas is particularly fond of drinking black coffee along with pounded babaçu nuts that have been stirred into a bowl or cup of manioc flour.

Oil extracted from babaçu nuts is the most valuable product of the palm in eastern Amazonia where it is used for cooking. One river dweller I visited in 1971 on an island in the Xingu downstream from Altamira just before the river reaches the Belo Monte rapids told me that he extracts babaçu oil to make soap. In some parts of Amazonia, especially in the eastern fringes of the forest in Maranhão, babaçu oil extraction is a major cottage industry; some half a million rural families are engaged in this enterprise (Anderson et al. 1991: 9).

From 1920 to 1935, babaçu kernels were traded internationally, then from 1940 to 1960 factories in Rio de Janeiro and São Paulo used babaçu oil to make margarine which was sold throughout Brazil and even exported to Argentina (May 1992; Pesce 1985: 81). In the 1920s, Brazil exported much of its babaçu oil production to France, but oil from coconut (*Cocos nucifera*) and African oil palm (*Elaeis guineensis*) now accounts for most of the international trade in palm oil (Markley 1971). Babaçu kernel oil production is not mostly confined to the Brazilian Northeast. In the Bolivian Amazon, oil from the nuts (*azeite de cusi*) is bottled for sale in some urban markets, such as Mercado Campesino in Trinidad.

Fig. 17.5 Farm boys gathering fallen babaçu fruits in a field abandoned to second growth. Cameleão, near São João de Pirabas, Pará, Brazil, 12-31-01

Extraction of oil from the palm nuts is no easy task. First, the fallen fruits have to be gathered from the ground. Then the dense endocarp has to be cracked open. To do this, locals place an upturned axe on the ground, put the endocarp on the blade, then strike it with a wooden club or mallet. When rural folk are splitting open babaçu endocarps they sometimes encounter beetle larvae (*Pachymerus nuclearum*) which provide a welcome snack and are also used for fish bait (Anderson et al. 1991: 114). Once the endocarp is split, the nuts are removed and placed in a container. The nuts are then pounded in a wooden mortar to make a mash which is then drained or squeezed to obtain the oil. In some areas, people roast the kernels lightly, mash them, and add water; the mixture is then heated to release the oil (Anderson et al. 1991: 113). The hard work involved in accessing the nuts is a major reason why babaçu oil has not taken off as a biofuel. However, babaçu oil is used in a few botanical-based hair conditioners and body oils.

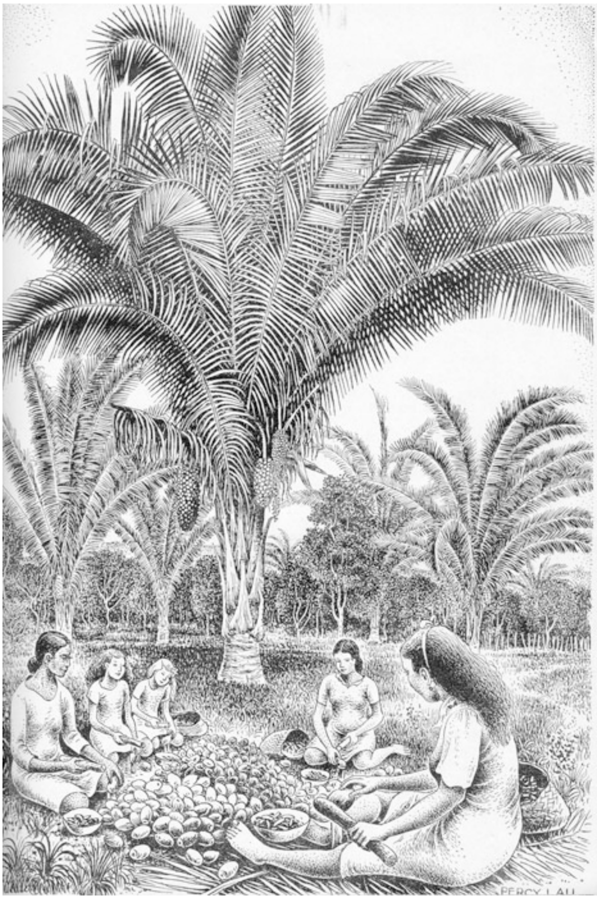

Fig. 17.6 Women in Maranhão cracking open babaçu endocarps to extract the nuts (Lau 1975: 97)

In the vicinity of São João de Pirabas, near Salinas in Pará, rural folk prepare a non-alcoholic drink (*vinho de babaçu*) with babaçu nuts. The nuts are pounded in a mortar and the mash is placed in a sieve where water is poured over the crushed nuts. After the oily liquid has finished draining into a container, sugar is added to taste.

Several byproducts from the oil extraction procedure are also useful. The seedcake (also referred to as press cake) remaining after the oil is extracted is sold for shrimp bait. In the Amazon estuary, river dwellers place a small plastic bag of babaçu seedcake inside their traps (*matapís*) to attract freshwater shrimp (*Macrobrachium amazonicum*) which enter through funnel-shaped entrances at each end. After several hours, the traps are pulled up and the shrimp are emptied into a basket by opening a small trap door on the top of the trap (Smith 2002: 192–196). Babaçu seedcake is sold in markets at the mouth of the Amazon, such as in Breves on Marajó Island, and is traded from Maranhão where most babaçu oil is produced. Sometimes babaçu seedcake is mixed with rice bran to attract shrimp. In the Brazilian northeast, some of the press cake is purchased for export to Western Europe where it is employed as livestock feed (Anderson et al. 1991: 152).

Babaçu nuts are also used to catch sirí crabs (*Callinectes bocourti*) in Mosqueiro near Belém in the southern part of the Amazon estuary. The nuts are pounded and then wrapped, without extracting the oil, in leaves from a banana plant or from several wild shrubs in the Marantaceae family. The bait is then placed in a cylindrical trap fashioned with sticks. The trap is then lowered into the water from a bridge over a tidal creek and periodically checked.

The split endocarps make an excellent cooking fuel because the wood is so dense and in Maranhão some rural folk sell charcoal made from them. During the rubber boom, the endocarps were burned to coagulate latex and to fuel steamships operating along the coast of Brazil and even across the Atlantic (Fonseca 1924: 18; Le Cointe 1922a: 321; Spix and Martius 1938: 31).

In the 1970s, colonists along the Transamazon near Agrovila Coco Chato at km 42 of the Marabá-Altamira stretch of the highway burned the endocarps of babaçu while working in their fields during the rainy season to ward off black flies (*Simulium* sp.). Known locally as pium, larvae of the miniscule flies attach to rocks in rapids and emerge as adults in swarms in search of a blood meal. Farmers kept smoldering braziers of split babaçu endocarps by their sides as they weeded and harvested their crops.

Fig. 17.7 Farm house thatched with palha branca (*Attalea speciosa*) fronds. Km 80 AM 363 near Itapiranga, Amazonas, Brazil, 10-14-12

The pulp surrounding the endocarp is too thin and of indifferent taste to be of much interest to locals. Nevertheless, the Mura of the lower Madeira River used to make a beverage from the mesocarp a century ago, but it is unclear whether remnants of the tribe continue that custom (Tastevin 1923). The parsimonious pulp evolved to attract agoutis (*Dasyprocta* spp.) which quickly nibble through the skin covering the mesocarp (Smith 1974). Some of the fruits are removed and buried, so the diurnal rodent acts as a seed dispersal agent. Other fruits are simply abandoned on the surface after the mesocarp is eaten. The endocarp is sufficiently tough, however, to withstand the powerful incisors of the agouti, so the seeds are unharmed. According to local informants, paca (*Agouti paca*), which is a larger nocturnal rodent, and the prehensile-tailed porcupine (*Coendou* sp.), also eat the mesocarp of babaçu. But their role, if any, in seed dispersal of the palm is unclear. Some indigenous groups have found uses for the hard endocarp for their crafts. The Asuriní, for example, make small disks from the durable wood which they thread on to a variety of necklaces (Lukesch 1976a: 92).

Fig. 17.8 Passenger boat thatched with fronds of *Attalea speciosa*, known locally as palha branca. Maués, Amazonas, Brazil 11-17-02

The generous, arching fronds serve as thatch for houses, huts, and boats. Palha branca (white straw), one of the common names for the palm in the state of Amazonas, Brazil, refers to its usefulness for thatching dwellings and huts for processing manioc flour (*casa da farinha*), as well as chicken coops, outhouses, and boats. In some of the simpler homes in the interior, babaçu fronds are also used to fashion walls. Babaçu fronds are occasionally sent to urban markets, such as Santarém at the confluence of the Amazon and Tapajós Rivers and Itacoatiara along the middle Amazon.

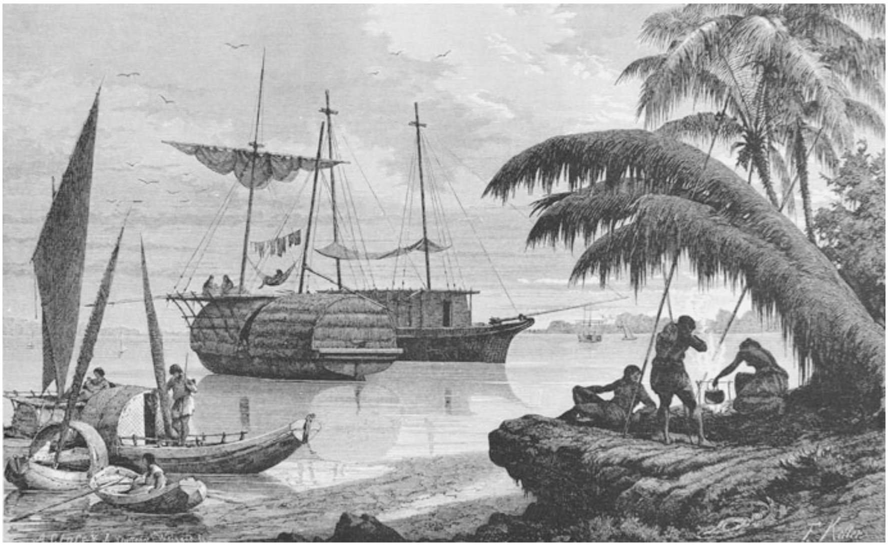

Fig. 17.9 A make-shift kitchen with a covering of *Attalea speciosa* fronds. Several of the boats and canoes are thatched with palm fronds. Manaus harbor, Rio Negro, c 1868 (Keller 1874: 33)

Fig. 17.10 Hut for processing manioc flour (*casa da farinha*) thatched with fronds of palha branca (*Attalea speciosa*). This 10 year-old hut has been re-thatched three times. Seringalzinho, Jaú River, Amazonas, Brazil, 10-3-12

Indigenous people use the fronds for thatch and to make mats. In the early twentieth century, the Mura of the lower Madeira used *Attalea speciosa* fronds to fashion make-shift coverings for their canoes to protect them from rain (Tastevin 1923). The related Pirahã, who live in several villages along the Maici River in the Municipality of Humaitá in the Madeira watershed, thatch their communal houses with the palm fronds (Gonçalves 2001: 126). The Matis in the Javari watershed in western Amazonas, Brazil, thatch their homes with the massive fronds (Erikson 1996: 172) as did the Parintintin of the Madeira River almost a century ago (Nimuendajú 1924). The Asuriní erect temporary shelters with roofs of babaçu leaves while in the forest on hunting expeditions (Lukesch 1976a: 45). The Xikrin who live on the Cateté River, an affluent of the Tocantins, rely on the fronds to thatch their village homes as well as temporary camps while on treks (Fuerst 2006: 115, 116). The Xikrin also place a layer of the fronds on the ground at their temporary camps to avoid skin contact with the soil (Fuerst 2006: 115, 116). The Xavante thatch their houses with the fronds of babaçu in combination with the leaves of other palms, such as buriti (*Mauritia flexuosa*) (Coimbra et al. 2002: 156). To the northwest, the Araweté who live along the Ipixuna, an affluent of the Xingu, thatch their houses with babaçu fronds (Viveiros de Castro 1992b: 42, 60). And in the eastern fringes of the Amazon forest in Maranhão, the recently contacted Awá also thatch their huts with massive fronds of the palm (Salgado and Shoumatoff 2013).

Fig. 17.11 Fronds of palha branca covering a canoe to prevent the wood from cracking and the paint from blistering. Sangaua, Urubu River, Amazonas, Brazil, 10-18-12

Indigenous people also use the leaflets of *Attalea speciosa* to make a variety of baskets and ornaments. The Xikrin employ leaflets of the ubiquitous palm to fashion bracelets and Xikrin women place boiled manioc in baskets made with fronds of the palm and soak them overnight in the river where they bathe (Vidal 1977: 70). One of the dance masks used by the Xikrin depicts a monkey's head and is made with plaited leaflets of the palm (Hartman 1967: plate 29). The Asuriní weave large baskets with the leaflets of the palm to carry produce from their fields, especially manioc tubers, as well as smaller handbags; the Asuriní also make mats with the leaflets to serve as doors (Lukesch 1976a: 83, 84). Likewise the Araweté make baskets from the palm fronds (Viveiros de Castro 1992b: 42).

The Pirahã fashion make-shift baskets with young fronds of the palm to take manioc roots or game back home; the rectangular baskets are also used to soak manioc tubers to soften them prior to making flour (Rodrigues and Oliveira 1977). The Tenetehara discard the backpack baskets made with babaçu fronds after they have finished carrying game or produce because the baskets only retain their strength when the leaves are green. The Tenetehara also fashion toys from the leaflets of babaçu fronds (Wagley and Galvão 1961: 192, 201).

The Parintintin make 3 cm-wide armbands from the leaflets to which feathers are affixed (Nimuendajú 1948a). The Apinajé weave small, square baskets fitted with lids from the leaflets of the palm (Nimuendajú 1983: 75). Traditionally, the only clothing worn by the Kayapó was penis sheaths made from babaçu leaflets. Boys were given the penis sheaths to wear when they reached about 15 years old; now, however, both adolescent boys and men wear shorts (Verswijver 1995: 269).

Fig. 17.12 Farm girl holding a bird cage for a chestnut-bellied seed finch (*Oryzoborus angolensis*), known as curió in Brazil. The bird was caught in a trap set nearby. The cage is fashioned from midribs of babaçu fronds. Ramal João Leãoquinho, Rio Xingu, 7 km upstream from Altamira, Pará, Brazil 7-16-96

In eastern Amazonia, rural folk make birdcages with the frond midribs (Balick et al. 1985). Although technically illegal, some rural folk capture songbirds and sell them in babaçu cages to supplement their income. But most of the cages are made for birds that are kept locally.

Fig. 17.13 Hut in a home garden thatched with palha branca (*Attalea speciosa*). Sucuriju, Urubu River, Amazonas, Brazil, 10-17-12

In eastern, southern and southwestern Amazonia, the enormous heart-of-palm of babaçu is cut out for sale in markets, such as in Ji-Paraná in Rondônia and São Pedro da Cipa along the BR 364 highway that links Cuiabá with Rondonópolis in Mato Grosso. To extract the palmito, the tree, which can reach 15 m in height, is chopped down. This trade does little to diminish the babaçu population, however, because the palm is so weedy in nature. In October 1993, babaçu palmito was being sold in 1-m sections for about US$1.40 in São Pedro da Cipa. Another use of the palmito is to accelerate the ripening of green bananas. The palmito is cut into small chunks then the unripe bananas are laid on top overnight. It is thought that gases emanating from the palmito spurs maturation of the banana fruits (May et al. 1985).

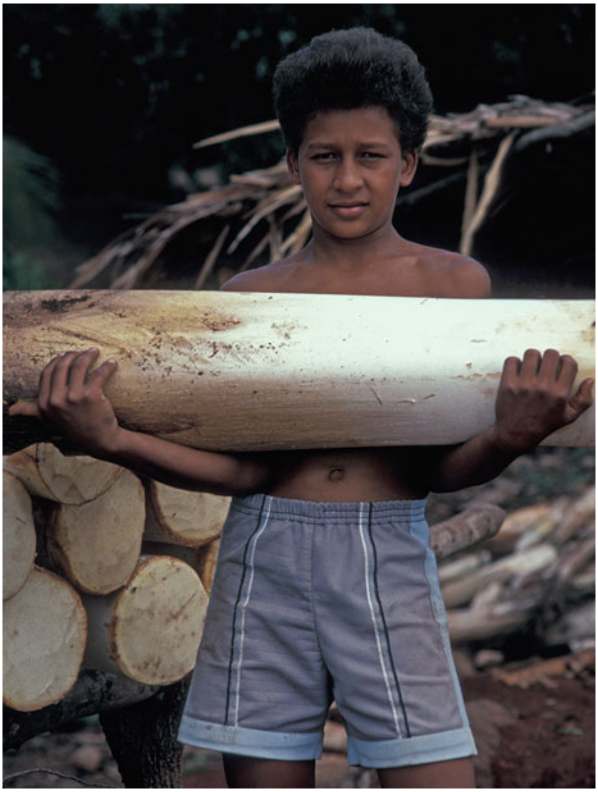

Fig. 17.14 Babaçu heart-of-palm for sale in a roadside market. This youngster and his father make a living by harvesting the palmito in nearby second growth, pastures, and farmers' fields. São Pedro da Cipa, BR 364 Highway, Mato Grosso, Brazil, 10-2-93

Harvesting babaçu heart-of-palm is an ancient practice. The Mojo who once inhabited the seasonally-flooded savannas in the Bolivian Amazon used to eat *Attalea speciosa* heart-of-palm of (Denevan 1966: 104). And in the 1940s, the Tenetehara along the Pindaré River in Maranhão, used to sell babaçu palmito for use as livestock feed (Wagley and Galvão 1961: 69). The Xikrin along the Cateté River southwest of Marabá in the Tocantins watershed still eat the palmito of this palm which they call rõ (Fuerst 2006: 57). Xikrin women are responsible for harvesting the heart-of-palm from young babaçu palms which they undertake in the dry season when the tribe leaves their village to trek in forest and savanna.

Attalea spectabilis

18

Brazil: Curuá, palha preta, palheira; kuruá (Wayana)

Status: Wild, spontaneous in cultural settings

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_18

Fig. 18.1 Curuá (*Attalea spectabilis*) in fruit in a home garden. Arapixuna, Igarapé do Jari, Santarém Municipality, Pará, Brazil, 7-22-96

The identity of curuá palm which is common on disturbed sites in parts of the Central Amazon is still uncertain. It may be that rural folk in central Amazonia are calling several different short-statured palm palms curuá, including *Attalea spectabilis* and *Attalea sagotii* (syn. *A. microcarpa*). In some instances, curuá could be a natural hybrid between babaçu (*Attalea speciosa*) and *Attalea sagotii* (Henderson 1995: 157). Conversely, it may be a stemless (acaulescent) form of babaçu rather than a separate species. Curuá certainly resembles a miniature babaçu palm because the fronds and fruit are similar. Some complex hybrids and/or new species await to be sorted out among the *Attalea* palms in eastern Amazonia. The long history of human occupation there has scrambled the vegetation, allowing for the greater mixing of *Attalea* palms adapted to disturbed habitats and thus creating chances for hybridization.

Curuá (*Attalea spectabilis*) is confined to the margins of the middle to lower Amazon in Pará State, Brazil (Lorenzi et al. 2010: 97). It is particularly common in the Santarém area where two rivers are named after the palm: Curuá, a northern affluent of the Amazon a little upstream from Santarém, and Curuá-Una, a smaller affluent entering the Amazon from the south a few kilometers downstream from the city.

Fig. 18.2 Curuá fruits The endocarp on the *right* has been gnawed by rodent, probably an agouti (*Dasyprocta* sp.), to access the nut. Arinduba, Amazon River, Santarém Municipality, Pará, Brazil, 7-23-96

Curuá flourishes on disturbed upland sites adjacent to the Amazon River from the Juriti (a little upstream from Santarém) to the estuary. It is also an understory palm in secondary forests. In areas where slash-and-burn farmers have been operating for a long time, curuá forms dense stands, which is a nuisance or a blessing, depending on one's perspective. To ranchers, curuá is a weed because it quickly invades pastures, shading out planted grasses. Even the most potent herbicides have failed to curtail the aggressive palm on plantations for pulpwood at Jari (Pires-O'Brien 1993).

Fig. 18.3 Village house with roof, walls, door, and window covers fashioned from curuá fronds. Arapixuna, Igarapé do Jari, Municipality of Santarém, Para, Brazil, 7-22-96

To rural folk, though, curuá has long served as a resource because the sizeable fronds are ideal roof thatch for houses, as well as for making interior and exterior walls of houses, and mats and baskets (Spruce 1850a). In the middle of the nineteenth century, villagers living near Monte Alegre along the middle Amazon fashioned arched canoe covers (*toldas*) from curuá fronds (Agassiz and Agassiz 1896: 364). And during the rubber boom, the fruits were burned to create smoke that was funneled up to a rotating stick were latex was poured and coagulated (Le Cointe 1922a: 321). In the Municipality of Santarém, the leaf midribs are also used to make cages to keep chicks out of harm's way, especially from hawks.

Fig. 18.4 Villager snapping leaflets of curuá so that they lay flat. The folded fronds will thatch her home. Vila Socorro, Lago Grande da Franca near Santarém, Pará, Brazil, 9-1-93

Rural folk enjoy the creamy pulp that surrounds curuá's hard endocarp. The squat palm fruits during the rainy months and into the early part of the summer, and farmers, especially children, typically tarry to snack on them while on their way to or from fields. The size of a large plum, curuá fruits are easy to gather because they are borne so low to the ground. The fruits are also taken home to prepare a creamy drink and to make a tamale-like meal. In Aninduba near Santarém, for example, villagers prepare juice (*vinho*) from the pulp, adding sugar to improve its otherwise bland flavor. The pulp is also an ingredient in *pomona*, a local answer to Mexico's *tamale* which is made with maize meal. To make *pomona* in the Santarém area, women scrape the pulp off curuá fruits, mix it with manioc flour, and wrap the gritty dough with the tips of curuá fronds prior to baking.

Fig. 18.5 A basket woven from the midribs of curuá palm fronds. This basket design is used to secure chicks and ducklings so that they are not picked off by hawks. Lower Arapiuns River, Pará, Brazil, 8-29-93

Once established, curuá palm is tenacious. The stunted palm soon re-sprouts after cutting. Curuá is thus found in home gardens as well as second growth in abandoned fields. Curuá often becomes part of agroforestry plots, such as in the outskirts of Arapixuna, where farmers initially clear curuá only to find it reappearing among their crops several months later. Fire has little impact on the roots. Only by allowing the forest to return can curuá be suppressed. The proliferation of curuá in the vicinity of Santarém is a legacy of the long history of farming and dense aboriginal populations in precontact times.

Bactris acanthocarpa 19

Brazil: Espinho de curupira
Colombia: kumapiza (Piapoco)
Peru: Ñejilla

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_19

Fig. 19.1 Espinho de curupira (*Bactris acanthocarpa*) in upland forest. Serengalzinho, lower Jaú River, Amazonas, Brazil, 10-3-12

Bactris acanthocarpa is a denizen up upland forest in Amazonas and Bahia, Brazil, Loreto in Peru, and the Guianas (Henderson 1995: 174; Lorenzi et al. 1996; Vásquez 1997: 762). Along the Jaú River in the Rio Negro watershed in Brazil, this relatively short understory palm is called "spine of the curupira" (*espinho de curupira*) on account of the 3 cm-long black spines that are found singly at intervals of about 20 cm along the underside of the leaf rachis. Curupira is a mythical forest gnome who can lead people astray, especially if they fail to leave presents of tobacco or sugarcane alcohol along trails.

Along the Jaú River, locals fashion fishing arrows from the leaf rachis, probably because arrowcane (*Gynerium sagittatum*) is rare or possibly absent along that black water river. The Piapoco in the northern part of the Colombian Amazon also make their arrow shafts from the leaf axis of the palm (Mesa and Galeano 2013). Arrowcane thrives on the floodplains of sediment-rich rivers and in other watersheds it is confined to home gardens and farmers' fields. Further east along the Trombetas River in Pará, the midribs are used to make fish traps (Miranda and Faria 2008: 125).

20 Bactris bidentula

Brazil: Marajá do igapó, marajá do jacaré
Peru: Ñejilla menuda
Venezuela: Uvita; hoashi mïsi (Yanomama)

Status: wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_20

Fig. 20.1 Ñejilla menuda (*Bactris bidentula*) in fruit in floodplain forest. Cocha Grande, near San Carlos, Rio Puinahua (a branch of the Ucayali River), Pacaya-Samiria, Loreto, Peru, 5-12-03

Bactris bidentula sometimes form clumps with up to 50 individuals in wetlands and occurs from the lower Amazon up the main trunk of the river to the Marañón and Ucayali in Peru, as well as parts of the Upper Orinoco and the Guianas. It also grows in galeria forests in the Llanos de Moxos in the Bolivian Amazon (Moraes and Sarmiento 1992). The palm also thrives around the margins of lakes, such as along the Puinahua River, an arm of the Ucayali, and along the banks of streams and rivers. The palm is at home in black waters as well as on the floodplains of sediment-rich rivers (Henderson 2000: 37).

Fig. 20.2 Fisherman gathering *Bactris bidentula* fruits from a canoe in floodplain forest. Cocha Grande, near San Carlos, Rio Puinahua (a branch of the Ucayali River), Pacaya-Samiria, Loreto, Peru, 5-12-03

The round fruits of *Bactris bidentula*, approximately 2 cm in diameter, are red skinned and acidic. In spite of their tartness, young and old alike enjoy snacking on the pale green flesh surrounding the single black seed. Although the fruits do not reach markets, the fruits of several other wild species of *Bactris* turn up occasionally in the street markets of Iquitos (Vásquez and Gentry 1989).

Fig. 20.3 Fisherman placing fruits of *Bactris bidentula* in a bowl to make juice. Cocha Grande, near San Carlos, Rio Puinahua (a branch of the Ucayali River), Pacaya-Samiria, Loreto, Peru, 5-12-03

Diminutive *Bactris bidentula* grows no taller than 4 m, so the fruits are easily reached at high water by canoeing up to the palm. About a dozen fruits are attached to the single infructescence which must be cut off with care to avoid being injured by the numerous spines that arm the palm's trunks and leaf stems. Fishermen sometimes tarry in their canoes by the palm to make juice by crushing the fruits into a bowl of water.

21 Bactris bifida

Brazil: Buçú-rana, ubim de espinho, marajá
Peru: Ñeja negra, ñejilla

Status: Wild

Fig. 21.1 A grove of ñejilla (*Bactris bifida*) in forest. Near Miraflores, Rio Tigre, Loreto, Peru, 7-1-06

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_21

A diminutive palm reaching no higher than 4 m, and usually 1–1.5 m tall, *Bactris bifida* is one several wild species in the genus with edible fruits. The narrow fruits are 2–2.5 cm long and 1–1.5 cm wide and resemble those of *B. concinna*, except that the latter palm is much taller.

Fig. 21.2 Fruits of *Bactris bifida* are gathered mainly by children because they are produced close to the ground. Near Miraflores, Rio Tigre, Loreto, Peru, 7-1-06

The black pointed fruits of *B. bifida* are gathered and eaten on the spot when traveling in forest during the rainy season. The fruits do not reach markets. As with most of the wild *Bactris* palms, the pulp is meager, but people, especially children, appreciate the sweet, tangy taste. Fruits are often encountered only 0.5 m from the ground, where youngsters can spot the fruits easier than adults.

Fig. 21.3 Children relish the fruits of *Bactris bifida* which are gathered in forests. The mesocarp is scraped off the single seed. Near Miraflores, Rio Tigre, Loreto, Peru, 7-1-06

Confined to the western Amazon mostly south of the Amazon River, *Bactris bifida* is usually found on floodplains but also grows occasionally in upland forests below 600 m (Henderson 1995: 79; Vásquez 1997: 762). On floodplains, such as the lower Tigre, dense colonies sometimes form containing hundreds of palms. The undersides of the narrow fronds are armed with long spines, so people generally circumvent the groves when making trails.

22 Bactris brongniartii

Bolivia: Marayaú
Brazil: Marajá, marajá pupunha
Colombia: Tuiri (Piapoco)
Peru: Ñejilla

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_22

Fig. 22.1 Ñejilla (*Bactris brongniartii*) palm in fruit in floodplain forest. Near Manco Capac, Rio Puinahua (a branch of the Ucayali River), Loreto, Peru, 4-15-06

Bactris brongniartii is one of the most widespread representatives of the genus, which contains several hundred species, since it ranges from the Amazon estuary throughout the river basin as well the Orinoco watershed and the Guianas (Henderson 2000: 40). This water-loving palm grows on the banks of black and sediment-rich rivers and streams and often occurs in clumps. As many as 200 palms can be found in a grove, such as along the Yanayacu River in the Pacaya-Samiria National Reserve in the Peruvian Amazon.

The cat's eye-sized fruits of *Bactris brongniartii* mature during the rainy season and require some work to remove the leathery skin, similar in texture to that of Muscadine grapes (*Vitis rotundifolia*). The tangy-sweet flesh under the dark red skin is similar in taste and texture to that of mamoncillo (*Melicoccus bijugatus*), a green-skinned fruit cultivated in coastal areas of Central America, the Caribbean, and northern South America. *B. brongniartii* can be easily distinguished from other species in the genus by its flattened, light tan-colored spines. The bright, lime-green leaflets are alternate, whereas those in some species of *Bactris* are opposite, such as in *B. concinna*.

Fig. 22.2 Fruits of *Bactris brongniartii* gathered in floodplain forest. Manco Capac, Rio Puinahua (a branch of the Ucayali), Pacaya-Samiria, Loreto, Peru, 4-15-06

The fruits are almost perfectly round, measuring 1.5–1.7 cm long and 1.5 cm in diameter, but the seed is 1.3 cm by 0.5 cm, so there is little room for pulp under the thick skin. The translucent layer of pulp surrounding the single black seed is relatively thin; evolution has proved parsimonious in this regard, carefully calibrating the reward for seed dispersal agents, such as fish. The infructescence has about ten short branches (rachilla) with about a dozen fruits each, so a single fruit bunch has around 120 fruits.

Fig. 22.3 Boy taking a break from fishing to snack on fruits of *Bactris brongniartii* that he gathered in floodplain forest from his dugout canoe. Near Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-25-06

Men and boys often lop off a fruit bunch while paddling to and from their favorite fishing spots, when hunting, or when on their way to tend crops. Women and girls also pick the fruits when they encounter groves of the palm near their homes and fields. Known as marajá at the mouth of the Amazon (a name applied to various species of aquatic *Bactris* palms in Brazil), the fruits are popular with cowboy families on Caviana Island where kids make a game of seeing who can eject the single, large black seed furthest when spitting them out.

Fig. 22.4 Cowboy holding two bunches of *Bactris brongniartii* fruits at the entrance to his home. Fazenda Santa Paz, Caviana Island, Amazon estuary, Pará, Brazil, 5-21-01

23 Bactris concinna

Bolivia: Marayaú
Brazil: Marajá, marajá pupunha, mumbaca
Colombia: Marayá
Ecuador: Chontilla
Peru: Ñejilla; uyainim (Aguarana), shiní (Shipibo)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_23

Fig. 23.1 A clump of *Bactris concinna* along a black water river. Near Yarina, Rio Yanayacu, Pacaya-Samiria, Loreto, Peru, 1-26-06

The dark purple-brown fruits of *Bactris concinna* are gathered along the banks of both black water and muddy water courses as well as in swamps from the central part of the Amazon basin west to lowland Bolivia, Peru, Ecuador, and Colombia. The palm also occurs occasionally in upland forest and several subspecies are recognized (Henderson 1995: 184). The pointed fruits, 2–2.7 cm long by 1 cm wide, are tightly packed on a fruit bunch consisting of two small branches (rachilla) that contain about 40 fruits each. One or two racemes are produced, so a single palm can produce 80–95 fruits (Santos et al. 2010). *Bactris concinna* fruits during the rainy season and they turn up occasionally in markets, such as Iquitos (Mejía 1992).

Fig. 23.2 *Bactris concinna* in fruit. Lower Rio Tigre near Miraflores, Loreto, Peru, 7-1-06

The elongated fruits are easy to gather in spite of the numerous round black spines that arm the trunk and fronds because the palm is relatively short, ranging between 1 and 4 m, so even children can easily reach the fruit. Whereas the stature of the palm does not present harvesting problems, the fruits are produced at high water when ants are forced up trees in floodplain forests. Ants often accumulate in the frutescence of ñejilla, and can deliver punishing stings and bites to those gathering the fruits. Before harvesting fruits of ñejilla or other wild fruits, locals have learned to keep an eye open for any nearby paper wasp nests. If a large nest is spotted near the fruits, they are left alone.

Fig. 23.3 *Bactris concinna* fruits gathered in a floodplain forest. Quebrada Santa Helena, affluent of the lower Yanayacu River a few kilometers upstream from Veinte de Enero, Pacaya-Samiria, Loreto, Peru, 7-13-10

Before the fruits ripen, kids sometimes gather them to eat the endosperms while they are still soft. In the vicinity of Yarina along the Upper Yanayacu in the Pacaya-Samiria National Reserve, boys sometimes stop to cut off a bunch of the green fruits to eat while they wait for fish to fall into their nets or to bite while pole fishing. The endocarp is not hard when the fruits are immature, so kids use their teeth to access the soft, creamy seed. When the fruits are mature, however, only the mesocarp is eaten. The fruits are also fed to livestock (Henderson 2000: 55). In the vicinity of Lago de Limão in the municipality of Iranduba near Manaus, Brazil, locals wrap fish in the fronds of mumbaca, as the palm is known there. The spines from the undersides of the leaves are removed before wrapping the fish and roasting them over a fire.

Fig. 23.4 River dweller biting into unripe fruit of *Bactris concinna* to access the soft endosperm. Near Yarina, Rio Yanayacu, Pacaya-Samiria, Loreto, Peru, 1-26-06

Bactris gasipaes 24

English: Peach palm
Bolivia: Chima, chonta; huanima (Chácobo), siríba (Sirionó), tembe (Yuracaré)
Brazil: Pupunha; tsu (Kanamari), kwenat (Korubo), wani (Matis), popúü (Parintintin), ĩ'tü (Ticuna), ʉrẽ (Tukano), ʉne (Tuyuka), rasha kë, lasa (Yanomama)
Colombia: Chontaduro, pijiwuao; uné (Cubeo), ërí-nyu (Desana), jota (Makuna), búyup, juyuni (Nukak), pipire (Piapoco), in tu (Ticuna), jimena (Witoto), púre (Yagua), pipirí (Yukuna)
Ecuador: Chonta dura; chunda (Kichwa), uwi (Shuar), dagenka (Waorani)
French Guiana: Parépou
Peru: Pijuayo, pifuayo; shiig kamanchá (Aguaruna), wani (Amahuaca), poporr (Amuesha), mééme (Bora), banin (Cashibo), kuri (Machiguenga), titado (Mayoruna)
Venezuela: Pijiguaio, piritu; jnema (Jodï), päjäre (Piaroa)

Status: Planted

> A spadix of Popúnha, laden with ripe fruit, is one of the most beautiful sights the vegetable world can show (Spruce 1853b)

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_24

Fig. 24.1 Villager with peach palm fruits gathered in his home garden. Mishana, Nanay River, Loreto, Peru, 1-8-06

Peach palm is a breakfast and snack food for people in many parts of the lowland humid tropics and mountain foothills in Central and South America (Mora-Urpí et al. 1997). The name peach palm was coined in the early nineteenth century by Alexander von Humboldt, the famous German explorer of northwestern South America:

> In the vicinity of the mouths of the Guaviare and Atabapo grows the Piriguao, one of the noblest of palm trees, whose smooth and polished trunk, between 15 and 20 metres high, is adorned with a delicate flag-like foliage curled at the margins. I know no palm which bears such large and beautifully coloured fruits. They resemble peaches, and are tinged with yellow mingled with a roseate crimson. Seventy or eighty of them form enormous pendulous bunches, of which each tree annually ripens three. This fine tree might be called the peach palm. (Humboldt 1849: 216–217)

Peach palm is cultivated in home gardens, agroforestry plots, and in monocrop plantations. In the latter case, the palm is most often planted for heart-of-palm for both national markets and export (Clement 2008). Peach palms in fields often remain productive for many years after the plot is abandoned, so farmers return periodically to gather the fruits. The Yukuna along the Miritiparaná in the Colombian Amazon plant peach palm in their fields so that they can return to them years after they have harvested short cycle crops (Schackt 2013: 81). The Waorani who live in the Napo watershed in the Ecuadorian Amazon visit groves of peach palm in the forest to gather the fruits; they recognize that stands of the palm are the sites of ancient home gardens around the longhouses of their ancestors (Rival 2002: 85).

Fig. 24.2 Peach palms in an abandoned home garden. People still visit the site, however, to gather the fruits. A kapok (*Ceiba pentandra*) tree towers over the palms. Near Missão, lower Tefé River, Amazonas, Brazil, 8-15-12

Fig. 24.3 Peach palms in a home garden at 858 m in the Andes, close to the altitudinal limit for this palm. This three-storied farmhouse was built in the early twentieth century by German settlers. Pozuzo, Pasco, Peru, 11-9-04

Fig. 24.4 Peach palms in a home garden intercropped with other perennials including plantain. San Carlos, Puinahua River (a branch of the Ucayali River), Pacaya-Samiria, Loreto, Peru 4-16-06

Peach palm reaches 20 m in height and most forms are armed with numerous black spines. Because of the palm's height and formidable armory, people generally use poles of various designs to bring down the fruits. Some have a blade tied to one end so that the fruit brunch can be cut off. Another design has a notch at the pole's distal end to wedge the fruit stalk (petiole) so that it can be twisted off. Spineless mutants have been selected in some areas, such as parts of the Peruvian Amazon, and locals have chosen them because they are more harvest friendly (Schultes

1977). And spineless forms are typically deployed for the protection of workers on peach palm plantations geared to the production of heart-of-palm (Clement and Manshardt 2000). The fruit bunch can contain up to 1,000 fruits, but several dozen to a few hundred fruits are typically found on a raceme (Clement et al. 2004).

Fig. 24.5 Notched pole used for harvesting peach palm fruits. Combu Island, Amazon estuary near Belém, Pará, Brazil, 11-20-98

Some peach palm varieties are red or yellow when ripe, whereas others remain green as they mature. The Yanomama even have suffixes for the different colors of their peach palm fruits which range from greenish-yellow to yellow, dark red, and reddish-green (Gertsch et al. 2002). The Desana recognize four color variations of peach palm, and give suffixes for each (Kumu and Kenhíri 1980: 157). Considerable genetic diversity is found among peach palm populations because the palm is an obligate outcrosser and famers make selections of preferred types (Johannessen 1967). Weevils cross pollinate peach palm (Rodrigues 2007). Several breeding programs have been established for fruit production with peach palm, but no standardized, high-yielding commercial varieties have yet been distributed to homogenize the crop.

Fig. 24.6 Peach palm fruits in a street market. Manacapuru, Amazonas, Brazil, 12-4-06

When and how farmers recruited peach palm from wild populations (*Bactris gasipaes* var. *chichagui*) is still debated (Hernández et al. 2008; Morcote-Rios and Bernal 2001; Mora-Urpí 1999). Some argue for multiple, independent harnessing of wild populations for cultivation in Central and South America (Hernández et al. 2011). Others argue for a single domestication event in southwestern Amazonia (Clement 1995; Clement et al. 2010; Rodrigues et al. 2004). Some scholars argue that cultivated forms of peach palm were introduced into Central America from South America (Johannessen 1966a), a pattern similar to the cacao story.

The domestication process for peach palm, as with many tropical perennial crops, probably started when hunter-gatherers enriched campsites and trails with the palm by discarding seeds (Clement 1988). As some campsites became more permanent, the dump heaps expanded and became village home gardens, providing plenty of light and a generous supply of nutrients for the palm and other plants (Clement et al. 2009). Later, peach palm was incorporated into expanding swidden-fallow systems, which complement the home gardens as “laboratories” for new crops and varieties.

Peach palm provides two edible products: starchy fruits with varying amounts of oil, and heart-of-palm. Western forms (landraces) of peach palm tend to have fruits with more carbohydrates whereas central and eastern forms are higher in oil (Clement et al. 1998). Despite its low protein content, the mesocarp of peach palm contains all essential amino acids and is high in dietary fiber (Yuyama et al. 2003). The ovoid fruits are boiled in salt water and the fibrous skin is peeled to reveal a filling pulp surrounding the single seed. Peach palm fruits contain higher levels of unsaturated fatty acids than maize, sorghum, or soybean (Jatunov et al. 2010). The savoury, orange-colored flesh is relished from Amazonia to Nicaragua. In addition to being a good source of energy derived from both carbohydrates and oil, peach palm fruits are frequently rich in vitamin A, nicotinic acid, and sometimes vitamin C (Johannessen 1966b). In the mid-nineteenth century, peach palm fruits were converted to flour to make cakes and unleavened bread (Wallace 1853: 94).

Several motives have been proposed to account for the early incorporation of peach palm into the "larder" of domesticated plants in Amazonia. One possibility is that the high levels of oil in some varieties of peach palm may have spurred domestication (Clement 1989, 1992). Interestingly, the Ticuna along the Solimões rub some of the seeds of peach palm with fat from tartaruga (*Podnemis expansa*) turtles in the belief that after planting the seeds the resulting peach palm fruits will be oily. This suggests that they like some of their peach palm fruits to be oily (Kerr and Clement 1980).

Peach palm wood is fashioned into various agricultural and weaving implements, and these uses could also have been an impetus for cultivating the palm. The Sirionó of eastern Bolivia, for example, carve a 1 m-long digging stick from the tough wood of peach palm. The digging stick is sharpened at one with a snail shell to form a blade. The digging stick is used to plant and till the soil, to excavate clay for making pots, and to dig out heart-of-palm and bees nests to obtain honey (Holmberg 1969: 25). The Yanomama also make a garden tool from the heartwood of the palm to dig a hole for transplanting suckers taken from banana and plantain trees. The implement, called *fimo*, has a broad blade at one end used for prying out the banana suckers (Smole 1976: 127).

The Mayoruna fashion a long shuttle from peach palm wood to open a space between vertical strings when weaving wrist bands with twine obtained from *Astrocaryum chambira* palm fronds (Romanoff et al. 2004: 47).

Fig. 24.7 Ambulant vendor with cooked peach palm fruits. A saucer of salt covers a *blue* bowl containing salsa to flavor the fruits. Pucallpa, Ucayali River, Peru, 1-22-04

In season, street stalls selling boiled peach palm are a common sight in many Latin American towns and cities, such as San José, Costa Rica, where it is known as pejibaye, and Manaus and Belém in Brazil. Ambulant vendors also wander the streets offering the boiled fruits, often with a plate of salt for dipping. In Pará, Brazil, the globular fruits ripen in the early rainy season and compete with popcorn and candy for the attention of moviegoers and other pedestrians in the larger towns. Boiled peach palm fruits are also a common sight in street markets in the Peruvian Amazon. Some vendors cut the cooked fruits in half and remove the single seed, thereby allowing their customers to fill the cavity with the salsa made from cocona (*Solanum sessiliflorum*), a cultivated relative of the tomato.

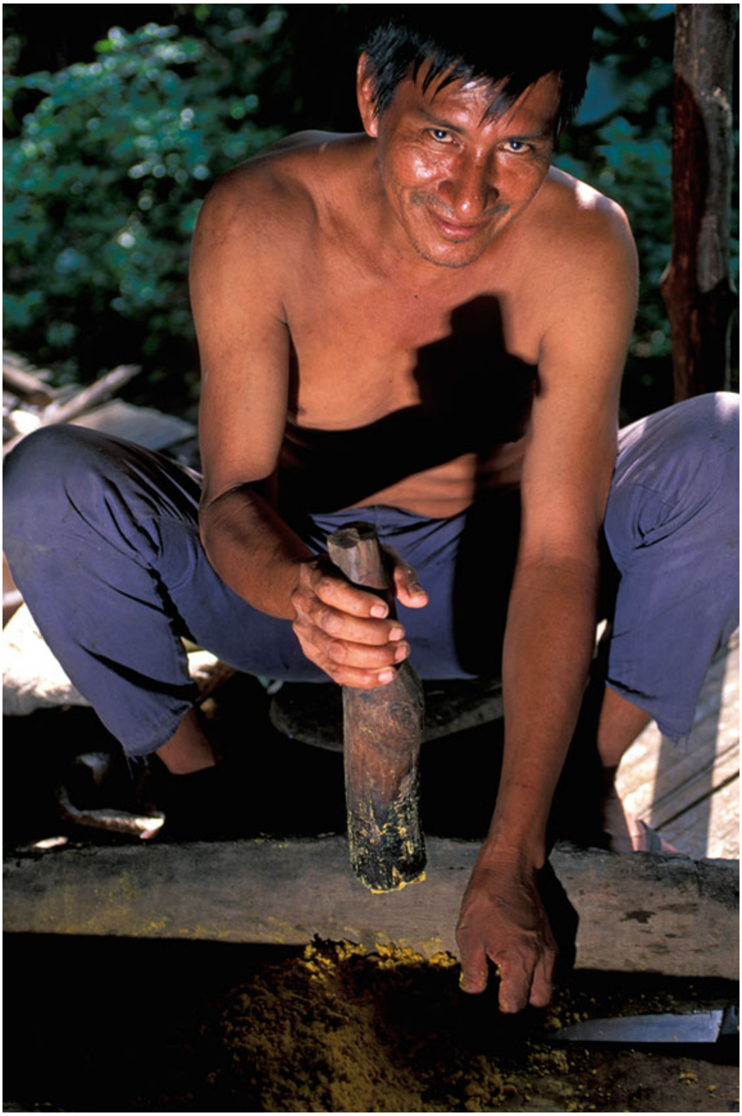

Fig. 24.8 Pounding boiled peach palm fruits in a trough to make beer (*masato de pijuayo*). San Carlos, Puinahua River (a branch of the Ucayali), Pacaya-Samiria, Loreto, Peru 8-5-03

Alcoholic drinks are prepared from peach palm fruits, especially in western Amazonia. The beverage is made by mashing boiled fruits, chewing some of the resulting pulp and mixing it back in. Then the dough-like pulp is left to ferment for a few days, the number of days determining the alcoholic content desired which ranges up to about 5 %. Enzymes found in saliva break down the starch into sugars which are then converted to alcohol by yeast. Women always do the masticating of the pulp. After a few days, some of the fermenting pulp is taken from the jar or bucket and mixed with water; it is consumed after passing through a sieve to remove the larger fibers.

Fig. 24.9 Farmer imbibing peach palm beer (*masato de pijuayo*). San Francisco, Marañón River, Pacaya-Samiria, Loreto, Peru, 3-10-04

Although this traditional process may appear unhygienic, fermentation sterilizes the beverage. The beer, variously called *caiçuma* in Brazil or *chicha* or *masato* in Spanish-speaking countries, looks like thin orange porridge, and has a delightful fresh, ripe-peach aroma. The spiked beverage is rich in energy, fiber, beta-carotene and other nutrients, much healthier in other words than most alcoholic beverages purchased in stores, bars, and restaurants. It is also safer than drinking water which is generally gathered from rivers, streams, or wells in rural areas of the Amazon and can be contaminated. The Matis, for example, refuse to drink fresh water because they consider it dangerous. The Matis consume fermented peach palm juice among groves of the palm at ancient habitation sites as a form of communion with the ancestors (Erikson 1996: 307).

Numerous indigenous peoples in northwestern South America and southern Central America celebrate the peach palm harvest with festivities which often include the ingestion of copious amounts of peach palm beer. The Maijuna who inhabit the Sucusari River, an affluent of the Napo in the northern part of the Peruvian Amazon, prepare a fermented beverage from peach palm fruits in old canoes (Gilmore et al. 2002). Along the Napo in the Ecuadorian Amazon, peach palm beer is the principal beverage during the fruiting season of the palm (Uzendoski 2005: 136). Women take pride in how drunk they can make their guests with home-made fermented beverages. Peach palm festivities often continue for 3 or 4 days, with considerable dancing and singing, and are followed 9 months later by a spurt of births. This may be how peach palm acquired its reputation as an aphrodisiac in Colombia.

Various Arawak and Tukanoan groups who inhabit the Colombian Amazon and contiguous areas of Brazil perform a masked dance to celebrate the peach palm harvest and consume fermented juice prepared from the fruits during the festivities (Cabalzar 2008: 24; Giacone 1949: 46; Hammen 1992: 232; Karadimas 2005: 172; Oyuela-Caycedo 2004). The Yukuna prepare their peach palm beer by boiling the fruits then peeling off the skins before grating the farinaceous pulp. A little water is then added and the dough is wrapped in leaves and stored for a couple of weeks during which it ferments. When festivals are underway, the fermented dough is mixed with water and drunk (Schackt 2013: 81). Fermented peach palm juice is not just reserved for special occasions, however. The Tukano who inhabit the Tiquié River in the northwestern part of the Brazilian Amazon, consume the rich beverage, which they call *uleko*, at any time during the day or night.

Fig. 24.10 Tukano girl drinking fermented juice made from peach palm fruits at breakfast. Serra do Mucura, Rio Tiquié, affluent of the Uaupés, Amazonas, Brazil, 10-28-12

A related Tukanoan group, the Makuna who live in the Apaporis watershed in the Colombian Amazon also celebrate the arrival of the fruiting season for peach palm, but they drink the juice fresh, rather than fermenting it. During the *baile de muñeco* (*rümiüa*), dancers don masks and special dresses that depict nature spirits, especially fish. In fact, fish are thought to have taught Makuna ancestors the rituals of the peach palm festival. The *baile de muñeco* is animated and is thought to help make children grow strong and healthy. Another function of the peach palm festival is to promote fecundity among crops and animals (Århem et al. 2004: 154–155).

The Nukak, a mostly hunting and gathering society in the northern part of the Colombian Amazon near the Venezuelan border, once held a dancing ritual to celebrate the fruiting season of peach palm (Politis 2007: 83). The Nukak still hold some ritual meetings in peach palm groves that they recognize as planted by their ancestors deep in the forest. Some of their ancestors are buried in peach palm enclaves, and funeral wakes for the recently deceased are held there (Politis 2007: 280).

Under certain circumstances, though, at least one indigenous group believes that peach palm fruits can make you sick. The Marúbo who inhabit the headwaters of the Ituí and Curuçá rivers, affluents of the Javari in southwest Amazonia, believe that if a person eats a peach palm fruit that has fallen to the ground and is damaged or warm, he or she may come down with malaria (Montagner 1996).

Peach palm fruits are also used for fish bait. In the Pacaya-Samiria National Reserve in the Peruvian Amazon, a protected area that allowed pre-existing residents to remain when it was established in the 1970s, boys mash the uncooked pulp of peach palm fruits with a little water then wrap the dough in a leaf and cook it on a fire for a few minutes. The warm, soft dough is then rolled into balls to be used as fish bait. Small pieces of the partially cooked dough are broken off from the tennis-sized ball, known locally as *ango*, to catch such fruit-eating fish as sardiña (*Triportheus*). The bait lasts 2 or 3 days before spoiling. And near Cachoeira do Arari on Marajó Island at the mouth of the Amazon, locals employ cooked peach palm fruits mixed with manioc flour and water (*pirão*) to bait hooks when fishing for aracu (species of *Leporinus* and *Schizodon*).

Fig. 24.11 Boys pole fishing from dugout canoes on a floodplain lake. They are employing dough made from peach palm fruits for bait. Cocha Huayllahua, Yanayacu River, near Veinte de Enero, Pacaya-Samiria, Loreto, Peru 3-11-04

During the last 30 years, peach palm has emerged as an important source of heart-of-palm, also known as palmito, a gourmet vegetable composed of the tender unexpanded leaves in the crown of the palm. During the second half of the twentieth century in Brazil, most heart-of-palm came from wild stands of juçara (*Euterpe edulis*) in the Atlantic forest from Bahia south to Rio de Janeiro, and açaí (*Euterpe oleracea*) in the Amazon estuary. As juçara became over harvested, commercial heart-of-palm extraction shifted focus to açaí at the mouth of the Amazon. But resistance to wholesale destruction of açaí mounted as rural people increasingly protected and managed their stands for fruit production as well as palmito. Consequently, peach palm plantations became economically viable, starting in Costa Rica in the 1970s. Since then, plantations have expanded throughout the lowland Neotropics, covering tens of thousands of hectares, especially in Brazil, Ecuador and Costa Rica, and are now worth more than peach palm fruit produced in the same region (Clement 2008). More recently, peach palm plantations for palmito have been established in Indonesia, Hawaii, and La Réunion (Couvreur et al. 2007). France is a major market for palmito, although Brazil has always had a strong internal market for the product in the central and southern part of the country. Within Amazonia, palmito from peach palm is not widely consumed, but it does reach some markets in the Peruvian Amazon, such as Iquitos.

Fig. 24.12 Customer buying *Bactris gasipaes* palmito in a street market. Mercado Belén, Iquitos, Loreto, Peru, 4-12-06

Peach palm provides a wide range of useful products in addition to its starchy fruit and heart-of-palm. The dense wood of the stem makes excellent weapons, and this could have been another motive for domestication the palm. The strong wood is used to make bows, such as among the Cashinawa (Métraux 1948), Jamamadí (Steere 1903), Machiguenga (Johnson 2003: 72), Matis (Erikson 2001), Mayoruna (Romanoff et al. 2004: 66), Piaroa (Rondón 2003), Suruí (Coimbra 1985), and the Yanomama (Albert and Milliken 2009: 58; Chagnon 1968: 21; Saffirio and Scaglion 1982). The Mura of the lower Madeira River once fashioned arrows with the hard wood of *B. gasipaes* (Nimuendajú 1948b). The Chácobo and Tacana in the Bolivian Amazon use the hard wood of peach palm to tip their arrows (Boom 1989; DeWalt et al. 1999), as do the Sirionó in eastern Bolivia (Holmberg 1969: 31). The Machiguenga in the Urubamba watershed in the southern part of the Peruvian Amazon also use the palm wood for their arrows (Johnson 2003: 72). The Yanomama also use peach palm wood for their arrows points which are dipped in curare and nicked so that tip breaks off in the game, thereby ensuring that more of the muscle relaxant that paralyzes the diaphragm circulates in the animal's blood (Lizot 1984: 68). The Tacana of the Bolivian Amazon no longer make bows, but in the past they made them from peach palm wood (DeWalt et al. 1999). Several tribes make spears with peach palm wood including the Mayoruna (Romanoff et al. 2004: 67) and the Parintintin (Freitas 1926).

Several tribes make blowguns with the palm stems. The Shuar in the Ecuadorian Amazon use the trunk of young peach palms to make lances and blowguns (Bennett 1992). The Waorani of the Ecuadorian Amazon select young specimens of *Bactris gasipaes* to make their blowguns while mature peach palms are felled for the hard wood to make spears (Clement et al. 2009; Kvist and Holm-Nielsen 1987; Rival 2002: 85). The Witoto once fashioned blowguns by taking two split segments of a young peach palm stem then making a groove along the flat side of each. Both sides were then joined together to form a narrow tunnel through which the dart would travel (Hardenburg 1913: 157). The hole was then polished by repeatedly pulling through a gummy cord that had been rubbed in sand. The blowgun was then covered in resin and wrapped with the inner bark of a wild tree to hold both halves together. Few indigenous groups manufacture blowguns anymore, except for the tourist trade since they have mostly adopted shotguns. The Yagua who live in various villages along the Amazon and the lower stretches of some of its affluents in Colombia and Peru also use the palm stem to make their blowguns which can reach 3 m long (Chaumeil 1987: 73).

The hard wood of peach palm is also used in the preparation of beverages, food, and entheogens. Matis women use batons made from peach palm wood to periodically stir maize brews undergoing fermentation (Erikson 1996: 301). Tukanoan groups along the Uaupés in Colombia fashion mortars from the trunks of peach palm to crush dried coca leaves to make snuff (Schultes 1980), as do the Witoto in the Caquetá watershed who also use their sizeable mortars to pound tobacco leaves (Whiffen 1915: 99).

Along the Tiquié in northwest Amazonas, Brazil, the Tukano and Tuyuka use posts fashioned from trunks of *Bactris gasipaes* to make their fish traps; the entrance is designed to resemble a vagina, allegedly attracting more fish. The Tukano and Tuyuka also assemble a trough-like fish trap (*caiá*) consisting of a lattice of peach palm wood; one end of the *caiá* is placed in rapids with fences at the mouth placed to steer fish to the opening (Cabalzar et al. 2005: 309, 310).

In some areas, the tough leaves of peach palm are fashioned into baskets and a green coloring is extracted from fresh fronds. In the vicinity of Tarapoto in the Peruvian Amazon, rural folk who cut down the palm to obtain palmito sometimes feed the fronds to guinea pigs which are raised to eat rather than keep as pets.

Given the multiple uses of peach palm in many areas of the Amazon, it is not surprising that the palm features in some indigenous lore and spiritual practices. Among the Miraña who inhabit the middle Caquetá, for example, peach palm was the first plant used by their creator (Karadimas 2005: 286). And the Nukak believe that when their ancestors emerged through a hole in the earth from the underworld they brought peach palm with them (Cárdenas and Politis 2000: 44). Ticuna sorcerers shoot magical spines obtained from peach palm trees which they believe harbour a spirit mother. The shaman asks the peach palm spirit for some magical spines. To receive them, he places a small calabash gourd with a hand-rolled cigarette laid across the top of the bowl at the foot of a peach palm tree. The next day he comes back to find the magical thorns which the shaman then swallows and directs to his right forearm. After sunset, the sorcerer heads into the forest from where he releases male and a female projectiles into his victim; the magical thorns then reproduce in the victim's body causing sickness and eventually death unless a curing shaman intervenes (Nimuendajú 1952: 102).

Bactris hirta 25

Brazil: Marajá, marajazinho; wihi (Tukano), wi (Tuyuka), urãte (Yuhupde)
Colombia: Joda jimena (Witoto)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_25

Fig. 25.1 *Bactris hirta* var. *spruceana* in fruit in upland forest. Igarapé Açaí, affluent of the Upper Tiquié, Amazonas, Brazil, 11-4-12

The genus *Bactris* encompasses over 70 species and some widespread species also have subspecies (Henderson 2000: 2). I have field notes on the uses of 11 species, and my list of useful palms in Amazonia grows with every visit to the region. Such is the case with *Bactris hirta* which I encountered on a forest excursion with some Tuyuka in the northwestern part of the Brazilian Amazon in 2012. The Tuyuka eat the fruits of this diminutive palm, which they call *wi*. A denizen of upland forest in lowlands, the palm ranges throughout the Amazon Basin and extends into the Guianas and the Atlantic forest of Brazil (Henderson 1995: 194; Lorenzi et al. 2010: 135).

26 Bactris major

Bolivia: Marayaú; chijchiva' (Tsimané)
Brazil: Mumbaca, marajá, marajá grande, tucum-mirim; kiripiri-hu (Guajá), piri'a-hu-'ɨ (Ka'apor)

Status: Wild, spontaneous in cultural settings

Fig. 26.1 Mumbaca (*Bactris major* var. *infesta*) palms in second growth. The river dweller is eating the pulp surrounding the single seed of a mumbaca fruit. Near Igarapé-Mirim, Pará, Brazil, 12-10-99

Bactris major is a wide ranging palm stretching from the Venezuelan Amazon and the Guianas in the north to the Bolivian lowlands in the south. Several varieties

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_26

are recognized, one of which extends into Central America (Henderson 1995: 201). It is absent from the Colombian, Ecuadorian, and Peruvian portions of the Amazon basin. The thin-stemmed palm occurs in small clumps in old second growth on higher parts of floodplains, including regrowth forest in tidal zone of the Amazon estuary. The palm also occurs occasionally in upland forest, though usually near water.

The purple-black fruits, measuring some 3 cm long by 2 cm in girth, are born in small clusters each containing about a dozen fruits. Mumbaca produces from one to two fruit bunches. Even though the fruit crop is meager, rural folk nevertheless appreciate the sweet, juicy pulp. Mumbaca, as the palm is called in Brazil, barely attains 3 m, and since the fruits are born in clusters at shoulder height, they are easy to gather. River dwellers tarry to snack on the dark purple, olive sized fruits, and often take a few fruit clusters home. The seeds are typically spat out and some of the groups of mumbaca palm are likely the result of people snacking on the fruits and discarding the seeds.

Bactris maraja 27

Bolivia: Chontilla; cocope' (Tsimané)
Brazil: Marajá, marajá peludo, ubim de espinho; mariawa (Guajá), maraya'ɨ (Ka'apor)
Colombia: Chontilla; pahp (Nukak), tuiri (Piapoco)
Ecuador: Chontilla; muraya kamanche (Shuar), emetogahue (Waorani)
Peru: Ñeja, ñejilla, chontilla; moyoanya kamanchá (Aguaruna), manataro (Machiguenga), bi ñi (Maijuna), taná (Shipibo)
Venezuela: Piritu; komorawë (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_27

Fig. 27.1 Ñejilla (*Bactris maraja*) palm in fruit along a river during the annual flood. Pucate River, affluent of the lower Yanayacu, Pacaya-Samiria, Loreto, Peru, 4-21-06

Bactris maraja is one of a dozen or so species in the genus *Bactris* with edible fruits that thrive in wetlands of Amazonia. This widespread palm and is so variable that it may eventually be split into several taxa (Henderson 1995: 205). One reason that the palm is so many forms is that it has an enormous range, from Costa Rica to vast swathes of northern South America including the Guianas and both the Orinoco and Amazon basins. Normally encountered in lowlands, especially wetlands, *B*. *maraja* is found as high as 1,500 m (Henderson 1995: 207). The palm is found singly as well as in small colonies.

Fig. 27.2 Boy in floodplain forest eating fruits of *Bactris maraja* near his village. Lower Rio Tigre, Loreto, Peru, 7-1-06

The fruits are widely appreciated throughout the palm's extensive range, including the Peruvian Amazon where they occasionally enter markets in Iquitos (Mejía 1992). Indigenous groups, rubber tappers, and river dwellers also eat the fruits in the Brazilian state of Acre (Campos and Ehringhaus 2003) as do the Maijuna in the Colombian and Peruvian Amazon (Gilmore et al. 2013). The fruits are also used for fish bait, as on Careiro Island on the Amazon floodplain near Manaus (Bahri 1992: 67). While fruits are the main food item obtained from *Bactris maraja*, at least one tribe, the Machiguenga, also cut out and eat the heart-of-palm (Johnson 2003: 74).

Fig. 27.3 Ripe fruits of *Bactris maraja*. Rio Pucate, affluent of the lower Yanayacu, Pacaya-Samiria, Loreto, Peru, 4-21-06

The turban-shaped fruits are born in clusters of about a dozen on a single infructescence during the rainy season. Each fruit bunch has some six branches (rachilla) containing 6–8 fruits, thus each bunch contains about 45 fruits. Although the 1.7 cm-wide fruits contain little pulp, the light tan mesocarp is sweet with an appealing flowery aroma. The palms are relatively short, usually under 5 m, so people typically gather the fruits from their canoes by cutting off the infructescence with a machete, taking care to avoid the numerous black spines that festoon the trunk, leaves, and fruit stalk. The fruits are dark-purple when fully ripe and are covered with a hard skin. Fish, such as tambaqui (*Colossoma macropomum*) are involved in dispersing the seeds (Silva et al. 2003).

The wood of *Bactris maraja*, as with some other members of this large genus, is useful for fashioning various implements and construction materials. The Yawanawá and Kaxinawá who inhabit the Acre River near Rio Branco, for example, use the hard stem to make bows, arrows, and spears (Campos and Ehringhaus 2003). The Machiguenga in the Peruvian Amazon fashion some of their bows from the stem (Johnson 2003: 74). The Nukak in the Colombian Amazon make harpoons for fishing from the palm's stem; the bark is trimmed off and then the shaft is polished. The Nukak also make blowguns from the stem, but *Bactris maraja* is not the preferred wood for making that hunting weapon (Cárdenas and Politis 2000: 44). The Asuriní fashion small disks from the wood, no more than 4 mm thick, through which they drill a hole to thread on to necklaces (Lukesch 1976a: 92).

Bactris martiana

28

Ecuador: Achupara
Peru: Ñejilla, ñeja

Status: Wild, spontaneous in cultural settings

Fig. 28.1 Ñejilla (*Bactris martiana*) palm fruits gathered in floodplain forest. Veinte de Enero, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-20-06

Bactris martiana grows in compact clumps along streams and rivers in the western part of the Amazon, from the border area between Brazil and Colombia,

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_28

west to Ecuador, and south to Peru, Bolivia, and Acre in Brazil (Henderson 2000: 121). Formerly classified as *Bactris concinna concinna*, Andrew Henderson of the New York Botanical Garden has recently elevated this palm to the species level (*Bactris martiana*) in honor of the nineteenth century German botanist Carl Friedrich Philipp von Martius.

The diminutive palm usually does not exceed 3 m but it is a copious fruiter, bearing as many as three bunches of purple, olive-shaped fruits per tree. Apart from the domesticated peach palm (*Bactris gasipaes*), *Bactris martiana* produces the largest edible fruits in the genus. Fruits of *B. martiana* measure some 3–5 cm long by 2.5–3 cm wide. Each frutescence contains between 20 and 60 fruits, so several thousand fruits can be gathered from a grove. The palm is festooned with numerous small thorns, including the fruit stalk itself, so people use a machete to lop off the fruit bunches.

Fig. 28.2 Ñejilla (*Bactris martiana*) palms in fruit in floodplain forest. At least 1,000 palms are found in this stand, possibly a vestige of enrichment by indigenous cultures that have long since disappeared. Marañón River near its confluence with the Yanayacu, Pacaya-Samiria, Loreto, Peru, 6-27-06

The fronds of *Bactris martiana* cover the trunks in umbrella fashion when the palm grows along sunlit streams and riverbanks. Deep in floodplain forest, however, the palm is a little taller and more open around the trunk as the fronds reach upward in search of light. Groves of *B. martiana*, known as *manchones* or *ñejillales* in the Peruvian Amazon, typically contain dozens of individuals, but in exceptional cases several hundred or even thousands of palms can be found in a stand.

The fruit's thick, leathery skin is peeled back to reveal a light cream-colored pulp. The mesocarp, known locally as *carne* ("meat"), has an intriguing flavor because it is sweet, yet with a hint of tartness. The juicy pulp is slightly fibrous, like some varieties of mango, and tastes like a cross between mango and peach. Once the pulp has been relished, the black, fingernail-sized seed, measuring some 2 cm by 1.5 cm, is spat out. Along the Puinahua, Ucayali, and Yanayacu Rivers in the Pacaya-Samiria National Reserve, children and adults snack on the fruits on their way to fish, hunt, or work in their fields. Villagers sometimes also bring bunches of the fruit home, but they are apparently never taken to market.

Fig. 28.3 Boy snacking on fruits of *Bactris martiana* that he has gathered in floodplain forest near his village. Marañón River near its confluence with the Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-27-06

Bactris riparia

29

Bolivia: Chonta, marayaú
Brazil: Marajá, marajá pupunha, pupunharana
Colombia: Jimaikɨrɨ (Witoto)
Ecuador: Chontilla
Peru: Chontilla; neuna (Shipibo)

Status: Wild

Fig. 29.1 A stand of chontilla (*Bactris riparia*) palms along a black water river. Near Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 1-15-06

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_29

With its bright lime-green fronds and tall, pale gray trunks, often arching over the water, chontilla (*Bactris riparia*) is one of the most elegant palms in the Amazon. It is also one of the tallest in the genus, reaching 5 m in height. The graceful fronds resemble those of its domesticated cousin, the peach palm (*Bactris gasipaes*) hence two of the common names for *B. riparia* in the Brazilian Amazon: marajá pupunha and pupunharana (like pupunha).

The natural history knowledge of rural peoples in Amazonia is impressive. It turns out that of all the hundreds of species in the genus, molecular analysis has shown that *Bactris riparia* is closest to peach palm (Couvreur et al. 2007). And according to Witoto mythology, peach palm was originally an aquatic plant which was looked after by bujurqui fish (*Cichlasoma* sp.). These fish guardians could transform themselves into women and walk on earth to deceive men. Bujurqui are considered the mother of peach palm, and when the Witoto go fishing with peach palm fruit as bait the first fish they generally catch is buijuqui (Landolt 2005: 49).

Fig. 29.2 Drawing by a river dweller depicting various palms, including chontilla (*Bactris riparia*) on *left* which provide fruits sought after by fish valuable for subsistence and commerce. Acarahuazo (*Astronotus ocellatus*) and gamitana (*Colossoma macropomum*) are depicted seeking palm fruits. Wilson Tello Casternoque, 16 years-old, Veinte de Enero, Yanayacu River, Pacaya-Samiria, Loreto, Peru, April 2006

Often forming large, compact stands along the banks of rivers and margins of lakes, *B. riparia* is an important source of food for fish, especially (*Colossoma macropomum*), known as gamitana in Peru and tambaqui in Brazil. The palm is particularly common along black water rivers (Couvreur et al. 2007), although it is also encountered along sediment-rich rivers (Henderson 2000: 139).

The fruits are produced during the rainy season and are rather insipid, so people generally do not eat them. But in certain parts of the Peruvian Amazon, such as in Manco Capac along the Rio Puinahua (an arm of the Ucayali), fishermen prepare juice (*refresco*) when the fruits turn purple, signifying that they are ripe. Unlike most other edible fruits of wild *Bactris* palms, chontilla fruits remain green for a long time, turning red for a brief period just before they fall into the water.

Fig. 29.3 *Bactris riparia* in fruit in floodplain forest. Near Manco Capac, Puinahua River (a branch of the Ucayali), Pacaya-Samiria, Loreto, Peru, 4-15-06

In the Colombian Amazon, the Witoto burn and sieve the ashes of 57 plants, including *Bactris riparia* (Echeverri and Román-Jitdutjaaño 2011). The salt thus obtained from the ashes is mixed with tobacco paste as an alkaline reagent, and used in various rituals.

Copernicia alba

30

English: Caranday palm
Bolivia: Palm blanca, palma negra
Brazil: Carandá
Paraguay: Ijnáque, ijná (Ayoreo)

Status: Wild, spontaneous in cultural settings

Fig. 30.1 Caranday palm (*Copernicia alba*) in seasonally-flooded savanna in the Bolivian Amazon. Cattle are grazing among the palms. Cercado, Beni, Bolivia, 6-4-05

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_30

The English name for the palm, caranday, is derived from karanda'y, a Guarani word which means water palm (Cisz 2011: 4). This palm, which can soar to 30 m, ranges from the Bolivian Amazon south to the Chaco region of Paraguay and northern Argentina and east into the Pantanal of Mato Grosso and Mato Grosso do Sul in Brazil (Henderson et al. 1995: 58; Pott et al. 2011). The fire-resistant stands can be so extensive that locals have designated terms for the groves, such as *candazal* in Brazil. The small, brown fruits are eaten, although not in significant quantities. The Ayoreo who inhabit the Chaco relish the palm heart (Schmeda-Hirschmann 1994), although this does not seem to be a common dietary item in the southern fringes of the Amazon Basin.

The elegant "white" palm drops out as one approaches the dense rainforests further north. Palma blanca tolerates flooding for a few months, but is not found in perennial swamps or marshes. In areas subject to prolonged flooding, the palm clings to higher ground, such as the perimeter of indigenous mounds, fairly common features on the Llanos de Moxos, which was densely settled in precontact times.

The fan-shaped fronds are used in weaving, while the trunks serve as house and fence posts. In the vicinity of Santa Cruz, Bolivia, the trunks are used for telephone poles and near Santa Rosa de Yacuma on the Llanos de Moxos, locals use the inflorescence for brooms.

The fronds of *Copernicia alba* are not coated with as much wax as the carnaúba palm (*Copernicia prunifera*), a relative native to the drier parts of northeastern and central Brazil and a source of high quality wax for cars and furniture. Presumably the dry season is not severe enough for *Copernicia alba* to have evolved a generous coating of wax on the leaves, so the palm is not exploited for that product.

31 *Desmoncus polyacanthos*

Brazil: Jacitara; ɨrapar-pukwa-ha (Ka'apor), beada (Tuyuka)
Colombia: Jalapatrás; kamawa (Piapoco)
Ecuador: Makaña (Shuar)
Guyana: Gomowaré
Peru: Vara casha; makayá (Aguarana), jijebɨmeme (Maijuna)
Venezuela: Voladora; mïsïkïrï (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_31

Fig. 31.1 *Desmoncus polyacanthos* in floodplain forest. Cocha Grande, near San Carlos, Rio Puinahua (a branch of the Ucayali), Pacaya-Samiria, Loreto, Peru, 4-18-06

A slender, climbing palm, *Desmoncus polyacanthos* has a wide distribution encompassing the Amazon and Orinoco Basins, the Guianas, and the Atlantic Forest of Brazil. The palm thrives in both upland and floodplain forests, but is more common in wetlands. It occurs as high as 1,000 m in the Andean foothills of Ecuador (Henderson 2011a). The cat-clawed palm is a highly variable species, especially in western Amazonia. The sharp, recurved thorns of the palm feature in a Desana myth about how the first Desana had no woman so he fashioned a hook and line from the vine-like palm and baited it with a forest fruit in order to catch a fish-woman, whom he could marry (Reichel-Dolmatoff 1996: 130).

Two varieties of the spiny palm are currently recognized: *Desmoncus polyacanthos* var. *prunifera*, producing larger fruits, confined to upland forest in the Amazonian portions of Colombia, Ecuador, and Peru; and the more widespread *D. polyacanthos* var. *polyacanthos* (Henderson 1995: 233). A denizen of forests on floodplains as well as *terra firme*, the palm stem is gathered in parts of its range to weave baskets and assemble rudimentary chairs (Goulding and Smith 2007: 224; Vásquez 1997: 766; Vásquez et al. 2010: 325).

In the Brazilian Amazon, various plants are employed to weave a sleeve-like press (*tipiti*) that is used to squeeze manioc dough. After the dough is extracted from a *tipiti*, it may be sifted before toasting on a flat oven to make flour (*farinha de mandioca*). *Tipitis* fashioned from the bark of jacitara have long been considered the most durable, outlasting those made from the fronds of other palms such as *Mauritia flexuosa* and *Oenocarpus bacaba*, as well as the petioles of arumã (*Ischnosiphon obliquus*, Marantaceae), an understory shrub in floodplain forest (Wallace 1853: 73).

Fig. 31.2 *Tipiti* made from jacitara palm for squeezing manioc dough. Santo Antonio de Itapucú, Lago de Tefé, Amazonas, Brazil, 8-27-12

Women make *tipitis* from jacitara in many parts of the Brazilian Amazon, including the vicinities of Santarém and Juriti in Pará and Maués in Amazonas. *Tipitis* are not encountered in the Peruvian Amazon because farmers in western Amazonia grow sweet manioc (yuca) which is typically boiled and eaten rather than made into flour. In contrast, bitter manioc, which contains poisonous prussic acid, is much more common than sweet manioc in the Brazilian Amazon and it must be processed into flour or toasted pancakes (*beiju*) before eating. In the Peruvian Amazon, then, vara casha, as the palm is known there, is employed mostly for making utilitarian baskets.

Fig. 31.3 Brothers striping fruits of açaí (*Euterpe oleracea*) palm into a basket made from jacitara. Rio Joroca on a floodplain island of the lower Tocantins River, Pará, Brazil, 7-2-07

Fig. 31.4 Weaving a basket with strips of bark from jacitara palm. Bacuri, Lago de Tefé, Amazonas, Brazil, 8-27-12

Fig. 31.5 Farm boy off to harvest manioc tubers with a jacitara basket on his back. Rio Croarí, Chaves municipality, Marajó Island, Pará, Brazil, 11-23-02

Baskets and sieves for various purposes are fashioned from jacitara bark. In the Amazon estuary, many of the baskets for taking fruits of açaí *(Euterpe oleracea*) to market are made from jacitara (Smith 2002: 89). Some sieves used to separate açaí seeds from pulp are fashioned from split midribs (rachis) of jacitara fronds. Fishermen on Marajó Island use open-weave jacitara baskets to scoop up fish chased against seines that have been strung across tidal creeks. Along the Tefé

River in Amazonas, Brazil, jacitara baskets are used to carry manioc tubers to *casas da farinha* where the roots are processed into flour. Jacitara baskets are also hung inside huts to provide secure places for hens to lay eggs.

Fig. 31.6 Farmer carrying manioc tubers in a basket fashioned from jacitara petiole strips. San Antonio de Itapucú, Lago de Tefé, Amazonas, Brazil, 8-27-12

Strips of bark torn from jacitara stems and petioles have long been used to wrap cured tobacco leaves into salami-shaped rolls in the Brazilian Amazon (Bates 1863a: 322; Smith 1879: 158). The tobacco in such rolls, which can be purchased in general stores throughout the Brazilian Amazon, is potent but can be hard to light because it is often damp. Smokers therefore often heat the tobacco in a tin can to expel some of the moisture. Such tubes of cured tobacco are less common than formerly since loose tobacco in plastic bags from the Northeast of Brazil are often preferred by people who roll their own cigarettes because the tobacco is drier and cheaper.

The now extinct Passé, an Aruak group that once lived in the vicinity of Tefé, used to wrap the shaft of their blowguns with strips of jacitara palm to prevent them from splitting (Bates 1863b: 236). The Guajajara in Maranhão use jacitara twine to attach arrow points, while the Apinajé further west in Pará employ the palm to treat stomachache (Balick 1988).

Fig. 31.7 River dweller tearing strips of jacitara on the dock of her home. She will make a basket with them. Limoeiro River, an affluent of the lower Tocantins, Pará, Brazil, 7-5-07

On Marajó Island, some rural folk consume the bright red fruits of jacitara after cooking, but the fruits are not commonly ingested. Fishermen also gather them for use as fish bait. According to river dwellers, jacitara fruits are eaten by certain highly-prized fish, such as *Colossoma bidens* and species of *Mylossoma* and *Leporinus*. The Piapoco in the northern part of the Colombian Amazon believe that the palm possesses magical properties: they sometimes rub their hands with fronds cut from the palm in order to improve their luck when fishing (Mesa 2011: 107; Mesa and Galeano 2013).

32 Elaeis oleifera

English: American oil palm
Brazil: Caiaué
Colombia: Nolí, corozo
Ecuador: Yunchick (Achuar)
Peru: Puma yarina
Suriname: Obi
Venezuela: Corozo colorado

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_32

Fig. 32.1 *Elaeis oleifera* in fruit in a floodplain forest inundated with black water. Termites have built a nest among the leaf bases. Igarapé Açu near Anori, Amazonas, Brazil, 6-22-07

American oil palm (*Elaeis oleifera*) is a cousin of the widely planted African oil palm (*Elaeis guineensis*) but its growth habit is quite different. American oil palm becomes prostrate with advancing age and in the wild is usually found in floodplain forests and swamps. African oil palm remains erect and is confined to uplands. However, American oil palm was introduced to uplands in Amazonia near settlements in pre-contact times where it has become feral in some places. Indeed the spider-like palm is often found near abandoned settlements and in home gardens along the Amazon and several of its tributaries, such as the Maués. Because of its propensity to grow in cultural settings in the Amazon, especially if they are on Amazonian Dark Earth, caiaué is considered an indicator species of archaeological sites (Balée 1988, 1989; Barcelos 1986; Clement et al. 2003; De Blank 1952; Fraser et al. 2011a; Junqueira et al. 2010a, b; Levis et al. 2012). In Sierra Leone, its African cousin (*E. guineensis*) is common in sacred groves, so both palms show an affinity with people (Lebbie and Guries 2008).

Fig. 32.2 New World oil palm along the Solimões River. These palms, or their ancestors, were likely planted on the river bank. Fazenda Jaguatirica, near Codajás, Amazonas, Brazil, 6-25-07

Fig. 32.3 American oil palms on an upland bluff overlooking the Tefé River. The palms are growing in a home garden on an Amazonian Dark Earth replete with potsherds. Indigenous people likely established the palms on this site long ago. Near Missão, a few km downstream from Tefé, Amazonas, Brazil, 8-15-12

One reason that American oil palm persists in and around human settlements is that it resists fires. People frequently burn yard trash around their homes in part to discourage snakes. Fires are also set in areas for planting crops. The palm, with its distinctive toothed leaf stalks, tolerates fires while many other plants succumb. This is surprising in that the "natural" habitat for American oil palm is seasonally-flooded forest where fires would be unusual in the absence of people.

Fig. 32.4 New World oil palm scorched by fire but still thriving on an archaeological site. A farmer has planted papaya (*Carica papaya*) because yields are high on the fertile Amazonian Dark Earth. Laguinho, Solimões River, near Iranduba, Amazonas, Brazil, 9-18-10

In Amazonia, the palm reaches as far west as the southeastern tip of the Ecuadorian Amazon and the Iquitos area of the Peruvian Amazon, but is absent from southwestern portions of the basin, including Bolivia (Kahn and Mejía 1986). In Ecuador, American oil palm is known only from a single location along a forest stream in the Province of Morona-Santiago in the southeastern part of the country (Balslev and Henderson 1986).

Fig. 32.5 Caiaué palms in second growth in an upland area that is repeatedly cleared and burned to grow crops. Archaeological sites abound in this area, so the ancestors of these palms were likely brought here long ago. Lower Tefé River, Amazonas, Brazil, 8-21-12

American oil palm is also found in swamp forests and wetland pastures along both coasts of Central America from Honduras southward, as well as in Colombia and the Guianas (León 1987: 58). Some have suggested that the palm originated in the Pacific lowlands of Costa Rica and was brought to South American in precontact times (Ghesquière et al. 1987; Morcote-Ríos and Bernal 2001). However, an analysis of nuclear RFLP reveals that Amazonian populations contain the greatest genetic diversity of *Elaeis oleifera* (Barcelos 1998). American oil palm therefore most likely arose in central Amazonia and then spread into other parts of the basin and as well as the Guianas and Central America. Boer (1965: 5) thinks *E. oleifera* was introduced to Suriname where it is confined to sandy soils on savannas. People have long been involved in dispersing the palm as suggested by its frequent occurrence on archaeological sites. An examination of genetic markers suggests that some of the populations of American oil palm on Amazon Dark Earth patches along the Madeira River, for example, were likely founded by indigenous groups who brought seeds from other areas in the Amazon (Barcelos 1998).

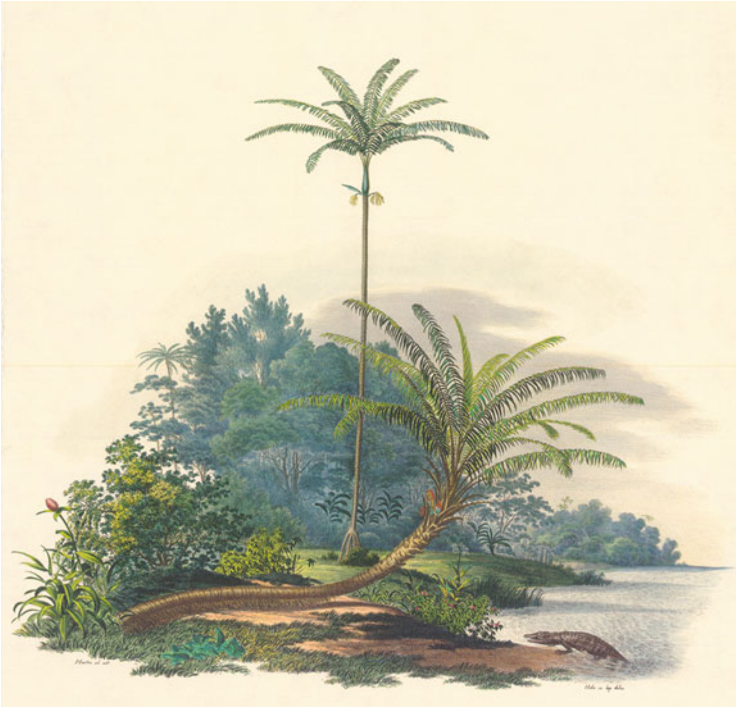

Fig. 32.6 Millipede-like American oil palm growing on the bank of a river in the Amazon. A caiman is emerging from the water (Martius 2010: 159)

American oil palm grows along the ground for up to 6 m before turning skyward, thereby resembling a saxophone (Henderson 2002: 22). The fruits are born in thick clusters among the leaf bases at waist height. The orange-red color of the fruits indicates that they are rich in vitamin A (Balick 1979). The fruits, about 3 cm long by 2 cm wide, are packed into a tight, flat bunch at the base of the frond petioles. Some care has to be exercised in extracting the fruits because the edges of the leaf stems are armed with sharp “claws”. Also, thorns (spiny bracts) emanate from among the fruits. Yields of up to 100 kg of fruit per year have been recorded from a single palm, though annual yields are usually closer to 25 kg (Balick 1979; Din et al. 2000).

In addition to the fruits, some rural folk along the margins of Lago de Tefé in Amazonas, Brazil, cut the fronds to shade their seasonal wells (*caçimbas*) that are excavated in clay along the shores of the expansive black water lake. The fronds are also used to shade raised vegetable beds, such as in the village of São José da Enseada along the Amazon River near Itapiranga in Amazonas, Brazil. A farmer along the Anebá River, an affluent of the lower Urubu, spreads caiaué fronds on the ground under the sprawling stems of West Indian gherkin (*Cucumis anguria*) so that the prickly yellow fruits do not touch the ground and start rotting during the rainy season. And in Boa Esperança on the shores of Lake Amanã which flows into the lower Japurá River near its confluence with the Solimões, one mother trims a few of fronds from a caiaué palm in her front yard when she wants to dry pirarucu (*Arapaima gigas*); the filleted and salted fish is laid on the fronds.

Fig. 32.7 Pirarucu (*Arapaima gigas*) drying on caiaué fronds on the front porch of a village home. The fronds were cut from a palm in front yard on the *left*. Boa Esperança, Lago Amanã, Amazonas, Brazil, 9-20-12

Although *Elaeis oleifera* is not important economically, it is of interest to plant breeders working with African oil palm (Barcelos 1998). As with many monocrops that are planted on a large scale, African oil palm plantations are vulnerable to a variety of pests and diseases. In the Amazon and other parts of tropical America, lethal yellowing is one of the most devastating diseases that afflict *E. guineensis*. A source of resistance to this inevitably fatal infection has been located in *E. oleifera*. The New World oil palm hybridizes easily with African oil palm, and has provided genes that have helped reinvigorate African oil palm plantations along the Pacific coast of Colombia which were first stuck by lethal yellowing in 1963 (Hartley 1988; Zaki et al. 2010). The New World oil palm is also more robust than African oil palm in the face of several other diseases (Meunier 1975). The short stature of American oil palm is another valuable trait because hybrids are shorter, thereby reducing harvesting costs without adversely affecting yields (Gascon et al. 1989; Hardon 1969). And the oil of *E. oleifera* is superior because it has less saturated fat than *E. guineensis* (Ooi et al. 1981).

Because of its usefulness in oil palm breeding, the Brazilian agricultural research service (Empresa Brasileira de Pesquisa Agropecuária-EMBRAPA) started a field genebank for *Elaeis oleifera* in 1982. Located along the margins of the Urubu River near Manaus, the genebank contained 244 accessions as of 2009. Germplasm expeditions for this genebank have been undertaken along various rivers, including the Amazon, Solimões, Negro, and Madeira (Cunha et al. 2009).

River dwellers boil the fruits then mash them in a mortar to extract the oily, yellow juice, such as along the lower Maués, in the vicinity of Codajás and Tefé along the Solimões, and in rural areas surrounding Itacoatiara along Amazon. The juice, known as *vinho de caiaué*, is then filtered before drinking, usually employing a sieve fashioned from the petioles of arumã (*Ischnosiphon obliquus*), a shrub found along creeks. Sometimes sugar or salt is added to taste. The fruits are also fed to pigs along the Maués as well as on Careiro Island on the Amazon floodplain near Manaus. In the early twentieth century, oil obtained from the fruit pulp was used for cooking and to make soap and candles (Le Cointe 1922a: 488).

Fig. 32.8 New World oil palm in fruit. Fazenda Jaguatirica, near Codajás, Rio Solimões, Amazonas, Brazil, 6-25-07

The oil of *Elaeis oleifera* fruits is used in various folk remedies (Allen 1965a; Smith et al. 1992: 239–242). In Colombia, for example, *curanderos* use the oil to treat stomach inflammation. In the Sinú Valley in northern Colombia, rural folk once planted the palm on alluvial soils to extract oil on a commercial scale, but many of the palms were felled in the 1950s to make way for cotton (Gordon 1957: 84). In Brazil and Colombia, the pale yellow oil is used as a hair conditioner and to treat dandruff, and some indigenous groups anoint themselves with the oil to repel insects (Plotkin and Balick 1984). In Amazonas, Brazil, some children are given a spoonful of the oil to treat whooping cough (Van den Berg and Silva 1986), certainly more palatable than cod liver oil which was dispensed to schoolchildren in the United Kingdom in the 1960s.

Some populations of caiaué are found on the floodplains of forest streams, often far removed from villages. Such low lying, boggy areas are often rank with vegetation and difficult to walk through; they are called *chavascais* in the Brazilian Amazon. A *chavascal* with scattered groups of caiaué along Igarapé do Sobrado, an upland stream about 2 km inland from the banks of the lower Tefé River, is reputed to be the haunts of curupira, a supernatural entity. Robeval, a 63 year-old river dweller recalled an encounter he had with curupira near the stream some 30 years ago. He was in his hut which he had erected close to his manioc field when he heard a strange whistle coming from the chavascal. It was 9 o' clock in the morning and he was preparing something to eat in the kitchen; he had never heard such a whistle before, it was mournful ("*meio triste*"). The strange whistle kept getting closer, and as he was alone he became afraid. Suddenly a loud whistle erupted inside the hut, but he could not see what was making the sound. He practically fainted. Fortunately, when the whistling continued, it was coming from further and further away. Robeval surmised that it was curupira on one of his walks. He explained that all places in the forest have their owner ("*todo lugar tem dono*"). To placate the curupira, Robeval left some tobacco and a bottle of *cachaça* (sugarcane alcohol) in the chavascal and he was not bothered again.

Euterpe catinga 33

Brazil: Açaí chumbinho, açaí de cutia, açaí caatinga; boso mipĩ (Tuyuka)
Colombia: Manaca
Peru: Huasaí de varillal, chontilla; sake (Aguaruna)
Venezuela: Hayakawë (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_33

Fig. 33.1 *Euterpe catinga* in a campinarana, a type of stunted forest found on sandy soils. Watershed of Igarapé Açaí, affluent of the Tiquié, Uaupés watershed, Amazonas, Brazil, 11-3-12

Açaí chumbinho (*Euterpe catinga*) is a short to medium-sized palm, generally under 16 m, restricted to poorly drained sandy soils in parts of central and western Amazonia (Henderson 1995: 107). The origins of patches of sandy soil (podzols) in the region are poorly understood, but are likely remnants of river courses or possibly sand dunes formed during drier climatic periods. The vegetation on such ill-drained, nutrient-poor soils is stunted and is called *campina*, *campinarana*, or *catinga* (hence its species name) in Brazil and *varillal* in Peru.

Fig. 33.2 *Euterpe catinga* in fruit in a campinarana. Watershed of Igarapé Açaí, affluent of the Tiquié, Amazonas, Brazil, 11-4-12

Solitary *Euterpe catinga* is not nearly as important culturally and economically as its other near relatives in the Amazon Basin, *Euterpe oleracea* and *E. precatoria*, both of which can form extensive stands. Nevertheless, the fruits of *E. catinga* are gathered in some areas, such as along the Upper Tiquié, an affluent of the Uaupés in northwestern Amazonia (Rezende et al. 2010). The Tuyuka who inhabit the Upper Tiquié also gather heart-of-palm from *E. catinga*.

Euterpe oleracea

34

Brazil: Açaí, açaí de touçeira, açaí do Pará; ačai'i (Araweté), mihi (Barasana), pinuwa-pihun (Guajá), wasaí-'ɨ (Ka'apor), kamere kràk (Kayapó), waira (Ticuna), mihpĩ (Tukano), mipĩ (Tuyuka)
Colombia: Asaí; pãta (Andoque), mijirika (Makuna)
Ecuador: Palmiche
Peru: Huasaí brasilera
Suriname: Podosirie
Venezuela: Manaca, palmito; waima (Yanomama)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_34

Fig. 34.1 Açaí (*Euterpe oleracea*) palms lining a tidal creek on a floodplain island along the lower Tocantins River, Pará, Brazil, 7-2-07

Euterpe oleracea is one of the few Amazonia fruits to gain a foothold in international markets, but it represents the tip of an iceberg of promising fruits from the region that may eventually penetrate overseas markets. Visitors to the Amazon either like or dislike açaí; there is no middle ground. When I first came to Belém in 1970, I immediately liked açaí. The purple color, smooth texture, and savory flavor were appealing. But açaí was by no means near the top of my list of favorite regional fruits. Açaí has taken off internationally because it is touted as a "super fruit", rich in antioxidants that slow ageing and thwart the onset of cancer (Costa et al. 2013; Gordon et al. 2012; Kang et al. 2010, 2011). So the health angle, rather than an intriguing new flavor, has propelled açaí on to the world stage. In 2009, exports of açaí fruit pulp from Brazil topped $90.5 million, three times the value of Brazil nut (*Bertholletia excelsa*) exports (Porro et al. 2012).

Açaí occurs from the Pacific coast of Colombia and Ecuador to the northern part of Colombia and eastwards to Venezuela, the Guianas, and the mouth of the Amazon (Henderson 1995: 109; Lindeman and Mori 1989; Roosmalen 1985: 248). In the Brazilian Amazon *Euterpe oleracea* occurs "naturally" from Maranhão and the Amazon estuary westwards to Parintins on the southern bank of the Amazon and Óbidos on the northern bank of the river, both in Pará (Ducke and Black 1954). The precise range of the palm before the arrival of humans is unclear because early hunters and gatherers likely began expanding the palm's range. For example, *E. oleracea* was introduced long ago to settlements along the Solimões and its tributaries; whether the indigenous people who were responsible for this were farmers or hunters and gathers is not known. River dwellers in the vicinity of Tefé cultivate

E. oleracea in their home gardens and fields because it produces some fruit all year whereas *E. precatoria*, which is regarded as a superior form of açaí, only fruits during the rainy season and early part of the dry period (January to July).

West of the Rio Negro, a close cousin, *Euterpe precatoria*, becomes more important. Both palms occur on floodplains, but *E. precatoria* also grows on uplands. The easiest way to distinguish the palms is by observing whether they are growing singly or in clumps: *Euterpe oleracea* is multi-stemmed, whereas *E. precatoria* is a solitary palm. Açaí de touçeira, one of the names for the *E. oleracea* in the Amazon estuary, means the palm that grows in clumps.

In the Peruvian Amazon, *E. oleracea* is only found as an occasional ornamental, such as along the waterfront promenade (*malecón*) in Iquitos, and its common name there, huasaí brasileira, recognizes its exotic nature. It was introduced to a private garden in Iquitos in the early 1950s and has since spread to other settlements in the Peruvian Amazon (Kahn and Granville 1992: 109), including Jenaro Herrera, a small town along the Ucayali, and Yarina, a village on the banks of the Yanayacu River in the Pacaya-Samiria National Reserve. In Pará state in the eastern part of the Brazilian Amazon, açaí is also planted as an ornamental. Before the Belém airport was renovated in 2001, for example, a clump of açaí palms stood prominently in the small garden by the terminal that welcomed deplaning passengers. *Paraenses* arriving from other states or abroad immediately felt at home when they inhaled the warm, humid air as they emerged on to the stairs to descend form the aircraft and were welcomed by the familiar açaí palms when they walked from the plane to the terminal. Now the planes pull right up to the new terminal and passengers deplane through air conditioned tubes.

Fig. 34.2 Açaí palms in a home garden. Igarapé Samaúma, affluent of Tocantins River near Limoeiro, Pará, Brazil, 7-3-07

Açaí is one of the most graceful palms with its tall, slender, light-grey trunk topped with an array of delicate bright green fronds. The feathery pinnate leaves bow and rustle in the breeze, which stir when afternoon thunderstorms brew, or when the southeast trade winds blow in the lower Amazon during the dry season. The fruit bunches are also picturesque, with multiple, pale branches (rachilla) studded with several hundred dark purple fruits.

Açaí's plump, blueberry-sized fruits have been gathered for thousands of years to make juice. Archaeologist Anna Roosevelt has found abundant remains of açaí seeds in sites once occupied by the Marajoara culture; this impressive society, which made large funeral urns painted with spectacular colored designs, held sway over much of Marajó Island at the mouth of the Amazon from 400 to 1,000 AD (Roosevelt 1991: 375). Indigenous civilizations, which were evidently based on highly productive agricultural systems, have long played a role in increasing the density of açaí stands and surely extended the palm's range (Neves et al. 2003). This process continues, such as in the Amazon estuary where rural folk are interplanting açaí with annual crops in recently cleared areas, in second growth, and in their home gardens in response to strong market demand for the fruits (Steward 2013).

Fig. 34.3 Girl ascending an açaí trunk in her home garden to gather fruits. She has fashioned a footsling (*peconha*) using young fronds of the palm. Limoeiro River, Pará, Brazil, 7-5-07

Açaí fruits are gathered by climbing the smooth-trunked palm, which can reach some 20 m, with the aid of a foot sling (*peconha*). Nowadays, most *peconhas* are fashioned from pieces of Polypropylene sacks, but some are still made from new fronds or the peduncular bract (*copa*) of açaí. Men, women, and children shimmy up açaí palms to cut off the fruit bunches, each of which contains about 100 marble-sized fruits. Particularly skillful and agile climbers sometimes save time by reaching out to nearby palms to harvest the fruit rather than climb down and ascend neighboring palms. A misstep or weakened palm can lead to tragic consequences. A mature açaí palm usually has one or two fruit bunches ready for harvesting when in season, which usually lasts about 8 months.

Fig. 34.4 Stripping (*debulhando*) açaí fruits into a basket fashioned from the petioles of arumã (*Ischnosiphon obliquus*). Limoeiro River, Pará, Brazil, 7-5-07

Once the fruit bunch has been dropped or carried down to the ground, the fruits are stripped off manually (*debulhar*) from the multiple rachilla that emanate from each stalk. If the gatherer is far from home, the fruits are stripped off in the forest and placed in baskets. Nearer home, the fruit bunches are generally brought inside and the fruits are pulled off into a large bowl. The discarded fruit stalks are sometimes piled up to make mulch for home gardens, or they are used as brooms for sweeping yards, such as in the vicinity of Afuá on Marajó Island and Tefé. Rural folk are quite fastidious about keeping the ground around their homes clear of litter because they believe it discourages snakes.

Fig. 34.5 Ceramic bowl (*alguidar*) used exclusively for soaking açaí fruits. This 71 year-old river dweller gathered the fruits himself from a grove behind his house. Limoeiro River, Pará, Brazil, 7-5-07

Warm water is then added to the bowl and the fruits soak for about an hour. Specialized ceramic bowls (*alguidars)* are made in the Amazon estuary for this purpose. *Alguidars* are large, about a meter across, and are sold in markets. Home-made, rectangular containers fashioned from boards or plastic bowls are also used to soak açaí fruits. In the vicinity of Tefé, river dwellers used to use a rectangular wooden trough to soak and mash the fruits. Known locally as *gambia*, such troughs which measure approximately 1 m by 75 cm, have largely been replaced by metal or plastic bowls.

Fig. 34.6 Yuhupde (Makú) woman pounding açaí fruits with a stick to remove the pulp. She gathered the fruits from palms sown in her home garden. Serra do Mucura, Tiquié River, affluent of the Uaupés, Amazonas, Brazil, 10-27-12

After the fruits have softened, the pulp is removed from the seed by hand, with a mortar, or by pouring the fruits into a metal or wooden churner (*batideira*). Both rural and urban folk employ specially designed açaí churns, either wooden ones with a handle similar to a butter churn that sell for a few dollars, or aluminum ones that run on electricity and sell for about $250. Both wooden and electrical beaters are a cottage industry in the Amazon estuary; the former are fashioned in the countryside, while the electrical ones are mostly made in Belém.

Fig. 34.7 Pouring açaí fruits into an electric *batideira* to make juice in the home of a river dweller. Rio Limoeiro, affluent of the lower Tocantins, Pará, Brazil, 7-3-07

In the Amazon estuary, a milder form of açaí juice (*açaí sem tinta*) is sometimes prepared for the elderly or inform. In this case, the skin is removed after soaking so that the resulting juice is less “strong”.

Fig. 34.8 Açaí fruits that have been soaked and their skins removed to make a less potent juice (*açaí sem tinta*). Arapaxi River, affluent of the lower Cajueiro, Chaves Municipality, Marajó Island, Para, Brazil, 8-15-00

Discarded açaí seeds often pile up outside kitchen windows and stores that sell the juice. Some of the seeds sprout, and may be transplanted to gardens and fields. After mulching for several months, the seeds are sometimes placed in baskets fashioned from split petioles of arumã (*Ischnosiphon obliquus*) that serve as pots for herbs and spices.

Fig. 34.9 Spring onions growing in soil with mulched açaí seeds. The baskets are made from the split petioles of arumã (*Ischnosiphon obliquus*). Limoeiro River, affluent of the lower Tocantins, Pará, Brazil, 7-4-07

Açaí juice is typically sold in plastic bags to be taken home and consumed fresh, particularly in the late afternoon, or is frozen for the ice-cream trade. Sometimes people drink açaí juice at the store, served in black calabash gourds (Smith 1999: 52, 2002: 85). Young and old congregate at açaí stores towards the close of day to chat between spoonfuls of açaí, which can be ordered in thick form at a higher price, or more diluted with water for the cost-conscious. Açaí stores thus serve as informal meeting places to gossip and exchange information.

Fig. 34.10 Porridge (*mingau*) of açaí fruit juice mixed with rice in a bowl fashioned from a calabash gourd (*Crescentia cujete*). The girl is in a street market and the porridge is her breakfast. Abaetetuba, Rio Tocantins, Pará, Brazil, 12-10-99

Açaí juice is sometimes sweetened with sugar and thickened with tapioca or manioc flour, and may become the last meal of the day. Açaí also starts the day both at home and in markets were the juice is sometimes mixed with rice to form a thick gruel. In both rural and urban areas, açaí juice is a significant source of calories for people of modest income, whereas for the middle and upper classes, the fruits are used more for making desserts (Brondizio 2008: 167).

Fig. 34.11 Açaí mixed with manioc flour. The 7 year-old farm boy has just eaten roasted fish for lunch and now he is enjoying dessert. Santo Antonio de Ipapucú, Lago de Tefé, Amazonas, Brazil, 8-27-12

Most markets for açaí fruits in the Amazon estuary are geared to wholesalers and retailers, rather than individual customers. The largest such market, Feira do Açaí, operates adjacent to the Ver-o-Peso market which sells fish, produce, and herbal remedies along Belém's waterfront. It starts around 4 a.m. and is essentially over 3 h later A similar, but smaller market operates before sunrise at Breves on Marajó Island.

Fig. 34.12 River dwellers waiting to offload their açaí fruits on to a boat at sunset. The fruits will be taken to Santana overnight and sold early the next morning. Curuá, Bailique, Amapá, Brazil, 5-16-02

Fruits for urban markets usually arrive in baskets at port overnight from estuarine creeks where locals come out to passing boats to sell their fruit the previous afternoon. The fruits spoil within 72 h, so traders bringing fruits from distant locations must place açaí in sacks and put them on ice. Some fishing boats, such as along the northern coast of Marajó, supplement their income by taking açaí fruits on as cargo. At Cametá along the lower Tocantins, however, the main market offers açaí to shoppers throughout the morning. The fruits are measured out in specialized metal scoops; two such scoops constitute a *frasco*, approximately a liter of fruits.

Fig. 34.13 Açaí fruits in a market. The vendor has a tin cup used for measuring half a *frasco* of fruits. Cametá, Tocantins River, Pará, Brazil, 7-1-07

Fig. 34.14 Açaí fruits in sacks awaiting transportation by fishing boat to Belém. Aruã along the northern coast of Marajó Island, Para, Brazil, 5-18-01

The dry months are the main fruiting season for açaí in the Amazon estuary. During the rainy season, prices of the fruit rise steeply as the availability declines. Growers and fruit gatherers are consequently on the lookout for trees that produce fruit during the offseason and gather the seeds to plant near their homes. Some river dwellers near Igarapé-Miri, for example, have obtained planting seed from açaí palms along parts of the Mojú River because they produce more fruit during the rainy season. And on Marajó Island, farmers have scoured the upper reaches of the Anajás, Mocoões and Pracuúba Rivers where certain populations of the palm are reputed to fruit out of season (Smith 2002: 91). Some river dwellers also trim off developing fruit racemes to "trick" the palm into producing fruit in the off-season (Muñiz-Miret et al. 1996). The reason for the anomalous pattern of fruiting among pockets of açaí palms is unclear; no obvious climatic or edaphic factors account for the unusual fruiting. Such fruiting patterns indicate a fair amount of genetic variability, however, and thus underscore the importance of conserving populations of the palm in different parts of its range.

Another indication of açaí's genetic variation is the seemingly random appearance of trees in the Amazon estuary that bear green fruits even when ripe. Known locally as açaí branco (white açaí), the olive-colored fruits fetch a higher price than the normal purple ones. The juice prepared from açaí branco is also creamier, reminiscent of avocado. Açaí branco is relatively rare, accounting for less than 5 % of the fruits marketed in Belém.

Although açaí fruits are gathered to make juice throughout the Brazilian Amazon, it is at the mouth of the Amazon that the appetite for açaí is keenest. Indeed in the estuary, açaí juice accompanies virtually every meal, and is a major source of calories because of the fruit's high oil content. In fact, açaí juice is more fattening than whole milk because it is loaded with lipids (Cavalcante and Johnson 1977). Over a century and a half ago, Alfred Russel Wallace noted the popularity of açaí juice at the mouth of the Amazon: "The inhabitants of Pará are excessively attached to this beverage, and many never pass a day of their lives without it." (Wallace 1853: 25)

Açaí took off as a major beverage in the Amazon estuary around 1870. Previously, guaraná (*Paullinia cupana*) was the main non-alcoholic drink in Belém, the capital of Pará state. An expression even arose in the second half of the nineteenth century that extols açaí's virtues: "Whoever visits Pará, lingers for a while; but if one drinks açaí, you end up staying" ("*Quem visitou Pará, parou; quem tomou açaí, ficou*").

The oil in açaí pulp imparts a smooth, agreeable texture to the juice, which has a savory, almost nut-like taste. Even though açaí fruits are not a significant source of protein, vitamins, or minerals, açaí juice is widely appreciated and helps satisfy hunger, especially when eaten with manioc flour or tapioca. Açaí also contains anthocyanins, the same antioxidant found in red wine, which allegedly has several health benefits ranging from antiviral properties to delaying the aging process by reducing cell damage (Iaderoza et al. 1992). Açaí juice reputedly contains 10–30 times as much antioxidant as red wine, a fact unbeknown to most rural inhabitants of the Amazon but touted for marketing purposes abroad (Kugel 2010). Açaí also contains sterols which can reduce the hardening of arteries and shrink an enlarged prostate. Indeed it is the health angle, rather than açaí's unusual taste, that has done much to promote the fruit's acceptance outside traditional markets.

Such is the esteem with which açaí is held in the lower Amazon that it has become part of the cultural fabric. Residents of Cametá on the left bank of the lower Tocantins, for example, are sometimes referred to as "black mouths" (*boca preta*) because of their dark purple lips, stained from drinking so much açaí juice. Riverine folk in the estuary are not the only people whose cultural identity is entwined with açaí; one of the clans of the Saterê-Maué, who inhabit the Maués River and some of its affluents in the middle Amazon, is named after açaí (Pereira 1954: 65).

Within the last few decades, markets for fresh fruit and frozen pulp of açaí have proliferated in Brazil and abroad. Reliable figures on the volume of trade in açaí fruits and frozen pulp are hard to come by because trade networks are so disperse and companies selling frozen pulp to southern Brazil may not want to divulge precise figures to avoid taxes. Michael Balick of the New York Botanical Garden estimated that some 60,000 t of açaí fruit entered commerce in Pará in 1980 (Balick 1984). It is a safe bet that figure has since doubled or even tripled. In 1986, sales of açaí fruit in the lower Amazon reached US$42 million, nearly double that of rubber which had dominated non-timber forest extraction since the mid-twentieth century.

As more people move from the countryside to towns and cities in search of better schools and jobs, they bring with them their habit of drinking açaí. All urban centers in the lower Amazon are burgeoning, especially Belém which has swollen to two million inhabitants from about 100,000 a century ago. Ambulant vendors selling home-made frozen pushups of regional fruit juices, including açaí, are a common sight in many towns along the Amazon River in Brazil.

Fig. 34.15 Home-made frozen pushup containing açaí juice. The ambulant vendor has a Styrofoam container to keep them cold. Itacoatiara, Amazonas, Brazil, 11-15-02

Markets for açaí are also expanding rapidly in other parts of Brazil, especially in Bahia, Rio de Janeiro, and São Paulo. Forty years ago, açaí juice was virtually unobtainable in Rio; now Cariocas can purchase açaí smoothies in just about every café and juice bar in their sprawling city nestled amongst imposing granite hills. Açaí smoothies in Rio tend to be cheaper and simpler than those available in foreign markets. One stand-up corner café in Rio's Ipanema district, for example, sells açaí juice mixed with lime juice and crushed ice for a dollar. Markets for açaí juice were pioneered in southern Brazil by "ex-patriates" from Pará who longed for their beloved açaí juice and ice cream. Then, as incomes rose in Brazil and the cost of air travel dropped, more people had a chance to visit Belém, where many experimented with, and soon liked, açaí juice and ice cream.

Markets for açaí juice have also surfaced in smoothie bars, cafés, and health clubs in North America and Europe. And açaí juice blends can be found in the chilled juice section of most supermarkets in the United States. Açaí is sold in pill form for "antioxidant support" and the oil turns up in some liquid soaps. Açaí has even made its way into some alcoholic drinks: Aboslut Berri Açaí, for example, is a blend of vodka, blueberry, pomegranate, and açaí. And in 2012, the Eel River Brewing Company in northern California began marketing Acai Berry Wheat Beer, which carries the USDA organic seal. In Brazil, açaí is generally not mixed with alcohol, nor is it fermented to make a wine.

Fig. 34.16 A recently weeded *açaízal*, formerly planted to annual crops. Rio Ipanema on the floodplain of the lower Tocantins River, near Abaetetuba, Pará, Brazil, 7-8-07

Buoyant markets for açaí products in Brazil and abroad have spurred wide scale planting of the palm in the Brazilian Amazon, particularly in the estuary (Hiraoka 1993; Hiraoka and Hida 1998). Many areas that were once planted to sugarcane, particularly during the colonial period, are now shaded by dense groves of açaí referred to as *açaízais*. By the early 1970s, *açaízais* covered an estimated 10,000 km^2 of the Amazon estuary (Calzavara 1972), a figure that must have increased several fold. Many riverine inhabitants of the estuary derive most of their income from the sale of açaí fruits (Anderson and Ioris 1992; Brondizio 2008: 176). Most açaí stands in the Amazon estuary did not begin by forest enrichment; rather, they arose from planting açaí seedlings after the harvest of annual crops. Numerous açaí groves, then, have taken the place of second growth, the fallow stage in slash and burn agriculture. Açaí palms near houses are typically interplanted with other fruit trees. Extensive groves of the palm are now common in the Amazon estuary and they are often managed by locals, such as by weeding and selective removal of older trees which are used for heart-of-palm (Anderson 1990; Anderson et al. 1995; Brondizio et al. 1994; Weinstein and Moegenburg 2004). Açaí fruit gathering is typically regarded as an extractive industry, whereas in many areas it is actually a crop.

Açaí is also exploited for its heart-of-palm which is canned or bottled and sent to southern Brazil and to the United States and Europe, particularly France. At first, the cutting down of açaí stands for palmito in the Amazon estuary generated alarm (Peters et al. 1989), but the strong market for fruits has provided a counter-weight. Now many rural folk manage their açaí stands for both fruits and heart-of-palm by culling their taller trees, which are more dangerous to climb, for palmito. Curiously, rural people in the Amazon estuary do not generally consume açaí palmito, although the well-to-do in urban areas purchase the canned product to serve as a side-dish. Some indigenous groups eat açaí heart-of-palm, including the Yanomama (Smole 1976: 161), although the Araweté, who inhabit the Ipixuna, a right bank tributary of the middle Xingu, will not eat palmito from açaí because they believe the palm is protected by a spirit, yɨrɨpađï, who punishes anyone who dares cut down the palm (Viveiros de Castro 1992b: 80).

Fig. 34.17 Açaí heart-of-palm cut by river dwellers. Rio Limoeiro, affluent of the lower Tocantins, Pará, Brazil, 7-4-07

In the late eighteenth century, the Portuguese naturalist Alexandre Rodrigues Ferreira described various dishes prepared with açaí heart-of-palm and judging by the recipes, it was likely served as a delicacy for the merchant class and political leaders. *Salada de uassahy*, for example, called for oil, vinegar, and powdered black pepper, the latter an expensive import item (Ferreira 1972: 237–238). In the colonial period, açaí palmito was cooked as a vegetable to accompany meat dishes and was also wrapped in pastry.

The trunks of açaí are occasionally used to provide flooring in rural homes in the Brazilian Amazon, such as on Marajó Island. Along the Tiquié River, an affluent of the Uaupés in northwestern Amazonia, a Tukano family has constructed a chicken coop with the trunks of *Euterpe oleracea*, which is more common in home gardens than the native açaí da mata (*E. precatoria*). The Urubu in eastern Amazonia use the palm stems for trusses in their homes (Ribeiro 1976: 52). The fronds are also used occasionally to construct shelters in the forest while hunting and gathering, such as among the Urubu (Ribeiro 1976: 51). The Urubu also use the fronds to construct temporary dams across streams while fishing.

35 Euterpe precatoria

Brazil: Açaí, açaí da mata, açaí da terra firme, juçara; manakhe (Baniwa), kamerikàk (Kayapó), tukanyéi (Kuruaya), mihpi (Tukano), boareko nipi (Tuyuka), maima (Yanomama)
Bolivia: Asaí, palmito; ma' ñerej (Tsimané)
Colombia: Asaí, manaca; mihí-nyu (Desana), yúbudi (Nukak), manakai (Piapoco)
Guyana: Manicole; wabo-yaka (Wapisana)
Ecuador: Huasaí, palmito; di'iva (Coián), pamihua (Kichwa), sakae (Shuar), pu'e (Siona-Secoya)
Peru: Chonta, huasaí; tsaké (Achuar), yayú (Aguaruna), tóóllíuji (Bora), yawei (Chayahuita), chorina (Machiguenga), ɨmɨmbi ñi (Maijuna), cobisan (Mayoruna), paná (Shipibo)
Venezuela: Manacá; nenea (Piaroa), waima (Yanomama)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_35

Fig. 35.1 Gathering fruits of açaí (*Euterpe precatoria*) in a home garden. Portal do Miwá, Lago Miwá near Codajás, Solimões River, Amazonas, Brazil, 6-24-07

Euterpe precatoria is a slender-trunked palm of forests throughout Amazonia, the Orinoco basin, and the Guianas. In eastern Amazonia the palm is found occasionally in upland forest, its place in wetlands taken mostly by its near relative *Euterpe oleracea*. In the Brazilian Amazon, the palm is sometimes referred to as açaí da terra firme in recognition of its ability to thrive in well-drained sites. *E. oleracea*, on the other hand, is always found along streams or the floodplains of rivers, unless it is planted in an upland garden where it can survive as long as it is watered while becoming established. The seeds are dispersed by certain birds, such as toucans, and some frugivorous fish, including tambaqui (Silva et al. 2003).

Fig. 35.2 River dweller descending a *Euterpe precatoria* palm while clutching fruit. The youngster has used a footsling (*peconha*) fashioned from a Polypropylene sack to shimmy up the trunk. Portal do Miwá, Lago Miwá near Codajás, Solimões River, Amazonas, Brazil, 6-24-07

At home in both uplands and higher terraces on floodplains, the elegant palm bears purple fruits essentially identical in appearance to those of *E. oleracea*. In the Peruvian Amazon, the round fruits, between 1 and 1.3 cm in diameter, are used to make a juice called *chicha* or *chapu*. In the Peruvian Amazon, though, heart-of-palm is the most economically important product gathered from *Euterpe* *precatoria*. Juice is of secondary importance there. In Peru and Bolivia, the fruits are pounded in a wooden mortar or mashed by hand to make juice. In the Brazilian Amazon, wooden or electric churns (*batideiras*) are generally used to separate the pulp from the seeds. Indigenous groups typically also make juice from the fruits, as among the Nambicuara in the southern fringes of the Amazon forest in Mato Grosso, Brazil (Rondon 1916: 322).

Fig. 35.3 Electric beater (*batideira*) for making juice from açaí (*Euterpe precatoria*) fruits. Lago Miwá near Codajás, Solimões River, Amazonas, Brazil, 6-24-07

In the Peruvian Amazon, chonta thrives on the higher parts of floodplains along the Ucayali and Marañón Rivers and their tributaries. Over a century ago, the Swiss botanist Jacques Huber who worked out of the Goeldi Museum in Belém, Brazil, remarked on the abundance of *E. precatoria* on elevated portions of the floodplains of the Ucayali and Solimões (Huber 1906, 1910). Chonta also grows on uplands in the "high jungle" (*selva alta*) up to 1,400 m, such as in the Mayo Valley, a tributary of the Huallaga (Kahn and Moussa 1994: 49).

At least in some populations, the fruit pulp of *Euterpe precatoria* contains significantly higher levels of antioxidants, specifically anthocyanin, than its relative *E. oleracea* (Kang et al. 2012; Pacheco-Palencia et al. 2009). The latter, though, accounts for the bulk of açaí juice marketed outside of Amazonia. According to rural folk in the vicinity of Tefé, fruits of *E. precatoria* taste better than those from its relative from Pará. Furthermore, *E. precatoria* fruits reputedly contain more oil "*muito banha*".

Fig. 35.4 Açaí (*Euterpe precatoria*) juice mixed with manioc flour. Lago Miwá near Codajás, Solimões River, Amazonas, Brazil, 6-24-07

The juice of *E. precatoria* is popular in San Carlos, a small town along the Upper Rio Negro in Venezuela. Locals obtain the fruits by climbing the palms in nearby forest. In Bolivia, asaí is typically cut down to obtain the fruits, usually for domestic consumption. *Euterpe precatoria* does not resprout after cutting, unlike its near relative *E. oleracea*.

Fig. 35.5 Açaí (*Euterpe precatoria*) palms in a secondary forest; the palms grew from seeds scattered by a farmer. Lago Miwá near Codajás, Solimões River, Amazonas, Brazil, 6-24-07

In the Peruvian Amazon, *E. precatoria* fruits are typically obtained when the tree is cut down for heart-of-palm. Rural folk will occasionally shimmy up a chonta palm to obtain the fruits, but that practice is not nearly as common as in the Brazilian Amazon. In the Pacaya-Samiria National Reserve, river dwellers in some communities plant seedlings of the palm in secondary forests, such as in the vicinity of Veinte de Enero along the lower Yanayacu, to boost production of heart-of-palm.

Along the Solimões in Brazil, the palm is planted in second growth to form groves, such as in the vicinity of Codajás. To establish such groves, seeds are simply scattered on the ground and the resulting seedlings protected by periodic weeding until they are well established. The palm is also planted in various agroforestry configurations in the vicinity of Codajás and Anori, small towns along the Solimões. Some farmers interplant *E. precatoria* in their manioc fields, along with other fruit trees, so that they form agroforests which can be visited for years to gather fruits.

Fig. 35.6 A year-old field planted to sweet manioc and açaí (*Euterpe precatoria*). In the background on the *left* is an agroforestry field of açaí and cupuaçu (*Theobroma grandiflorum*). The açaí orchard on the *right* is 15 years-old. Boa Esperança, Lago Amanã, Amazonas, Brazil, 9-18-12

The deliberate planting or sowing of *E. precatoria* is an old custom. The late Protásio Frikel, an anthropologist and former Catholic priest at the Goeldi Museum in Belém, noted that the Makú (Yuhupde), who wander the upland forests of the Negro watershed in search of food, take the trouble to plant açaí so that more fruits will be available next time they pass through the area (Frikel 1978). The Yuracaré and Trinitario in the Bolivian Amazon plant the palm in their fields and home gardens (Thomas and Van Damme 2010). And the Waimiri-Atroari look after spontaneous seedlings of the palm to encourage their survival (Miller 1994). The palm is often found on or near anthropogenic dark soils, another indication of its long affinity with humans. Seeds of *E. precatoria* are especially abundant at all levels in an archaeological site along the Purité River an affluent of the Putumayo in the border region between Colombia and Brazil (Morcote-Ríos 2008: 95).

Fig. 35.7 Açaí (*Euterpe precatoria*) interplanted with cupuaçu (*Theobroma grandiflorum*). Km 5 Anori-Mato Grosso road, Amazonas, Brazil, 6-22-07

A small factory at Codajás along the Solimões processes fruits of *E. precatoria* for the U.S. market. The main fruiting season for the palm in the middle Solimões is from September to March which spans both the dry and wet seasons. According to locals in Anori, the main advantage of fruits of *E. precatoria* over *E. oleracea* is that they are never "*travaso*" (the taste and cloying texture of unripe banana) even when they are picked a little early.

In addition to fresh juice, açaí is consumed as ice cream, pushups, puddings, and in layer cakes. Frozen pushups are especially popular among those of more modest means because they are inexpensive and widely available. Deep purple açaí pushups are sold by ambulant vendors, usually boys, in markets, bus stations, busy streets, and ports. Known as *gelaldinha, dindin,* or *chop* in the Brazilian Amazon, pushups are prepared by women who own freezers. Their children, or other youngsters who live nearby, keep the pushups cold in Styrofoam containers fitted with a shoulder strap while plying the streets for customers.

Fruits of *E. precatoria* are used in a variety of other ways. The Yawanawá and Kaxinawá who live along the Acre River in the southwestern part of the Brazilian Amazon, extract oil from the fruit pulp for cooking and to condition their hair (Campos and Ehringhaus 2003). A small farmer who also operates an ornamental nursery and a rural tavern near Tingo Maria along the Upper Huallaga in the Peruvian Amazon has found a way to incorporate the fruits into an intriguing alcoholic beverage. Huasaí fruits are left to soak in a potent alcoholic mixture containing *aguardiente*, honey, and bee pollen. *Aguardiente* is a raw, unaged alcohol made by distilling fermented sugarcane juice. The resulting *trago de huasaí* is smooth, reminiscent of coffee liqueur, and much appreciated by patrons in the farmer's simple wooden tavern along the Tingo Maria-Monzón road.

Fig. 35.8 Heart-of-palm obtained from *Euterpe precatoria* in a managed forest. A buyer will take the palmito to Iquitos. Veinte de Enero, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-9-04

In the Peruvian and Bolivian Amazon, the principal use of the palm is to obtain palmito for urban markets and the export trade. Chonta is chopped down to retrieve the heart-of-palm, which, depending on the age of the palm, is from about a meter to a meter-and-a half long. An older palm yields two sections of 80 cm each; younger palms yield only one. The numerous sheath-like layers are peeled off until a 3–4 cm thick cylinder (known as a *tallo* in the Peruvian Amazon) is obtained. The edible portion is only about the thickness of a hot dog. In a street market in Requena along the Ucayali River, 80 cm-long sections of chonta were fetching US$0.45 each in April 2006. Some indigenous groups also extract heart-of-palm from *Euterpe precatoria*, such as the Yanomama in northern Brazil (Anderson 1978), the Siona-Secoya in the Ecuadorian Amazon (Vickers 1994), and the Campa in the Peruvian Amazon (Denevan 1971).

In Peru, chonta is shredded into long thin strips and eaten raw. River dwellers along the Yanayacu River in the Pacaya-Samiria National Reserve consider the palmito of *E. oleracea* too tough; that palm is simply planted as an ornamental in some of their communities. In Brazil, in contrast, the heart-of-palm of *E. oleracea* is diced into small, salami-like sections and served as an hors d'ouevre in restaurants and in the homes of the well-to-do. In Brazil, palmito also serves as a popular pizza topping. Rural folk in the Brazilian Amazon, however, rarely eat heart-of-palm.

At present only one heart-of-palm factory, CAMSA, is operating in Iquitos and the canned product is dispatched to France. France is also the main export market for açaí palmito produced in the Amazon estuary. Some canneries for heart-of-palm obtained from *E. precatoria* also operate in Riberalta in the Bolivian Amazon, although palmito is not an important item in the local diet (Claros 1996). Heart-of-palm from *E. precatoria* is the second most important non-timber forest product in the Bolivian Amazon after Brazil nuts (Brokamp et al. 2011). Almost all of the palmito canned in Bolivia is destined for export. In 2008, Bolivia exported 3,580 t of palm heart worth US$9.4 million.

Fig. 35.9 Village house with walls made from split trunks of chonta (*Euterpe precatoria*). The floor is fashioned from split trunks of cashapona (*Socratea exorrhiza*) palm. Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 1-15-06

Another important use of the palm is in house construction. The trunks are split in two and the curved sections (*ripas*) are used to make walls within houses in rural areas, especially in the Peruvian Amazon. The trunks are light yet sufficiently resilient to serve as exterior walls as well, as practiced by the Piapoco in the northern part of the Colombian Amazon and neighboring Venezuela (Mesa 2011: 106; Mesa and Galeano 2013) and among the scattered villages of the Maijuna in the northeastern part of the Peruvian Amazon (Gilmore et al. 2013). The Kichwa in the Ecuadorian Amazon employ the trunks of the palm as house posts (Balslev and Barford 1987) while in Brazil, a few river dwellers along the Jaú River, an affluent of the lower Negro, still lash the trunks of the palm together to serve as flooring in their homes. The Yanomama use the split trunks to make shelves inside their communal houses and to fashion table tops (Albert and Milliken 2009: 75; Anderson 1978).

Fig. 35.10 Floor of river dweller's home consisting of split trunks of açaí (*Euterpe precatoria*). Palha branca (*Attalea speciosa*) fronds have been used for thatch. Near Seringalzinho, Jaú River, Amazonas, Brazil, 10-3-12

The fronds are used by some indigenous groups to cover their houses, temporary shelters, and to fashion baskets in the forest. In the Bolivian Amazon, the Tacana and Chácobo employ the fronds to thatch their dwellings (Boom 1988; DeWalt et al. 1999) as do the Piaroa in the Orinoco watershed (Rondón 2003). The fronds of *E. precatoria* are not very durable, so other palms are usually employed to cover dwellings. However, the fronds are sometimes used to erect shelters while in the forest, such as among the Maijuna (Gilmore et al. 2013). The now extinct Curuaya, who once inhabited the Curuá River (an affluent of the Iriri in the Xingu watershed), made backpacks with the fronds to carry loads in the forest. The make-shift backpack was essentially a frame, open at the top and on one side, to which goods were lashed with vines. The weight of the backpack was mainly supported by a headband, made from the inner bark of a tree that was attached to the frame (Snethlage 1910).

Diverse other uses are also found for the widespread palm. The principal use of *Euterpe precatoria* among the Pumé, who inhabit the Llanos de Apure in south-western Venezuela, is to extract a resin to seal and bind various items, including arrows (Gragson 1992). The Waorani in the Ecuadorian Amazon and the Yanomama along the Brazilian and Venezuela border area use the stems of the young palms to make blowguns (Macía 2004; Saffirio and Scaglion 1982). The Nukak in the Colombian Amazon have a variety of uses for the palm; the trunks are cut down so that they become infested with beetle larvae that can be extracted and eaten, the dried fronds are used as torches to smoke out bee hives, and after removing the fruits, the rachis is sometimes employed as a broom (Cárdenas and Politis 2000: 53).

Some 14 medicinal uses have been recorded for the palm (Sosnowska and Balslev 2009). Many of the pharmaceutical uses of the palm can be traced to indigenous cultures. The Maijuna, who inhabit the lower Napo and other affluents of the Amazon River including the Putumayo, prepare a decoction of the roots to treat malaria (Gilmore et al. 2013). The Chayahuita, who live in the Peruvian Amazon in a region bordered by the Marañón River to the north, the Huallaga River to the east, and the Cahuapanas River to the west, prepare a tincture from the roots of the palm to treat bleeding (Odonne et al. 2013). The Waorani in the Ecuadorian Amazon employ the roots to make remedies for coughs and sore throats (Macía 2004), and the Tacana in the Bolivian Amazon prepare an infusion from the roots to treat pains emanating from the back and sciatic nerve (Deharo et al. 2004).

Along the Rio Tigre in the Peruvian Amazon, river dwellers also prepare a remedy from the aerial roots of *Euterpe precatoria* to treat malaria. Technically known as pneumatophores, such roots are produced when the palm is growing in a poorly drained location, such as the margin of a lake. The palm can survive floodwaters up to 3 m for several months thanks to the pneumatophores that permit gas exchange under water (Goulding and Smith 2007: 125). Pneumatophores of *E. precatoria* can be found in the medicinal plant section of the warren-like Belén market in Iquitos where they are touted as a blood “fortifier”. Rural folk in various parts of the Peruvian and Brazilian Amazon prepare a tincture from the roots of *E. precatoria* to treat skin ulcers (Boaventura and Galotta 2009). Root extracts from this palm are high in antioxidants which help reduce inflammation among other health benefits (Galotta et al. 2008).

Fig. 35.11 Aerial roots (pneumatophores) of *Euterpe precatoria* in the medicinal section of a street market. Mercado Belén, Iquitos, Loreto, Peru, 7-10-10

One old timer who lives along the lower Tefé River recounted an interesting use of the leaf base of the palm. Lucas, now 81 years old, used to work in the forested watershed of the Japurá gathering the latex of sorva (*Couma macrocarpa*); there was once a thriving market for milky sorva sap in Manaus to caulk boats. Sometimes Lucas would cut down the tree in order to obtain more latex. He would procure the leaf bases (*curumatá*) of *Euterpe precatoria* in the forest to provide a "canoe" to collect the dripping latex. Now sorva is only tapped sporadically for local use in caulking canoes. In the vicinity of Lago Amanã in Amazonas, Brazil, the leaf bases (also called *pencas*) were once used as torches to set slash-and-burn fields on fire; now, however, farmers mostly use gasoline to ignite the fields.

This widespread palm is also planted as an ornamental in various urban areas in western Amazonia. In Nauta along the lower Marañón, for example, several

Euterpe precatoria palms grace the main square. And in Codajás, the main promenade along the Solimões River is lined with the palm.

Fig. 35.12 Açaí (*Euterpe precatoria*) lining a street. Codajás, Solimões River, Amazonas, Brazil 6-23-07

Geonoma deversa 36

Bolivia: Jatata (Tacana)
Brazil: Ubim, ubim juriti; warama si (Yanomama)
Colombia: Blui (Nukak), pubezianí (Piapoco)
Peru: Palmiche; nini ñi (Maijuna), quebón juani (Shipibo)
Venezuela: Tharai (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_36

Fig. 36.1 *Geonoma deversa* in upland forest. Seringalzinho, Rio Jaú, Amazonas, Brazil, 10-3-12

Geonoma is a large genus and many of the species are used a variety of purposes, particularly thatch. Such as is the case with *G. deversa* which occurs from Central America to northern South America, including the Amazon Basin and the Guianas (Flores and Ashton 2000; Henderson 1995: 268; Paniagua-Zambrana 2005). Known as ubim in the Brazilian Amazon, the palm grows mostly in upland forests. The stems are short, usually 1–3 m, so the fronds are easy to cut.

Fig. 36.2 Farm house with roof and walls of *Geonoma deversa* fronds. Igarapé Açu near Anori, Amazonas, Brazil, 6-22-07

The durability of *Geonoma deversa* fronds has been recognized for a long time by indigenous people. The Tacana in the Bolivian Amazon, for example, claim that thatch made with this palm lasts 25 years (Moraes et al. 1995). In Beni, Bolivia, the Tsimane' sell the fronds to outsiders (Reyes-García et al. 2014). The Yuracaré who live along the Chapare River in the Bolivian Amazon also gather the fronds in the forest to thatch their houses (Thomas et al. 2011). And in the southeastern part of the Peruvian Amazon, the Ese Eja also gather the fronds for thatch (Arco et al. 2011) as do the Maijuna (Gilmore et al. 2013). The Maijuna also spread the fronds on the ground to cut up game while in the forest. The Yanomama employ the fronds of *G. deversa* for thatch, but they prefer *G. baculifera* for this purpose (Anderson 1978).

In addition to thatch, the palm serves a variety of other uses. The fronds have long been used to line baskets (Wallace 1853: 65). The Yanomama still use the fronds for that purpose (Anderson 1978). The leaves of several species of *Geonoma* are used to line baskets, such as in the vicinity of Afuá on Marajó Island. When *cachaça*, a distilled liquor made from fermented sugarcane juice, used to be stored in large glass containers (*frasceiras*) in the Amazon estuary, the flagons were protected with a covering of ubim (*Geonoma* sp.) leaves kept in place by petiole strips torn from arumã (*Ischnosiphon obliquus*). Most of the sugarcane distilleries in the Amazon estuary, such Engenho São João along Furo do Seco near Igarap-é-Miri, Pará, went out of business in the latter part of the twentieth century due to competition from mega-distilleries in the Brazilian Northeast and São Paulo state.

The few remaining *cachaça* producers near the mouth of the Amazon no longer use *frasceiras*.

Along the Jaú River, an affluent of the lower Rio Negro, locals use the slender leaf stems to make shelves and small platforms (*jiraus*) for their houses. And the Yanomama in northern Brazil and bordering Venezuela will eat the fruits in emergencies (Albert and Milliken 2009: 56). The Nukak in the Colombian Amazon have a novel use for the palm: youngsters cut sections of the stem, about 80 cm long, which they then bend as a strengthening exercise (Cárdenas and Politis 2000: 53).

Geonoma macrostachys

37

Brazil: Ubím
Bolivia: Jatata
Colombia: Zíínuikorɨ (Witoto)
Ecuador: Macana grande, chontilla, pantalón panga; chipire cofaje (Cofán), enwenemomo, ucsha panga, macana panga, puma sisa panga (Kichwa), oco buin, daru (Siona-Secoya), monkabo (Waorani)
Guyana: Dalibana
Peru: Calzón panga, palmiche; kampanak, tujúji duka (Aguarana), nini ñi (Maijuna), manëche (Mayoruna), sapáp (Shuar)
Venezuela: barubaru

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_37

Fig. 37.1 *Geonoma macrostachys* var. *acaulis* in fruit in the understory of a floodplain forest. Near Veinte de Enero, Rio Yanayacu, Pacaya-Samiria, Loreto, Peru, 6-28-06

Palms in the genus *Geonoma* are small, understory bushes, barely higher than one's waist. In spite of their diminutive size, several species provide durable fronds for rural folk to thatch their homes. At least 21 species occur in Amazonia, on both uplands and floodplains (Henderson 1995: 254), although that figure is growing as more collecting and taxonomic work are undertaken. *Geonoma deversa* is one of the most important sources of thatch in Amazonia, but many other species are used to provide roofs including *G. baculifera*, *G. interrupta* var. *euspatha*, *G. leptospadix*, *G. longepedunculata*, *G. macrostachys* (var. *macrostachys* and var. *poiteauana*), *G. maxima*, *G. oldemanii*, *G. poeppigiana*, *G. stricta*, and *G. trigochin* (Henderson 1995: 262–289).

Geonoma macrostachys sometimes forms dense patches in upland forest, such as in the Tigre watershed in the Peruvian Amazon. In the Yasuní National Park in the Upper Napo River in the Ecuadorian Amazon, the palm is also found in floodplain forest and poorly-drained areas with open vegetation (Montufar and Pintaud 2006). This palm, which embraces three varieties, is widespread in Amazonia (Henderson 1995: 274). *Geonoma macrostachys* var. *acaulis* generally prefers floodplain forest, whereas *Geonoma macrostachys* var. *macrostachys* is more common on well-drained sites; the two subspecies differ primarily in the shape of their leaves (Roncal 2006; Svenning and Macía 2002). Often stemless (acaulescent) and generally under a meter high, the fronds of this palm are occasionally used for thatch, especially among indigenous groups in the Ecuadorian Amazon (Balslev et al. 1997: 24). The Maijuna in the Peruvian and Colombian Amazon spread the fronds on the forest floor to cut up game before taking the carcasses back to their villages (Gilmore et al. 2013).

How the fronds are gathered affects the sustainability of the resource. In some areas, *Geonoma* palms are killed when all the leaves are cut (Svenning and Macía 2002). In other parts, only a few fronds may be removed allowing the palm to survive. In the Brazilian Amazon, many rural areas have witnessed an exodus of the rural population to urban areas. This migration combined with the widespread adoption of manufactured roofing, especially zinc, has undoubtedly reduced pressure on *Geonoma* palms in many parts of the Brazilian Amazon. In Peru, Bolivia, and Ecuador, however, rural people and even some inhabitants of the poorer districts of towns and cities still rely heavily on palms for thatch. Demand for palm thatch is thus likely to grow in western Amazonia and this may eventually led to reduced supplies of suitable fronds in the future.

Geonoma maxima

38

Brazil: Ubim, ubim branco, ubimzinho, ubimarana; mui so (Tuyuka)
Colombia: Mata de coloraditos; kerabiu, pubezianí (Piapoco), goguiɨ (Witoto)
Peru: Yugkup (Aguaruna), chonco (Mayoruna)
Venezuela: Thomithomi (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_38

Fig. 38.1 Ubimzinho (*Geonoma maxima* var. *chelidonura*) in secondary forest. Santa Luzia, Lago Amanã, Amazonas, Brazil, 9-3-12

Geonoma maxima is one of a dozen or so species in the genus with fronds that are employed for thatch. Known by various names in Brazil, this species is highly variable and several subspecies are recognized. In the vicinity of Lago Amanã along the lower Japurá, *Geonoma maxima* var. *chelidonura* is called ubim branco or ubimzinho whereas the taller *G*. *maxima* var. *spixiana* is known as ubim açú. *G*. *maxima* is widespread in Amazonia, the Guianas, and the Magdalena Valley in the Colombian Andes (Henderson 1995: 278).

Fig. 38.2 Ubim açú (*Geonoma maxima* var. *spixiana*) in upland forest. Igarapé Ubim, Lago Amanã, Amazonas, Brazil, 9-17-12

Fronds of the *spixiana* and *chelidonura* subspecies are both used for thatch and they dry to a different color. The former becomes a coppery tan over time, whereas the latter turns a light, almost pale yellow color with age, hence the common name: ubim branco (white ubim). Fronds from ubim açú are allegedly more durable, but ubim branco is much more common.

Fig. 38.3 Village home thatched with alternate layers of ubim açú (*G. maxima* var. *spixiana*), with *darker* fronds, and *lighter* colored ubim branco (*G. maxima* var. *chelidonura*). Bom Jesus de Baré, Lago Amanã, Amazonas, Brazil, 9-2-12

In the vicinity of Lago Amanã, the *chelidonura* subspecies tends to occur in more low lying areas, sometimes subject to periodic flooding, whereas the *spixiana* subspecies is confined to well-drained upland sites. Also, the latter tends to be solitary, whereas the *chelidonura* subspecies can occur in patches of around a dozen individuals. In some areas, several patches of ubim branco (var. *chelidonura*) apparently expand and merge, forming large stands of dozens of individuals called a *palhão*.

Fig. 38.4 Gathering fronds of ubimzinho (*Geonoma maxima* var. *chelidonura*). Ilha do Copaíba, near Bom Jesus de Baré, Lago Amanã, Amazonas, Brazil, 9-3-12

Old timers living along the shores of Lago Amanã recall that river dwellers living on the outskirts of the lake would make trips to Ubim, a small village named after the palm, in the 1930s to gather the palm fronds. They would attach them to slender wooden poles (*ripas*) using the petioles so that the fronds lay flat in lengths (*feixo*). The visitors would then pile the *feixos* on their canoes, and paddle home. Such visits by outsiders have since ceased as more and more rural folk use metal roofs.

Fig. 38.5 Hut for processing manioc thatched with ubim branco (*Geonoma maxima* var. *chelidonura*). Smoke from the manioc oven has tinted the fronds. The sleeve-like tipití press for squeezing manioc dough hanging from the rafters is made from strips torn from the bark of jacitara (*Desmoncus polyacanthos*) palm. Ubim, Lago Amanã, Amazonas, Brazil, 9-17-12

Fronds of *Geonoma maxima* are used to thatch houses and a variety of other structures, including huts for processing manioc flour (*casa da farinha*), pig pens, and floating docks. Lago Amanã is rich in archaeological sites, many with deep Amazon Dark Earth, suggesting not only dense settlements in precontact times but a long history of human occupation. Undoubtedly, the former inhabitants of Lago Amanã also used fronds of *Geonoma maxima* and possibly other palms to thatch their homes and ceremonial centers. The Yanomama, for example, use fronds of *G. maxima* to thatch their communal roundhouses (Gertsch et al. 2002).

Fig. 38.6 Floating dock thatched with ubim branco (*Geonoma maxima* var. *chelidonura*). The boys are handline fishing while their mother washes clothes. Bom Jesus de Baré, Lago Amanã, Amazonas, Brazil, 9-3-12

The Piapoco in the Colombian Amazon sometimes wrap game meat or fish in the fronds of *Geonoma maxima* to improve the flavor while cooking. Although not commonly used for making weapons and hunting implements, the Piapoco also fashion their bows from the stems of the palm (Mesa and Galeano 2013).

Fig. 38.7 Pig pen thatched with ubimzinho (*Geonoma maxima* var. c*helidonura*). Boa Esperança, Lago Amanã, Amazonas, Brazil, 9-4-12

39 Iriartea deltoidea

Brazil: Paxiubão, paxiúba barriguda; takpan (Matis)
Bolivia: Copa; ojdó (Tsimané)
Colombia: Cahuda barriguda, bombona; buhu bëge (Desana), juruda-wa (Nukak), vahta ~nyo (Uanano), fegona (Witoto)
Ecuador: Pambil, palma negra, cacho de toro; taraputu (Kichwa), ambakai (Shuar)
Peru: Huacrapona, pona; tuntuám (Aguaruna), taoo (Amahuaca), kundúma (Candoshi), tó (Cashibo), wákra pona (Lama), oseno (Machiguenga), niste (Mayoruna)
Venezuela: Konopo (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_39

Fig. 39.1 Stilt-rooted *Iriartea deltoidea* interspersed with *Wettinia maynensis* palms in a cattle pasture. Snow-capped Sanguay volcano in the background. Puyo Valley, Pastaza, Ecuador, 9-23-13

One of the small group of stilt-rooted palms in the Amazon, *Iriartea deltoidea* grows in upland forests in central and western Amazonia, reaching north into Central America as far as Nicaragua (Henderson 1995: 94; Goulding and Smith 2007: 227). This tall palm is usually encountered singly in Central Amazonia but in the Andean foothills relatively dense stands can be found, especially along streams and on the higher parts of river floodplains. In lower lying areas, such as in Amazonas, Brazil, the upper part of the trunk is typically swollen, whereas populations of the palm towards its upper altitudinal limit at 1,200 m generally do not. The purpose of this swelling is not clear, but may be related to the onset of flowering (Henderson 1990: 18). Tukanoan groups in the Upper Uaupés watershed in Colombia and Brazil compare the swollen upper trunk of the palm to an anaconda swallowing its prey and to a pregnant woman (Reichel-Dolmatoff 1996: 106).

Fig. 39.2 Paxiubão (*Iriartea deltoidea*) with distinctive swollen trunk towards the *top*. Upland forest near Santa Luzia, Lago Amanã, Amazonas, Brazil, 9-3-12

One of the common names for the palm in Brazil, paxiúba barriguda means the big-bellied paxiúba. Paxiúba without a suffix refers to *Socratea exorrhiza*, another stilted palm. And the other common name for *Iriartea deltoidea* in Brazil, paxiubão, simply means the big paxiúba, probably referring not only to the bulge in the trunk but also to the greater height attained by *I. deltoidea*. According to a Jesuit priest who worked in the Peruvian Amazon in the early eighteenth century, some Indians believed that if one buried the left over meal of a Spaniard at the base of the palm, the Spaniard's stomach would expand as the tree grew (Maroni 1988: 164).

The palm has served a variety of uses in the past, but many of these have waned over the years due to cultural change. For example, along the shores of Lago Amanã along the lower Japurá, some river dwellers recall that the floors of their homes used to consist of split trunks of paxiubão. Now they are typically made with sawn timber. In the middle of the nineteenth century, Wallace (1853: 38) reported that the hard wood obtained from paxiúba barriguda was used to fashion harpoons to hunt manatee (*Trichechus inunguis*), now an endangered species due to overhunting. And in the early twentieth century, the Baniwa, who inhabit parts of the Uaupés watershed in the northwestern part of the Brazilian Amazon, made narrow canoes from the trunks of the palm (Koch-Grünberg 1995: 233). The Matis, who live along the Javari River in the border area between Brazil and Peru, fashion their exceptionally long blowguns from hollowed stems of the palm (Erikson 2001).

Fig. 39.3 Matis blowgun fashioned from stem of *Iriartea deltoidea*. Bark strips are wrapped around the barrel to help prevent splitting. Private collection, Gainesville, Florida

Further west, though, the palm is often used for construction, especially by indigenous groups. The Amahuaca make granaries for storing harvested maize which rest on platforms fashioned from the split trunks of the palm (Dole 1998). Some Kichwa houses along the Upper Pastaza still retain floors fashioned from the split trunks of the palm, which they call taraputu. The Shuar also split the trunks to make walls for their houses (Pederson and Balslev 1992). Villagers in Yarina along the Upper Yanayacu in the Pacaya-Samiria National Reserve in the Peruvian Amazon sometimes use the palm to make flooring, but *Socratea exorrhiza* is used more often for that purpose probably because it is more common in that area.

Further south in the vicinity of Tingo Maria, where the palm is known as pona, the split trunks are used for the floors and walls of rural homes. The split trunks are also used to erect backyard fences near Tingo Maria. A few *ribeirinhos* around Lago Amanã still make fences using stakes (*ripas*) cut from the trunks of paxiubão to protect their vegetables from livestock.

Fig. 39.4 A Kichwa home with a floor composed of split trunks of *Iriartea deltoidea* laid on bare earth. An ocelot (*Felis pardalis*) pelt has been tacked to an inside wall. Canelos, Alto Pastaza, near Puyo, Ecuador, 9-21-13

People do not eat the fruits of *Iriartea deltoidea*, but in the Upper Pastaza region of Ecuador, the Kichwa feed them to their pigs. The fruits feed humans indirectly because several game animals, such as forest deer (*Mazama* spp.), consume the ripe fruits when they fall to the ground (Goulding and Smith 2007: 229).

Fig. 39.5 *Iriartea deltoidea* in fruit. Puyo Valley, Pastaza, Ecuador, 9-23-13

In parts of Acre, Brazil, rural folk fell the palm to obtain palmito for domestic consumption (Pinard 1993). In the early part of the twentieth century, the Candoshi and the Lama in the Peruvian Amazon also obtained heart-of-palm from *Iriartea deltoidea* (Tessmann 1999: 129, 159). The Shuar and Kichwa in the Ecuadorian Amazon still obtain palmito from *I. deltoidea* and they also eat the endosperms while they are still soft (Pederson and Balslev 1992). And in the Peruvian Amazon near Iquitos, river dwellers extract grubs (*suri*) of the palm weevil (*Rhynchophorus palmarum*) from the trunks of the palm which they eat raw, fried, or roasted (Pinedo-Vasquez et al. 1990). The Nukak in the Colombian Amazon deliberately fell the palm for this purpose (Cárdenas and Politis 2000: 56).

40 *Iriartella setigera*

Brazil: Paxiubinha, paxiúba miri, jupati; bupu yõ (Tukano), horoma si (Yanomama)
Colombia: Buhu bëge (Desana), ú-baká (Nukak), maawi (Piapoco)
Peru: Ponilla
Venezuela: Mabe; yuruhua (Piaroa), Yoroama si (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_40

Fig. 40.1 Young paxiubinha (*Iriartella setigera*) in secondary forest. Santa Luzia, Lago Amanã, Amazonas, Brazil, 9-3-12

A medium-sized palm attaining 12 m, *Iriartella setigera* occupies a range similar to its larger cousin, *Iriartea deltoidea*, except that it does not reach into Central America. Paxiubinha, as the palm is known in the Brazilian, occurs in upland and some floodplain forests in central and western Amazonia (Henderson 1995: 91).

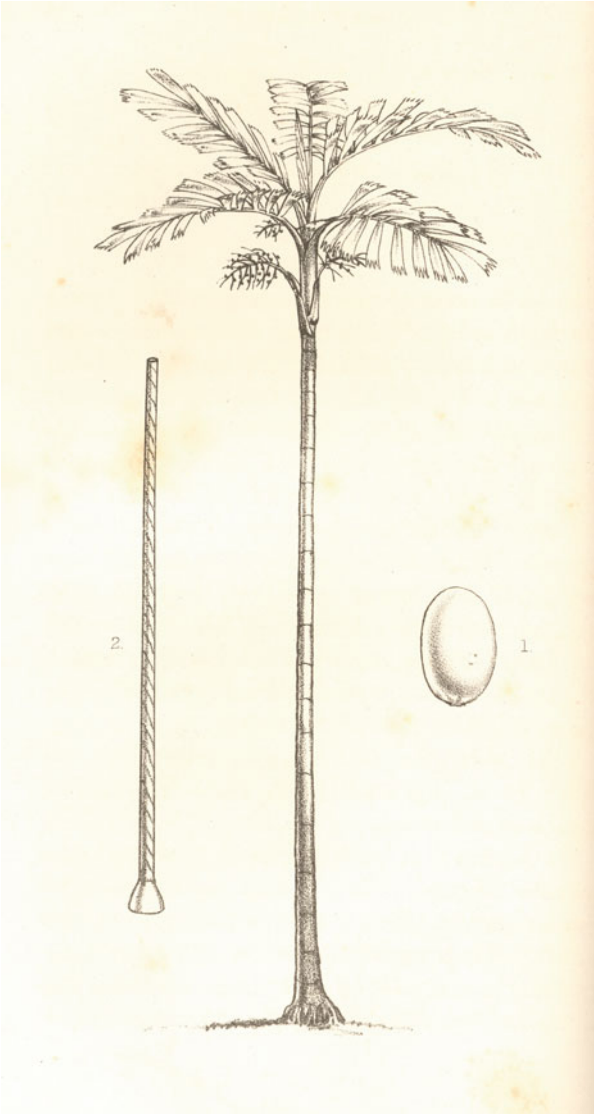

Fig. 40.2 Blowgun fashioned from the stem of *Iriartella setigera* (Wallace 1853: 39)

The main use of the palm in the past has been to manufacture blowguns, known in Brazil as *sarabatana* and in Spanish-speaking countries as *zarabatana* or *cerbatana*. Sarabatana is also the name of a popular music band in Brazil. Paxiubinha seems to have been used mostly in the Upper Rio Negro region for making blowguns, whereas peach palm (*Bactris gasipaes*) or *Iriartea deltoidea* have been used traditionally for the same purpose in other areas of Amazonia. In the nineteenth century along the Uaupés River, the naturalist Alfred Russel Wallace took careful notes on how blowguns were made: two sections of *Iriartella setigera* stems were cut, one a little larger than the other. Both sections were then hollowed out using a long hardwood rod. Once the pith had been removed, the smaller stem was fit snugly inside the larger one. Then the bore was rubbed and cleaned using a small bunch of roots from a tree fern which was repeatedly pulled through the blowgun using a cord (Wallace 1889: 147).

Although few indigenous people still make blowguns, the Baniwa along the Rio Içana, an affluent of the Upper Rio Negro, continue to make those weapons from the palm stem to target game in the forest canopy, such as monkeys and guans (Endo et al. 2010). The Nukak also still manufacture their blowguns using stems from the palm. Nukak blowguns are 2.5–3.5 m long, and smaller versions are made for boys to practice with (Politis 2007: 170, 198). Likewise the Piapoco in the northern part of the Colombian Amazon use the palm stems to make their blowguns (Mesa and Galeano 2013). Blowguns do not seem to have been used in eastern Amazonia, at least in historical times, perhaps because *Iriartella setigera* is only found in the Upper Xingu in that part of the Amazon Basin, and *Iriartea deltoidea* is absent in central and eastern Amazonia. However, peach pam has long been cultivated in the eastern part of the Amazon watershed.

In a few places the palm is used to make arrows. Yanomama boys make arrows from the rachis for practicing their archery skills (Gertsch et al. 2002) while adult males tip arrows used for shooting monkeys with sharpened pieces of the palm's stem (Albert and Milliken 2009: 61).

The slender trunks of *Iriartella setigera* are still split in a few areas to fashion walls and floors of rural homes, but that practice is becoming less common. The Katukina who live along the Biá River, an affluent of the Jutaí in Amazonas, Brazil, use the stems to make walls and floors for their homes (Barboza 2010). The Piapoco in the Colombian Amazon occasionally use the stems of the palm to provide a frame for applying mud when erecting wattle-and-daub walls (Mesa and Galeano 2013).

Along the Tefé River in Amazonas, Brazil, a community is named after the palm: São Francisco de Paxiubinha. However, no-one uses the palm for walls or flooring in that village today. In the vicinity of Lago Amanã along the lower Japurá, old timers recall that they once made fences from the stems of the palm, but that rarely if ever occurs today. In the Brazilian Amazon, sawn timber is readily available in most areas, and with the influx of larger amounts of cash in the interior because of economic development and government programs such as *Bolsa Familiar*, rural folk have increasingly turned to manufactured materials when building their houses.

Fig. 40.3 Wall of an external kitchen fashioned with the split stems of paxiubinha. The roof is thatched with fronds of caraná (*Mauritia carana*) palm. Cacautuba, Tefé River, Amazonas, Brazil, 9-10-12

41 Leopoldinia major

Brazil: Jará açú, jará
Colombia: Yaraguasú

Status: Wild

Fig. 41.1 Jará açú (*Leopoldinia major*) on the floodplain of a black water river. Rio Jawijari, affluent of the lower Uaupés, Amazonas, Brazil, 11-12-12

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_41

Leopoldinia major is a wetland palm confined to black water rivers in the Upper Rio Negro watershed (Henderson 1995: 104). Apart from its more restricted distribution, *L. major* can be distinguished from its slightly smaller cousin *L. pulchra* which also grows along dark water rivers by the large colonies it forms (Henderson 2011b). Along the Lower Jawijari near its confluence with the Uaupés, for example, *L. major* forms a dense stand of several thousand palms lining the banks of the river for several kilometers. Both palms occur in the Rio Negro system, but *L. pulchra* also grows along black water rivers and streams in other watersheds.

Known as jará açú in the Brazilian Amazon, river folk gather the fruits from canoes to eat on the spot or at home. The fruits are a local delicacy and do not enter markets. The Tukano along the Uaupés and some of its tributaries seek the fruits when they turn red, indicating they are ripe. In the past, the fruits were burned and then the ashes were washed to extract a floury substance which served as a substitute for salt (Wallace 1853: 15).

Fig. 41.2 *Leopoldinia major* with immature fruit. Rio Jawijari, affluent of the lower Uaupés, Amazonas, Brazil, 11-12-12

Leopoldinia piassaba 42

English: Piassaba
Brazil: Piaçava
Colombia: Chíquichíqui, fibra
Venezuela: Chíquichíqui; marärамä (Piaroa), raea (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_42

Fig. 42.1 Piassaba (*Leopoldinia piassaba*) palm (Wallace 1853: 17)

As with many palms in Amazonia, piassaba (*Leopoldinia piassaba*) is exploited for a variety of products. The most important is fiber, which is used for making brooms and baskets, and in some areas locals prepare a beverage from the fruits and thatch their homes with the fronds. The Yanomama occasionally eat the fruits raw (Gertsch et al. 2002; Smole 1976: 161) and sometimes use the fronds to thatch their dwellings (Cocco 1975: 149). The Piaroa who inhabit parts of the Orinoco drainage also occasionally thatch their houses with the palm fronds (Rondón 2003). The dark brown fibers are the remains of leaf sheaths (ligules) that hang down the entire stem, obscuring it like a thick beard. So strange is the appearance of piassaba palms that they have been described as "rampant bears" (Putz 1979). The indefatigable Yorkshire botanist Richard Spruce was equally impressed by the palms in the mid-nineteenth century:

> Nothing that I have seen in Amazonian forests dwells more strongly and pleasantly on my memory than my walk among these strange bearded columns, from whose apex sprang the green interlacing arches which shaded me overhead. . .To have escaped from the cloud of mosquitos on the bank of the river no doubt enhanced the enjoyment. (Spruce 1859)

Fig. 42.2 *Maloca* being thatched with fronds of *Leopoldinia piassaba*. The building will be used for meetings by indigenous groups. FOIRN, São Gabriel da Cachoeira, Rio Negro, Amazonas, Brazil, 10-23-12

Fig. 42.3 Sweeping the porch of a rural home with a piassaba broom. Itapiranema, Lago de Tefé, Amazonas, Brazil, 8-25-12

This short palm, some 4–5 m high, occurs in scattered patches in low-lying areas of the Upper Negro and Orinoco Basins (Henderson 1995: 104). Piassaba is generally found in areas that flood at least every few years and where the groundwater is within a half meter of the surface (Goulding and Smith 2007: 214; Lescure et al. 1992). Chíquichíqui, as the palm is called in Venezuela and Colombia, is derived from the Baré language (Wallace 1853: 17).

Piassaba gatherers work in the rainy season when it is easier to reach piassaba stands by canoe. The palm is first struck to expel dangerous insects, such as scorpions, as well as snakes. At least one vector for *Trypanosoma cruzi*, the etiological agent for Chagas disease, lives in the fibrous mat that covers piassaba trunks. A blood-sucking bug, *Rhodnius brethesi*, has been recorded biting people while they harvest piassaba fibers (Costa 1999; Lent and Wygodzinsky 1979). Reduviid bugs inhabiting piassaba palms have been implicated in the transmission of several Chagas disease cases in the Brazilian Amazon (Ferraroni et al. 1977).

Fig. 42.4 Bundles of piaçava (*Leopoldinia piassaba*) fiber at a river port awaiting shipment to Manaus. São Gabriel da Cachoeira, Rio Negro, Amazonas, Brazil, 10-25-12

Piassaba fibers are cut and bundled up for purchase by middlemen. In the nineteenth century, bundles of piassaba fibers were placed on rafts consisting of lashed trunks of buoyant *Cecropia*, a second growth tree, and taken downstream to settlements where the bundles would be packed into the holds of boats destined for Manaus (Brown and Lidstone 1878: 375). In Brazil, piassaba fibers are still shipped down the Rio Negro to Manaus. From there, the fibers are sent to various parts of Brazil, including Rio de Janeiro. Broom and brush makers in Manaus also dispatch their products to various towns in the Amazon, such as Tefé, where they are sold in small hardware stores alongside similar products fashioned from a regional vine, cipó-titica (*Heteropsis spruceana*, Araceae), or nylon.

Fig. 42.5 Bundles of *Leopoldinia piassaba* fiber on the roof of a river trader's boat. Barcelos, Rio Negro, Amazonas, Brazil, 9-14-73

At Maroa along the Upper Rio Negro in Venezuela, Colombian buyers in the early 1970s were purchasing most of the chíquichíqui for a broom factory in the foothills of the Colombian Andes. Several cities in Colombia still manufacture brooms with the palm fiber, but demand has slackened with the widespread availability of brooms made with synthetic fibers (Bernal 1992).

Fig. 42.6 Brooms made from a forest vine, cipó-titica (*Heteropsis spruceana*) with light tan bristles on the *left*, and darker piaçava (*Leopoldinia piassaba*) fiber on the *right*. Hardware store in Tefé, Amazonas, Brazil, 8-20-12

During the colonial period, piassaba fibers were woven into rope for use by boat crews in the Amazon and Orinoco Basins (Schomburgk 1840a). Ropes some 50 m long and as thick as a man's arm were once used for pulling large canoes (*batelões*) up rapids. One end of the rope was taken in a small canoe upstream and passed around a tree on the bank of the river and then brought back to the boat where rowers hauled the large canoe against the current (Koch-Grünberg 1995: 55). The smaller canoe was then taken in tow until needed again. A major advantage of piassaba rope for use on boats is that it floats and is flexible and durable (Edwards 1847: 141). During the nineteenth century, piassaba fibers were shipped from Manaus to Belém and thence to England where they were manufactured into rope for ships as well as brooms. Street sweepers in London once employed piassaba brooms as reported by Berthold Seemann, a German botanist employed at the Royal Botanic Gardens in Kew:

> Take, for instance, a walk in the streets of London, and observe everywhere how substances originally obtained from palms, and turned to useful purposes, meet your eye. That ragged boy, sweeping the crossing, and begging you with a faltering voice, real or assumed, to "remember poor Jack," holds in his hands a broom, the fibrous substance of which was cut by the wild Indians of Brazil from the stems of a palm. (Seemann 1856: 4)

Piassaba apparently had limited use among indigenous groups. However Yanomama shamans in the border region between Venezuela and Brazil fashioned crowns with the palm fiber which they associated with a luminous radiance (Gertsch et al. 2002).

Piassaba palms inhabit the imaginary landscapes of rural people in the Amazon. Curupira, a boy-like figure with supernatural powers, is thought to haunt piassaba groves, so indigenous peoples avoid such places at night (Schultes 1974). People of mixed ancestry also fear curupira. A widow I spoke with at Tapurucuara on the Upper Rio Negro in 1979 recalled a frightening experience she had while gathering piassaba fiber with her family in the headwaters of the Parahá River. A curupira enticed her 9 year-old son to follow him, which he did. Eventually, she and her husband noticed that their son was missing and called out for him. But he did not reply. So they made a cross on the trail and prayed. Finally, their son responded to their urgent calls. But when they located him he was not the same; he was scared and quite unlike himself. He did not recognize his parents. He only regained his sanity back home with the help of a curer.

Not all encounters with the supernatural in or near piassaba groves are terrifying. An interview I conducted with another informant living at Tapurucuara in 1979 reveals the compassionate nature of some supernatural entities. The elderly gentleman recounted a strange encounter that befell his uncle while he was looking for piassaba palms in the vicinity of Rio Preto, an affluent of the Negro about one and a half day's motorboat journey upstream from Barcelos:

> My uncle had been combing the forest but he was not having much luck. The groves of piaçava he found had all been recently cut. Uncle grew worried because he was short of cash and his *patrão* (boss) was pressuring him for payment. One day, as he walked along a narrow jungle trail, he came upon a woman sitting on a thick branch that had fallen across the path. The woman did not pay him any attention and continued to stroke her thick, coarse hair with a comb made from stiff piaçava bristles. Her hair was long and looked like strands of piaçava, only it was light colored.
>
> Uncle halted abruptly. It was most peculiar for a woman to be alone in the forest, especially so far from any settlement. The man's amazement soon turned to curiosity, so he proceeded along the trail. As he did so, however, the woman stopped grooming, got up, and walked down the path away from him. Her cascading hair dragged behind her like a bridal train. Shortly, the silent lady turned off the path, looked back momentarily to make sure that she was still being followed, then vanished into the wall of trees. Uncle hurried to the spot where the intriguing woman had left the trail, but he could not see her. He entered the trackless forest to seek her out, but to no avail. Although he could not find the elusive lady, he soon happened upon a virgin piaçava grove with plenty of mature palms ready for trimming.
>
> That night, after an arduous day of harvesting piaçava, uncle quickly fell asleep. In a dream, the mother of piaçava (*mãe de piaçava*) appeared to him. "I felt sorry for you, that is why I led you to the virgin piaçava grove," she said. "Please cut piaçava properly and do not destroy it," pleaded the mother of piaçava before departing. (Smith 1996: 136.

Leopoldinia pulchra

43

Brazil: Jará, jará-miri
Colombia: Yará
Venezuela: Morichito, cucurrito, palmiche

Status: Wild

Fig. 43.1 Jará (*Leopoldinia pulchra*) with immature fruit by a stream in a campinara (a stunted forest on sandy soils). Trilha do Itaubal, near Seringalzinho, Jaú River, Amazonas, Brazil, 10-4-12

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_43

Named after Maria Leopoldinia, the archduchess of Austria and the first empress consort of Brazil in the early nineteenth century, the genus *Leopoldinia* consists of three species, all of which are confined to the central Amazon Basin and Upper Orinoco (Henderson 2011b). Piaçaba (*Leopoldinia piassaba*) is the most important economically because of the long fibers that are produced from the leaf sheaths which are gathered to make brooms, brushes, and formerly ropes. Piaçaba grows on sandy soils with a high water table in the Upper Rio Negro watershed. The other two species in the genus, *Leopoldinia major* and *L. pulchra*, are both confined to wetlands. The former is restricted to the upper Rio Negro watershed and adjoining black water courses of the Upper Orinoco, whereas *L. pulchra* has a wider distribution from the Upper Orinoco south through the Casiquiare Canal and down the Rio Negro. It also crops up in isolated populations along clear and black water affluents of the middle to lower Amazon, including the Trombetas, Tapajós and Xingu (Ferreira and Prance 1998; Goulding and Smith 2007: 212).

Fig. 43.2 Jará (*Leopoldinia pulchra*) on the banks of a black water river at low water. Caru River, AM 363 highway, Amazonas, Brazil, 9-20-10

Leopoldinia pulchra is picturesque with a slender trunk reaching no more than 5 m, topped by relatively short fronds with leaflets (pinnae) that droop slightly towards the ends. Orchids sometimes perch on the persistent leaf bases along the matted trunk. The species name aptly comes from the Latin for beautiful (*pulcher*). Jará occurs alone or in small clusters in floodplain forests and the fruits are gathered at high water and eaten locally or dried and then pounded to make flour for later consumption.

Although people eat jará fruits, the water-loving palm is more valuable as an indirect food source because turtles and fish feed on the fruits when they fall into water. *Leopoldinia pulchra* tolerates prolonged flooding, so the fruits are released into the water over a protracted period. The fruits float and are dispersed by currents as well as several species of fish and turtles, including the highly prized giant river turtle (*Podocnemis expansa*) and the big-headed Amazon River turtle (*Peltocephalus dumerilianus*) (Pérez-Emán and Paolillo 1997).

In the nineteenth century, trunks of the jará palm were often used for fencing in towns and villages along the Rio Negro (Spruce 1853b; Wallace 1853: 14). The glossy fronds were also brought into Manaus from the surrounding countryside to fashion small shelters for images of saints on their festival days. Jará poles have largely been replaced by planks and bricks to make fences these days in Manaus. And while Catholics continue to honor a variety of saints throughout the year, the custom of bringing jará fronds from the Rio Negro has faded.

Indigenous groups use jará palms for a variety of other purposes, from obtaining salt to performing rituals. In the latter part of the nineteenth century, indigenous communities in the Upper Negro watershed used to collect large quantities of the fruit which they burned and washed to extract ash salt. And further south along the Madeira River, the Mura used to undertake a flagellation ceremony after burning brush to boost yields of manioc planted in their gardens. A whip was fashioned from *Leopoldinia pulchra* which was used by one of the tribal elders to flog youngsters rounded up for the ceremony. The flagellation ceremony involved singing and dancing; apparently the beating was not enough to inflict harm, but sufficient to placate the supernatural entities overseeing agricultural production (Nimuendajú 1948b). It is not clear whether the remnants of the Mura tribe still undertake this ritual.

Large earthworms take refuge in the fiber and frass, remnants of leaf bases, along the trunk during the flood season. Brown capuchin monkey (*Cebus apella apella*) extract these worms and eat them (Barnett et al. 2002). Rural folk must have learned from these monkeys for they also procure worms on jará trunks to use as fish bait.

Lepidocaryum tenue 44

Brazil: Caranaí, caranã, buritizinho; shina (Baniwa)
Colombia: Puy, caraná, yapurá; tɨ'da (Andoque), ererɨ (Witoto)
Peru: Irapay; pwuínaya (Maijuna), tanac (Mayoruna); achúku, raápie (Shuar)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_44

Fig. 44.1 Pleating leaflets of irapay (*Lepidocaryum tenue* var. *tenue*) over a pole cut from the trunk of pona (*Socratea exorrhiza*) palm. After drying, the panels of folded irapay fronds will be used for thatch. Jenaro Herrera, Ucayali River, Loreto, Peru, 1-11-06

Irapay (*Lepidocaryum tenue* var. *tenue*) is one of the most important plants for thatch in northwestern Amazonia (Coomes 1995; Navarro et al. 2011). A denizen of *terra firme* forests below 500 m (Balslev et al. 2010b), the fronds of this understory palm are easy to gather because the stems do not usually exceed 4 m. The fronds are cut with a machete for domestic use and for sale in urban centers, such as Iquitos (Mejía 1992).

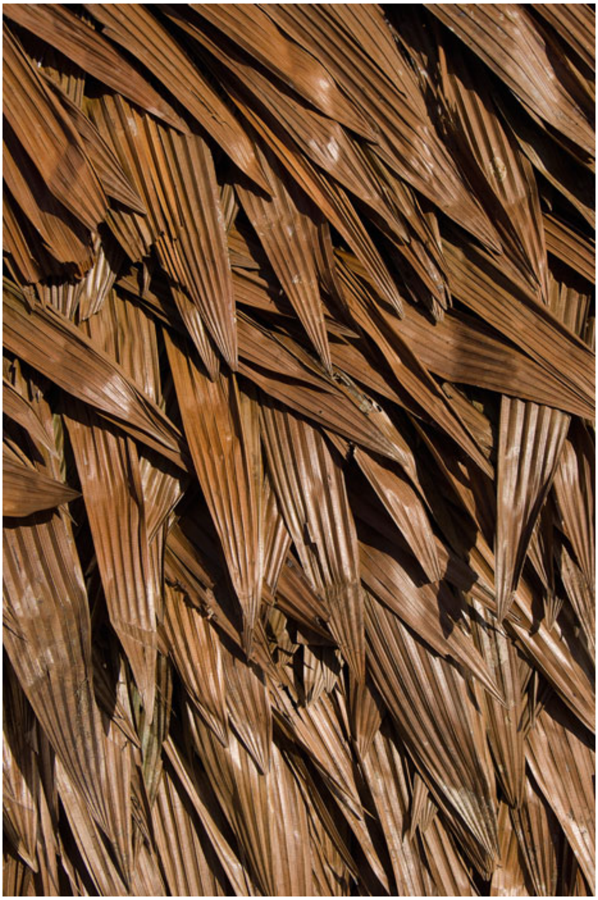

Fig. 44.2 Irapay thatch on a river boat. When freshly dried, irapay fronds shine and have a distinctive copper color. Requena, Loreto, Peru, 4-19-06

A house thatched with irapay is easy to recognize because the newly laid fronds are copper-colored and shiny. After a few years, though, they turn a light gray tan, as is the case of fronds of other palms used for thatch in the Peruvian Amazon, particularly yarina (*Phytelephas macrocarpa*) and shapaya (*Attalea phalerata*).

Fig. 44.3 Irapay fronds stacked at port (on *right*). The boat on the *left* has a roof of irapay fronds. Belén district of Iquitos, Rio Itaya, Loreto, Peru, 1-8-06

Irapay is used to cover houses and boats both by *campesinos* and some indigenous groups, such as the Witoto in the Colombian Amazon (Gasché 1972), the Maijuna (Tessmann 1999: 111), and the Mayoruna in eastern Peru (Romanoff et al. 2004: 28). The Mayoruna (also known as the Matsés) also use the fronds of the palm to wrap fish for cooking.

Fig. 44.4 Houses thatched with irapay fronds. Requena, confluence of Tapiche and Ucayali Rivers, Loreto, Peru

This highly variable palm is divided into three forms and their ranges extend from the western Amazon in Peru, Colombia, and Amazonas and Acre in Brazil, to the Upper Rio Negro region and Guyana, south into the Madeira watershed and eastwards to the interfluve between the Tapajós and Xingu (Henderson 1995: 73). Buritizinho and caranaí, the common names for *Lepidocaryum tenue* in Brazil, are so named because the fruits resemble miniature versions of the fruits of buriti (*Mauritia flexuosa*), caranaí (*Mauritiella* spp.), and caraná (*Mauritia carana*). However, the scaly fruits of *L. tenue* do not appear to be eaten anywhere in its vast range, perhaps because they are so small, measuring only1.5–3 cm long and 1–2 cm in diameter (Henderson 1995: 78).

Fig. 44.5 The thatch on the house on the *left* has been partially repaired with irapay, easily distinguished by the band of copper-colored fronds. Miraflores, confluence of the Tigre and Marañón Rivers, Loreto, Peru, 4-26-06

Manicaria saccifera

45

Brazil: Buçú, palheira
Colombia: Jicara, temiche; waazi (Piapoco), ahï (Witoto)
Guyana: Truli
Peru: Yarinilla
Venezuela: Temiche; awewé (Piaroa), yahuhi, yaha (Warao), yawatoa (Yanomama)

Status: Wild, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_45

Fig. 45.1 Gathering fronds of buçú (*Manicaria saccifera*) in a floodplain forest. The river dweller will use the fronds to thatch his house. Rio Ipanema, lower Tocantins River, near Abaetetuba, Pará, Brazil, 7-8-07

Buçú palm is easily recognized by its broad, sheet-like fronds that elbow out competition along creeks and rivers. The generous fronds can reach 8 m long and are much sought after by rural folk to cover their houses and canoes. When layered tightly, about one finger width between midribs (rachis), buçú thatch can last a dozen or so years before it needs to be replaced, as noted by the Portuguese explorer Alexandre Rodrigues Ferreira almost three centuries ago (Ferreira 1971: 234). And two centuries ago, the German naturalists Johann Spix and Carl Martius remarked on how people in Breves in the southern part of Marajó Island preferred the palm to thatch their houses because the interiors were so much cooler than those with tiled roofs (Spix and Martius 1938: 111). At the mouth of the Amazon, fronds from this water-loving palm are recognized as the best thatch for covering houses and boats.

Indigenous people also use the fronds of *Manicaria saccifera* for thatch. At the beginning of the twentieth century, for example, the Witoto in the Colombia Amazon where using the fronds to thatch their capacious *malocas* (Whiffen 1915: 43). Buçú is also the preferred thatch among the Palikur and Galibí, indigenous groups who live along the Oiapoque River that forms the boundary between the Brazilian state of Amapá and French Guiana (Arnaud 1989: 27; Granville 1999). The Piaroa who live in the Orinoco watershed also use the fronds to thatch their dwellings (Rondón 2003). Buçú fronds have been known to endure 13 years on the tree, the greatest longevity for a frond of any of the world's palms. Buçú is also one of the longest living palms, attaining almost 500 years in some cases (Henderson 2002: 67, 91).

Fig. 45.2 Rural home thatched with buçú fronds. Furo Flechal, near São Miguel de Pracuúba, Marajó Island, Pará, Brazil, 5-20-99

Relatively common in the Amazon estuary, *Manicaria saccifera* is the only representative of the genus and occurs sporadically in wetlands in the northern part of the Amazon Basin, the Orinoco delta, coastal Guianas, and parts of the Atlantic Coast of Central America (Gasson 2002; Henderson 1995: 99, 101). In the Orinoco delta, the Warao employ the giant, plume-like fronds as sails for their canoes (Wilbert 1976), while the Wapishana, who inhabit a landscape of mixed forest and savanna near the border between Brazil and Guyana, construct temporary shelters with fronds of the palm while on hunting and fishing trips (Farabee 1918: 18).

Fig. 45.3 Buçú (*Manicaria saccifera*) thatch on a motorized canoe (*rabeta*). The fronds have been laid over a framework of split petioles of arumã (*Ischnosiphon obliquus*). Afuá, Marajó Island, Pará, Brazil, 8-16-98

The one-to-three lobed fruits, some 6 cm in diameter, are covered with a rigid outer skin (Balick 1979). A mature buçú palm produces around four fruit bunches a year and while the embryos are still liquid they serve as an emergency supply of water in the forest. The studded wooden skin is chopped open with a machete to reveal the one to three endocarps, each the size of billiard ball; an opening is then made in the seed to drink the clear liquid. In the Guianas, buçú "water" is taken to calm coughs and is given to babies to treat thrush, a fungal infection of the palate. The liquid endosperm gradually solidifies into a jelly and then to a hard nut. River dwellers, such as on Curuá Island in the Bailique archipelago at the mouth of the Amazon, occasionally snack on the slippery endosperm (*massa*) when working in floodplain forest, such as while weeding their açaí groves.

When the fruits mature the embryo hardens to an ivory color and the woody pyramid-studded outer structure decays and sloughs off, thus leaving the fruits to fall into the water where they are dispersed by currents.

Fig. 45.4 Buçú palm fruit opened to expose the liquid endosperm which people drink when in floodplain forests. Near Limoeiro, Pará, Brazil, 7-5-07

Buçú fruits mature in the latter part of the rainy season and into the dry months. If the fruits fall to the ground at low tide, pigs have a chance to forage in tidal forests and crunch open the tangerine-sized endocarps to feed on the endosperms. At high tide, boys venture out in canoes to scoop the red to black fruits out of the water and bring them home to feed pigs (Smith 2002: 109). So many floating fruits are encountered in some rivers that they create an incessant din as they strike the aluminum hulls of speedboats.

Fig. 45.5 Drinking the liquid endosperm of a buçú fruit. Rio Ipanema, lower Tocantins River, near Abaetetuba, Pará, Brazil, 7-8-07

A fibrous mat (peduncular bract) covers the developing fruits. This veil-like brown material, called *tururi* in the Brazilian Amazon, is gathered and sold in Belém to make handbags and caps for the tourist trade. The fibrous material is removed before the developing fruits grow large enough to rupture the matting. In the 1930s, river dwellers along the lower Tocantins made bag-like nets from *tururi* to catch two kinds of tiny shrimp (*aviú*) at the beginning and tail end of the rainy season (Lustosa 1976: 274). The closing of the Tucurui dam on the Tocantins in 1984 may well have wiped out this shrimp fishery. In the vicinity of Belém, river dwellers employ the inner bark of the palm to wash wounds and to treat inflammations (Lisboa and Silva 2009).

Fig. 45.6 Buçú palm fruits destined for pig feed. The boys collected the buoyant fruits from canoes near their village. Afuá, Marajó Island, Para, Brazil, 8-15-98

The lime-green, blade-like fronds of buçú are unmistakable along rivers and streams, but alas are an increasingly rare sight in many places because of over-harvesting. Buçú fronds are marketed in urban areas, such as Muaná on the southern coast of Marajó, Macapá in the northern part of the estuary, and Belém. One of Belém's ports, *Porto de Palha* (the thatch port), is named after buçú. Rapid urban growth has contributed to the decline of buçú. Some farmers on floodplain islands of the lower Tocantins opposite Abaetetuba have planted buçú to counteract the decline in the highly valued palm.

Fig. 45.7 Offloading buçú fronds at a port. Breves, Marajó Island, Para, Brazil, 5-13-00

The Warao at the mouth of the Orinoco formerly relied heavily on sago starch obtained from the trunks of *Manicaria saccifera*. Since they adopted agriculture, however, palm starch is less important in their diet (Wilbert 1976). It is possible that indigenous groups at the mouth of the Amazon also obtained starch from the palm in precontact times. Warao adults make spinning tops from the nut shells of the palm for their children (Gomez-Beloz 1997).

Mauritia carana

46

Brazil: Caraná; ttiiña (Baniwa), muhĩ (Tukano), ñapopu (Tuyuka)
Colombia: Caraná, puy; muhí-nyu (Desana), kañakona, duizékɨna (Witoto)
Peru: Guacamayo aguaje, aguaje de varillal
Venezuela: Moyenarïmi (Yanomama)

Status: Wild, planted

Fig. 46.1 Caraná (*Mauritia carana*) in fruit in campinarana, a stunted forest on sandy soil. Near Seringalzinho, Jaú River, Amazonas, Brazil, 10-4-12

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_46

Caraná (*Mauritia carana*) is a comparatively short relative of towering *Mauritia flexuosa*, and is another water-loving, fan-leaved palm with scaly, edible fruits. Caraná is a medium-sized palm, reaching up to 20 m, and grows in forest on clear and black water stream banks, especially in sandy areas (Anderson 1981). Caraná is mostly restricted to the Rio Negro watershed, although it is also occasionally found on ill-drained podzols (*varillales*) in Loreto, Peru, and south of the Amazon River, such as in the vicinity of Santarém and in the Madeira Basin. In 1971, surveyors laying out the route for the Transamazon Highway in the Aripuanã watershed (a tributary of the Madeira) made fruit juice from caraná whenever they encountered the palm along rainforest streams. It is mostly associated with campinarana, a miniature forest found on sandy soils.

Fig. 46.2 Young caraná palms in a campinarana. Igarapé Açaí, affluent of the Tiquié, northwest Amazonas, Brazil, 11-4-12

Caraná flowers during the dry season and produces fruits during the rainy months, although some of the palms also produce fruit during the dry period, such as along the lower Jaú River. Locals gather the orange-colored fruits to make juice, as in the village of Murumuru at the scarp of a forest-clad plateau near Santarém. The round fruits are larger than those of *Mauritia flexuosa*, measuring some 7 cm in diameter. One of the Peruvian names for the palm, guacamayo aguaje, means the macaw aguaje, suggesting that large parrots are fond of the fruits and may disperse some of seeds. The ecology of *Mauritia carana* is still poorly known (Goulding and Smith 2007: 119).

Fig. 46.3 Unripe caraná fruit. Near Seringalzinho, Jaú River, Amazonas, Brazil, 10-4-12

The palmate fronds of caraná make durable thatch. The fronds can last at least 7 years if they are layered thick enough and become coated with tar from fires used for cooking and keeping warm at night. Indeed, the Tuyuka along the Upper Tiquié, a tributary of the Uaupés in northwestern Amazonia, consider caraná fronds superior to other palms in their area for thatch (Rezende et al. 2010). Caraná is also preferrred for thatching *malocas* and kitchens among the Desana (Reichel-Dolmatoff 1997: 281). And the Maué also have long thatched their homes with the palm (Nimuendajú 1963a). In the first half of the twentieth century, Ticuna houses were thatched with the palm fronds which were intertwined and attached to lathes of *Socratea exorrhiza* palm wood (Nimuendajú 1952: 11). Today, the houses more likely have metallic roofs, as I observed in 2012 in an outlying Ticuna community at Ponta do Castanha on the margins of Tefé Lake.

Fig. 46.4 Caraná palms planted in a manioc field along with cucura (*Pourouma cecropiifolia*). Tukano farmer, Serra de Mucura, Tiquié River, affluent of the Uaupés, Amazonas, Brazil, 11-11-12

In some areas, such as parts of the Tiquié watershed in northwestern Amazonia, caraná is either scarce or has been overharvested, so some farmers have resorted to planting the palm in their manioc fields. Another reason that the supply of caraná fronds does not meet demand is that most indigenous groups now live in single-family houses with separate kitchens rather than communal *malocas*. Communal houses are a more efficient way of providing shelter than individual houses because fewer fronds are needed for the inhabitants and the domestic fires provide smoke that helps preserve the thatch. No wonder so many indigenous communities in the Upper Rio Negro have resorted to metal or asbestos roofs for their homes.

Fig. 46.5 Tukano family returning to their village after gathering caraná fronds. Tiquié River, affluent of the Uaupés, Amazonas, Brazil, 10-28-12

Fig. 46.6 A Tuyuka *maloca* thatched with caraná fronds. Fronds of açaí (*Euterpe oleracea*) cover each end of the communal center above the doorways. São Pedro, Tiquié River, Amazonas, Brazil, 11-2-12

Other indigenous groups that reportedly use caraná to thatch their dwellings or shelters include the Waimiri Atroari who live in the extensive forests north of Manaus (Milliken et al. 1992: 40), the Deni who inhabit the interfluvial forest between the Juruá and Purus Rivers (Pezzuti and Chaves 2009), the Mura-Pirahã who live along the Maici, an affluent of the Madeira (Rodrigues and Oliveira 1977), and the Ticuna who live along the Upper Solimões (Acosta 2001). Non-indigenous river dwellers also occasionally use the fronds to thatch their houses or attached kitchens, such as along the Tefé River in Amazonas, Brazil.

Fig. 46.7 Caraná thatch blackened from smoke from a cooking fire in an external kitchen. Ilha de Taraqua, upstream from São Gabriel da Cachoeira, Rio Negro, Amazonas, Brazil, 10-26-12

In addition to houses, caraná is also used to thatch kitchens and huts for making manioc flour in the Upper Rio Negro. The petioles are cut into strips to make mats (*tupé*) by indigenous groups, such as the Tukano in the Upper Rio Negro region. Over a century ago, the now extinct Siusí of the Aiarí, an affluent of the Içana, wove small baskets from a single frond for a variety of uses, including trash containers (Koch-Grünberg 1995: 211). And in the nineteenth century, the Makú (Yuhupde) in the Uaupés watershed made twine from the fronds of caraná to attach poisoned arrows to arrowcane shafts (Spruce 1855). Also in the nineteenth century, fishermen in the vicinity of Santarém would light the petioles to serve as torches while fishing at night (Smith 1879: 163).

Herbert Smith (1879: 384) also noted that the petioles were used for making baskets in the vicinity of Ereré, a village near Monte Alegre on the left bank of the Amazon. Strips were torn from the leaf stems to make open weaved, wicker baskets, that were then lined with leaves to store and transport manioc flour, the staple food of the region.

Fig. 46.8 Young cowboy removing mangaba (*Hancornia speciosa*) fruits from a basket fashioned from the split rachis of a caraná. Fazenda Anjos, Marajó Island, Pará, Brazil, 12-17-01

Baskets are still fashioned from the petioles of *Mauritia carana*. On Marajó Island, for example, strips are torn from caraná petioles to make small cylindrical baskets for selling the delicate fruits of mangaba (*Hancornia speciosa*) which are gathered in patches of scrub savanna. The open weave baskets, some half a meter long, are lined with leaves of arumã (*Ischnosiphon obliquus*). Ambulant vendors hawk the fruits on beaches popular with tourists from Belém, such as in the vicinity of Salvaterra and Soure. Mangaba fruits in baskets of *tala de caraná* can also be seen hanging from carts selling fruit, such as at the ferry crossing at Boca do Camará. Leaf petioles of caraná serve as bottle stoppers on the island (Henderson et al. 1991).

Fig. 46.9 An 82 year-old Tuyuka woman with a mat (*tupé*) she made from split petioles of caraná. Ilha de Taraqua, upstream from São Gabriel da Cachoeira, Rio Negro, Amazonas, Brazil, 10-26-12

47 *Mauritia flexuosa*

Bolivia: Palma real; guaish (Chiquitano), boriti (Chriguano), carandai-guazu (Guarayo), mirísi (Paucerna)

Brazil: Buriti, miriti; miriti'iw (Guajajara), mɨrišɨ-'ɨ (Ka'apor), ihkira (Kanamari), ngrwa (Kayapó), krow (Krahò), kuwai (Macuxi), yélasu (Nambicuara), tema (Ticuna), neẽ (Tukano), kuai (Wayana), ngrua (Xikrin), eteweshi, liõkoho (Yanomama)

Colombia: Cananguche, cañangucha, moriche; neé-nyu (Desana), rẽ (Makuna), iñe-e (Miraña), eú, uj (Nukak), idéwi (Piapoco); kɨnena (Witoto), ndase (Yagua)

Ecuador: Morete; morete (Kichwa), achu (Shuar), ne'e (Siona-Secoya), notoca (Waorani)

French Guiana: Palmier-bâche

Guyana: Itah (Makuxi), aeta (Wapishana)

Peru: Aguaje; áchu (Achuar), achu (Aguaruna), wúmöya (Amahuaca), toniro (Ashéninka), iñéjhe (Bora), kacho (Candoshi), banin (Cashibo), miriti (Cocama), ačuál (Lama), ne ñi (Maijuna), itia (Mayoruna), vinóng (Nocamán), nusítja (Sápara), binón (Shipibo)

Venezuela: Moriche; jtali ji (Jodï), ekuai (Makiritare), werë (Piaroa), ohidu (Warao), tu (Yaruro), kuai (Yekuana)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_47

Fig. 47.1 Miriti (*Mauritia flexuosa*) in fruit towering over açaí (*Euterpe oleracea*). Mouth of the Limoeiro River, a tributary of the lower Tocantins, Pará, Brazil, 7-5-07

The extraordinary number of indigenous names for *Mauritia flexuosa* indicates the cultural importance of the palm as well as its ample distribution. With its towering, light grey trunks akin to Roman columns and its massive, palm-shaped fronds resembling oversized Chinese fans, *Mauritia flexuosa* is one of the most easily recognized palms in the Amazon. This aquatic tree is also one of the most widespread palms in the region because it grows in all water types from coffee-and-cream colored rivers loaded with sediment eroded from the Andes to clear streams rivers flowing across granitic shields and black waters draining sandy areas. The palm is hyperdominant in some aquatic environments, and it has been suggested that 1.5 billion Mauritia palms may be growing in Amazonia and the Guianas (Steege et al. 2013).

Fig. 47.2 Aguaje palms along the margin of a lake. Opposite Tamshiyacu, Loreto, Peru, 6-18-06

This regal palm occupies a wide variety of aquatic habitats from the banks of upland streams to rivers with broad floodplains. It can tolerate brackish waters in tidal zones at the mouth of the Amazon but it is particularly plentiful in freshwater swamps in old floodplains long abandoned by meandering rivers.

Mauritia palm is found throughout the Amazon and Orinoco basins, reaching north to the Guianas and extending south into the cerrado of central Brazil along slivers of galeria forests (Goulding and Smith 2007: 90). Throughout its vast range, the shape and color of the fruits vary, and several subspecies may be involved. For example, miriti (as the palm in known at the mouth of the Amazon) fruits tend to be round, whereas those in the Peruvian Amazon are more elliptical (obovoid). When I showed pictures of Mauritia palm fruits from Marajó Island to villagers in Veinte de Enero along the lower Yanayacu River in the Pacaya-Samiria National Reserve in Peru they immediately recognized them as aguaje (as the palm is known in Peru), but noted that they were bigger and more globular. Over a century ago, Richard Spruce (1908: 14) noted that globular fruits of the palm were restricted to the mouth of the Amazon whereas elsewhere in Amazonia the fruits are oblong.

Fig. 47.3 Aguaje palm in fruit in a home garden. Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-25-06

Although *Mauritia flexuosa* is more common below 300 m, stands of the palm can be found as high as 1,000 m in the foothills of the Andes, such as around the village of Jepelacio near Moyobamba in the Mayo Valley, Peru. On a farm at 660 m along the Monzón road near Tingo Maria, one farmer remarked that although aguaje thrives at that altitude, reaching maturity within 8 years when the palms are 6 m tall, the fruits are acidic and best used for making juice rather than eating fresh.

Fig. 47.4 Vendor peeling an aguaje fruit with a deep orange mesocarp. This type is known as *shambo* aguaje and it fetches a premium price in markets in the Peruvian Amazon. Yurimaguas, Huallaga River, Loreto, Peru, 8-27-04

The palm's fruits are rich in vitamins A and C and serve as the Amazon's answer to oranges and carrots, except that the fruits contain about three times as much vitamin A as carrots (Aguiar et al. 1980; Mariath et al. 1989; Pechnik et al. 1947; Plotkin and Balick 1984; Santos 2005). The amount of carotene evidently varies because the flesh of some fruits is deep orange, suggesting higher levels of carotene, whereas others are yellow under the red, scaly skin. The peculiar scales covering the fruit are rubbed off after soaking since they are inedible. Interestingly, the scales on the palm fruit turn up in a Witoto myth in which an ancestor takes aim at a parrot eating the fruit with his blowgun. However, a scale dislodged by the parrot while it is eating falls into the hunter's eye, irritating it, and the hunter is unable to take aim (Preuss 1994: 351). Fruits of *Mauritia flexuosa* are sufficiently important in the diet of the Witoto that a clan is named after the palm (Candre-Kinerai and Alvaro 1993: viii).

In the Peruvian Amazon, aguaje fruits with orange flesh are called *shambo*, and they command a higher price even though they are often smaller than the more common yellow kind (Delgado et al. 2007). *Shambo* fruits reputedly contain more oil (*grassa*) than the yellow kind, and thus may be also richer in calories. In the Pacaya-Samiria National Reserve in the Peruvian Amazon, locals typically mark the trunks of *shambo* aguajes so that they can be more easily located in groves that may contain several thousand palms. The ecotypes of aguaje are poorly understood, but according to one informant, *shambo* aguaje prefers areas with running water. Other aguaje gatherers, however, claim that *shambo* is randomly dispersed throughout aguaje stands.

Fig. 47.5 Aguaje fruits and pulp (*massa*) for making juice (*aguajina*) in a street market. Ready-made *aguajina* is also for sale in the large container. Mercado Belén, Iquitos, Loreto, Peru, 6-21-06

At least one indigenous group also recognizes different fruit types. The Maijuna who inhabit the Algodón and lower Napo Rivers in the Peruvian Amazon classify three types of *Mauritia flexuosa* fruits based on pulp color: "red" (*ma ne*), "yellow" (*sɨño ne*) and "white" (*bo ne*) (Gilmore et al. 2013). *Ma ne* is known as *shambo* among river dwellers in Peru and *bo ne* is actually pale yellow and is called aguaje posheco in some parts of the Peruvian Amazon. The very pale fleshed variety (*bo ne*) presumably has less carotene. Fruit color is but one indication of the genetic diversity of the palm which in some areas is being threatened by the onslaught of tree cutting to supply urban markets with fruit.

In spite of its extensive range, significant quantities of the fruit are sent to market in only two parts of the Amazon: in Peru and in the southern part of the Amazon estuary in the towns of Abaetetuba and Igarapé-Miri. Abaetetuba has hosted an annual festival in honor of the palm since 2003. The *Festival do Miriti*, sometimes shorted to *Miritifest* on T-shirts, is held on a weekend in early June. The festival features dances and copious quantities miriti porridge, and as with all festivals in the Brazilian Amazon, considerable quantities of beer and *cachaça*. Abaetetuba is not a pioneer with regards to festivals celebrating the palm fruit. The Tuyuka along the Tiquié, an affluent of the Uaupés in upper Rio Negro watershed, hold a festival (*dabucuri*) for the palm every year when the fruits come into season (Valle 2010), as does another Tukanoan group, the Barasana, along the Pirá-paraná River in the Colombian Amazon (Hugh-Jones 1979: 41). Generous amounts of manioc beer are consumed on such occasions, and men who play the long flutes also take ayahuasca (*yagé*), an entheogen.

Only in the Peru, though, is the palm an important item in commerce. Indeed, aguaje is the single most important wild fruit in the Peruvian Amazon both in terms of nutrition and income generation (Padoch 1988). The province of Loreto is the land of aguaje eaters, and Iquitos is the epicenter of consumption. Over 20 t of aguaje fruit are sold daily in Iquitos, a town of a little over 400,000 inhabitants (Penn 2008).

Aguaje fruits reach Iquitos on steel passenger and cargo ships (*lanchas*), smaller wooden boats, and rafts. The Masusa port in Iquitos is one of the main entry points for aguaje fruits in the city because large passenger and cargo ships dock there. Aguaje fruits are typically offloaded in tall polypropylene sacks and sold by middlemen (*remetistas*) to vendors who in turn sell the fruits, pulp, and juice in other parts of Iquitos. Curiously, Mauritia palm fruits are not important in the regional diet in the Bolivian Amazon even though the palm is plentiful there. In the past, though, fruits of Mauritia palm were likely consumed by indigenous groups in the Bolivian Amazon, such as the extinct Baure who may have encouraged or even planted the palm in their engineered landscapes (Erickson 2000).

A single aguaje fruit stalk typically contains hundreds of fruits, and as many as two or three such racemes can be ready for harvesting from a single palm. Near Igarapé Miri in the southern part of the Amazon estuary, I have seen a miriti with ten fruit stalks, and near Tarapoto in the Peruvian Amazon, an aguaje palm in the home garden of a farm had eleven racemes. However, the number of fruits on the racemes of the latter palm was smaller than those on aguajes in the area with fewer racemes. Thus more racemes do not necessarily mean fruit yields will be higher.

During the course of a few months an aguaje palm can produce several thousand fruit (Cavalcante and Johnson 1977).

Fig. 47.6 Black water palm swamp dominated by *Mauritia flexuosa*. Tahuamanu River, Pando, Bolivia, 5-29-05

Mauritia palm is not only prolific but it sometimes occurs in immense stands, especially in swamps. Some Mauritia palm groves occupy over 1,000 sq km (Gilbert 1995).

These boggy environments, with deep peat-like soils derived from debris that falls from the palms, can stretch for tens of kilometers. Known as *aguajales* in Peru, *moretales* in Ecuador, *palmares* in Bolivia, and *buritizais* or *miritizais* in Brazil, some indigenous groups also have special terms for these giant palm swamps. The Siona-Secoya in the Ecuadorian Amazon, for example, call extensive soggy stands of Mauritia palm *ne' e dayawi* (Vickers 1994). In the mid-nineteenth century, Alfred Russel Wallace captured admirably the ambience of these seemingly endless groves:

> The Mirití is a social palm, covering large tracts of tide-flooded lands on the Lower Amazon. In these places there is no underwood to break the view among interminable ranges of huge columnar stems rising undisturbed by branch or leaf to the height of eighty or a hundred feet, –a vast natural temple which does not yield in grandeur and sublimity to those of Palmyra or Athens. (Wallace 1853: 50)

Although extensive palm swamps occurred in Amazonia prior to the arrival of humans, some of the stands may well have been seeded by people in the past. In the llanos of the Orinoco Basin, fires set by humans and triggered by lightening are thought to be responsible for the immense stands of the palm. The frequent fires have prevented the return of mixed trees in galeria forests (Rull 1992, 1999). Mauritia palms can survive fires as long as there is not too much combustible material, as I have observed in rice fields in the vicinity of Tarapoto, Peru, and others have noticed along the Caquetá River in Colombia (Veléz and Veléz 1999: 111).

Most aguaje fruits fall during the rainy season, but some palms also produce during the drier months. Even along a single river, populations may have different fruiting seasons. Along the lower Marañón towards the end of the dry season in November, for example, aguaje is not ripe, whereas upstream from the confluence with the Tigre, aguaje fruits are ready for gathering. It is not known why aguaje populations are ready for harvest in some areas but in contiguous zones the fruits are still not ripe. This mosaic of fruiting patterns means that urban markets are supplied year round with the popular fruit.

Fig. 47.7 Buriti fruits are eaten fresh after soaking for a while in water. Caru, Lago de Tefé, Amazonas, Brazil, 8-29-12

Aguaje fruits are mostly eaten fresh after soaking to soften the pulp. The riper the fruit, the less time it takes to render the mesocarp easier to chew. Color is a good indicator of ripeness. In the Pucallpa markets, for example, ripe fruits are generally dark red and are called *negrito*, whereas those requiring longer soak times are referred to as *coto aguaje*, after the ocher-colored coat of the red howler monkey (*Alouatta seniculus*). In urban areas, the water for soaking the fruits is usually warmed over a charcoal or gas fire, but in the countryside, people typically heat water over wood-fueled fires in their kitchens. In the village of Parinari along the

Marañón, locals place plastic bowls filled with aguaje fruits and water outside to warm in the sun.

Fig. 47.8 Miriti fruits soaking in warm water in the kitchen of a river dweller's home. Someone has been testing one of the fruits to see if it has softened sufficiently. Limoeiro River, affluent of the lower Tocantins, Pará, Brazil, 7-5-07

Street vendors with small piles of peeled fruits on tables or even on the sidewalk are a common sight in towns in the Peruvian towns such as Iquitos, Nauta, Requena, and Yurimaguas. The fruits are sold in small plastic bags with a pinch of salt and are remarkably cheap; a dollar can buy between 35 and 70 fruits. Most shoppers purchase bags containing about a dozen of the peeled fruits. The flesh is savory and before soaking, crisp, similar in texture to fresh baby carrots.

Fig. 47.9 Aguaje juice (*aguajina*) prepared in a village kitchen. Miraflores, mouth of the Tigre River, Loreto, Peru, 4-26-06

Both rural and urban dwellers are fond of aguaje juice in the Peruvian Amazon. Known as *aguajina*, the yellow-orange juice is scooped from large urns into glasses for consumers in markets and on street corners. Vendors of aguaje fruits often have bags of the pulp available for customers to make their own juice.

Fig. 47.10 Aguajina juice prepared at a village home. A saddle-back tamarin (*Saguinus fuscicollis*) is resting on the girl's arm. Miraflores, Tigre River, Loreto, Peru, 4-26-06

In the Ecuadorian Amazon, the widely dispersed Kichwa sometimes ferment the juice to make *chicha de morete*, such as in the vicinity of Puyo in the Alto Pastaza. Likewise the Guahibo who inhabit the eastern llanos in Colombia and Venezuela make a similar drink by mashing fruits of the palm and allowing the pulp to ferment for 3 or 4 days (Balick 1980). Fermented juice of the palm fruits was formerly common in many parts of the Amazon, such as the Upper Rio Negro (Spruce 1871). However, the widespread availability of more potent sugarcane alcohol (*aguardiente, cachaça*) has dampened the art of making alcoholic beverages from fruit juices.

Urban dwellers also have access to frozen aguaje juice in the form of pushups, popsicles, and ice cream. Pushups containing frozen aguaje juice are popular in towns and cities throughout the Peruvian Amazon. Known as *curichi*, the aguaje juice is frozen in clear, cylindrical plastic bags, which makes it easy to suck on the orange-colored contents. *Curichi* is a cottage industry, and young boys obtain them from their mothers, or purchase them from other households for sale from Styrofoam containers. Aguaje popsicles (*chupete*), in which the juice is frozen on to a stick, are also popular. *Chupetes* and *curichis* can only be made in towns because electricity is largely absent or only sporadically available in rural parts of the Peruvian Amazon. Although some villages in the Peruvian Amazon have electrical generators, the diesel-powered motors generally only run for a few hours after sunset to economize on fuel. When they break down, months may go by before repairs are carried out. Some taverns and stores in villages have their own gasoline-powered generators, but they are only operated long enough to refrigerate beer and soda.

Fig. 47.11 Boy enjoying a frozen aguaje pushup that he has purchased from a street vendor. Plaza de Armas, Lamas, San Martin, Peru, 8-25-04

Aguaje fruits and popsicles are also starting to penetrate Lima, Peru's largest city with over eight million inhabitants. It is markets in working class districts of Lima, such as Breña and Magdalena, rather the upscale areas such as Miraflores or San Isidro, where most customers for aguaje and other fruits and juices from the *selva* are found. The influx of people from Amazon region to Lima in search of jobs and better schools and medical facilities has created this nascent market for jungle fruits. In the markets of Breña and Magdalena, for example, several stalls sell aguaje fruits as well as suri, the beetle grubs that tunnel in rotting aguaje trunks. The fruits come from Pucallpa, and bring welcome relief to the nostalgic palates of migrants from the Ucayali and Marañón watersheds. Recently, Toya, a company in Manaus, has begun marketing a buriti popsicle that can be found for sale in other urban centers in the Brazilian Amazon, such as Tefé. Thus far, though, aguaje products have not found a "niche" in international markets.

Fig. 47.12 Customers conversing while drinking miriti porridge for breakfast in a street market. The *mingau de miriti* is being served in calabash gourds. Abaetetuba, Pará, Brazil, 7-7-07

The only other major center for consumption of fruits and juice of Mauritia palm is in the southern part of the Amazon estuary. In Abaetetuba and Igarapé Miri, miriti fruits are sold in markets but most fruits are destined to make porridge rather than for eating fresh. To make *mingau de miriti*, the fruits are first simmered in water for about 12 h so that the pulp is soft and easy to remove from the single seed. Salt is then added to the savory, orange-yellow gruel which tastes a bit like cheesecake. Some add cooked rice or gritty manioc flour to thicken the porridge and make it an even more substantial meal.

Fig. 47.13 Customer emerging from a house with a bag of açaí (*Euterpe oleracea*) juice. The *red* flag advertises that three grades of açaí juice are for sale, whereas the *yellow* flag indicates that miriti porridge is also available. Igarapé Miri, Pará, Brazil, 11-25-02

Miriti porridge can be purchased from private homes or from street vendors. Homes that sell miriti porridge display a yellow flag by the door when the product is ready. Residences that sell miriti porridge may also offer açaí palm fruit juice, in which case both a red and yellow flags are on display. Customers can also purchase *mingau de miriti* during the morning in street markets. Served in bowls fashioned from calabash gourds, a single serving can satisfy until lunchtime.

The practice of preparing juice from the fruits of Mauritia palm can be traced to indigenous cultures, especially in the Negro and Orinoco watersheds (Balick 1980; Hardenburg 1913: 160; Humboldt and Bonpland 1818: 334; Spruce 1871). People have likely been snacking on the fruits of *Mauritia flexuosa* and making juice from them since humans first arrived in the Amazon. Carbonized seeds of the palm fruit have been found in the floor of an ancient house at an archaeological site along the lower Tapajós. The site is one of many Amazon Dark Earth sites at Parauá and has been dated at 1,020 BP (Gomes 2008). Seeds of the palm have also been detected at an archaeological site near Leticia in the Colombian Amazon (Morcote-Ríos 2012: 96).

Oil is extract from the fruit pulp for use in cooking and to make soap in some areas. The Yanomama in northern Amazonas, Brazil, for example, obtain the oil by boiling the palm fruits; the oil is mixed with water and rubbed on to baked manioc waffles, known in Brazil as *beiju* (Anderson 1978). Rural folk make hand-crafted soap with buriti oil for domestic use in Tocantins, Brazil (Sampaio et al. 2008) as well as in Mâncio Lima, Acre (A. Lima, pers. comm.). Several Brazilian Companies, such as Natura in São Paulo; Nutriphitos Cosméticos in Pinhais, Paraná; and Pharmakos da Amazônia in Manaus, are manufacturing soaps containing buriti oil for the customers seeking natural products.

Mauritia palms feed people indirectly through domestic pigs that roam freely in floodplain forests and game animals. Brocket deer, tapir, peccaries, paca, agouti, and tortoises, for example, are known to seek out fallen fruits of Mauritia palm (Bodmer 1989, 1991; Bodmer et al. 1999; Fragoso 1998; Govoni et al. 2004; Kiltie 1981a; Milliken et al. 1992: 26; Moskovits 1998). Both the white lipped peccary (*Tayassu pecari*) and the collared peccary (*Pecari tajacu*) also uproot seedlings of Mauritia palm and eat the attached endosperm (Fragoso 1999).

Accordingly, indigenous groups conduct hunting trips in palm swamps. The Waimiri-Atroari near Manaus erect platforms in the forest near buriti palms because they know that tapir come to feed on the fruits at night. The Waimiri-Atroari look after spontaneous seedlings of buriti to increase their chances of survival (Miller 1994). In the Ecuadorian Amazon, Achuar hunters wait by Mauritia palm because peccary are attracted to the fruits, and in the Colombian Amazon, the Yukuna and Tanimuka who live along Mirití-Paraná River, an affluent of the Caquetá, wait in groves of the palm to shoot tapir, white-lipped peccary and white-collared peccary that come to feed on the fallen fruits (Descola 1994: 244; Walschburger and Hildebrand 1988). In the Peruvian Amazon, the Maijuna erect platforms in aguajales, which they call *ne cuadu*, to shoot paca, armadillos, and tapirs at night when the animals come to feed. The Maijuna also shoot collared peccary, white-lipped peccary, and agoutis when they feed in the palm swamps during the day. All told, some 20 species of mammals, birds, and reptiles are hunted by the Maijuna in swamps dominated by *Mauritia flexuosa* (Gilmore et al. 2013). Rural inhabitants of mixed ethnic ancestry, such as on Ilha das Onças in the Amazon estuary near Belém, continue the ancient tradition of waiting for game in buriti groves (Anderson et al. 1985).

Several fish also eat *Mauritia flexuosa* fruits when they fall into to the water. The Maijuna take advantage of their natural history knowledge by using pieces of the fruit to bait their hooks (Gilmore et al. 2013). Several species of turtle also eat the fruits, including the big-headed Amazon River turtle (*Peltocephalus dumerilianus*) which passes the seeds intact thus acting as a dispersal agent (Pérez-Emán and Paolillo 1997). The big-headed Amazon River turtle, which resembles the alligator snapping turtle of the southeastern U.S. both in shape and size, inhabits clear and black water rivers in the Amazon and Orinoco watersheds. River folk capture the turtles and keep them alive in their backyards, such as in Barcelos along the Rio Negro, until they are ready to eat them. Mauritia palm swamps also provide habitat for edible snails (*churo* in Peru) that are gathered and eaten fresh in *ceviche*.

Fig. 47.14 Gathering snails in a swamp dominated by *Mauritia flexuosa*. The river dweller is gathering the snails among seedlings of the palm. Near Yarina, Rio Yanayacu, Pacaya-Samiria, Loreto, Peru, 1-15-06

Because of the palm's great height, soaring up to 30 m, most gatherers of the fruit destined for commerce in the Peruvian Amazon cut down the palm rather than risk shimmying up the smooth trunk (Lopez-Parodi and Freitas 1990). Mauritia palms are dioecious, that is male and female flowers are born on separate trees. Thus a large grove of Mauritia palms does not mean that abundant fruit harvests are guarantee. In some areas within easy access of rivers or roads, many of the palm stands are now dominated by male trees (Manzi and Coomes 2009; Prance 1988).

Fig. 47.15 Felling an aguaje palm to gather the fruits. Nahuapa River, affluent of the lower Tigre, Loreto, Peru, 7-2-06

In order to promote more sustainable harvesting methods, several organizations have encouraged the use of various climbing devices (Goulding and Smith 2007: 106). While climbing techniques have been adopted in some communities, such as San Carlos and Veinte de Enero in the Pacaya-Samiria National Reserve in the Peruvian Amazon, the vast majority of fruits entering urban markets in the Peruvian Amazon are still coming from trees that have been sacrificed.

Fig. 47.16 River dweller ascending an aguaje palm using a climbing device (*estrobo*) that employs a wooden stirrup. Quebrada Paima, near Veinte de Enero, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 7-13-10

The felling of buriti for its fruit is relatively rare in the Brazilian Amazon because the fruits are not as commercially valuable as they are in Peru. For the most part, buriti fruits in the Brazilian Amazon are gathered from the ground, or from the surface of water courses and lakes because the fruits float. Occasionally, an adjacent tree with sturdy branches is used to get close enough to the fruit bunches of Mauritia palm in order to cut them down.

Fig. 47.17 Stripping miriti fruits in a floodplain forest. Ipanema River, lower Tocantins, near Abaetetuba, Pará, Brazil, 7-8-07

In addition to fruit, Mauritia palms provide nutrition through tasty beetle grubs that feed on the pith of trunk lying on the ground. In the Peruvian Amazon, larvae of the palm beetle (*Rhynchophorus palmarum*) are a regional delicacy and a significant source of protein (Delgado et al. 2008). The grubs also contain more vitamin A than cow's milk (Carda et al. 2004). Known as suri in the Peruvian Amazon, the beetle grubs are dug out of fallen Mauritia trunks and eaten raw, fried in their own fat, or roasted on skewers. Rural and urban folk alike are fond of the thumb-sized grubs and they can be readily purchased in street markets.

Fig. 47.18 Tuyuka woman chopping open the trunk of a rotten buriti palm to extract beetle grubs. The palm sprouted spontaneously in the home garden from discarded seeds. São Pedro, Tiquié River, affluent of the Uaupés, Amazonas, Brazil, 11-2-12

The custom of eating palm beetle grubs arose among indigenous groups. The Maijuna in the Peruvian Amazon extract grubs of *Rhynchophorus palmarum* as well as another species, *R. barbirostris*, from Mauritia trunks which they eat and use for fish bait (Gilmore et al. 2013). The Tuyuka along the Tiquié River in northwestern Amazonia are partial to the beetle grubs. The Yanomama also harvest the grubs from fallen Mauritia palms (Albert and Milliken 2009: 66; Chagnon 1992: 75). The Kichwa in the Ecuadorian Amazon likewise eat the grubs (Onore 2004). In some indigenous cultures, ingestion of suri is thought to boost human fertility. Among the Desana of the Uaupés in the Colombian Amazon, for example, men eat the grubs in the belief that it will increase their semen (Reichel-Dolmatoff 1971: 62). Grub eating appears to decline as one travels eastwards across the Amazon Basin. The Ticuna along the Solimões are fond of beetle larvae extracted from buriti palms (Lima 2006: 161), and the Nambicuara in Mato Grosso also eat the grubs (Oberg 1953: 92), but they are not commonly consumed in central and eastern Amazonia.

Fig. 47.19 Eating fried suri grubs (*Rhyncophorus palmarum*) in a street market. Mercado Belén, Iquitos, Loreto, Peru 5-9-03

Oil is extracted from the grubs and sold in bottles for medicinal purposes in some urban markets in the Peruvian Amazon, such as Pucallpa. Locals rub yellow suri grease on to the chest to treat congestion, a practice that likely arose among indigenous cultures. The Takana of the Bolivian Amazon, for example, rub suri oil on the chests of those suffering from coughs and bronchitis (Bourdy et al. 2000). In the central market of Puyo in the Alto Pastaza region of the Ecuadorian Amazon, a lady explained to me that she puts a single suri beetle in water, mixes them in a blender, then drinks the creamy concoction to treat bronchitis.

In the Orinoco delta, the Warao have traditionally extracted sago from the trunks of *Maurita flexuosa*, though the exotic taro (*Colocasia esculenta*) is now their main source of carbohydrates (Heinen and Ruddle 1974; Wilbert 1976). At one time, sago was a major item in the diet of the Warao, but the starch is still consumed in limited quantities. A Warao shaman signals the start of a festival to celebrate the harvest of the palm starch, which involves the use of sacred implements and instruments (Ruddle et al. 1978: 11). Although there are no records of extracting starch from buriti trunks in the Amazon, it is possible that some indigenous groups did so in the past.

A river dweller who lives near Afuá in the heavily forested northwest part of Marajó Island told me that rural folk used to fell miriti palms to obtain a sweet sap. Only male trees were felled for this purpose because the female ones apparently produce little if any sap. So gathering miriti "honey" did not apparently interfere with fruit production; enough male trees must have been left standing to provide pollen for the female palms. Known as *mel de miriti*, a basin was hollowed out in the fallen trunk for the sap to collect. The other name for the palm in Brazil, buriti, is derived from *dembyriti*, a Tupi-Guarani word that means "a palm that oozes liquid" (Martins et al. 2012). In Pre-Columbian times, the sweet sap of buriti was likely fermented in parts of the Amazon to provide a mildly alcoholic beverage, similar in many respects to mead from watered down honey or *pulque* obtained from the sap maguey (species of *Agave*) plants in Mexico. The Warao of the Orinoco prepare "mead" from the sap of *Mauritia flexuosa* (Lévi-Strauss 1952).

The practice of obtaining the sweet sap from the palm has diminished considerably. The introduction of sugarcane during the colonial period most likely dampened demand for Mauritia "honey". In the 1930s, however, rural folk on Marajó still occasionally cut down the palm to gather the sugary sap (Lustosa 1976: 388). But that practice seems to have stopped sometime in the mid-twentieth century in the Amazon. Many rural folk maintain a clump of sugarcane in their fields or home gardens to obtain the sweet tan-colored juice, or they purchase relatively inexpensive sugarcane products in stores.

Fig. 47.20 River dweller weaving a basket with strips obtained from miriti fronds. Rio Joroca on a floodplain island of the lower Tocantins River, Pará, Brazil, 7-2-07

Fig. 47.21 Baskets made from strips torn from buriti fronds. The baskets are serving as planting pots for spring onions. Caxiuanã River, Pará, Brazil, 11-9-95

In addition to the fruit and beetle grubs, Mauritia palm provides many other useful products, particularly fiber. Over two dozen uses have been recorded for Mauritia palm (Goulding and Smith 2007: 96; Hada 2010: 24; Henderson et al. 1991). In vicinity of Abaetetuba alone, river dwellers have 18 different uses for the palm (Hiraoka 1999).

In various parts of the Amazon and Orinoco Basins, indigenous people and other rural folk use fiber obtained from Mauritia palm fronds and strips torn from petioleds to make baskets, carry bags, manioc presses, mats, articles of clothing and hammocks. Xavante women, who live in scattered villages on the cerrado of the Upper Tocantins watershed, weave large mats with the palm fiber for sleeping and smaller ones to serve as a "table cloth" for food (Coimbra et al. 2002: 156). The Xavante use large buriti baskets for delivering game meat to the home of brides in a ritual known as "meat-basket weddings" (Welch 2014). The Mekranoti, who live in several villages in the forested interfluves between the Xingu, Iriri and Curuá Rivers, make mats and bags with buriti fiber; men weave a mat with buriti and cotton thread that they present to their brides (Verswijver 1996: 59).

In the early nineteenth century, women at São Gabriel da Cachoeira along the Upper Rio Negro wove hammocks with buriti fibers for sale downstream in Manaus and even as far as Belém at the mouth of the Amazon; they created distinctive figure designs in their hammocks using fibers colored with various vegetable dyes (Schomburgk 1840a). In the middle of the twentieth century, the Kamayurá in Mato Grosso employed buriti fiber to make some of their hammocks (Oberg 1953: 34). Similarly, the Mehinaku of the Upper Xingu continue to make hammocks with buriti twine (Pinagé et al. 2000). Nukak women in the Colombian Amazon still prepare fiber from the epidermis of Mauritia palm fronds to weave hammocks; the twine is colored orange-red using *Arrabidaea chica*, which is also used for face paint in northwestern Amazonia (Politis 2007: 217). The Piapoco in the northern part of the Colombian Amazon also make hammocks, as well as bags and hats, with Mauritia fiber (Mesa and Galeano 2013). However, coarse buriti hammocks are now encountered much less frequently in the Brazilian Amazon because softer cotton hammocks made in the Brazilian Northeast, especially Ceará, are widely available in stores.

Fig. 47.22 Fisherman lying in a hammock woven with buriti fibers. Canal das Tartarugas, Marajó Island, Pará, Brazil 5-17-01

In the nineteenth century, the Conibo (since merged with the Shipibo) who lived along the Ucayali in the Peruvian Amazon fashioned their bowstrings from aguaje twine (Marcoy 1873: 36). The Nambicuara of Mato Grosso still obtained twine from the emerging fronds of young Mauritia palms in the mid-twentieth century, and the Kamayurá made mats with twine obtained from buriti and cotton to store feathers used for making flights for their bows (Oberg 1953: 35, 94).

Strips torn from buriti petioles have long been used to make simple baskets for carrying or storing produce and to make *tipitis*, a sleeve-like press for squeezing manioc dough (Smith 1879: 384). The Kamayurá make baskets by using strips torn from the petioles of buriti leaves for carrying manioc tubers, fruits, and to hold cotton. The Jurúna of the Upper Xingu tear strips from the petioles to weave *tipitis* (Oliveira 1970). The Jurúna also make baskets from the strips. The Pumé who inhabit the llanos of Venezuela make baskets from moriche palm to hold flour obtained from the seeds of *Campsiandra angustifolia*, a wild tree (Stergios 1993). The Kayapó make a small basket made with strips of buriti leaflets to protect a calabash gourd that has been hollowed out to store small parrot feathers and down that is glued to bodies during ceremonies. Men make the gourd (*Crescentia cujete*) container which has a single hole at the top with a beeswax stopper, while women paint geometric designs on the bottom of the gourd (Verswijver 1995: 307–308). In the early twentieth century, the now extinct Nocamán in the Peruvian Amazon used to tear strips from the midribs (rachis) of the palm fronds to make brooms (Tessmann 1999: 100).

Fig. 47.23 Broom made with strips torn from midribs (rachis) of miriti fronds. Rio Joroca on a floodplain island of lower Tocantins River, Pará, Brazil, 7-2-07

For the Xinguano of the Upper Xingu, Mauritia palm is an important source of twine for making cordage (Heckenberger 2005: 199). The Apinajé, who inhabit the interfluve between near the confluence of the Tocantins and Araguaia Rivers, weave carry bags with the twine (Nimuendajú 1983: 75), as do the Tapirapé, who live at the confluence of the Tapirapé and Araguaia Rivers (Wagley 1977: 102). The Xerente who inhabit the Upper Tocantins make necklace strings and small baskets with buriti twine, and large baskets (*côfo*) by plaiting the palm fronds (Moi 2007: 112). In the interfluvial forests between the Xingu and Tocantins Rivers, the Kayapó also make various pouches with buriti fiber (Verswijver 1995: 325). Kayapó men make the pouches for use by women for storing seeds of annatto (*Bixa orellana*), which are ground and used for body paint and dyeing fibers.

The Kayapó make various ornaments, slings, and belts from the buriti fiber. For example, males make headdresses using the palm for their maize festival. The rachis of the fronds is removed, then the dried leaves are cut to 30–70 cm lengths and tied in the middle with buriti fiber. One or two macaw flight feathers are inserted in the tie and a buriti string is also attached to the knot to serve as a head band (Verswijver 1995: 163). The Kayapó also make small mats, 10–15 cm high and 6–10 cm wide, with buriti fibers which are worn on the back. The back mats are attached by string to the back of a necklace or simply tied around the neck. Pendants hang from the two bottom corners consisting of glass beads, polished palm nuts, and macaw body feathers. Small back mats worn between the shoulders are used exclusively by pubescent boys for one of the dances during the maize festival; the back hangers are made by the boys' fathers (Verswijver 1995: 218). Kayapó women use slings made with buriti fibers to carry their babies (Verswijver 1995: 239).

The Kayapó manufacture a wide variety of belts with buriti fiber, some of which have suspended ornaments of freshwater mussels, shells of tucumã (*Astrocaryum vulgare*) nuts, body feathers of macaws, toe nails of peccaries, or Brazil nut (*Bertholletia excelsa*) shells (Verswijver 1995: 273–275, 279). Some belts are worn by both sexes, others are reserved for men or boys. Belts with hanging pericarps of Brazil nuts, for example, are worn around men's ankles so that they rattle during dances. One belt has no ornaments and is worn exclusively by boys of the Gorotíre village during their initiation ceremony (Verswijver 1995: 278).

The fiber of *Mauritia flexuosa* is put to several other uses among indigenous peoples of Amazonia and the neighboring Orinoco Basin to the north. The Makuxi who inhabit the savanna region straddling Roraima in Brazil and contiguous Guyana fashion head bands from young fronds of the palm to help support baskets they carry on their backs (Schomburgk 1840b). The Erigpactsá of the Upper Juruena, a tributary of the Xingu, employ tufts of Mauritia palm fiber to cover their private parts (Mee 1988: 50), as do the Nambicuara in Mato Grosso (Rondon 1916: 327) and the Parintintin of the Madeira (Nimuendajú 1924). The Xavante fashion dance-masks with the fine fibers obtained from Mauritia palm fronds (Maybury-Lewis 1967: 116) as do the Karajá of the Araguaia River (Hartman 1967: plate 7). The dance masks of the Mehinaku in the Upper Xingu are made of wood, but buriti raffia hangs down from the masks to cover the dancer (Braun et al. 1995: 105). The Peba and closely related Yagua, who inhabit the lower Putumayo and Napo Rivers, make a skirt of fibers obtained from young fronds of *M. flexuosa* which is worn by men and women (Steward and Métraux 1948), although most Yagua have now abandoned such garments in favor of purchased clothes (Chaumeil 1987: 61). The Kichwa of the Upper Pastaza in Ecuador sometimes use elongated curtains of morete fiber to let light into their homes while providing some privacy. To make such curtains, Kichwa women boil morete fronds, extract the fibers, and then sun-dry them.

Fig. 47.24 A fringe of morete fibers serves as a curtain in some Kichwa homes. Canelos, Alto Pastaza River, near Puyo, Ecuador, 9-21-13

The ample fronds of *Mauritia flexuosa* are used for a variety of other purposes, including thatch on some occasions. The Wapishana who inhabit the savanna/forest ecotone along the border between Guyana and Brazil employ the fronds to thatch their communal houses and to obtain fiber for making hammocks, nets, and bags (Farabee 1918: 17, 26; Hada 2010: 31). The Apinajé sometimes make provisional hammocks while in the forest by intertwining the tips of buriti fronds (Nimuendajú 1939: 17). The Pumé who live in scattered groups in the llanos of Venezuela use the palm fronds to thatch their dwellings, make large baskets, and to obtain twine (Gragson 1995) while the Piaroa who live in another part of the Orinoco watershed also use the fronds for thatch (Rondón 2003). African-Brazilian communities inhabiting the cerrado in Goiás, in the headwaters of the Tocantins River, employ the fronds of buriti palm to cover their houses and huts for keeping their chickens safe at night (Martins et al. 2012). The Maijuna along the Sucusari River, a tributary of the Napo in northern Peru, use old, dry leaves of the palm to start fires in their cleared fields and to dry the hulls of their new dugout canoes (Gilmore et al. 2002, 2013).

The soft, balsa-like petioles of Mauritia palm are employed to make miniature boats for toys and religious purposes. At Terra Santa, a small town nestled at the juncture of the Amazon and Nhamundá Rivers, women fashion miniature rafts from the pithy petioles of buriti to honor Saint Isabel. In the evening of the 29th of June, when the festival (*Círio*) of Santa Isabel reaches its climax, dozens of the 20 cm-long rafts, decked with candles, are nudged on to the waters of the Amazon floodplain. This custom reflects the diverse spiritual traditions of the Amazon, which embrace African beliefs in a water goddess (Iemanjá), who is typically honored with candle-lit rafts on New Year's Eve in tropical parts of Brazil, as well as indigenous stories of female aquatic spirits (Iara) and Catholic Saints.

Fig. 47.25 Toy boats made from miriti petioles. The youngster's boats are on *top* of traps (*matapis*) for catching freshwater shrimp. Limoeiro River, affluent of the lower Tocantins, Pará, Brazil, 7-5-07

Mauritia petioles are extremely buoyant and are soft so that they can be easily carved to make toys, tied together to make rafts or coffins, or lit to make torches. The Nambicuara of Mato Grosso sometimes make a bundle of the midribs and place it under one of their arms to serve as a floatation device when crossing rivers (Rondon 1916: 327). Yanomama boys fashion small arrows from the petioles (Gertsch et al. 2002). Mayoruna fathers fashion arrows from the midribs of Mauritia palm fronds for their sons to practice their archery skills (Romanoff et al. 2004: 112). In the early twentieth century, baptized Apinajé were buried in coffins fashioned from buriti petioles (Nimuendajú 1939: 152). In the past, fishermen would sometimes use bundles of buriti petioles as torches while fishing at night, but now they use flashlights. During the rubber boom, tappers fashioned spouts from the petiole to channel latex into cups attached to rubber trees (Le Cointe 1922a; Stradelli 1889). In Acre, Brazil, rural folk use pieces of the petioles to make corks, bird cages, and traps (Campos and Ehringhaus 2003) and in Manaus, boys in poorer neighborhoods fashion kites using sections of buriti midribs for the frame because they are light.

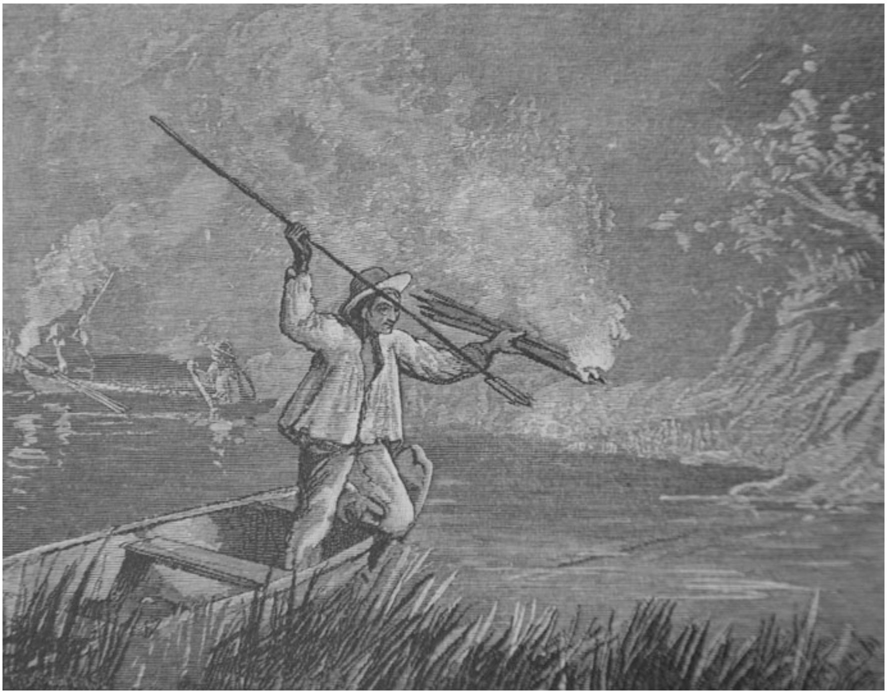

Fig. 47.26 Fishing at night near Santarém in the nineteenth century with the aid of a burning bundle of buriti petioles (Smith 1879: 164)

Some uses for the palm are unusual and may have dropped out of fashion. In the nineteenth century, for example, the Makuxi in the Rupununi watershed fashioned shoes from the leaf bases of the palm (Brown 1876: 108). When walking on stony parts of the Rupununi savannas, the Wapishana also fashion sandals using the fibrous and spongy base of the leaf base (Farabee 1918: 80). The Bororo of Mato Grosso construct giant wheels made with sections of buriti petioles which are bound together with twine obtained from the palm's fronds; these wheels, some 2 m high, are used in one of the tribe's sporting events (Lévi-Strauss 1994: 105).

The trunks of Mauritia palm are employed for log races by several indigenous groups who belong to the Gê linguistic family in eastern Amazonia, such as the

Xavante and the Apinajé (Maybury-Lewis 1967: 245; Nimuendajú 1939: 113). The palm is incorporated in Apinajé marriage ceremonies (Balick 1988). When a young Apinajé man wishes to marry, he must prove his strength by carrying a piece of *Mauritia flexuosa* trunk from the forest to the village. Upon arrival, he is surrounded by a circle of singing women. The sister of the bride and her godmother take the groom by the arm to greet the bride. They then share a meal, and the groom and bride are then considered husband and wife. Young Xavante men cut 1 m-long lengths of the palm trunk to carrying out their team races.

The Krahô in the upper Tocantins watershed have competitions in which teams of men carry trunks of the palm to attest to their prowess (Nascimento et al. 2009). The Krahô organize two teams for the buriti log races, and when the person carrying the log tires, one of his team mates takes over. Women also have similar races, though less frequently, as do children. Female and younger participants carry smaller sections of buriti trunk. Women race against another female team, never against men. The races are conducted on a variety of occasions, including the maize harvest and the arrival of the rainy season (Melatti 1976). In 1954, Harald Schultz (1909–1966), a German ethnographer, photographed a Krahô cemetery in which sections of buriti logs line the grave of the recently deceased person. The logs were used in relay races, as is common among tribes belonging to the Gê linguistic family. The log sections were placed around the grave to prevent pigs from rooting at the burial place (Augustat 2013: 45).

Another Gê group, the Canela, who live in a forest/cerrado transition zone in the eastern fringes of Amazonia, conduct daily relay races using buriti logs. These races take place in the mid-afternoon, usually when men are returning from work in the fields or a hunt (Crocker 1990: 124). It takes four men to lift the 100 kg section of buriti trunk on to the left shoulder of the first runner. To some extent such log races can be considered sport, and they certainly contribute to the fitness of participants.

In the Amazon estuary, entire logs of miriti palm are sometimes lashed together to form a raft to support heavy timbers that would otherwise sink on their way to a sawmill. The trunks also serve as convenient walkways from the port of river dwellers to the top of the bank; some cut steps into the log when the bank is steep (Smith 2002: 104). And in the mid-nineteenth century, Mauritia trunks replete with fronds were brought to the Trinidade square and sunk into the ground for the Corpus Christi festival (Bates 1863a: 90). The Mauritia trunks were used to construct a pavilion which was decorated with colored lamps and lined with red and white cloth.

Fig. 47.27 Traditional Kuikuro manioc grater on *right* with embedded "teeth" of Mauritia palm wood and the metal kind they use today on the *left*. Graters courtesy of Morgan Schmidt

The trunks of Mauritia palm have been used in the past to obtain hard wood for graters. The Kuikuro, for example, traditionally made the "teeth" for their manioc graters using slivers obtained from the freshly cut Mauritia palm. First, a soft wooden board was punctured in numerous places in the center using the long sharp teeth of the carnivorous "fish dog" or *peixe cachorro* (*Rhaphiodon vulpinus*). Then the jaw of a piranha (*Serrasalmus* spp.) was used to sharpen the hard, brown wood from the Mauritia palm before driving the slivers into the board. Today, though, the Kuikuro mostly use metal graters and the traditional ones are occasionally made only for the artisanal trade (Morgan Schmidt, pers. comm.).

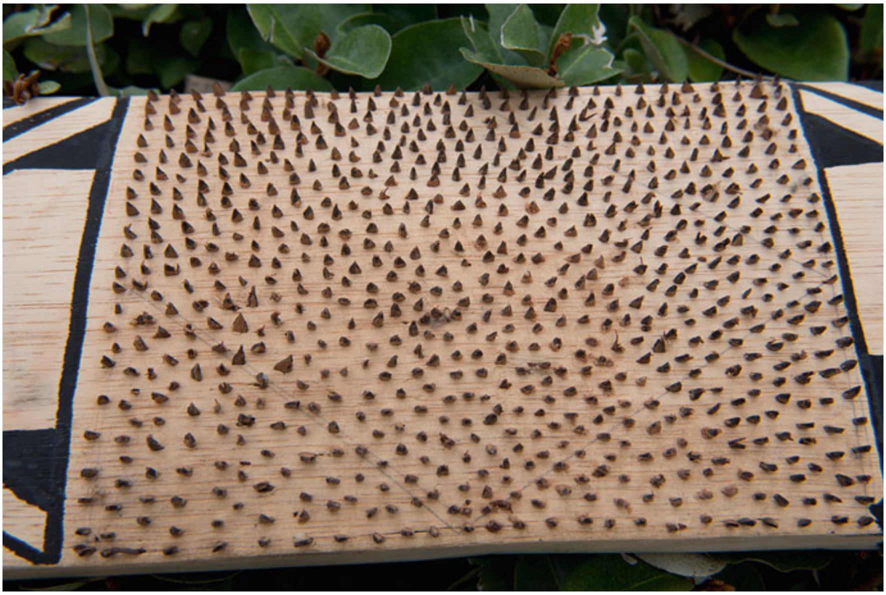

Fig. 47.28 "Teeth" of Mauritia palm wood embedded in a Kuikuro manioc grater made for the artisanal trade. Grater courtesy of Morgan Schmidt

Given the palm's widespread importance to people in the Amazon it is not surprising that a close association has developed between humans and Mauritia palm. *Mauritia flexuosa* sprouts readily from discarded seeds and indigenous groups have enriched their surroundings with this useful palm for a long time. Some Mauritia palm stands are partially anthropogenic, such as on Marajó Island (Schaan 2010). Interestingly at least one indigenous group recognizes that humans have influenced the distribution and density of the palm. The chief of one Yanomama village asserts that some of the Mauritia palm groves visited by his people to gather fruits were planted by their ancestors (Gertsch et al. 2002). The practice of planting Mauritia palm in home gardens and fields continues in many parts of the Amazon (Carrera 2000; Dole 1998; Padoch et al. 1985; Works 1990).

Fig. 47.29 Aguaje palms in home gardens. Some were planted while others arose spontaneously from discarded seeds. Buenos Aires, Pucate River, affluent of the lower Yanayacu, Pacaya-Samiria, Loreto, Peru, 7-12-10

In home gardens, the palm usually fruits within 7 years or so, and because there is less competition for light, the fruits are born closer to the ground and are thus easier to harvest. In a home garden in Monte Belo, a village along the Ucayali in the southeast corner of the Pacaya-Samiria National Reserve, for example, an aguaje planted 13 years ago produces fruits low enough for children to reach. Further downstream along the Ucayali, the Bora have identified a dwarf form of aguaje that fruits when barely a meter high. The Bora call this ecotype, which fruits within 5 years, *shapischico aguaje* (Delgado and Couturier 2003).

Fig. 47.30 Farmer weeding aguaje seedling interplanted with plantain on the floodplain of the Marañón River. Near Veinte de Enero, Pacaya-Samiria, Loreto, Peru, 7-22-10

With an eye to the growing market for aguaje fruits, some farmers in the village of Veinte de Enero along the lower Yanayacu River in the Pacaya-Samiria National Reserve have also begun to plant the palm in their fields (*chacras*). The palm can even survive when planted in upland locations, such as manioc fields in the vicinity of Lago Amanã along the lower Japurá.

Although some promising genotypes can undoubtedly be found under cultivation, the best way to promote increased production of Mauritia fruits for markets is through better management of wild stands. Swamps are not suitable for most development activities, so the palm's habitat is relatively safe. Large-scale planting of a single variety of Mauritia palm would most likely invite diseases and pest epidemics; at least eight insect species are known to attack *Mauritia flexuosa* (Vásquez et al. 2008).

Aguaje has not only worked its way into regional agricultural systems, but the palm has also permeated folklore. *Aguajales* are extensive swamps, often in remote locations, the perfect setting for supernatural entities. Chullachaqui is a short, human-like figure that roams certain parts of the forest, including aguaje palm swamps. His feet are deformed in various ways, depending on the story teller. One leg may end in a stump, or in the Brazilian Amazon where the mythical creature is called curupira, both feet may be turned backwards (Smith 1996: 43). Chullachaqui is a shape-shifter, sometimes turning itself into someone known to the victim in order to lead him or her astray.

The following supernatural abduction story involving chullachaqui was recounted by José Villacorta, a 52 year-old farmer, fisher, and gatherer of aguaje fruits in 2005. José was born in Miraflores, a village on stilts at the mouth of the Tigre River in the Peruvian Amazon, and has a family with two sons who help with farming and fishing tasks as well as the gathering of forest products. The story involves a youngster and his father who also live in Miraflores:

> Eleven years ago, a chullachaqui led eleven year-old Eduardo astray when he was gathering aguaje fruits with his father near Missión Cocha, not far from Miraflores. Chullachaqui tricked Eduardo into thinking it was his father beckoning him, and chullachaqui led him deep into the forest. This happened as father and son were heading out of the *aguajal* carrying sacks of aguaje fruits on their backs. When Eduardo's Dad reached the canoe which they would use to paddle home, he noticed his son was missing. Several residents of Miraflores helped Eduardo's father look for his son, but in vain. Three days later, Eduardo was spotted in a guaba tree by some people on their way to their *chacra*. He was found at a place called Solterito, several kilometers from the aguajal in which he had become lost. Eduardo was festooned with spines from the ñejilla palm and was covered with mosquito bites. Eduardo had to be taken to a shaman who blew tobacco smoke over him and performed other rituals to restore his faculties.

Aguaje features in other lore involving the shape-shifting powers of supernatural creatures. Juan Carlos Galeano, a Colombian poet, has recorded this fascinating tale along the Amazon River of his native country:

> **The Girl and the Anaconda**
>
> Once upon a time there was a girl who lived with her family near a pond that was full of fish and surrounded by fruit trees. Every day she would go to the pond and walk in waist deep water collecting aguaje palm fruit. Some afternoons she would sit sadly on a tree trunk on the banks of the pond feeling lonely. She didn't know that in that very place there lived an anaconda that had fallen in love with her.
>
> One day he appeared in the form of a handsome young man. He began courting her and she fell so deeply in love with him that each day she spent more and more time with him. Every day at noon she would go to the pond and knock three times on a gourd to call him, *toc-toc-toc*. Then she would wade into the pond and the young man would wrap himself around her waist and they would lie embracing each other until dusk. Every day she would return home with aguaje fruit that she collected and many fish that the anaconda had given her.
>
> Her parents and little brothers and sisters were very pleased with the fish, and they asked how she always managed to get such delicious tucunarés and pacos. The girl said she caught them with hooks and nets forgotten by a fisherman that she found on her way to the pond.
>
> Her older brother didn't believe her, so he followed her and secretly watched her call the anaconda with the gourd, *toc-toc-toc*. After a few days her brother took the gourd and went to the pond with some neighbors and himself called the anaconda, *toc-toc-toc*. When the anaconda heard the three knocks of the gourd, he was convinced it was the girl and stuck his head above the water. The brother and his friends threw harpoons and fired guns at it.
>
> The next morning when the girl called her lover, the anaconda did not appear. Finally she found his dead body floating in the pond. She was heartbroken and went back to her mother, crying and confessing everything about her lover and the fish she had been bringing home. She also confessed to her mother that she was pregnant.
>
> The people of the settlement wanted to condemn her to live alone in the deep forest, but her parents took pity on her and allowed her to live with them. Nine months later the girl gave birth to several very pretty anacondas. Hearing the baby anacondas crying like humans, her parents were glad they hadn't kicked her out of the house. They built little

> wooden boxes for cradles and helped their daughter raise them until they were old enough to live in the pond. If at any time the infant anacondas got hungry and cried, the young woman would take them to the aguaje grove in the pond to feed them. Some time passed and the anacondas were able to survive on their own, but they never forgot their mother. Every morning their mother and her family would find fresh fruit piled in the family's dugout near the shore. The family was delighted with these gifts of the grown-up anacondas to their mother.
>
> This all happened long ago. Nowadays, people don't allow their daughters to go alone to the nearby rivers and ponds, for they say they don't want to take care of children who don't look like humans. (Galeano 2005: 46)

This erotic tale embodies a common theme in many legends and folk stories in the Amazon: women copulating with snakes (Chernela 1988; Roe 1982: 56). In this particular tale involving an *aguajal*, one senses the fertility of the aguaje grove and the sexual potency of the anaconda. Among the Wawai of the Upper Essequibo, anacondas symbolize river fertility as well as sexuality (Fock 1963: 97).

Mauritia palm is featured in a variety of roles in other indigenous lore both in Amazonia and the neighboring Orinoco river system. The Makiritare of the Upper Orinoco, for example, recount a myth involving a massive flood that covers the earth. A couple of boys escaped, however, by climbing two side-by-side Mauritia palms and building a platform between them. The boys snacked on the palm fruits until the waters finally subsided (Civrieux 1980: 80). In a myth of the Kamayurá who inhabit the Upper Xingu, Mavutsinim, the first man on earth, made girls out of logs but he noticed that after his incantation, the logs turned into girls with no hair or teeth. So he went into the forest to gather some buriti fiber for their hair (Villas Boas and Villas Boas 1975). The Mehinaku of the Upper Xingu recount a myth about a man and his four brothers embarking on a night of fishing using a torch fashioned from a dry buriti frond. The men chase a fish that leads them up into the river in the sky, the Milky Way (Stang 2009: 62).

Another indigenous group of the Upper Xingu, the Baciarí, recount a legend involving the twins Keri and Kame who did not know how to sleep, so their aunt suggested that they seek out Po, the lizard, who owned sleep. Po received Keri and Kame graciously and invited them to lie down in a hammock made with buriti fiber where they fell asleep. The next day the twins felt better and departed Po's residence with the hammock. They soon grew tired walking along the path and lay down in the hammock. But they could not sleep. So they returned to Po's house, caught the lizard, and pulled out his eyelids. Armed with the lizard's eyelids, the twins were then able to sleep (Oberg 1953: 79).

Buriti features in several myths recounted by the Kayapó who inhabit scattered villages in the interfluvial forest between the Xingu and Tocantins. In one such myth, a group of Kayapó encounter the daughter of rain on one of their seasonal treks. One boy went ahead so he could have some privacy while going to the bathroom when he noticed a girl sitting on the buttress root of an enormous tree. He ran back to tell the others and the group came and took the daughter of rain back to their village. There she was eventually adopted, had her hair cut in the Kayapó style and her body painted with red annatto (*Bixa orellana*) and black genipap (*Genipa americana*) dyes, and got married. But after a while, the men were having no luck hunting and the women were encountering few forest fruits. The villagers grew increasingly hungry. So the daughter of rain remarked that food was abundant where she came from in the sky. Her husband suggested that she return to her parents above to obtain some food. To help her accomplish that task, he took his wife to a savanna where he bent back a buriti palm and invited his wife to climb on to the crown of the tree. Then he released the trunk and the daughter of rain was catapulted into the sky. The husband then laid down in the shade of the buriti palm and waited her return. After a while, the daughter of rain return with an armload of sweet manioc, sweet potato and other tasteful items and they both returned to the village (Lukesch 1976b: 94–97).

Some of the more economically important plants in the Amazon are deemed to harbor spirit protectors. Such is the case with buriti among the Ticuna who live in numerous villages spread out along the Solimões in Brazil and contiguous areas in the Colombian and Peruvian Amazon. The Ticuna population is growing and these riverine people are making an effort to record their cultural beliefs. Old timers, for example, recount the exploits of Wüwürü, owner of buriti stands. This fearsome bald-headed creature with strong teeth, long sharp nails, and a pair of prominent spurs on each heel tickles people to death and then eats them. This capricious, boy-like figure weeds buriti stands and gathers the fruits (Gruber 1997: 29). The Wawai of the Upper Essequibo believe that aguaje palms embody spirits that can cause illness to anyone harming, or even mocking, the palms (Fock 1963: 97).

Mauritia palm groves are the haunts of another supernatural entity according to the Tukano who inhabit northwest Amazonia along the border between Colombia and Brazil. In 1940, a 70 year-old Tukano Indian at the Pari Falls along the Tiquié River, an affluent of the Uaupés, told a Salesian Missionary about how some Tuiuca (Tuyuka) Indians along that river became woolly monkeys:

> Many Tuiuca went to gather fruits in a large *miritizal* where they had an encounter with Uaktí, the devil. The Indians were so busy gathering up the miriti fruits that they did not notice that the day was ending and there was not enough time to get out of the forest before night fall. So they decided to sleep in the forest. While they were sleeping, Uaktí crept up and blew on their eyes, thereby blinding them. One Tuiuca, however, was still awake, and the devil left him alone.
>
> In the morning, upon waking up they could not see anything. So they complained that the night seemed endless and that day would never break. The Tuiuca who was not blind told the rest what had happened. They began to shout and cry, asking their companion who could see whether he could lead them home. So he cut a liana and told his blind companions to secure the liana and follow him. While holding on to the liana as they walked, the blind ones cried out:
>
> "What will our wives think when we arrive home? Oh what shame will befall us? We will be laughed at. It would be a good idea to insert fake eyes, because without them we will be very ugly."
>
> They asked their companion leading the way to look for a seed that resembled a human eye. So he went to look for such a seed, and gave two to each of the blind men to put in their eye sockets; but when they picked up the vine to continue on their journey home, the leader cut it and fled, leaving the blind men in the forest. They then all began to climb up trees and began to shout:
>
> Au! au au! And thus they became woolly monkeys. (Giacone 1949: 104)

Petioles of the palm figure prominently in a ceremony celebrating the firstborn among the Kayapó. Buriti represents strength, toughness, and greatness and these properties are mystically transmitted to the newborn during the ceremony. Relatives of the newborn gather petioles in 3 m lengths and then paint them with red annatto (*Bixa orellana*) paste and also attach ornaments. Relatives paint their bodies black with dye obtained from fruits of *Genipa americana* as well as charcoal; a red circle is painted with dye obtained from crushed annatto seeds. Participants then enter the open space of the village each carrying a painted petiole of *Mauritia flexuosa*. They sit on the ground in front of the men's house and face the open village square; the petioles are placed across the knees and participants place their elbows on the petioles and support their chins with their hands. The presence of the petioles near the newborn during this ceremony transfers strength to the baby (Lukesch 1976b: 276–277).

The Ticuna affirm that unless tribal members eat the grubs of the palm beetle extracted from buriti trunks, they are not sanctified and cannot reach Évare, a sacred place (Lima 2006: 161). The Witoto believe that malevolent spirits shoot darts fashioned from the spines of chambira (*Astrocaryum chambira*) palm into their human victims. A shaman attempting a cure must fast on the previous day, drinking only a beverage prepared with fruits of *Mauritia flexuosa*. The juice of Mauritia palm fruits enables the shaman to use his magic powers to counteract the evil brought on by the darts (Schultes 1974). And Cubeo shamans of the Upper Uaupés watershed make small boxes from leaf strips of *Mauritia flexuosa* to contain quartz crystals that they use to summon lightning strikes (Allen 1947).

Mauritiella armata

48

Bolivia: Palmilla
Brazil: Caranaí, caraná, buritirana
Colombia: Zííyaña, yumuna (Witoto)
Peru: Aguajillo; bɨe ne ñi (Maijuna)
Venezuela: Moriche negra; caraña (Yekuana), kohere (Yanomama)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_48

Fig. 48.1 Aguaje (*Mauritia flexuosa*) palms interspersed with clumps of smaller aguajillo (*Mauritiella armata*) along a stream. Opposite Tamshiyacu, Loreto, Peru, 6-18-06

Two species of *Mauritiella* are currently recognized. *Mauritiella aculeata* is restricted to black waters in the middle and Upper Rio Negro watershed, while *M. armata* is widespread in wetlands throughout the Amazon Basin, the Guianas and northeastern and central Brazil (Henderson 1995: 77; Ferreira and Stohlgren 1999). Both are slender with fan-shaped fronds similar to Mauritia palm (*Mauritia flexuosa*), only with shorter trunks and smaller leaves. Furthermore, the trunks are armed with spines: hence the species names *armata* (armed) and *aculeata* (sting). Unlike *M. flexuosa* though, *Mauritiella* palms are multi-stemmed and usually found in clumps. Both species of *Mauritiella* produce edible fruits.

Fig. 48.2 A clump of *Mauritiella aculeata* along a black water river. Rio Tiquié, affluent of the Uaupés, Amazonas, Brazil, 10-26-12

Known as aguajillo in Peru, *Mauritiella armata* thrives along streams, the margins of lakes, swamps, and seasonally-flooded savannas up to 900 m in the foothills of the Andes. Aguajillo fruits are scaly like those of aguaje, only smaller and are pale orange rather than deep orange or red. People use their teeth to peel the thin skin before eating the lime-yellow pulp that surrounds the single reddish-brown seed. The fruits are also made into juice, such as on Marajó Island at the mouth of the Amazon.

Fig. 48.3 Aguajillo (*Mauritiella armata*) fruits in a street market. Mercado Belén, Iquitos, Loreto, Peru, 6-21-06

The fact that aguajillo is armed with sharp conical spines rules out any of the "sustainable" fruit harvesting methods that are being promoted for aguaje (*Mauritia flexuosa*) in Peru. Although not as tall as aguaje, aguajillo still reaches some 20 m, so it is not practical to use poles to cut or knock down the fruits. Fruit gatherers typically chop down aguajillo with an ax or even a machete because the trunks are so slim. Fruits that have evaded parakeets fall to the ground when ripe, where they can be picked up and eaten as a snack. But most aguajillo fruits entering markets come from trees that have been felled.

Fig. 48.4 Shopper testing an aguajillo fruit in a street market. Mercado Belén, Iquitos, Loreto, Peru, 6-21-06

Aguajillo produces fewer fruits than aguaje, with only one fruit bunch containing several dozen fruits, in contrast to the thousands of fruits that can be encountered on a single aguaje palm (Smith et al. 2007: 76). In the Peruvian Amazon, aguajillo fruits enter urban markets from May through August, spanning the tail end of the rainy season and the beginning of the dry season. Near Manaus, caranaí is in fruit in December at the beginning of the rainy season. Given the palm’s extensive range, it is not surprising that some trees are bearing fruit in the rainy season, while other produce fruit during the drier period. Known as caranaí or caraná in the Brazilian Amazon, the fruits turn up occasionally in the street markets of Belém (Cavalcante 2010: 93).

Fig. 48.5 River dweller gathering fruits of *Mauritiella armata* after felling the palm. The silvery undersides of the fronds are characteristic of this water-loving palm. Rio Nahuapa, affluent of the lower Tigre, Loreto, Peru, 7-2-06

Mauritiella armata forms clumps of up to a dozen palms on seasonally flooded savannas, especially on sandy soils, such as in the vicinity of Mosqueiro and in the Tauá watershed on Marajó Island, both in the Amazon estuary. Organic matter from fallen fronds tends to pile up at the base of the palms, thereby providing a drier platform for other plants less tolerant of flooding to colonize wetlands (Smith 2002: 106). In this manner, *Mauritiella armata* is a pioneer species in seasonally flooded savannas, eventually giving way to forest provided that fires are not too intense.

Fig. 48.6 Orange aguajillo (*Mauritiella armata*) fruits and red aguaje (*Mauritia flexuosa*) fruits in a street market. Mercado Belén, Iquitos, Loreto, Peru, 6-21-06

49 Oenocarpus bacaba

Brazil: Bacaba, bacabão; kohto (Kanamari), uêdndü (Nambicuara), ñumu mahka (Tukano), ñomʉ (Tuyuka), nyümü (Wanano), kumú (Wayana), hoko, hokoma (Yanomama)
Colombia: Seje pequeño, kumbu, patabá, milpesillo; nyomʉ (Barasana) ñomü (Makuna), yáab butu (Nukak), pubéri (Piapoco), izɨna (Witoto), tónči (Yagua)
Suriname: Kumu (Trio)
Venezuela: Palma de vino, seje, sejito, seje pequeño; pouri (Piaroa), kujedi (Yekuana), hoko (Yanomama)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_49

Fig. 49.1 Bacaba (*Oenocarpus bacaba*) spared when the farmer cleared his field in secondary forest dominated by *Cecropia* (on *right*). Boa Esperança, Lago Amanã, Amazonas, Brazil, 9-20-12

The wine palms (*Oenocarpus*), similar to *Astrocaryum*, *Bactris* and *Geonoma*, encompass a large number of species that are useful to rural and urban folk in Amazonia. Named after the Greek word for wine, all nine species of *Oenocarpus* occur in the Amazon Basin in both wetlands and upland forest and at least five provide useful products, especially fruit. *Oenocarpus bacaba* is found mostly north of the Amazon River, and its range extends into the Guianas, the Orinoco watershed, and as far west as the Colombian Amazon (Henderson 1995: 115). It is abundant a little south of the Amazon River in several places, however, such as in the vicinity of Tefé and along the lower Maués River. Known as bacaba in Brazil, this palm is usually found in upland forests but it is also occurs occasionally on higher parts of floodplains, such as along the upper Juruá (Campbell 1992).

Fig. 49.2 Descending a bacaba (*Oenocarpus bacaba*) tree with fruit in old secondary forest. The climber has padded his chest to prevent abrasions. Itapirapanema, Lago de Tefé, Amazonas, Brazil, 8-25-12

In the Tefé area, bacaba is often found in association with Brazil nut (*Bertholletia excelsa*) trees in old secondary forest. Both Brazil nut trees and bacaba palms are favored when patches of forest are periodically cleared to grow crops and the fields are then left to fallow. A bacaba gatherer told me of a harrowing experience he had 1 day which underscores the propensity of bacaba and Brazil nut trees to grow in the same area. Atemir, a 30 year-old river dweller, recounted a perilous incident with a harpy eagle (*Harpia harpyja*) while he was gathering bacaba fruit in forest along Igarapé de Itapiranema, a stream that flows into Tefé Lake. He was up a bacaba palm near a Brazil nut tree when he was attacked by a harpy eagle. He swiped at the swooping bird with his machete, and nearly lost his grip. Fortunately, his brother was with him on the ground and he kept the harpy eagle at bay using a catapult. His brother shot little clay balls at the bird every time it approached Atemir. The brothers had dried the clay balls in the sun the previous day and had brought them along to shoot down a few bacaba fruits to make sure that they were sufficiently ripe before climbing. Atemir concluded that the slingshot saved his life "*a baladeira foi a salvação*". The brothers surmised that the harpy eagle had a nest in a nearby Brazil nut tree and decided to move on.

Fig. 49.3 Stripping off fruits of *Oenocarpus bacaba* on to a cloth in old secondary forest. Itapirapanema, Lago de Tefé, Amazonas, Brazil, 8-25-12

The ranges of *Oenocarpus bacaba* and a palm with similar fruit, *O. distichus*, overlap on Marajó Island at the mouth of the Amazon. The latter is restricted to eastern and southern Amazonia and can be easily distinguished in the field from *O. bacaba* because the fronds are distichously arranges, that is the fronds emerge in a flat plane from opposite sides. The fronds of *O. bacaba*, on the other hand, grow fountain-like in all directions. The range overlap on Marajó may be a human artifact. I have seen both species together only in home gardens, such as in the community of Nossa Senhora da Luz along the Tauaú River, an affluent of the Parauaú near Breves in southern Marajó Island. *Oenocarpus distichus* may be native to Marajó, but *O. bacaba* might have been brought to the island from Amapá, possibly in pre-contact times. Humans have altered the "natural" distribution of economic plants in Amazonia for millennia. Another clue to the agency of people in the distribution of bacaba is that the palm has a close affinity with many Amazon Dark Earths, the sites of ancient indigenous villages (Clement et al. 2003; Hiraoka et al. 2003).

Fig. 49.4 Carrying fruits of *O. bacaba* in an old secondary forest. Several bacaba seedlings are growing nearby. Itapirapanema, Lago de Tefé, Amazonas, Brazil, 8-25-12

Bacaba is not exceptionally tall, generally less than 22 m, and is not armed with spines. Teenagers and young adults generally shimmy up the tree using a footsling to harvest the fruits, though in some areas, such as along the Guaviare River in the Colombian Amazon, people are beginning to cut the palm down to obtain the fruits (Mesa 2011). The Waimiri-Atroari, who inhabit the forest north of Manaus, also typically fell bacaba palms to gather the fruits (Milliken et al. 1992: 27). Bacaba bears fruit when only a few meters tall if it is growing in a well-lit environment, such as a home garden. The round fruits, approximately 1.5 cm in diameter, are born in horse-tail bunches containing several rachillae that are about a meter long. Dozens of purple fruits thus adhere to a single bunch. The fruits are stripped, soaked and then mashed by hand to make a tan-colored juice. The Victorian naturalist Alfred Russel Wallace held bacaba juice in high esteem, comparing it to “filberts and cream” (Wallace 1853: 29).

Bacaba fruits appear occasionally in street markets, such as in Maués in the Brazilian state of Amazonas were the fruits were being sold in 2-l plastic bags containing about 1.5 kg of fruit for the equivalent of US$ 0.42 in November 2002. In the nineteenth century, people living in the vicinity of Santarém used to extract oil from bacaba pulp to light their lamps (Spruce 1853a), but kerosene has since replaced turtle and bacaba oil in household lamps in the Amazon.

Fig. 49.5 A spontaneous seedling of *Oenocarpus bacaba* in a manioc field. The farmer has spared the palm because it will eventually produce edible fruit. Boa Esperança, Lago Amanã, Amazonas, Brazil, 9-20-12

Bacaba fruits are widely appreciated, so the palm is generally left standing when forest is cleared for fields, such as in the vicinity of Murumuru in the Municipality of Santarém. The Sateré-Maué further also leave the palm when clearing forest to plant guaraná (*Paullinia cupana*) which they plant to produce a stimulating beverage. Bacaba then becomes part of agroforestry plots that often contain a mixture of wild and cultivated plants. Bacaba is a welcome addition to fields because it fruits during the dry season when both wild and cultivated fruits are less abundant.

Fig. 49.6 Saterê-Maué girl with bacaba fruits in a calabash bowl. Igarapé Aruã, Urupadi River, an affluent of the Maués, Amazonas, Brazil, 11-16-02

Forest clearing for fields which are then eventually abandoned can actually enhance bacaba fruit production. Bacaba palms that arise spontaneously in fields, evidently dispersed by birds or mammals, are spared. Established bacaba palms along the forest edge produce more fruit because of increased light (Brum et al. 2008). In traditional slash-and-burn agriculture, cleared areas eventually return to forest, so bacaba populations may increase over time.

Fig. 49.7 A line of bacaba palms in fruit in a pasture near an archaeological site. The small-scale rancher spared the palms when he cleared the secondary forest to plant the pasture. A dense stand of inajá (*Attalea maripa*) palms in the background are also a testament to the long history of human occupation in this area. Near Silves, Amazonas, Brazil, 11-11-12

Palatable heart-of-palm can be extracted from several palms in Amazonia, especially açaí *(Euterpe oleracea* and *E. precatoria*), and at least one indigenous group, the Yanomama, obtain palmito from bacaba (Anderson 1977). The Yagua who inhabit the lower reaches of several affluents of the Amazon River in Peru between the mouth of the Napo and Leticia express juice from bacaba palmito to treat scorpion stings and bites from poisonous spiders. The liquid is applied directly to the wound several times a day (Chaumeil 1998: 314).

The strong wood of bacaba is also put to several uses. The Yanomama employ bacaba wood to fashion bows (Albert and Milliken 2009: 58; Saffirio and Scaglion 1982). The hard wood is also used for house posts and joists in some areas, such as among the Ticuna who live along the Solimões (Lima 2006: 160) and among the Yanomama (Gertsch et al. 2002).

In some areas, women weave strips torn from petioles of bacaba into a sleeve-like press (*tipiti*) for squeezing manioc dough. In 1996, I watched a farmer who lives in Flexal, a village on the northern edge of the Amazon floodplain in the Municipality of Óbidos, make a bacaba *tipiti* for a neighbor in a little over an hour. She earned the equivalent of US$5 for her trouble. Bacaba *tipitis* are also made in the vicinity of Juriti on the southern bank of the Amazon in Pará.

Fig. 49.8 Farmer weaving a *tipiti* to squeeze manioc dough using petiole strips from a bacaba palm. Flexal, near Óbidos, Pará, Brazil, 5-24-96

The fronds are occasionally fashioned into rudimentary baskets for carrying produce or small animals, such as among the Kanamari who inhabit the middle Jutaí River in southeastern Amazonas state (Carvalho and Reesink 1993), the Ticuna along the Solimões, (Lima 2006: 160), the Wayana in the northern part of the Brazilian Amazon (Velthem 1998: 89), the Tuyuka in northwestern Amazonas (Ramos 2012: 93), and the Piaroa in the Orinoco watershed (Rondón 2003). A century ago, the Pareci who still live in several villages in northwestern Mato Grosso, made fans, the shape of butterfly wings, with leaflets of bacaba palm (Roquette-Pinto 1950: 143).

The Yanomama in northern Brazil employ the young fronds in certain dances (Albert and Milliken 2009: 104) and the women fashion ear ornaments from fresh leaflets for use during women's initiation rites (Gertsch et al. 2002). In Surinam, the Trio attach fronds of the palm to the ridge of their homes which are thatched with

Geonoma baculifera fronds (Mans 2012: 56). The Ticuna employ the fronds to cover their huts (Lima 2006: 160).

Bacaba fruits have long been appreciated in the Amazon and the palm has infiltrated regional lore. In 1940, a 70 year-old Tukano at the Pari Falls along the Tiquié River in northwestern Amazonia recounted to a Salesian priest how some of the Makú were transformed into peccaries. Although the Makú cultivate a few crops, the bulk of their food comes from game, fish, and fruits and nuts gathered in the forest. The story involves a Makú *pagé*, or shaman:

> Once some Maku Indians were walking in the forest, looking for fruits to eat. Their *pagé* found a large bacaba tree with a lot of ripe fruit, with the fruit bunches so heavy they touched the ground. He cut just one fruit bunch which was enough to fill his basket. He took the fruits to a stream, washed them thoroughly and then gave them to the other Maku who happily ate the fruit. As this *pagé* brought his basket full of the fruits each day, the other Maku asked him where he was getting so many bacaba fruits. The *pagé* showed them a large bacaba tree and told them that they should wash the fruits well before eating them. Very happy, the Maku went to gather the bacaba fruits, but they forgot to wash them, instead eating them as they gathered them. . .and thus they were transformed into peccaries. This is why peccaries always travel in bands, just as the Maku walk in groups (Giacone 1949: 108).

And the Tuyuka, who also inhabit parts of the Tiquié watershed, recount a myth that also features bacaba. It concerns the Sloth God who objects to a snake that transforms into a toucan and periodically flies off from its abode on a hill:

> Near the house of the snake-toucan there was an island. There Sloth God created a bacaba tree, and hid nearby to kill the snake-toucan. When the snake-toucan arrived to eat the bacaba fruits, Sloth God blew a blowgun dart at the snake-toucan, thereby killing it. (Ramos 2012: 103).

Bacaba also surfaces in Ticuna lore about a hunter who recruited several wives. One of the wives was acquired in the following manner. The man went out to hunt and came upon a bacaba palm in fruit. An arapaço bird (a woodcreeper, *Nasica* sp.) was sitting in the fruit cluster. “Let me have a bowlful of your bacaba juice” pleaded the hunter. When he returned, a pretty girl offered him a bowl of bacaba juice. He drank it and took the girl home to be his wife. The girl was indeed pretty, but her feet were repulsive. The hunter’s mother remarked “My son, couldn’t you find a better woman than this one who has such ugly feet?” Because of her mother-in-law’s reaction, the girl did not wish to remain in the hunter’s home (Nimuendajú 1952: 151).

The notion that certain trees, including some palms, harbor spirits is widespread among indigenous peoples of lowland South America. The Waiwai, a Carib group who inhabit the Mapuerá and the upper Essequibo rivers in Guyana, believe that bacaba trees have a spirit protector. Anyone who strikes or tries to destroy a bacaba tree risks becoming ill, with symptoms such as stomachache and vomiting (Fock 1963: 20).

Oenocarpus bataua

50

Bolivia: Majo; itsama (Chácobo)
Brazil: Patauá, bacabão; ponama (Baniwa), toda (Kanamari), isan (Matis), ñumu pahka (Tukano), wakarika (Tuyuka), kõanari, koanani (Yanomama)
Colombia: Milpesos, seje grande, patabá; nyumu-nyu (Desana), wakarika (Makuna), yáab (Nukak), punama (Piapoco), komáiña (Witoto), semëse (Yagua)
Ecuador: Ungurahua, milpesos, kunkuk; shihua (Kichwa), tsákomak (Sápara), kunkúk (Shuar), gõsa (Siona-Secoya), petohue (Waorani)
Guyana: Turu palm
Peru: Ungurahui; shímpi (Aguaruna), sheeja (Ashéninka), koóme (Bora), ngúndzi (Candoshi), isan (Cashibo), sega (Machiguenga), ósa (Maijuna), isan (Mayoruna), manáka (Quijos), itá (Shipibo)
Venezuela: Seje grande; yáaru (Baniwa), punamá (Curripaco), kajse' (E'ñepa), uli ba'de (Jödi), kunwada (Pemón), kaemaewae (Piaroa), muhi (Winikinarao), haprua, hapruawë (Yanomama), kuhedi (Ye'kuana), patawá (Yeral)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_50

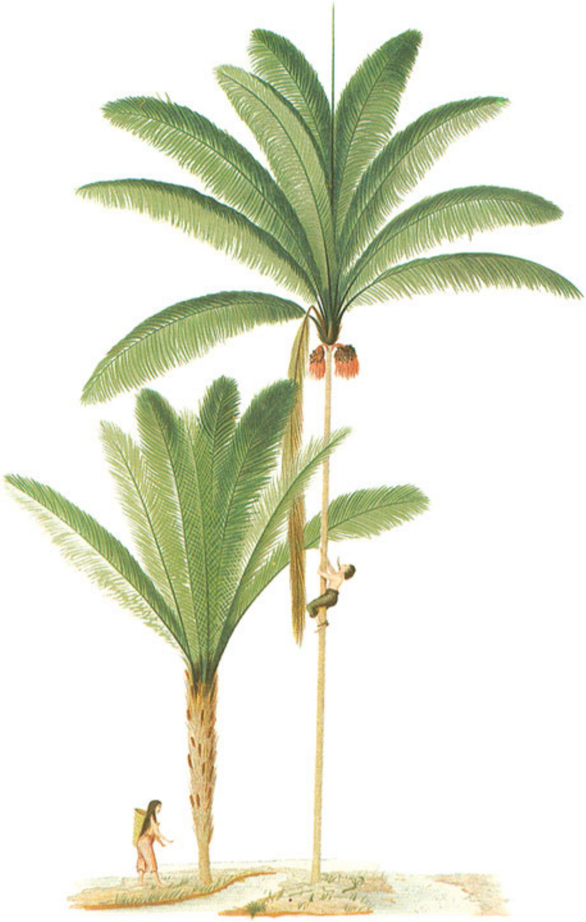

Fig. 50.1 Man climbing a patauá (*Oenocarpus bataua*) palm to gather the fruits (Rodrigues 1903: plate 41)

Oenocarpus bataua is distinguished by its massive fronds and is rivaled only by jupati (*Raphia taedigera*) with respect to leaf size. The fronds of *O. bataua* splay out in all directions and reach 9 m long, whereas those of jupati can attain 12 m. The ranges of the two palms overlap in the Amazon estuary, and it is easy to distinguish between them because jupati is shorter and has arching, coppery leaves, whereas *O. bataua* is tall with stiff, dark green fronds.

This elegant palm grows in secondary and mature forests in both uplands and on floodplains throughout the lowlands of northern South America, reaching as far north as Trinidad and eastern Panama. The palm flourishes on the higher parts of floodplains of all water types, from muddy to black and clear (Navarro and

Maldonado 2004: 63). Although the palm is not common above 1,000 m, it is found as high as 1,400 m on steep slopes near streams in some Andean valleys (Kahn and Moussa 1994).

At the mouth of the Amazon, patauá grows along clear and black water streams, rather than along the muddy banks of the Amazon and its side-channels. It is thus confined to the interior of estuarine islands. In some areas of the Amazon Basin, such as along the sediment-charged Purus, *Oenocarpus bataua* forms extensive stands called *patauazais* where densities reach 300 palms per hectare (Clement et al. 1997). Thick stands of the palm are also found on patches of sandy soils subject to water logging inland from Jenaro Herrera on the Ucayali River and in the vicinity of Manaus at the mouth of the Rio Negro in Brazil (Kahn and Granville 1992: 57, 66, 68).

The purple fruits are larger and more elongated than other edible fruits in the genus and are harvested by felling the tree or climbing the trunk, which can soar some 25 m. *Oenocarpus bataua* is generous, providing between 1,200 and 2,200 fruits per tree (Kahn 1991). In the Amazon estuary and the vicinity of Santarém along the middle Amazon, the fruits are ready for gathering in the dry season which stretches from July to November. The large olive-sized fruits, some 2.5–4.5 cm long and 2–3 cm wide, are gathered using a footsling or, in some cases, by chopping down the tree (Mesa 2011: 108). Although cutting the palm is quicker and safer than climbing, it can lead to a reduction in fruit availability in the area if practiced frequently. On the other hand, the fallen trunks are used by the palm beetle (*Rhynchophorus palmarum*) to lay their eggs. The resulting thumb-sized grubs are widely appreciated in Amazonia, especially in the western part.

In the Peruvian Amazon, where the palm is known as ungurahui, fruiting patterns of the palm differ somewhat from those found at the mouth of the Amazon. At Iquitos, for example, ungurahui fruits can be found in the Belén market in early May at the tail end of the rainy period, as well as in August during the dry season. In some areas of the palm's vast range, such as in parts of Ecuador and the Guianas, the palm fruits twice a year, whereas in other places the palm fruits every other year (Henderson 2002: 106).

Fig. 50.2 Mashing patauá fruits to make juice in the spathe of an inajá (*Attalea maripa*) palm. São Vicente, Fazenda Mangueiras, Croarí River, Chaves Municipality, Marajó Island, Pará, Brazil, 11-24-02

The ovoid fruits are used to make a calorie-laden and protein-rich drink, the equal of any "power" smoothie. The juice is prepared by first soaking the fruits in water for about an hour. Without pouring out the water, the fruits are then mashed by hand in a bowl and the liquid is then passed through a sieve to remove the seeds. In the Brazilian Amazon the sieve is typically fashioned from the petioles of moisture-loving arumã (*Ischnosiphon obliquus*). The juice is then poured through a finer sieve, sometimes of nylon, to remove bits of skin and other particles before drinking.

Fig. 50.3 Schoolboy drinking ungurahui juice purchased from a street vendor. The urn with the *white* spigot contains ungurahui juice while the other contains *chicha morada*, an unfermented drink made with a purple variety of maize. Nauta, Marañón River, Loreto, Peru, 6-11-04

Purple-tan colored ungurahui juice is drunk straight or mixed with sugar. Some stir in manioc flour, for an even more filling beverage that quickly satisfies hunger for several hours. In the eighteenth century, a Jesuit missionary who worked in the Peruvian Amazon noted that the juice was sometimes mixed with ripe plantain for a satisfying meal "*engaña mucho el apetito*" (Maroni 1988: 163). The savory juice of this palm fruit is enjoyed throughout the Amazon by urban and rural folk, including indigenous groups (DeWalt et al. 1999; Rondon 1916: 322). In the Colombian Amazon, the Yukuna who inhabit the Miriti River, an affluent of the lower Caquetá, ferment the juice of *O. bataua* fruits (Hammen 1992: 232). In the Bolivian Amazon, the Tacana make a juice from the fruit and extract cooking oil from the seeds, one per fruit. So rich is the juice that the palm has become incorporated in some tribal mythology with a maternal theme. The Makuna of the Piraparaná River in the Colombian Amazon look upon seje, as the palm is known there, as the incarnation of female spirits who continue to feed the living with their breast milk (Schultes 1974).

Fig. 50.4 Girl placing ungurahui fruits in a plastic bag in a street market. The fruits have been soaking in water. Her mother is holding uvilla (*Pourouma cecropiifolia*) fruits. Mercado Bella Vista, Pucallpa, Peru, 1-22-04

The popularity of this rich juice has spurred a brisk trade in the palm's fruits. In western Amazonia, the fruits are typically sold in cylindrical plastic bags after they have been soaked. In this manner, customers can prepare the juice as soon as they return home. The pulp is also sold in plastic bags to save time for the customer. The smooth textured juice is also made into ice cream and popsicles in various cities and towns in the Peruvian Amazon (Smith et al. 2007: 82).

Fig. 50.5 Purple ungurahui (*Oenocarpus bataua*) pulp and orange-yellow aguaje (*Mauritia flexuosa*) pulp in a street market. Mercado Belén, Iquitos, Loreto, Peru, 6-16-04

Fruits of *O. bataua* contain appreciable amounts of oil, similar in fatty acid content to olive oil (Darnet et al. 2011; Pesce 1985: 69). While traveling along the Upper Rio Negro in Brazil in the nineteenth century, the English botanist Richard Spruce compared patauá juice to fresh milk and noted that when it was mixed with manioc flour the resulting porridge made a fine breakfast. Half of the mesocarp of *Oenocarpus bataua* is lipids on a dry weight basis (Montúfar et al. 2010); no wonder, then, that Spruce also noticed that the indigenous population grows "exceedingly fat during the season of patauá, and there can be no doubt of its being very nourishing" (Spruce 1908: 478).

In the late 1700s, the Ecuadorian historian and Jesuit Juan de Velasco considered the oil of *O. bataua* superior to that of olive oil: "From it edible oil is pressed, which is sweeter, clearer, and tastier than that from the olive" (Velasco 1977: 134). So similar are the two oils that unscrupulous shopkeepers in Belém used to cut imported olive oil with equal portions of patauá oil in the mid-nineteenth century. It was easy to fool shoppers because "even the best judges can scarcely distinguish it" (Spruce 1854a).

Indigenous groups in the Ecuadorian Amazon still use the oil for cooking and to beautify their hair (Balslev and Barford 1987). This palm oil is taken up into the Andes for sale in cities, such as in health and natural food stores in Quito where a small factory produces a shampoo containing *O. bataua* oil (Miller 2002). During the Second World War, patauá oil exports from Brazil peaked at 214,674 kg in 1944 but had declined to 24,656 kg by 1949 (Balick 1981; Brücher 1989: 138; Pinto 1951). Brazil no longer exports patauá oil; rather it imports olive oil from Iberia and Italy, when a native palm oil is just as good, if not better. In spite of its potential, *O. bataua* has never been planted on a commercial scale.

The amino acid content of the fruit pulp is comparable to animal protein, and much better than that of grains or legumes (Balick 1984; Balick and Gershoff 1981). The mesocarp is so nutritious, both in terms of calories and protein, that it can sustain a person for a long time. Apprentice hunters among the Waorani of the Ecuadorian Amazon must follow a strict diet consisting solely of *O. bataua* pulp for 2 months (Miller-Weisberger 2000). The Waorani are so fond of the fruit that they locate their long houses on the tops of forested ridges because that is where the palm tends to congregate in their territory (Rival 1998). The concentration of the palm on such ridges may be a vestige of ancient settlements.

The pulp of *O. bataua* fruits is also rich in antioxidants and some have argued that it also merits being classified as a "super fruit" alongside açaí (*Euterpe oleracea* and *E. precatoria*), two other palms found in the Amazon (Rezaire et al. 2014). Because of the health benefits of both the oil and mesocarp, this overlooked palm may soon emerge as an important export commodity in the trade of non-timber forest products.

Game animals are also fond of the palm's fruit. Both the white-collared peccary (*Pecari tajacu*) and the white-lipped peccary (*Tayassu pecari*) eat the creamy pulp and spit out the seed (Bodmer 1991). Agoutis (*Dasyprocta* spp.) eat the fallen fruits and bury some of them, a few of which later germinate. The Swiss botanist Jacques Huber noted the role of agoutis in dispersing *O. bataua* over a century ago (Huber 1910: 155). In the Cuyabeno Faunistic Reserve in the Ecuadorian Amazon, another forest rodent, the green acouchy (*Myoprocta prattii*) also disperses seeds of the palm (Miller 2002). Several species of monkey also eat the palm fruits.

The heart of this palm is eaten by certain indigenous groups, such as the Achuar, Sápara, and Siona-Secoya in the Ecuadorian Amazon (Descola 1994: 253; Tessmann 1999: 296; Vickers 1994), the Candoshi in Peru (Tessmann 1999: 159), and the Yanomama in northern Brazil (Anderson 1977). Fallen trunks are used by certain beetles to lay their eggs, and the Surui in Rondônia, Brazil, return to extract the resulting grubs for a protein-rich, calorie-laden snack (Coimbra 1985). River dwellers in the vicinity of Iquitos also obtain larvae of *Rhynchophorus palmarum* from trunks of ungurahui (Pinedo-Vasquez et al. 1990).

The palm is also used to treat various illnesses. The Cubeo of the Upper Uaupés, an affluent of the Rio Negro in northwestern Amazonia, heat the blue-black fruits of *Pagamea coriacea* with the oil of *O. bataua* to eliminate fungal infections of the ear (Schultes 1980). Further north in the llanos of eastern Colombia, the oil is used to treat a variety of respiratory ailments, from coughs and asthma to TB (Balick 1980).

The Maijuna use unripe fruits to prepare a medicine for treating TB (Gilmore et al. 2013). In the vicinity of Puerto Ayacucho along the Upper Orinoco, oil from the pulp is used in folk remedies for asthma, flu, and TB (Narváez and Stauffer 1999). In the Ecuadorian Amazon, the Waorani employ the palm's adventitious roots to prepare concoctions for expelling worms, arresting diarrhea and headaches, and to calm upset stomachs (Davis and Yost 1983). All told, some 14 medicinal uses have been recorded for *Oenocarpus bataua* (Sosnowska and Balslev 2009).

In addition to ungurahui's popularity for making juice and in preparing folk medicines, the long, arching fronds of the palm are cut in some parts of the Amazon to cover houses, such as along the Curicurari River, an affluent of the Upper Rio Negro (Mee 1988: 78). The Yanomama employ the giant fronds to protect the thatched roofs of their communal houses from strong winds (Milliken and Albert 1997). Similarly, the Waorani and the Nukak in the Ecuadorian and Colombian Amazon, respectively, employ fronds of the *Oenocarpus bataua* to thatch their dwellings (Macía 2004; Politis 1996b: 87).

The fronds are also used to make mats and baskets in some areas. The Machiguenga, for example, weave the fronds to make mats for sitting (Johnson 2003: 74). Several indigenous groups make baskets from *Oenocarpus bataua* fronds, including the Kanamari along the middle Jutaí River in Amazonas, Brazil, who use them for carrying manioc tubers from their fields (Carvalho and Reesink 1993), while the Nukak in the Colombian Amazon use the basket to bring home the palm fruits (Cárdenas and Politis 2000: 64). The Maijuna also fashion simple baskets in the forest with the palm fronds which are soon discarded after returning home (Gilmore et al. 2013). The Mayoruna in the northeastern part of the Peruvian Amazon make provisional baskets by weaving the palm leaflets which they line with large leaves. Such baskets are used for collecting the resin from certain trees which is then brought back to the village. The resin is used to create torches. The Mayoruna also prepare makeshift baskets using the palm fronds to carry home *O. bataua* fruits (Romanoff et al. 2004: 29, 91). The Yanomama also weave baskets from the fronds, and also make screens with the fronds to separate family areas within their communal houses (Anderson 1978).

The petioles and fiber that results from the degraded leaf bases are also used by several indigenous groups. In the Bolivian Amazon, the Chácobo lash together the petioles from the palm to serve as doors to their houses (Boom 1988) while the Maijuna use the fibers that accumulate along the lower trunks for kindling fires (Gilmore et al. 2013).

Fig. 50.6 Blowgun dart made from a spine taken from the trunk of a patauá palm (Wallace 1853: 31)

Long black spines from the leaf bases of young specimens of the palm have long been used for blowgun darts by various indigenous groups in northwest Amazonia (Spruce 1853b, 1855; Wallace 1853: 31), including the Witoto who still occupy forest between the Putumayo and Caquetá Rives in the Colombian Amazon (Whiffen 1915: 109). However, as the palm matures, these spines fall off. The Nukak use the spines for their blowgun darts, which are 50–75 cm long. The Nukak tie fluff that surrounds the seeds of the kapok tree (*Ceiba pentandra*) at one end of the dart so that they can be blown out of the tube; each dart is nicked near the distal end so that it breaks off in the victim thus ensuring that the game animal is unable to dislodge the poisoned missive (Politis 2007: 201). However, following the widespread adoption of shotguns and rifles by the surviving indigenous groups in the Amazon and Upper Orinoco, blowguns are rarely made anymore.

Fig. 50.7 Young patauá palm in a home garden. The spines emanating from the lower trunk are used for blowgun darts. Near Seringalzinho, lower Jaú River, Amazonas, Brazil, 10-3-12

Indigenous people use the hard wood of *Oenocarpus bataua* for a variety of uses. The Matis still make their famously long blowguns from the palm's wood (Erikson 1996: 221, 2001). The Yanomama make bows as well as arrow tips from the palm's trunk, as well as needles to pierce the lips of girls (Albert and Milliken 2009: 58, 61, 105). The Yanomama also make clubs from the hard wood of the palm, typically used in internal disputes over women (Anderson 1978). And the Tukano and Tuyuka along the Tiquié River in northwest Amazonas, Brazil, make cone-shaped fish traps (*matapis*) with strips of the palm wood which they deploy with wooden fences on either side to provide support and channel fish into the trap (Cabalzar et al. 2005: 310).

Given the diverse uses of *O. bataua*, it is not surprising that some families have planted the nutritious palm in their backyards, such as in the village of Monte Bello along the Ucayali on the southern perimeter of the Pacaya-Samiria National Reserve. In the vicinity of Tamshiyacu, a small town on the banks of the Amazon about 30 km upstream from Iquitos, farmers sometimes plant ungurahui along with other fruit trees in agroforestry fields (Padoch et al. 1985). In the vicinity of Pucallpa along the Ucayali River, the palm is found in fallows and forest, suggesting that some of the "wild" ungurahui may be vestiges of plantings in fields

(Fujisaka et al. 2000). And in the foothills of the Peruvian Andes at 900 m, residents of Moyobamba also plant ungurahui in their home gardens (Works 1990). The palm also sprouts spontaneously in home gardens from seeds discarded after making juice, such in communities along the Alto Pastaza in Ecuador.

This process of enriching habitation sites with *Oenocarpus bataua* palms has been going on for a very long time. For example, seeds of the palm are abundant at Peña Roja, a preceramic archaeological site along the Middle Caquetá that was occupied from 9250 to 8100 BP (Oliver 2001). And during his sojourn along the Upper Rio Negro near San Carlos in Venezuela during the mid-nineteenth century, Richard Spruce remarked that "the forests opposite San Carlos, extending from the Rio Negro to Xié, are literally sown with patauá" (Spruce 1908: 479).

Some groves of *Oenocarpus bataua* palms clearly arose, or at least have been extended, from seeds discarded by people. Concentrations of the palm between the Guaviare and Inirida rivers in the Colombian Amazon, for example, are attributed to the Nukak who leave large numbers of *O. bataua* seeds at their camps (Politis 1996a). The Nukak occupy some 70–80 campsites each year, which are normally not re-occupied. Furthermore, the Nukak population is around 400, divided into several groups containing a handful of families, so they are clearly enriching large swaths of the interfluvial forest between the Guaviare and Inirida Rivers with *O. bataua* (Politis 2001). And along the Caquetá River in the Colombian Amazon, the palm is considered an indicator species for anthropogenic black earth which is formed at ancient village sites (Mora 2001). People have most likely extended both the range of *O. bataua* as well as increased its density (Morcote-Ríos and Bernal 2001). It is not surprising, then, that some settlements in Amazonia are named after the palm, such as Patauá, a cluster of nine houses along the Unini, an affluent of the middle Negro.

Oenocarpus bataua surfaces in some regional lore. The Matis, for example, consider *O. bataua* the mythological ancestor of peach palm (*Bactris gasipaes*). The Matis claim that their ancestors domesticated peach palm by planting the seed of a prototypical giant *O. bataua* (Erikson 2001). And the Nukak believe that in the world above the intermediate domain they now inhabit, where they will live when they pass on, has plenty of palm trees with edible fruits, especially *O. bataua* (Politis 2007: 85).

Oenocarpus distichus

51

Brazil: Bacaba, bacaba-de-leque; pïdowa'i (Arawaté), pinuwa'ɨ (Guajá, Ka'apor), makaba (Kayabí), kamêrê (Kayapó), kapir (Krahô)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_51

Fig. 51.1 Bacaba (*Oenocarpus distichus*) with unripe fruit in a home garden. The farm boy has placed a pole against one of the fruit bunches so that he can access the fruits. Km 56 Santarém-Rurópolis Highway, Santarém Municipality, Pará, Brazil, 11-17-92

Oenocarpus distichus is the eastern and southern counterpart to its cousin *O. bacaba*, occurring in the Brazilian states of Maranhão, Pará, Tocantins, Mato Grosso, and Rondônia (Henderson 1995: 121). In Pará, the palm reaches as far west as the Tapajós River. Both known as bacaba, *O. distichus* is generally shorter and looks like its apex and fronds have been flattened. Technically known as distichously arranged, the fronds appear as it they have been ironed into a single plane. Confined to uplands, bacaba is found in both forest and savannas.

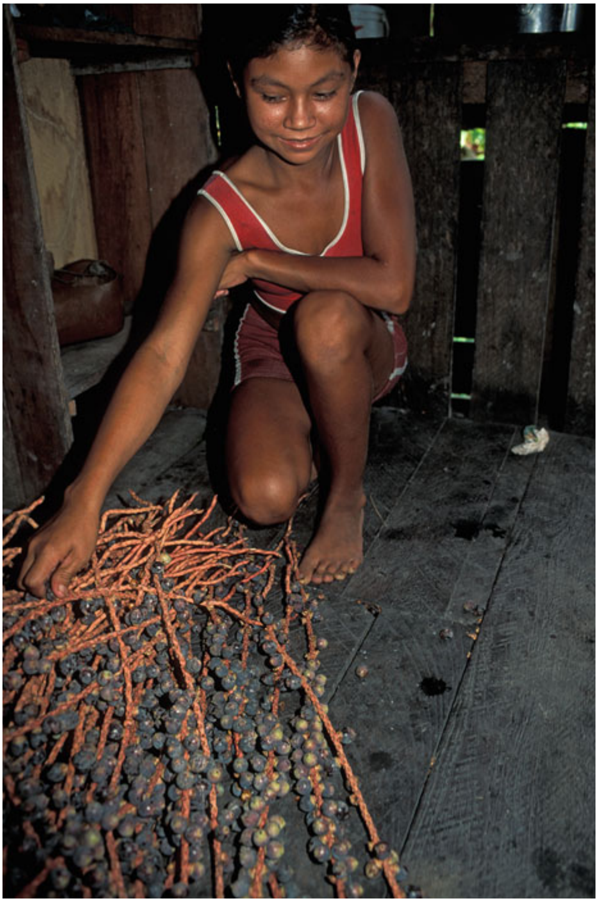

Fig. 51.2 Bacaba fruits on the floor of a kitchen in a river dweller's home. Lower Pacajá River, near Portel, Pará, Brazil, 5-15-00

Farmers typically spare the palm when clearing home sites or fields, such as in the villages of Belterra and Carariacá, south and east of Santarém, respectively. Ranchers often leave bacaba palms standing when clearing forest to establish pastures so that they, and their employees, can benefit from the fruits (Santos and Mitja 2011). River dwellers also plant *Oenocarpus distichus* on higher parts of floodplains, such as on Combu Island near Belém. And on uplands at Colonia Jamic in the vicinity of Tomé-Açu in Pará, a Japanese-Brazilian settler has established a small orchard of bacaba palm to sell the fruit.

Fig. 51.3 River dweller eating lunch of bacaba fruit juice mixed with manioc flour. The boy gathered the fruits in nearby upland forest. Lower Pacajá River, near Portel, Pará, Brazil, 5-15-00

Bacaba palm flowers at the onset of the dry season and fruits are ready at the cusp of the rainy period in late November and December. Ripe bacaba fruits are then available until the end of the rainy season in June. The fruits are gathered by climbing the trunk, which is typically under 10 m. If the tree is deemed too tall, however, rural folk may fell the tree, as noted in the mid-nineteenth century in the vicinity of Maicá near Santarém (Bates 1863b: 39). Women belonging to the Krahô tribe, who occupy savanna interlaced with galeria forests in the watershed of the Upper Tocantins, used to be solely responsible for climbing *Oenocarpus distichus* to gather the fruits to make juice; now, however, the palms are simply cut down to obtain the fruits (Nascimento et al. 2009).

Fig. 51.4 Villager enjoying a home-made frozen pushup (*chopp*) of bacaba juice. The 10 year-old boy purchased the pushup from an ambulant vendor. Santa Cruz do Arari, Marajó Island, Pará, Brazil, 4-24-00

The globose to ellipsoid fruits are 1.8–2 cm long and 1.5–1.7 cm in diameter with a purple mesocarp surrounding an endocarp with a single seed. Bacaba fruits turn up occasionally in street markets. The fruits are soaked to soften the pulp and then the juice is drunk straight or mixed with manioc flour to form a savory porridge. The Kayabí add honey to their bacaba porridge (Ribeiro 1979: 122). The juice is also made into frozen pushups which are hawked by ambulant vendors.

Fig. 51.5 Bacaba fruits just offloaded from a river boat. While the river dweller is waiting for customers, a couple of boys are helping themselves to some of the fruits. He also has a couple of cupuaçu (*Theobroma grandiflorum*) fruits for sale. Portel, Rio Pacajá, Pará, Brazil 5-14-00

Bacaba fruits have most likely been gathered to make juice since people entered the Amazon tens of thousands of years ago. Surviving indigenous people relish the fruits, including the Ka'apor who inhabit the eastern fringes of the Amazon forest in Maranhão (Balée 1993: 67). Further west in Pará, the Apinajé make a decoction from the fruits to treat hepatitis (Balick 1988). In the southern fringes of Amazonia in Mato Grosso, the Nambicuara make juice from the fruits (Rondon 1916: 322). In the interfluvial region between the Xingu and Tocantins Rivers, the Kayapó use the endocarps for making necklaces (González-Pérez et al. 2013) while the Kayabí shape the heartwood of the palm to make their bows (Ribeiro 1979: 122).

Bacaba fronds are also used to make temporary shelters while in the forest on hunting and gathering expeditions, such as among the Urubu (also known as the Ka'apor) who live along affluents of the Gurupi and Turiassu Rivers in Maranhão (Ribeiro 1976: 51). Although the Gurupi and Turiassu Rivers do not flow into the

Amazon, and therefore are not technically part of the Amazon Basin, the forest that the Urubu- Ka'apor inhabit is similar in many respects to forests in the watershed of the Tocantins-Araguaia further to the west. The Apinajé who live near the juncture of the Tocantins and Araguaia Rivers employ the fronds to make an archway at the rear entrance to their homes when a son embarks on a prolonged initiation ritual. A cross stick is placed at the apex of the vaulted passageway from which the boy's spindle shaft, a ritual implement, is hung. If the boy displays any weakness during log races, an elder takes him to a stream where he gashes the boy's legs with a rodent tooth. The boy then scrapes away the blood with the midrib cut from a bacaba frond and rubs ash into the wound obtained by burning the nest of an arboreal ant (Nimuendajú 1939: 47, 72).

Given the many uses of bacaba, people have enriched their surrounding with the palm. The site of an ancient village of the Tembé in eastern Amazonia, for example, is known as Bacabal because of the concentration of the palm there (Ribeiro 1996: 99). And one of the Apinajé villages is called Bacaba (Nimuendajú 1939: 14).

Oenocarpus mapora

52

Bolivia: Bacaba; quëboitsama (Chácobo), majillo (Tacana)
Brazil: Bacabinha, bacaba-i, bacaba de anta, bacaba de serra; nyë (Ticuna)
Colombia: Mil pesillos; popere (Nukak), gurɨkaɨ (Witoto)
Ecuador: Ungurahua pequeña, shimpi; patsatsa nijon'cho (Cofán), chimbia, sisahua, pamihua (Kichwa), shimbi (Shuar), wi gõsa (Siona-Secoya)
Peru: Sinamillo, ciame, ungurahuillo; shímpi (Achuar), tiroti (Machiguenga), bi bosa ñi (Maijuna), cuëbun isan (Mayoruna)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_52

Fig. 52.1 *Oenocarpus mapora* in fruit in a home garden. Ilha do Risco, Rio Amazonas, near Itacoatiara, Amazonas, Brazil, 12-8-06

Oenocarpus mapora grows in both upland and floodplain forest from Costa Rica south to the Maracaibo Basin in Venezuela and the western and central part of the Amazon Basin (Boom 1986; Henderson 1995: 123). In uplands, the palm is typically found near water courses. For some time, a smaller version of the palm, known as bacabinha in Brazil, was considered a separate species (*O. minor*). Now, however, *O. minor* is subsumed under *O. mapora* (Bernal et al. 1991).

In the Brazilian Amazon, rural folk recognize four kinds of *Oenocarpus* palms. The largest, both in size of the tree and the fruit bunch, are bacaba (*Oenocarpus bacaba*) and patauá (*O. bataua*). *Oenocarpus distichus* is a medium-sized tree. The smallest is called bacabinha or bacaba-i, formerly classified as *O. minor* but now placed in *O. mapora*. An intermediate form is dubbed either bacaba, bacaba de anta (the tapir bacaba) or bacaba de serra (the hillside bacaba), which can be classified as

O. mapora pending further studies. In Peru, *O. mapora* is known as sinamillo, ciame, or ungurahuillo. Bacabinha tends to form clumps (*touceiras* in Portuguese), whereas other species in the genus tend to be solitary, although they can form groves. Although bacabinha is more slender than other economically-valuable palms in the genus, the fruits measure 2.3 cm long and 1.9 cm in diameter and are surpassed in size only by *O. bataua*.

Fig. 52.2 Fruits of bacaba (*Oenocarpus mapora*) gathered in a home garden. Ilha do Risco, Rio Amazonas, near Itacoatiara, Amazonas, Brazil, 12-8-06

Along the lower Ucayali, *Oenocarpus mapora* is often found in swamps dominated by aguaje (*Mauritia flexuosa*) palm (Kalliola et al. 1991). In such locations, density of the palm can reach as high as 351 trunked trees per hectare, a veritable orchard (Kahn and Granville 1992: 78). In the savanna region of the Colombian Amazon, *O. mapora* is often common in gallery forests. The palm is found as high as 600 m in the Andes, such as in the vicinity of Sauce by Laguna Azul in the Huallaga Valley of Peru, where it is called ciame (Smith et al. 2007: 84). In the Peruvian Amazon, sinamillo fruits in the latter part of the rainy season and the early part summer.

Fig. 52.3 Village children waiting for water to finish warming over a fire in order to soak sinamillo fruits. A 9 year-old boy on the *right* can't wait and has stuffed some fruits in his mouth. Miraflores, confluence of the Tigre and Marañón Rives, Loreto, Peru, 6-4-04

When the fruits have turned dark purple, signaling that they are ripe, youngsters and adults alike shimmy up the tree to lop off the single fruit bunch. Villagers often keep a ladder handy to facilitate harvesting the fruits of sinamillo as well as other trees in their home gardens. Sometimes boys use catapults to bring down a few fruits to snack on. Each fruit bunch has a dozen or so raquilla, each with 30–50 fruits, for a total of 300–400 fruits per bunch. As with other *Oenocarpus* palms, the fruits are soaked in warm water to soften them before mashing them by hand to make a thick, nutritious juice. In some parts of Acre, rural folk extract oil from the mesocarp for cooking and to serve as a skin conditioner (Campos and Ehringhaus 2003).

Fig. 52.4 River dweller using a catapult to bring down some bacabinha fruits in his backyard. Near Caretas, Urubu River, Amazonas, Brazil, 10-16-12

The palm typically occurs in clumps of up to a dozen individuals and is planted, or arises spontaneously from discarded seeds, in home gardens, such as in the vicinity of Itacoatiara and Itapiranga along the Amazon River downstream from Manaus as well as in the vicinity of Tefé. Bacabinha is common in upland home gardens in the Municipality of Manicoré along the middle Madeira River (Fraser et al. 2011b). Sinamillo is found around rural homes throughout the Peruvian Amazon, such as along the Itaya River near Iquitos and in various communities in the Reserva Nacional Pacaya-Samiria. One home garden on a high river bank in Miraflores, a village nestled at the confluence of the Tigre and Marañón Rivers, has seven sinamillo palms divided into two clusters. That home garden is flooded by the sediment-rich waters of the Tigre roughly every 3 years.

Indeed, it is difficult to tell if clumps of the palm are truly wild even when they are found some distance from settlements; they could be vestiges of old homesites or camps.

Fig. 52.5 Bacabinha palms at the edge of a soccer pitch. The village is on an archaeological site. Pontão, Urubu River, near Silves, Amazonas, Brazil, 10-11-12

In addition to fruit, the wood of *Oenocarpus mapora* is also valuable. The Kichwa in the headwaters of the Napo in the Ecuadorian Amazon, for example, use the trunks for floors and house posts and the fronds for thatch (Balslev et al. 1997). Similarly, the Maijuna use the trunks as posts for temporary shelters (Gilmore et al. 2013). In Boa Esperança, a village on the shores of Lake Amanã along the lower Japurá, some fishermen, such as at the village of Boa Esperança, fashion bows from the dark, durable wood of bacabinha. This is likely an ancient practice as evidenced by a similar use for the palm among some indigenous groups including the Mayoruna (Romanoff et al. 2004: 66). In the first half of the twentieth century, the Ticuna used the stem to make their exceptionally long blowguns (Nimuendajú 1952: 27). Today, few tribes still hunt with blowguns, and they are mostly concentrated in western Amazonia, especially in Ecuador. The dense, durable wood is also fashioned into poles (*ripas*) to tie palm thatch in some areas.

Fig. 52.6 Children snacking on bacabinha fruits in a home garden. The girl on the *right* has eaten so many fruits her lips have turned purple. Vila Valente, lower Tefé River, Amazonas, Brazil, 8-21-12

Although not a preferred palm for thatching, the fronds are occasionally used to cover houses and huts. The Chácobo and the Tacana in the Bolivian Amazon, for example, employ the fronds for thatch (Boom 1988, 1989; Moraes et al. 1995). The Kichwa also fell the tree to eat heart-of-palm.

Fig. 52.7 Fronds of ubim branco (*Geonoma maxima*) attached a narrow section of the trunk (*ripa*) of bacabinha (*Oenocarpus mapora*). Roof of a manioc processing hut. Bom Socorro, Paraná Tambaqui, near Lago Amanã, Amazonas, Brazil, 9-22-12

Phytelephas macrocarpa

53

Bolivia: Marfil
Brazil: Jarina
Peru: Yarina, anon de palma, polo punta; chápi (Aguaruna), jupu (Amahuaca), kompiroshe (Ashéninka), tókehííba (Bora), epe (Cashibo), kompiro (Machiguenga) jépe (Shipibo)

Status: Wild, spontaneous in cultural settings, planted

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_53

Fig. 53.1 Grove of yarina (*Phytelephas macrocarpa*) on a ridge in floodplain forest. Quebrada Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-22-06

Yarina (*Phytelephas macrocarpa*) grows in forests on higher parts of floodplains in western Amazonia where the palm is widely used for thatch and to a lesser extent for its fruits and nuts. Yarina fronds last about 5 years. The palm has evidently furnished thatch for a long time as evidenced by the large number of indigenous people who cover their houses with the fronds including the Amahuaca (Tessmann 1999: 93), Matsigenka (Johnson 2003: 74), the now extinct Omagua (Maroni 1988: 163), and the Tacana (DeWalt et al. 1999).

Fig. 53.2 Gathering yarina fronds for thatch. Yanayacu River, 4 km upstream from Yarina, Pacaya-Samiria, Loreto, Peru, 7-24-10

The understory palm ranges from northern Peru south to Bolivia and east to the Upper Purus in Brazil. Yarina is highly variable and some populations of the palm have little if any trunk. Although more common in lowlands, yarina can be found as high as 900 m in the Andean foothills (Kahn and Moussa 1994).

Fig. 53.3 Village houses thatched with yarina. The home gardens are stocked with palms including aguaje (*Mauritia flexuosa*), chonta (*Euterpe precatoria*), and coconut (*Cocos nucifera*). Veinte de Enero, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 7-21-10

Yarina grows on abandoned banks (*restingas*) of water courses in floodplain forests (Kahn and Granville 1992: 78). Yarina sometimes occurs in groves, called *yarinales* in Peru and *jarinais* in Brazil. A *yarinal* that contains thousands of the squat palm extends for some 5 km along an old *restinga* in the watershed of Quebrada Yarina, a stream that flows into the lower Yanayacu, an affluent of the lower Marañón. Villagers from Veinte de Enero near the mouth of the Yanayacu have made a trail through the *yarinal* to gather the fruits to fashion vegetable ivory (*tagua*) from the hardened endocarp, and to gather the fronds which are used extensively for covering houses, boats, and rafts. Another extensive *yarinal* is found further up the Yanayacu near the village of Yarina; this *yarinal* stretches 3 km through the forest.

Fig. 53.4 Mound created by leaf cutter ants (*Atta* sp.) as they mine tunnels underground for their nest. Such sites create opportunities for yarina and other trees to colonize floodplains. Quebrada Santa Helena, affluent of the lower Yanayacu River a few kilometers upstream from Veinte de Enero, Pacaya-Samiria, Loreto, Peru, 7-13-10

Leaf cutter ants (*Atta* sp.) appear to be involved in the formation of some yarina groves. The industrious ants, which can number in the millions in a single colony, excavate underground galleries where they cultivate fungi on beds of cut up leaves. Some mounds created by leaf cutter ants attain 2 m in height, such as in the vicinity of Veinte de Enero along the Yanayacu. These relatively dry mounds then become ideal places in floodplains for yarina and other trees that can only tolerate limited flooding.

Some ancient inhabitants of the Pacaya-Samiria National Reserve in the Peruvian Amazon made earthen mounds for dwellings and to grow crops, and some of the *yarinales* likely rest on ancient raised fields and village sites. This may explain why locals consider *yarinales* a good indicator for fertile soils when selecting sites for their fields (Vormisto et al. 2004). At Lake Charo some 65 km south of Iquitos, a *yarinal* occupies a sandy ridge with a layer of anthropogenic dark earth. Potsherds in this dark sand, combined with high levels of phosphorus, confirm that the site was once occupied by an indigenous village (Coomes 2004b).

Almost 150 years ago, William Chandless noted that when yarina is small, the fruit can be half buried in the ground. The British explorer also observed that the now extinct Manetenery, who once lived along the Purus, “eat the unripe seeds while pulpy, and the fleshy substance that encloses the seeds when ripe” (Chandless 1866). And along the Huallaga in Peru in the early nineteenth century, the German explorer Eduard Friedrich Poeppig observed that indigenous folk drank the liquid endosperm and that the half buried fruits could be mistaken for a caiman hiding in the mud for prey (Poeppig 2003: 262).

Fig. 53.5 Yarina palm in fruit. Near Buenos Aires, Pucate River, affluent of the lower Yanayacu, Pacaya-Samiria, Loreto, Peru, 7-21-10

The studded, wooden-skinned fruits of yarina are packed tightly together and resemble medieval maces. The clustered fruits, each of which contains several nuts, break apart as they mature and eventually fall to the ground. Unripe fruits with fluid endosperms, similar to green coconuts, are referred to as *choclito* in Peru. The water in yarina nut cases is refreshing because the palm grows in shade. As in the case of the buçú (*Manicaria saccifera*) palm in the Amazon estuary, the fruits thus serve as an emergency water supply in the forest. Yarina water is crystal clear and has long slaked the thirst of those trekking in the Amazon forests of Peru (Jaramillo-Arango 1952: 331).

Fig. 53.6 Villager drinking the liquid endosperm of yarina. Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 11-6-03

As the fruits mature, the liquid embryos turn into a sweet, translucent jelly, which can be scooped out with a finger and eaten. Fruits with liquid or jelly embryos are sold in streets markets, such as in Iquitos. Although never plentiful in markets, yarina fruits can be found year-round and sell for about 16 to the US$.

Fig. 53.7 Snacking on the jelly-like endosperm of yarina. Quebrada Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 6-22-06

Eventually, the endosperm solidifies into a solid nut, too hard to eat. From the eighteenth century to the early 1900s, rural folk in the Peruvian *selva* used to gather the mature nuts for the vegetable-ivory (*tagua*) trade. The hardened endocarps were fashioned into buttons, billiard balls, chess pieces, and spindles. In the nineteenth century, vegetable ivory from *Phytelephas macrocarpa* was exported to England as observed by a former director of the Royal Botanic Gardens, Kew: "in the turners' and toy-shops of London, may be purchased for a shilling each, the nuts, or more properly speaking the seeds, either entire, or with one half of the coat removed by turning, so as to exhibit the beautiful ivory-like texture of the interior" (Hooker 1849). By the mid-twentieth century, prices for the vegetable ivory had slipped dramatically in Europe and North America due to competition from plastics and most tagua factories went out of business (Barford et al. 1990). Attempts are underway, however, to revive the tagua industry in Iquitos to provide souvenirs for tourists. And the tagua trade in Ecuador, based on a near relative *Phytelephas tenuicaulis*, is experiencing a renaissance.

Fig. 53.8 Yarina fruit with endosperms that have hardened. Known as *tagua* in Peru, the solid endosperms are used for vegetable ivory. Quebrada Santa Helena, affluent of the lower Yanayacu River a few kilometers upstream from Veinte de Enero, Pacaya-Samiria, Loreto, Peru, 7-13-10

Fig. 53.9 Carving (*tallando*) yarina vegetable ivory (*tagua*). Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 7-24-10

Fig. 53.10 *Tagua* carved with bird designs. Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 7-24-10

A thin but creamy pulp covers the endocarp. The orange mesocarp under the hard wooden skin (pericarp) is only ready for eating when the fruit falls to the ground and the embryo has hardened. A machete is used to chip away the bumpy skin and snack on the vitamin A-rich pulp. According to local informants along the Yanayacu River in the Pacaya-Samiria National Reserve, agoutis (*Dasyprocta* spp.) eat the mesocarp and the terrestrial rodents may be involved in dispersing the palm.

Fig. 53.11 Snacking on the mesocarp of a yarina fruit. Buenos Aires, confluence of the Pucate and Yanayacu Rivers, Pacaya-Samiria, Loreto, Peru 4-20-06

Fig. 53.12 Drawing of an agouti approaching a fallen yarina fruit. By Julio Cesar Zamaro, 12 years old, Veinte de Enero, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 2004

Yarina is also used to prepare a number of folk remedies. In the Brazilian state of Acre, for example, the young fronds are widely used to treat snake bites and headaches. Some indigenous groups also use the leaves to alleviate the painful wounds inflicted by stingrays and to subdue fevers (Campos and Ehringhaus 2003).

Given the subsistence and market value of yarina fruits, as well as the durable fronds for covering houses, it is not surprising that some families plant the palm in their backyards. Yarina can be found in home gardens in the Peruvian Amazon, such as Monte Bello and Jenaro Herrera along the Ucayali. Some farmers also plant yarina in their fields, as in the vicinity of Victoria along the Puinahua, an arm of the Ucayali. In one agroforestry field (*chacra*) near Victoria, yarina is intercropped with as many as 20 other perennials, mostly fruit trees.

Fig. 53.13 Yarina fronds drifting downstream on a raft. Rio Yanayacu, Pacaya-Samiria, Loreto, Peru, 3-8-04

As is common with trees in the Amazon that play a prominent role in the local economy, some lakes and settlements are named after yarina. Several floodplain lakes in the Ucayali watershed are called Yarina. Yarina Cocha is an outlying district of Pucallpa that borders a floodplain lake. And Yarina is a village along the Upper Yanayacu, an affluent of the lower Marañón.

Fig. 53.14 Yarina fronds covering plantains on a raft. Nauta, Marañón River, Loreto, Peru, 6-21-06

Yarina crops up in some folktales. The following story about an encounter with a supernatural forest entity called chullachaqui was told to me by Tony, a 30 year-old villager in Yarina along the Yanayacu River on 6 March 2004. Tony was deceived by a chullachaqui when he was 12 years old while hunting in the forest alone about 2 h downstream by canoe from Yarina:

> I was a bit young to be hunting alone in the forest, but I am an only son and my mother depended on me to bring home game meat. I was in a *yarinal* when a tremendous storm broke with fierce lightning, so I ran for cover among the buttress roots of a lupuna tree. I crouched for two hours waiting for the storm to pass, when I noticed a person walk by. Relieved to know that I was no longer alone, I yelled "amigo", but there was no response. I hurried after the person to try and talk, but I could not catch up. I lost sight of the person and realized that I was lost. Then chullachaqui thumped a tree. It was getting dark and I was frightened. I felt like crying; I was scared of snakes and of jaguars. I made camp at the base of a tree with buttress roots; I fenced off the entrance with yarina fronds for protection and spent the night there. At daybreak I ate chonta (heart-of-palm), and fruits of yarina and sachamangua. Later that morning, I heard my Dad calling out for me, but I was scared because I thought it was chullachaqui again; so I hid in some bushes and peered out through the leaves. When I realized that it was in fact my father together with my uncle and my mother, I stepped out and was taken home by my relieved relatives.
>
> But that afternoon I developed a high fever, a splitting headache, and became nauseous. I was taken to a shaman near Arequipa along the Yanayacu River and the curer blew some tobacco smoke over me. The shaman also prepared a decent tasting beverage called cama

> longa which I was instructed to drink and that night I dreamed of chullachaqui. The shaman explained that I should not have followed chullachaqui, even though I had no idea it was a chullachaqui. I drank the cama longa infusion for two days to combat the evil spell (*saca la mala suerte*). The shaman charged a fee for his services.

According to Tony, chullachaqui has one foot turned backwards. It is a hairy, human like figure.

Raphia taedigera

54

Brazil: Jupatí
Colombia: Pángana

Status: Wild

Fig. 54.1 Jupatí (*Raphia taedigera*) palm in the middle ground with miriti (*Mauritia flexuosa*) palms towering behind. Fleshy-leafed aninga (*Montrichardia arborescens*) line the tidal stream. Limoeiro River, a tributary of the lower Tocantins, Pará, Brazil, 7-5-07

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_54

Raphia taedigera is the only New World representative of a genus with 20 species in Africa and has the longest fronds of any palm in Amazonia. Leaves can reach 15 m, yet they are not used for thatch, at least in Amazonia. This relatively short palm with its formidable display of fronds has a curious disjunct distribution: it is found along the Caribbean coast of Nicaragua south to Antioquia and the Chocó in northern Colombia, and then reappears in the Amazon estuary (Allen 1965b; Goulding and Smith 2007: 245; Henderson 1995: 68; Vann 1959). And at the mouth of the Amazon, this palm is restricted to the southern part of the estuary. Known as jupatí in Brazil, the palm is confined to tidal forests. As the fronds age, they turn a coppery color which in addition to their huge size, helps them stand out in the wall of green along creeks and rivers.

Virtually identical to its West African cousin, *Raphia vinifera*, *R. taedigera* most likely reached the New World from Africa as a seed or seeds dispersed by currents in the Atlantic Ocean. Remnants of *R. taedigera* fruits have been found in swamps in Nicaragua that were deposited in muck some 2,000 years ago (Urquhart 1997). Archaeological work in Panama has revealed that people were using the palm fruits there by AD 880 (Wake 2006).

The curious scaly fruits of jupatí, similar in appearance to those of salak (*Salacca zalacca*) palm in Southeast Asia, were once collected by rural inhabitants in the Amazon estuary to extract oil for cooking, to make soap, and to treat rheumatism (Carney and Hiraoka 1997; Le Cointe 1922a: 490; Teixeira 1953: 18). To obtain jupatí oil, the red scales of mature fruits were first scraped off then the mesocarp was removed from the single seed with a spoon and boiled in water (Pesce 1985: 88). The oil would rise to the surface where it was skimmed off with ladles. Today, however, most river dwellers fry fish and meat in oil derived from soybean, maize, or cottonseed purchased in town, or in pig lard (*banho de porco*). As in the case of oil from murumuru (*Astrocaryum murumuru*) palm, improved transportation links to southern Brazil, especially industrial centers such as São Paulo, have flooded the estuary with mass-produced goods that sometimes undercut cottage industries.

Fig. 54.2 Jupatí fruits. Igarapé Muaná. Affluent of the Limoeiro River, a tributary of the lower Tocantins, Pará, Brazil, 7-4-07

Although the fruits are rarely gathered anymore, the palm still retains several other uses. The midribs (rachis) of fronds are split to make shrimp traps (*matapís*). Freshwater shrimp are an important item in subsistence and commerce along much of the Amazon River, including the Ucayali in Peru. Cylindrical shrimp traps have two cone-shaped entrances, one at each end. Once the shrimp enter the submerged trap, most cannot find their way out. A small trap door is used to introduce the bait, either rice bran or crushed nuts of babaçu (*Attalea speciosa*) palm. Fishermen wrap the bait in a small piece of plastic so that it is not washed away and to prevent the shrimp from consuming it too quickly. Most shrimp are caught in such traps during the dry season, when water levels drop.

Fig. 54.3 Shrimp traps fashioned from midribs of jupatí. The fisherman is baiting the traps before placing them in the water. Tocantins River near Limoeiro, Pará, Brazil, 7-3-07

In the Amazon estuary, the manufacture of shrimp traps is a widespread cottage industry. Most of the 1 m-long traps are made from the leaf stems of arumã (*Ischnosiphon obliquus*) and the midribs of urucuri (*Attalea phalerata*) or patauá (*Oenocarpus bataua*) palms because these plants occur throughout the estuary. But shrimp traps made from jupatí are reputed to be more durable, so they are relatively common in the southern part of the estuary. A trade in shrimp traps made with jupatí has evolved to supply some shrimpers in Amapá in the northern part of the estuary where jupatí is absent. One river dweller along the Pixuna River on Amapá's southern shore prefers jupatí traps because he claims that they last the entire 6 month shrimping season, whereas traps made from other plants often have to be replaced after 2 or 3 months. Jupatí shrimp traps retail for about US$1.10 each, and some shrimpers purchase as many as 80 for use in the summer months.

Fig. 54.4 Cutting a jupatí petiole. The palm is in flower. Rio Ipanema, lower Tocantins River, near Abaetetuba, Pará, Brazil, 7-8-07

Many of the jupatí traps sold in towns in the Amazon estuary, such as Macapá, the capital of Amapá, and Mosqueiro near Belém, are made in Abaetetuba and Igarapé-Miri. Shrimp traps stacked on the front porch or dock of rural homes is a common sight throughout the estuary. Petioles of jupatí are used to make large cylindrical holding “cells” for shrimp captured in traps. Known as *viveiros*, the floating cylindrical corrals keep shrimp alive until ready for sale. Jupatí petioles are spongy inside and thus buoyant.

Fig. 54.5 Brothers embarking a canoe to go fishing. The boy on the *left* is carrying a fishing pole fashioned from a jupatí petiole. Limoeiro River, affluent of the lower Tocantins, Pará, Brazil, 7-5-07

The midribs of jupatí fronds serve as fishing poles, such as near São Miguel de Pracuúba in the southern part of Marajó Island and along the lower Tocantins and its affluents. In the vicinity of Igarapé Miri in the southern part of the Amazon estuary, the midribs of jupatí are used to make a roll up fences (*pari*) that are placed across creeks at high tide. When the tide has gone out and fish are trapped in the narrowed creek, a piscicidal root (*timbó*) is crushed into the water upstream from the fence and the stupefied fish are then scooped out with baskets as they congregate by the fence. Thin sections of the rachis are cut to provide skewers for cooking fish.

Fig. 54.6 Mapará catfish (*Hypophthalmus edentatus*) skewered with pieces of jupatí petioles. The 75 year-old river dweller has fashioned a makeshift grill with the rachis of an açaí (*Euterpe oleracea*) palm frond. Rio Panité on a floodplain island of the lower Tocantins, Pará Brazil, 7-2-07

The leaf stems (petioles) also provide several useful products. In the nineteenth century, the petioles were used for window shutters in Belém and for making birdcages, boxes, and even walls for houses (Wallace 1853: 44). Along the lower Tocantins, the split leaf stalks were once fashioned into laths and lashed together to form a mat that was hoisted to serve as a rudimentary sail (Bates 1863a: 157). Today, cotton hammocks are used to propel canoes on windy days instead. And in the vicinity of Belém, fisher folk used to obtain twine from jupatí petioles to make nets which were stretched across creeks at high tide. At low tide, the fish were thus trapped and easy to capture (Spruce 1850b). Nowadays, fishermen make or purchase nets of monofilament or multifilament nylon.

Fig. 54.7 Tearing strips from a jupatí petiole. Rio Ipanema, lower Tocantins River, near Abaetetuba, Pará, Brazil, 7-8-07

Strips are still torn from the covering of jupatí petioles to supply twine to weavers along the lower Tocantins. The weavers, usually women but also some men, make baskets for the Belém market. Jupatí twine is tan colored and is used to create contrasting bands with lighter-colored twine from Mauritia palm (*Mauritia flexuosa*).

Fig. 54.8 A 68 year-old weaver using strips from a jupatí petiole to make a laundry hamper. The frame is fashioned from marupá (*Simarouba amara*). Limoeiro River, affluent of the lower Tocantins, Pará, Brazil, 7-5-07

Fig. 54.9 A 25 year-old weaver using alternating petiole strips of *tan-colored* jupatí and *light-colored* miritί (*Mauritia flexuosa*). Limoeiro River, affluent of the lower Tocantins, Pará, Brazil, 7-5-07

Socratea exorrhiza

55

Bolivia: Paxiuá, pachiubilla, pachuba, pachiuba; onipa (Chácobo), vijri (Tsimané)
Brazil: Paxiúba; pači'i (Araweté), poopa (Baniwa), paši-'ɨ (Ka'apor), ngrowareoaák-y (Kayapó), cuhaca, manáca (Mayongong), wahtaño (Tukano), watawõ (Tuyuka), manaka (Yanomama)
Colombia: Zancona, macanilla, choapo; besuʉ (Barasana), buhu-nyu (Desana), ñikõño (Makuna), juru (Nukak), puba (Piapoco), dótina (Witoto)
Ecuador: Ponilla, pambil, borbón, rayador; chingu, shiquita (Kichwa), kupat (Shuar), ñinco, nico (Siona-Secoya), yarewe (Waorani)
Peru: Cashapona, pona; kupat (Aguarana), nisti (Amahuaca), camonach (Amuesha), iíwajyu (Bora), kodoma (Candoshi), shihshi (Chayahuita), sinu (Cashibo), kamona (Machiguenga), jɨco ñi (Maijuna), pëdi (Mayoruna)
Venezuela: Macanilla; kuyaka (Yekuana)

Status: Wild

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_55

Fig. 55.1 Severing the stilt roots of *Socratea exorrhiza*. The river dweller will fell the palm and remove the bark to repair the flooring in his village home. Near Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 11-6-03

The walking palm (*Socratea exorrhiza*) is so-named in English for its stilt roots that splay out in all directions from the trunk. Thought to provide stability and help the palm thrive in wet environments, the palm is found throughout the Amazon and Orinoco basins and extends into Central America as far north as Nicaragua (Goulding and Smith 2007: 227; Henderson 1995: 95). The stilted palm, which can reach 20 m, is found in floodplain forests up to 1,300 m in the Andes. The walking palm is also common in tidal forests at the mouth of the Amazon.

The cultural importance of the palm varies across the Amazon. In the Peruvian Amazon, the main use of the palm is to make flooring for rural homes. The stilt roots are first severed with a machete so that the palm will fall once the trunk is cut through. The stilt roots can reach 4 m (Kahn and Granville 1992: 37), and over a dozen of these flying buttresses can be attached to the trunk. Once the trunk is on the ground, the thick bark is struck with an axe so that it splits longitudinally into narrow sections. The bark is then shaken loose from the pithy interior using the dull side of the axe. The sections, approximately 3 cm wide, remain loosely connected by tough fibers and are then rolled up like a mat to be taken home. Back at the house, the mat is then unfurled across a framework to make the floor.

Fig. 55.2 Loosening the split bark of a cashapona palm. Near Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 11-6-03

Even in upland areas, most rural folk in the Peruvian Amazon construct their houses on stilts. In the countryside of the Brazilian Amazon, in contrast, most houses have floors of wooden planks, concrete slabs, or tamped down earth. In mid-twentieth century, many homes of some small farmers in Acre still had floors fashioned from paxiúba palm trunks (Guerra 1955: 142, 165, 198), but that practice seems to be increasingly rare in Brazil. However, a few indigenous groups in the western and northwestern part of the Brazilian Amazon still employ the palm to make the floors and walls of their dwellings (Gilmore et al. 2013; Pezzuti and Chaves 2009; Prance 1972). The Piapoco in the Colombian Amazon employ the palm to make walls for their homes (Mesa 2011: 109; Mesa and Galeano 2013) as do the Yanomama in Brazil and neighboring Venezuela (Albert and Milliken 2009: 74; Milliken and Albert 1997). The Tuyuka along the Tiquié River used to section off parts of their communal houses (malocas) for privacy with walls fashioned from paxiúba, especially for couples with newborns (Koch-Grünberg 1995: 314), but Salesian missionaries forbad the construction of such communal dwellings in the early twentieth century. The Tuyuka have recently started building *malocas* again, but only for meetings and ceremonies, and they no longer have interior walls.

Indigenous groups in other parts of the Amazon Basin continue to use the palm in house construction, especially for floors, platforms, and walls, as well as for beams and rafters. The Candoshi of the Pastaza River in the Peruvian Amazon use long sections of the tough bark of the palm for beams and rafters in their homes (Surrallés 2009: 131). The Deni who occupy interfluvial forest between the Juruá and Purus rivers use the palm to make their house floors (Pezzuti and Chaves 2009). The external kitchens of the Ticuna, who live along the Solimões/Amazon River in Brazil and Peru, consist of a platform fashioned with the palm bark upon which earth is placed to prevent the wood from catching fire (Acosta 2001). In the first half of the twentieth century, Curt Nimuendajú made three visits to the Ticuna along the Solimões during which he observed houses with walls made with poles of paxiúba palm; the removable doors also had a framework of paxiúba poles (Nimuendajú 1952: 11). The Kanamari who live along the Upper Jutaí and the middle course of the Juruá in Amazonas, Brazil, also make kitchen platforms for their cooking stoves with the split trunk of the palm (Carvalho 2002: 156). The Yanomama, Chácobo, and the Tacana use the palm in the construction of their dwellings (Anderson 1977; Boom 1989; DeWalt et al. 1999; Moraes et al. 1995), and in the past corrals for keeping turtles were also made from the durable trunks (Wallace 1853: 36). The palm is also used to fashion walls in rural communities of central Panama (Aguilar and Condit 2001).

The now extinct Siusí of the Ariarí River, an affluent of the Içana in the Upper Rio Negro region, used to make shelves out of the split palm trunk for storing baskets in their communal houses (Koch-Grünberg 1995: 100), a practice that continues today among the Tukano of the Tiquié River, an affluent of the Uaupés. And along the Maici River in the Madeira watershed, the Pirahã construct a platform fashioned from split trunks of *Socratea exorrhiza* for each family in their communal houses upon which family members sleep and household goods are stored (Gonçalves 2001: 127).

Floors of cashapona, as the palm is known in the Peruvian Amazon, have certain advantages. The small cracks allow spills to drain, yet the cracks are sufficiently narrow to prevent valuable objects from falling through. Young children can emerge from the mosquito net covering their bed on the floor and simply urinate without having to negotiate the narrow gangplank to the outhouse in the dark. In the morning, mothers simply splash some water on the spot and it quickly dries.

Fig. 55.3 Cashapona floor in a kitchen with a dividing wall of split logs of chonta (*Euterpe precatoria*). The hens of this household are encouraged to lay eggs inside so that predators don't get them. Yarina, Yanayacu River, Pacaya-Samiria, Loreto, Peru, 7-24-10

The Tukano still use vertical sections of paxiúba bark (*tala*) to attach fronds of caraná (*Mauritia carana*) palm to thatch their community centers and schools. In the early nineteenth century, Spix and Martius (1938: 180) reported that boat crews overnighting along the banks of the Amazon would sometimes assemble shelters with the fronds of *Socratea exorrhiza*, but the palm is rarely used for thatch, at least today.

In the Amazon estuary, some fish traps (*cacuris*) are made with the trunks of paxiúba. *Cacuris* range in size but all have a similar keyhole shape. A fence extends from the bank out into the river to direct fish into a circular trap with fences extending on either side of the opening in an inverted V pattern in case fish try to go round. The fences are made with stems of paxiúba or marajá (*Bactris* sp.) palms, or split trunks of a native bamboo (*Guadua* spp.). Some fish traps are made with several plants and frequent repairs are necessary because floating logs, or even boats, collide with the traps. Fishermen enter the bulbous end of the *cacuri* through a small door so that they can scoop out the catch with a hand net. Most of the fish are caught as the tide goes out.

Fig. 55.4 A fish trap made with poles of açaí (*Euterpe oleracea*), paxiúba (*Socratea exorrhiza*), and taboka (*Guadua* sp.), all lashed together with twine extracted from the fronds of miriti (*Mauritia flexuosa*). Xingu River on a floodplain island of the lower Tocantins, near Abaetetuba, Pará, Brazil, 7-7-07

Long poles are fashioned from the paxiúba stems in the lower Tocantins to identify fish encircled in large seines (*rede de borqueio*). Up to two dozen fishermen operating from several canoes extend the seine, which stretches for up to 300 m, around fish schools. Once surrounded, several fishermen prod the depths with a paxiúba pole and report to the others which species of fish are present judging by how the fish bump the pole.

Fig. 55.5 Fisherman probing the water with a paxiúba pole to determine which kind of fish are trapped in the seine (*rede de borqueio*). Praia da Bandeira, Tocantins River near Limoeiro, Pará, Brazil, 7-4-07

The thorn-studded stilt roots of *Socratea exorrhiza* are employed as graters for processing manioc and plantains, such as among the Tacana in the Bolivian Amazon (DeWalt et al. 1999) and the Maijuna in the Peruvian and Colombian Amazon (Gilmore et al. 2013). The Chácobo also used to use the roots for the same purpose but in many areas people have shifted to metal graters (Boom 1989). The Nukak in the Colombian Amazon still use the stilt roots to grate sweet manioc tubers, fruits of peach palm (*Bactris gasipaes*) and Mauritia palm (*Mauritia flexuosa*) as well as plantain; the shredded fruits and tubers are used in preparing drinks (Politis 1996b: 316). In the early 1960s, the Urubu who inhabit the eastern fringes of the Amazon forest in Maranhão, also used the stilt roots to grate manioc (Ribeiro 1976: 53), as did the Asuriní in the 1970s (Lukesch 1976a: 86).

The thorns on the stilts are actually devices (pneumatorrhizae) that help young palms breathe in water logged conditions. Once the tree matures, they harden into spines and provide protection (Kahn and Granville 1992: 122). In the Amazon estuary, frames for some of the sieves used for straining juice of açaí (*Euterpe oleracea*) fruits are fashioned from paxiúba (Strudwick and Sobel 1988).

Although the fruits are rarely eaten, the Tukano consume the ovoid-cylindrical fruits that measure some 3 cm by 2 cm (Schultes 1974). The Chácobo of the Bolivian Amazon drink a juice prepared from the fruits to treat fever (Boom 1988). And the Kichwa in the Ecuadorian Amazon hunt near the palm because monkeys eat its fruits (Balslev and Barford 1987). Other game animals, such as white-lipped peccaries (*Tayassu pecari*) and white-collared peccaries (*Pecari* *tajacu*) also eat the yellow fruits of *Socratea exorrhiza* when they fall to the ground and probably serve as dispersal agents for the palm since they pass the seeds whole (Kiltie 1981b).

Indigenous groups employ the palm for a variety of other uses, including weapons. The Karipuna, who earned a reputation for fiercely defending their territory from rubber tappers along the Upper Madeira in the mid-nineteenth century, used the palm to make their sturdy bows (Keller 1874: 49); now, however, the tribe is down to only a dozen individuals. The Yanomama who inhabit the forest in the border area between Brazil and Venezuela use young stems of the palm to fashion their bows (Saffirio and Scaglion 1982) as do the Yagua (Chaumeil 1987: 74). Harpoons for fishing have long been fashioned from young paxiúba stems (Wallace 1853: 36). Several indigenous groups carve spears from paxiúba wood including the Maijuna in the Peruvian and Colombian Amazon (Gilmore et al. 2013), the Waorini in the Ecuadorian Amazon (Davis and Yost 1983), and the Nukak in the northern part of the Colombian Amazon (Politis 1996b: 297). Nukak spears are approximately 2.5 m long and 2 cm in diameter and are used mostly for medium-sized game such as peccaries and occasionally for fishing (Politis 2007: 203).

In the nineteenth century, indigenous groups of the upper Rio Negro used the hard wood of *Socratea exorrhiza* to make arrowheads (Spruce 1853c). The tips were notched so that they broke off in game animals, thus allowing the poison to take effect. In times of war, the Karapanã of the Panuré River, a tributary of the Uaupés, booby-trapped paths leading to their villages with large paxiúba splinters tipped with poison that would impale the feet of would-be attackers (Spruce 1854b). In the early twentieth century, the Makú, who still obtain most of their food from hunting, fishing, and gathering in the Japurá and Uaupés watersheds, also made arrow points with the durable wood of paxiúba (Tastevin 1922). The Yanomama still use wood obtained from the trunk of the palm to fashion arrowheads for shooting monkeys (Albert and Milliken 2009: 61), as do the Asuriní who use arrows to hunt a wide assortment of game (Lukesch 1976a: 80).

In the nineteenth century, long pins fashioned from paxiúba were used to secure feather headdresses along the Uaupés and its tributaries (Spruce 1855). The Ikpeng of the Upper Xingu make clubs from the palm (Simões 1963), while the Xikrin in the Tocantins watershed fashion digging sticks from the wood to plant maize (Fuerst 2006: 65). Tukanoan groups along the Uaupés and the Pirá-paraná Rivers in northwestern Amazonia make sacred flutes (*jurupar*í*s*) from the palm stems (Field 1996; Hugh-Jones 1979: 134; Schultes 1974). Such flutes are wrapped in palm leaves and stored in the bed of stream or river for use in certain rituals. Women are not allowed to see the flutes in Tukanoan society under any circumstances. The Barasana also use the palm wood for the inner tube of trumpets (Hugh-Jones 1979: 135).

In the Ecuadorian Amazon, the Siona-Secoya eat heart-of-palm extracted from nico, as they call the palm. Pieces of the palmito are also inserted among *Attalea* palm fronds used to thatch their houses in order to ward off insects (Balslev 1987).

The walking palm enters the mythology of some indigenous groups. The palm features in Baniwa stories about the beginning of the world. In honor of the first ancestors, the Baniwa fashion flutes and trumpets from the stem of the palm which they bring out on certain occasions (Wright 2013: 170). And the Makuxi who inhabit Roraima in the northern part of the Brazilian Amazon recount a myth about two sons of the Sun who decide to do away with the grandmother who adopted them because they considered her responsible for the death of their mother. Their grandmother was also raising two young jaguars. One day, the brothers invited the grandmother help them burn a field cleared in the forest so that they could plant crops. The grandmother was asked to go to the center of the field to set fire to the slashed vegetation. Once there, the brothers set fire to the perimeter of the field and she was trapped. The boys ensconced into a hut they had built with stems of paxiúba palm for protection. When the fire reached the grandmother she exploded and burning pieces of stone rained down on the hut, but the brothers were safe because paxiúba wood is so hard (Diniz 1971).

56 Syagrus inajai

Brazil: Pirima, pupunharana, siriva; marari-'ɨ (Ka'apor)

Status: Wild

Fig. 56.1 *Syagrus inajai* with immature fruit at the edge of a podzol (campina). Km 102 Itacoatiara-Manaus highway (AM 010), Amazonas, Brazil 12-9-06

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_56

A relatively short palm in upland forests, *Syagrus inajai* occurs in central and eastern Amazonia as well as the Guianas (Henderson 1995: 131; Lorenzi et al. 2010: 330). Although not economically important, the fruits are consumed on occasion, and the Nambicuara in Mato Grosso made bows from the palm stem in the mid-twentieth century (Oberg 1953: 93). The palm occurs singly and is not common. Even so, people may have had something to do with the palms distribution as well as its density.

Fig. 56.2 Young *Syagrus inajai* growing in secondary forest on an archaeological site with Amazon Dark Earth (ADE). Caretas, Rio Urubu, Amazonas, Brazil, 10-17-12

Along the lower Urubu River, for example, *S. inajai* grows on an archaeological site above a rocky shore with abundant a petroglyphs depicting faces, hence the name of the site: Caretas. The people who carved the numerous faces on the scattered sandstone rocks along that section of the river are long gone, but judging by the worn appearance of many of the petroglyphs, they occupied the site a long time ago.

Further west in the Andean foothills, a sister species, *Syagrus sancona*, is found from Colombia south to Bolivia (Henderson 1995: 135). Its distribution is also considered anthropogenic, at least in part.

Fig. 56.3 Inchahui (*Syagrus sancona*) in montane forest in foothills of the Andes at 742 m. Near Sauce, Laguna Azul, Peru, 8-23-04

Wettinia maynensis

57

Ecuador: Kilo, huevo de toro, palma blanca; terena (Shuar)
Peru: Pona, ponilla; kúun (Aguaruna)

Status: Wild

Fig. 57.1 Kilo (*Wettinia maynensis*) with drooping leaflets intermingled with taller *Iriartea deltoidea* palms. Andean foothills at 400 m, Puyo valley, Pastaza, Ecuador, 9-23-13

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1_57

Wettinia maynensis is a solitary palm in the foothills of the Andes in Colombia, Ecuador, and Peru. The Kichwa in the Upper Pastaza watershed use the fronds for thatch and the stems are split to make flooring (Henderson 1995: 100). A sister species, *W. augusta* occurs in Colombia, Peru, and Acre, Brazil, and is used for similar purposes. They may in fact be one and the same species.

Fig. 57.2 Pona *Wettinia augusta* in flower in montane forest in the Andes at 956 m. Morro de Calzada, Mayo Valley, San Martin, Peru, 8-20-04

Appendices

Appendix 1: Voucher Specimens of Palms Collected in Peru

Local name	Scientific name	Voucher
Aguajillo	*Mauritiella armata*	IHC 7898
Chontilla	*Bactris riparia*	IHC 7567
Ñejilla	*Bactris bifida*	NS 016, IHC 7890
Ñejilla	*Bactris brongniartii*	IHC 7799, 7850, 7742
Ñejilla	*Bactris concinna* var. *sigmoidea*	NS 004, 026, IHC 7839
Ñejilla	*Bactris maraja*	NS 002, IHC 7885
Ñejilla	*Bactris martiana*	IHC 7630, 7822

Note
Voucher specimens were collected in 2005 and 2006 with the collaboration of Rodolfo Vasquez and his assistant Isau Huamantupa and deposited with the Herbario Nacional in Lima and herbaria of the Missouri Botanical Garden in Oxapampa, Peru, and in St. Louis, USA

Appendix 2: Some Indigenous Groups in Amazonia that Use Palms

Name	Location
Achuar	Pastaza, Morona and Corrientes River in southern Ecuador
Amahuaca	Headwaters of Purus and Juruá Rives and headwaters of right bank affluents of the Ucayali in Peru and contiguous areas of Brazil
Apinajé	Interfluve between the Tocantins and Araguaia near the confluence of the rivers
Araweté	Ipixuna River, a right bank affluent of the middle Xingu
Asuriní	Forest inland from the right bank of lower Xingu near its confluence with the Bacajá
Baciarí	Upper Xingu
Baniwa	Içana River, affluent of the Upper Negro, Amazonas, Brazil

(continued)

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1

Name	Location
Barasana	Pirá-paraná River, Colombia
Bora	Left bank affluents of the Amazon River between the Napo and Putumayo Rivers in Colombia and Peru
Bororo	Mato Grosso
Candoshi	Pastaza River, Peru
Cashinawa	Curanja and Upper Purús Rivers, Peru, and contiguous areas in Brazil
Canela	Eastern fringes of Amazonia in headwaters of Santo Estévão and Ourives Rivers, Maranhão
Chácobo	Beni Department, Bolivia
Chayahuita	Peruvian Amazon in an area bordered by the Marañón River to the north, the Huallaga River to the east, and the Cahuapanas River to the west
Cubeo	Upper Uaupés, Colombia
Desana	Upper Uaupés and Tiquié Rivers in Brazil and Colombia
Deni	Interfluvial forest between the Juruá and Purus Rivers
Erigpactsá	Upper Juruena, a tributary of the Xingu
Ese Eja	Southeastern part of the Peruvian Amazon
Galibí	Oiapoque River, border between Amapá, Brazil, and French Guiana
Gaviões	Affluents of the right bank of the middle Tocantins River, Pará
Gorotirê Kayapó	Fresco River, a tributary of the Xingu
Guajá (Awá)	Turiaçu River, Maranhão
Guajajara	Western Maranhão
Ikpeng	Upper Xingu, Mato Grosso
Jamandí	Purús River, Amazonas, Brazil
Jurúna	Upper Xingu
Ka’apor	Western Maranhão
Kaiabí	Juruena River, Mato Grosso
Kamayurá	Mato Grosso
Kanamari	Jutaí and middle Juruá Rivers, southeastern Amazonas, Brazil
Karajá	Araguaia River
Karapanã	Panuré River, a tributary of the Uaupés
Karipuna	Upper Madeira River
Katukina	Biá River, an affluent of the Jutaí in Amazonas, Brazil
Kaxinawá	Acre River, Acre, Brazil and contiguous Peru
Kayabí	Upper Xingu
Kayapó	Widely scattered villages in the interfluvial forest between the Xingu and Tocantins
Kichwa	Andean foothills, Ecuador
Krahô	Upper Tocantins, Goiás
Kuikuro	Upper Xingu
Kuruaya	Curuá River, affluent of the Iriri, Xingu Basin
Lama (Lamisto)	Lamas and Huallaga Rivers, Peru
Machiguenga	Urubamba and Upper Manu Rivers, Peru
Maijuna (Orejón, Coto)	Putumayo watershed (Colombia and Peru) and lower Napo and Algodón, affluents of the Amazon in Peru
Makú (Yuhupde)	Right bank affluents of the Upper Rio Negro in Brazil and Colombia

(continued)

Name	Location
Makuna	Apaporis River, Colombia
Makuxi	Rupununi savannas in Roraima and neighboring Guyana
Matis	Javari River, border between Brazil and Peru
Mayoruna (Matsés)	Galvez and Javari watersheds in Peru and Brazil
Mehinaku	Upper Xingu
Mekranoti	Interfluvial forest between the Xingu, Iriri and Curuá Rivers, Pará
Miraña	Middle Caquetá River, Colombia
Mura	Madeira River, Amazonas, Brazil
Nambicuara	Mato Grosso
Nocamán	Headwaters of the Inuya, affluent of the lower Urubamba, Peru
Nukak (Makú)	Interfluvial forest between Guaviare and Inirida Rivers, affluents of the Upper Orinoco, Colombia
Palikur	Coast of Amapá and adjacent French Guiana
Pareci	Northwestern Mato Grosso
Parintintin	Middle Madeira River, Amazonas, Brazil
Peba	Lower Putumayo and Napo Rivers
Pemon	Northern Amazon and contiguous areas of the Guianas
Piapoco	Guaviare watershed, Colombia
Piaroa	Middle Orinoco
Pirahã	Maici River, a tributary of the Marmelos which in turn flows into the Madeira, Amazonas, Brazil
Sápara	Napo and Alto Pastaza Rivers, Ecuador
Saterê-Maué	Maué River Basin, Amazonas, Brazil
Shipibo	Ucayali River
Shuar	Zamora-Chinchipe Province, Ecuador
Siona-Secoya	Upper Putumayo, Colombia and Ecuador
Siriono	Interfluvial areas between the Mamoré and San Martin Rivers, eastern Bolivia
Suruí	Ji-Paraná River, Rondônia, Brazil
Tanimuka	Mirití-Paraná River, an affluent of the Caquetá, Colombia
Tapirapé	Tapirapé River, left bank affluent of the Araguaia
Tacana	Madidi River, affluent of the Beni, Bolivia
Tembé	Border area between Pará and Maranhão
Tenetehara	Pinaré and nearby rivers in western Maranhão
Ticuna	Solimões River, Brazil, Amazon River in Colombia and Peru
Trinitario	Beni Department, Bolivia
Tsimane’	Beni Department, Bolivia
Tukano	Tiquié River, affluent of the Uaupés, Amazonas, Brazil
Tuyuka	Upper Tiquié River, affluent of the Uaupés, Amazonas, Brazil
Urubu (Ka’apor)	Western Maranhão
Waimiri-Atroari	Amazonas/Roraima border area, Brazil
Waorani	Southern tributaries of the middle Napo River, Ecuador
Wapishana	Rupununi savannas in Roraima and neighboring Guyana

(continued)

Name	Location
Waurá	Upper Xingu
Wayana	Northern Amapá and Pará, Brazil, and contiguous French Guiana
Witoto	Caquetá and Putumayo Rivers, Colombia
Xavante	Rio das Mortes, affluent of the Upper Araguaia in Tocantins State
Xerente	Upper Tocantins River, Tocantins, Brazil
Xinguano	Upper Xingu
Yagua	Amazon River and lower courses of some affluents in Peru and Colombia
Yanomama	Border area between Amazonas, Brazil, and southern Venezuela
Yawanawá	Upper Gregório and Acre Rivers in Acre, Brazil
Yukuna	Miritiparaná River, affluent of the Caquetá, Colombia
Yuracaré	Cochabamba and Beni Departments, Bolivia

References

Ab'Sáber AN (2001) The prehistoric human geography of Brazil. Amazoniana 16(3/4):303–311

Acosta LE (2001) Los sistemas de producción de la etnia Ticuna del resguardo de Puerto Nariño, sur del trapecio Amazónico: una aproximación socioeconómica. Cadernos de Desarrollo Rural 46:101–132

Adler GH, Kestell DW (1998) Fates of Neotropical tree seeds influenced by spiny rats (*Proechimys semispinosus*). Biotropica 30(4):677–681

Agassiz L, Agassiz EC (1896) A journey in Brazil. Houghton, Mifflin and Company, Boston

Aguiar JPL, Marinho HA, Rebêlo YS, Shrimpton R (1980) Aspectos nutritivos de alguns frutos da Amazônia. Acta Amazon 10(4):755–758

Aguilar S, Condit R (2001) Use of native tree species by an Hispanic community in Panama. Econ Bot 55(2):223–235

Alarcón JGS, Peixoto AL (2008) Use of terra firme forest by Caicubi caboclos, Middle Rio Negro, Amazonas, Brazil: a quantitative study. Econ Bot 62(1):60–73

Albert B, Milliken W (2009) Uhiri a: a terra-floresta Yanomami. Instituto Sociambental (ISA)/ Institut de Recherche pour le Devéloppement, São Paulo

Alfinito J (1975) A preservação da tartaruga amazônica. Brasil Florestal 6(21):20–23

Allen PH (1947) Indians of southeastern Colombia. Geogr Rev 37(4):567–582

Allen PH (1965a) Rain forest palms of Golfo Dulce. Principes 9:48–62

Allen PH (1965b) *Raphia* in the western world. Principes 9:66–70

Anderson AB (1977) Os nomes e usos de palmeiras entre uma tribo de índios Yanomama. Acta Amazon 7(1):5–13

Anderson AB (1978) The use of palms among a tribe of Yanomama Indians. Principes 22:30–41

Anderson AB (1981) White-sand vegetation of the Brazilian Amazonia. Biotropica 13(3):199–210

Anderson AB (1990) Extraction and forest management by rural inhabitants in the Amazon estuary. In: Anderson AB (ed) Alternatives to deforestation: steps toward sustainable use of the Amazon rain forest. Columbia University Press, New York, pp 65–85

Anderson AB, Ioris EM (1992) Valuing the rain forest: economic strategies by small-scale forest extractivists in the Amazon estuary. Hum Ecol 20(3):337–369

Anderson AB, Posey DA (1985) Manejo de cerrado pelos índios Kayapó. Boletim do Museu Paraense Emílio Goeldi, Botânica 2(1):77–98

Anderson AB, Gely A, Strudwick J et al (1985) Uma sistema agroflorestal na várzea do estuário amazônico (Ilha das Onças, Município de Barcarena, Estado do Pará). Acta Amazon 15(Suppl 1–2):195–224

Anderson AB, May PH, Balick MJ (1991) The subsidy from nature: palm forests, peasantry, and development on an Amazon frontier. Columbia University Press, New York

Anderson AB, Magee P, Gély A, Jardim MAG (1995) Forest management patterns in the floodplain of the Amazon estuary. Conserv Biol 9(1):47–61

Araújo-Lima C, Goulding M (1997) So fruitful a fish: ecology, conservation, and aquaculture of the Amazon's tambaqui. Columbia University Press, New York

N. Smith, *Palms and People in the Amazon*, Geobotany Studies,
DOI 10.1007/978-3-319-05509-1

Arco MP, Torre-Cuadros M, Reynel C (2011) Cultural transmission on palms among Ese Eja communities in Peru. Bioremediat Biodivers Bioavailab 5:92–99

Århem K, Cayón L, Angulo G, García M (2004) Etnografía Makuna: tradiciones, relatos y saberes de la gente de agua. Acta Universitatis Gothoburgensis, Göthenborg

Arkcoll D (1990) New crops from Brazil. In: Janick J, Simon JE (eds) Advances in new crops. Timber Press, Portland, pp 367–371

Arnaud E (1964) Notícia sôbre os índios Gaviões de Oeste, Rio Tocantins, Pará. Boletim do Museu Paraense Emílio Goeldi, Nova Série, Antropologia 20:1–35

Arnaud E (1989) O índio e a expansão nacional. CEJUP, Belém

Augustat C (2013) Beyond Brazil. Museum für Völkerkunde, Vienna

Baar R, Cordeiro M, Denich M, Fölster H (2004) Floristic inventory of secondary vegetation in agricultural systems of east-Amazonia. Biodivers Conserv 13:501–528

Bahri S (1992) L'agroforesterie, une alternative pour le développement de la plaine alluviale de l'Amazone: l'exemple de l'île de Careiro. Thesis, Université de Montpellier

Baldus H (1970) Tapirapé: tribo Tupí no Brasil central. Companhia Editora Nacional, São Paulo

Balée W (1987) Cultural forests of the Amazon. Garden 11(6):12–14, 32

Balée W (1988) Indigenous adaptation to Amazonian palm forests. Principes 32(2):47–54

Balée W (1989) Cultura na vegetação da Amazonia brasileira. In: Neves WA (ed) Biologia e ecologia humana na Amazonia: avaliação e perspectivas. Museu Paraense Emilio Goeldi, Belém, pp 95–109

Balée W (1993) Footprints of the forest: Ka'apor ethnobotany- the historical ecology of plant utilization by an Amazonian people. Columbia University Press, New York

Balée W (1998) Historical ecology: premises and postulates. In: Balée W (ed) Advances in historical ecology. Columbia University Press, New York, pp 13–29

Balée W (2010a) Culturas de distúrbio e diversidade em substrates Amazônicos. In: Teixeira W, Kern DC, Madari BE et al (eds) As terras pretas de índio da Amazônia: sua caracterização e uso deste conhecimento na criação de novas áreas. EDUA/EMBRAPA, Manaus, pp 49–53

Balée W (2010b) Contingent diversity on anthropic landscapes. Diversity 2:163–181

Balée W (2013) Cultural forests of the Amazon: a historical ecology of people and their landscapes. University of Alabama Press, Tuscaloosa

Balée W, Campbell DG (1990) Evidence for the successional status of liana forest (Xingu River Basin, Amazonian Brazil). Biotropica 22(1):36–47

Balée W, Gély A (1989) Managed forest succession in Amazonia: the Ka'apor case. In: Posey DA, Balée W (eds) Resource management in Amazonia: indigenous and folk strategies, vol 7, Advances in economic botany. New York Botanical Garden, Bronx, pp 129–158

Balick MJ (1979) Amazonian oil palms of promise: a survey. Econ Bot 33(1):11–28

Balick MJ (1980) Economic botany of the Guahibo, I: Palmae. Econ Bot 33(4):361–376

Balick MJ (1981) *Jessenia bataua* and *Oenocarpus* species: native Amazonian palms as new sources of edible oil. In: Pryde EH, Princen LH, Mukherjee KO (eds) New sources of fats and oils. American Oil Chemists' Society, Champaign, pp 141–155

Balick MJ (1984) Ethnobotany of palms in the Neotropics. Adv Econ Bot 1:9–23

Balick MJ (1988) The use of palms by the Apinayé and Guajajara Indians of Northeastern Brazil. In: Balick MJ (ed) The palm, tree of life: biology, utilization and conservation, Advances in economic botany 6. New York Botanical Garden, Bronx, pp 65–90

Balick MJ, Gershoff SN (1981) Nutritional evaluation of the *Jessenia bataua* palm: source of high quality protein and oil from tropical America. Econ Bot 35(3):261–271

Balick MJ, Anderson A, Balick MJ, Frazão JMF (1985) Subsistence benefits from the babassu palm (*Orbignya martiana*). Econ Bot 39(2):113–129

Balslev H (1987) Palmas nativas de la Amazonía Ecuatoriana. Revista Colibrí 3:64–73

Balslev H (2011) Palm harvest impacts in north-western South America. Bot Rev 77(4):370–380

Balslev H, Barford A (1987) Ecuadorian palms- an overview. Opera Botanica 92:17–35

Balslev H, Henderson A (1986) *Elaeis oleifera* (Palmae) encontrada en el Ecuador. Publicaciones Museo Ecuatoriano de Ciencias Naturales 5:45–49

Balslev H, Rios M, Quezada G, Nantipa B (1997) Palmas utiles en la cordillera de los Huacamayos: etnobotánica de palmas de la comunidad Quichua de Santa Rita, Provincia del Napo, Ecuador. PROBONA, Quito
Balslev H, Knudsen TR, Byg A et al (2010a) Traditional knowledge, use, and management of *Aphandra natalia* (Arecaceae) in Amazonian Peru. Econ Bot 64(1):55–67
Balslev H, Eiserhardt W, Kristiansen T, Pedersen D (2010b) Palms and palm communities in the Upper Ucayali River valley: a little known region in the Amazon Basin. Palms 54(2):57–72
Balslev H, Kahn F, Millan B et al (2011) Species diversity and growth forms in tropical American palm communities. Bot Rev 77:381–425
Barboza MSL (2010) Os morcegos (Chiroptera, mammalia) como fonte de alimento para as indígenas Katukina do Rio Biá na Amazônia. Curso de Especialização em Indigenismo. Universidade Positivo, Curitiba
Barcelos E (1986) Características genético-ecológicas de populações naturais de caiaué (*Elaeis oleifera*, H.B.K., Cortés) na Amazônia brasileira. Instituto Nacional de Pesquisas da Amazônia/Universidade do Amazonas, Manaus
Barcelos E (1998) Étude de la diversité génétique du genre *Elaeis* (*E. oleifera* (Kunth) Cortés et *E. guineensis* Jacq.) pour marqueurs moléculaires (RFLP et AFLP). Doctoral dissertation, École Nationale Supérieure Agronomique, Montpellier
Barford AS, Bergmann B, Pedersen HB (1990) The vegetable ivory industry: surviving and doing well in Ecuador. Econ Bot 44(3):293–300
Barnett AA, Borges SH, Castilho CV et al (2002) Primates of the Jaú National Park, Amazonas, Brazil. Neotrop Primates 10(2):65–71
Bates HW (1863a) The naturalist on the River Amazons, vol 1. John Murray, London
Bates HW (1863b) The naturalist on the River Amazons, vol 2. John Murray, London
Beck H (2006) A review of peccary-palm interactions and their ecological ramifications across the Neotropics. J Mammal 87(3):519–530
Bellwood P (2005) First farmers: the origins of agricultural societies. Blackwell Publishing, Oxford
Bennett BC (1992) Plants and people of the Amazonian rainforests: the role of ethnobotany in sustainable development. Bioscience 42(8):599–607
Bernal RG (1992) Colombian palm products. In: Plotkin M, Famolare M (eds) Sustainable harvest and marketing of rain forest products. Island Press, Washington, DC, pp 158–172
Bernal R, Galeano G, Henderson A (1991) Notes on *Oenocarpus* (Palmae) in the Colombian Amazon. Brittonia 43(3):154–164
Bernal R, Galeano G, García N et al (2010) Uses and commercial prospects for the wine palm, *Attalea butyracea*, in Colombia. Ethnobot Res Appl 8:255–268
Bernal R, Torres C, García N et al (2011) Palm management in South America. Bot Rev 77:607–646
Boaventura MAD, Galotta ALQ (2009) Polar constituents of *Euterpe precatoria* roots and their plant growth activity. Chem Nat Compd 45(5):700–701
Bodmer RE (1989) Frugivory in Amazonian artiodactyla: evidence for the evolution of the ruminant stomach. J Zool Soc Lond 219:457–467
Bodmer RE (1991) Strategies of seed dispersal and seed predation in Amazonian ungulates. Biotropica 23(3):255–261
Bodmer RE, Puertas PE, Garcia JE et al (1999) Game animals, palms, and people of the flooded forests: management considerations for the Pacaya-Samiria National Reserve, Peru. In: Padoch C, Ayres JM, Pinedo-Vasques M, Henderson A (eds) Várzea: diversity, development, and conservation of Amazonia's whitewater floodplains, Advances in economic botany 13. New York Botanical Garden, Bronx, pp 217–232
Boer JGW (1965) Palmae. In: Lanjouw J (ed) Flora of Suriname. E. J. Brill, Leiden, vol 5(1), pp 1–172

Boll T, Svenning J, Vormisto J et al (2005) Spatial distribution and environmental preferences of the piassaba palm *Aphandra natalia* (Arecaceae) along the Pastaza and Urituyacu rivers in Peru. For Ecol Manage 213:175–183

Boom BM (1986) A forest inventory in Amazonian Bolivia. Biotropica 18(4):287–294

Boom BM (1988) The Chácobo Indians and their palms. In: Balick MJ (ed) The palm, tree of life: biology, utilization and conservation, Advances in economic botany 6. New York Botanical Garden, Bronx, pp 91–97

Boom BM (1989) Use of plant resources by the Chácobo. In: Posey DA, Balée W (eds) Resource management in Amazonia: indigenous and folk strategies, Advances in economic botany 7. New York Botanical Garden, Bronx, pp 78–96

Bora PS, Narain N, Rocha RVM et al (2001) Caracterización de las fracciones protéicas y lipídas de pulpa y semillas de tucuma (*Astrocaryum vulgare* Mart.). Ciencia y Tecnología Alimentaria 3(2):111–116

Borchsenius F, Bernal R (1996) Aiphanes (Palmae), Flora Neotropica monograph 70. New York Botanical Garden, Bronx

Borgtoft PH (1992) Uses and management of *Aphandra natalia* (Palmae) in Ecuador. Bulletin de l'Institut Français d'Études Andines 21(2):741–753

Borgtoft PH (1996) Production and harvest of fibers from *Aphandra natalia* (Palmae) in Ecuador. For Ecol Manage 80:155–161

Bourdy G, DeWalt SJ, Michel LRC et al (2000) Medicinal plants uses of the Tacana, an Amazonian Bolivian ethnic group. J Ethnopharmacol 70:87–109

Braun B, Roe PG, Mekler A (1995) Arts of the Amazon. Thames & Hudson, London

Brokamp G, Valderrama N, Mittelbach M et al (2011) Trade in palm products in north-western South America. Bot Rev 77:571–606

Brondizio ES (2008) The Amazonian caboclo and the açaí palm: forest farmers in the global market, vol 16, Advances in economic botany. New York Botanical Garden, New York

Brondizio ES, Moran EF, Mausel P, Wu Y (1994) Land use change in the Amazon estuary: patterns of caboclo settlement and landscape management. Hum Ecol 22(3):249–278

Brown CB (1876) Canoe and camp life in British Guiana. Edward Stanford, London

Brown CB, Lidstone W (1878) Fifteen thousand miles on the Amazon and its tributaries. Edward Stanford, London

Brücher H (1989) Useful plants of Neotropical origin and their wild relatives. Springer, Berlin

Brum HD, Nascimento HEM, Laurance WF et al (2008) Rainforest fragmentation and the demography of the economically important palm *Oenocarpus bacaba* in central Amazonia. Plant Ecol 199:209–215

Bye R (1993) The role of humans in the diversification of plants in Mexico. In: Ramamoorthy TP, Bye R, Lot A, Fa J (eds) Biological diversity of Mexico: origins and distribution. Oxford University Press, New York, pp 707–731

Byg A, Balslev H (2006) Palms in indigenous and settler communities in southeastern Ecuador: farmers' perceptions and cultivation practices. Agrofor Syst 67:147–158

Cabalzar A (2008) Filhos da cobra de pedra: organização social e trajetórias Tuyuka no Rio Tiquié (Noroeste Amazônico). Editora UNESP, São Paulo

Cabalzar A (2012) Manejo dos peixes na bacia do Rio Tiquié: memórias e perspectivas. Instituto Sociambental (ISA)/Federação das Organizações Indígenas do Rio Negro (FOIRN), São Paulo

Cabalzar A, Lima FCT, Lopes M (2005) Peixe e gente no Alto Rio Tiquié: conhecimentos Tukano e Tuyuka, ictiologia, etnologia. Instituto Sociambental, São Paulo

Calzavara BBG (1972) As possibilidades do açaizeiro no estuário Amazônico, Boletim 5. Faculdade de Ciências Agárias do Pará, Belém

Campbell DG (1992) A comparison of the phytosociology and dynamics of three floodplain (várzea) forests of known ages, Rio Juruá, western Brazilian Amazon. Bot J Linn Soc 108:213–237

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 Amazonia. Econ Bot 57(3):324–344

Candre-Kinerai H, Alvaro J (1993) Tabaco frío, coca dulce. Colcultura, Bogotá

Carda H, Araujo Y, Glew RH, Paoletti MG (2004) Palm worm (Coleoptera, Curculionidae: *Rhynchophorus palmarum*) a traditional food: examples from Alto Orinoco, Venezuela. In: Paoletti MG (ed) Ecological implications of minilivestock: potential of insects, rodents, frogs and snails. Science Publishers, Enfield, pp 353–366

Cárdenas D, Politis GG (2000) Territorio, movilidad, etnobotánica y manejo del bosque de los Nukak orientales. Instituto Amazónico de Investigaciones Cientificas, Bogotá

Carney J, Hiraoka M (1997) *Raphia taedigera* in the Amazon estuary. Principes 41(3):125–130

Carrera L (2000) Aguaje (*Mauritia flexuosa*) a promising crop of the Peruvian Amazon. Acta Horticult 531:229–236

Carvalho MR (2002) Os Kanamari da Amazônia ocidental: história, mitologia, ritual e xamanismo. Casa de Palavras, Salvador

Carvalho MR, Reesink EB (1993) Ecologia e sociedade: uma breve introdução aos Kanamari. In: Sociedades indígenas e transformações ambientais. Núcleo de Meio Ambiente, Universidade Federal do Pará, Belém, pp 113–153

Cavalcante PB (2010) Frutas comestíveis na Amazônia. Museu Paraense Emílio Goeldi, Belém

Cavalcante PB, Johnson D (1977) Edible palm fruits of the Brazilian Amazon. Principes 21(3):91–102

Cavelier I, Rodriguez C, Herrera LF et al (1995) No solo de caza vive el hombre: ocupación del bosque Amazónico, Holoceno temprano. In: Cavelier I, Mora S (eds) Ambito y ocupaciones tempranas de la América tropical. Fundación Erigaie/Instituto Colombiano de Antropologia, Bogotá

Chagnon NA (1968) Yanomamö: The Fierce People. Holt, Rinehart and Winston, New York

Chagnon NA (1992) Yanomamö: the last days of Eden. Harcourt Brace & Company, San Diego

Chandless W (1866) Ascent of the River Purus. J Roy Geogr Soc 36:86–118

Chaumeil J-P (1987) Ñihamwo: los Yagua del nor-oriente peruano. Centro Amazónico de Antropología y Aplicación Práctica, Lima

Chaumeil J-P (1998) Ver, saber, poder: el chamanismo de los Yagua de la Amazonía Peruana. CAAAP/IFEA/CAEA-CONICET, Lima

Chaves JM, Pechnik E (1947) Tucumã. Revista de Química Industrial 16(184):5–19

Chernela JM (1988) Righting history in the northwest Amazon: myth, structure, and history in an Arapaço narrative. In: Hill J (ed) Rethinking history and myth. University of Illinois Press, Urbana, pp 35–49

Cintra R (1998) Sobrevivência pós-dispersão de sementes e plântulas de três espécies de palmeiras em relação a presença de componentes da complexidade estrutural da floresta Amazônica. In: Gascon C, Moutinho P (eds) Floresta Amazônica: dinâmica, regeneração e manejo. Instituto Nacional de Pesquisa da Amazônia (INPA), Manaus, pp 83–98

Cintra R, Horna V (1997) Seed and seedling survival of the palm *Astrocaryum murumuru* and the legume tree *Dipteryx micrantha* in gaps in Amazonian forest. J Trop Ecol 13:257–277

Cisz ME (2011) The spatial distribution of *Copernicia alba* (Morong) in the district of Bahía Negra, Paraguay. M.S. thesis, Michigan Technological University, Houghton

Civrieux M (1980) Watunna: an Orinoco creation cycle. North Point Press, San Francisco

Claros MP (1996) Ecology and socioeconomics of palm heart extraction from wild populations of *Euterpe precatoria* Mart. in eastern Bolivia. Master's thesis, University of Florida

Cleary D (2001) Towards an environmental history of the Amazon: from prehistory to the nineteenth century. Lat Am Res Rev 36(2):65–96

Clement CR (1988) Domestication of the pejibaye palm (*Bactris gasipaes*): past and present. In: Balick MJ (ed) The palm, tree of life: biology, utilization and conservation, Advances in economic botany 6. New York Botanical Garden, New York, pp 155–174

Clement CR (1989) A center of crop genetic diversity in western Amazonia: a new hypothesis of indigenous fruit-crop distribution. Biotropica 39(9):624–631

Clement CR (1992) Domesticated palms. Principes 36(2):70–78

Clement CR (1995) Pejibaye (*Bactris gasipaes*). In: Smartt J, Simmonds NW (eds) Evolution of crop plants. Longman, London, pp 383–388

Clement CR (1999) 1492 and the loss of Amazonian crop genetic resources. I. The relation between domestication and human population decline. Econ Bot 53(2):188–202

Clement CR (2008) Peach palm. In: Janick J, Paull RE (eds) The encyclopedia of fruit and nuts. CABI Publishing, Wallingford, pp 93–101

Clement CR, Junqueira AB (2010) Between a pristine myth and an impoverished future. Biotropica 43(5):534–536

Clement CR, Manshardt RM (2000) A review of the importance of spines for pejibaye heart-of-palm production. Sci Hortic 83:11–23

Clement CR, Alfaia SS, Iriarte-Martel JH et al (1997) Fruteiras nativas e exóticas. In: Noda H, Souza LAG (eds) Duas décadas de contribuições do INPA à pesquisa agronômica no trópico úmido. Instituto Nacional de Pesquisa da Amazônia, Manaus, pp 111–129

Clement CR, Aguiar JP, Arkcoll D (1998) Composição centesimal do óleo em três populações de pupunha (*Bactris gasipaes*) ao longo do Rio Solimões, Amazonas, Brasil. Rev Bras Frutic 20 (1):115–118

Clement CR, McCann JM, Smith NJH (2003) Agrobiodiversity in Amazonia and its relationship with dark earths. In: Lehmann J, Kern DC, Glaser B, Woods WI (eds) Amazonian dark earths: origin, properties, management. Kluwer, Dordrecht, pp 159–178

Clement CR, Weber JC, Van Leeuwen J et al (2004) Why extensive research and development did not promote use of palm fruit in Latin America. Agrofor Syst 61:195–206

Clement CR, Rival L, Cole DM (2009) Domestication of peach palm (*Bactris gasipaes* Kunth): the roles of human mobility and migration. In: Alexiades MN (ed) Shifting spaces, changing times: mobility, migration and displacement in indigenous lowland South America. Berghahn Books, Oxford, pp 117–140

Clement CR, Cristo-Araújo M, d' Eechenbrugge GC et al (2010) Origin and domestication of native Amazonian crops. Diversity 2:72–106

Cocco L (1975) Parima: dove la terra non accoglie i morti. Libreria Ateneo Salesiano, Rome

Coimbra CEA (1985) Estudos de ecologia humana entre os Suruí do Parque Indígena Aripuanã, Rondônia: elementos de etnozoologia. Boletim do Museu Paraense Emílio Goeldi, Série Antropologia 2:9–36

Coimbra CEA, Flowers NN, Salzano FM, Santos RV (2002) The Xavánte in transition: health, ecology, and bioanthropology in central Brazil. University of Michigan Press, Ann Arbor

Cook OF (1909) Vegetation affected by agriculture in Central America, Bulletin 145. U.S. Department of Agriculture, Bureau of Plant Industry, Washington, DC

Coomes OT (1995) A century of rain forest use in western Amazonia: lessons for extraction-based conservation of tropical forest resources. For Conserv Hist 39:108–120

Coomes OT (2004a) Rain forest 'conservation-through-use'? Chambira palm fibre extraction and handicraft production in a land-constrained community, Peruvian Amazon. Biodivers Conserv 13:351–360

Coomes OT (2004b) Paleoriverine features of the Amazon lowlands: human use of the 'Arena Negra' soils of Lake Charo, northeastern Peru. In: Glaeser B, Woods WI (eds) Explorations in Amazonian dark earths. Springer, Heidelberg, pp 53–65

Costa J (1999) The synanthropic process of Chagas disease vectors in Brazil, with special attention to *Triatoma brasiliensis* Neiva, 1911 (Hemiptera, Reduviidae, Triatominae): population, genetical, ecological, and epidemiological aspects. Memórias do Instituto Oswaldo Cruz, Suppl I, pp 239–241. http://memorias.ioc.fiocruz.br/94sup1/26.html

Costa AGV, Garcia-Diaz DF, Jimenez P, Silva PI (2013) Bioactive compounds and health benefits of exotic tropical red-black berries. J Funct Foods 5:539–549

Couvreur TLP, Hahn WJ, Granville J et al (2007) Phylogenetic relationships of the cultivated neotropical palm *Bactris gasipaes* (Arecaceae) with its wild relatives inferred from chloroplast and nuclear DNA polymorphisms. Syst Bot 32(3):519–530

Crocker WH (1990) The Canela (Eastern Timbira), I: an ethnographic introduction. Smithonian Institution Press, Washington, DC

Cunha RNV, Lopes R, Rocha NC et al (2009) Domesticação e melhoramento de caiaué. In: Borém A, Lopes MTG, Clement CR (eds) Domesticação e melhoramento: espécies Amazônicas. Editora da Universidade Federal de Viçosa, Viçosa, pp 279–300

Daniel J (2004) Tesouro descoberto no máximo rio Amazonas. Contraponto, Rio de Janeiro

Darnet SH, Silva LHM, Rodrigues AMC, Lins RT (2011) Nutritional composition, fatty acid and tocopherol contents of buriti (*Mauritia flexuosa*) and patawa (*Oenocarpus bataua*) fruit pulp from the Amazon region. Cienc Tecnol Aliment 31(2):488–491

Davis EW, Yost JJ (1983) The ethnobotany of the Waorani of eastern Ecuador. Bot Museum Leaflets Har 29(3):159–217

De Blank S (1952) A reconnaissance of the American oil palm *Elaeis melanococca* (Gaertner (em. Bailey) = *Corozo oleifera* (Giseke) *Alfonsia oleifera* (H.B.K.). Trop Agric 29:90–101

Deharo E, Baelmans R, Gimenez A et al (2004) *In vitro* immunomodulatory activity of plants used by the Tacana ethnic group in Bolivia. Phytomedicine 11:516–522

Delgado C, Couturier G (2003) Relationship between *Mauritia flexuosa* and *Eupalamides cyparissias* in the Peruvian Amazon. Palms 47(2):104–106

Delgado C, Couturier G, Mejía K (2007) *Mauritia flexuosa* (Arecaceae: Calamoideae), an Amazonian palm with cultivation purposes in Peru. Fruits 62:157–169

Delgado C, Couturier G, Mathrews P, Mejía K (2008) Producción y commercialización de la larva de *Rhynchophorus palmarum* (Coleoptera: Dryophtoridae) en la Amazonía peruana. Bol Soc Entomol Aragon 41:407–412

Denevan WM (1966) The aboriginal cultural geography of the Llanos de Mojos of Bolivia, Ibero-Americana 48. University of California Press, Berkeley

Denevan WM (1971) Campa subsistence in the Gran Pajonal, eastern Peru. Geogr Rev 61:496–529

Desbiez ALJ, Santos SA, Keuroghlian A, Bodmer RE (2009) Niche partitioning among white-lipped peccaries (*Tayassu pecari*), collared peccaries (*Pecari tajacu*), and feral pigs (*Sus Scrofa*). J Mammal 90(1):119–128

Desbiez ALJ, Rocha FL, Keuroghlian A (2010) Interspecific association between an ungulate and a carnivore or a primate. Acta Ethologica 13:137–139

Descola P (1994) In the society of nature: a native ecology in Amazonia. Cambridge University Press, Cambridge

Descola P (2013) Beyond nature and culture. University of Chicago Press, Chicago

DeWalt SJ, Bourdy G, Michel LRC, Guenevo C (1999) Ethnobotany of the Tacana: quantitative inventories of two permanent plots of northwestern Bolivia. Econ Bot 53(3):237–260

Dillehay TD, Collins MB (1988) Early cultural evidence from Monte Verde in Chile. Nature 332:150–152

Din MA, Rajanaidu N, Jalani B (2000) Performance of *Elaies oleifera* from Panama, Costa Rica, Colombia, and Honduras in Malaysia. J Oil Palm Res 12(1):71–80

Diniz ES (1971) Mitos dos índios Makuxí. Journal de la Société des Américanistes 60:75–103

Dole GE (1998) Los Amahuaca. In: Santos F, Barclay F (eds) Guía etnográfica de la Alta Amazonía, volumen III: Cashinahua, Amahuaca, Shipibo-Conibo. Smithsonian Tropical Research Institute/Ediciones Abya-Yala, Quito, pp 125–273

Ducke A, Black G (1954) Notas sôbre a fitogeografia da Amazônia brasileira, Boletim Técnico 29. Instituto Agronômico do Norte, Belém

Dull RA, Nevle RJ, Woods WI et al (2010) The Columbian encounter and the little ice age: abrupt land use change, fire, and greenhouse forcing. Ann Assoc Am Geogr 100(4):1–17

Echeverri JA, Román-Jitdutjaaño OE (2011) Witoto ash salts from the Amazon. J Ethnopharmacol 138:492–502

Eden MJ, McGregor DFM, Vieira NAQ (1994) Pasture development on cleared forest land near Maracá Island. In: Hemming J (ed) The rainforest edge: plant and soil ecology of Maracá. Manchester University Press, Manchester, pp 134–157

Edwards WH (1847) A Voyage up the River Amazon, including a Residence at Pará. John Murray, London

Endo W, Peres CA, Rebêlo GH et al (2010) Padrões de uso da vida silvestre entre os Baniwa. In: Cabalzar A (ed) Manejo do mundo: conhecimentos e práticas dos povos indígenas do Rio Negro. Instituto Sociambental (ISA)/Federação das Organizações Indígenas do Rio Negro (FOIRN), São Gabriel da Cachoeira, Amazonas, pp 114–121

Erickson CL (2000) An artificial landscape-scale fishery in the Bolivian Amazon. Nature 408:190–193

Erickson CL (2006) The domesticated landscapes of the Bolivian Amazon. In: Balée W, Erickson CL (eds) Time and complexity in historical ecology. Columbia University Press, New York, pp 235–278

Erickson CL (2008) Amazonia: the historical ecology of a domesticated landscape. In: Silverman H, Isbell WH (eds) Handbook of South American archaeology. Springer, New York, pp 157–183

Erickson CL, Balée W (2006) The historical ecology of a complex landscape in Bolivia. In: Erickson CL, Balée W (eds) Time and complexity in historical ecology. Columbia University Press, New York, pp 187–233

Erikson P (1996) La griffe des aïeux: marquage du corps et démarquages ethniques chez les Matis d'Amazonie. Peeters, Paris

Erikson P (2001) Myth and material culture: Matis blowguns, palm trees, and ancestor spirits. In: Rival L, Whitehead N (eds) Beyond the visible and material: the Amerindianization of society in the work of Peter Rivière. Oxford University Press, Oxford, pp 101–121

Escheverri JA, Román OE (2011) Witoto ash salts from the Amazon. J Ethnopharmacol 138:492–502

Farabee WC (1918) The central Arawaks, vol 10. The University Museum, University of Pennsylvania, Philadelphia

Ferraroni JJ, Nunes de Melo JA, Camargo ME (1977) Moléstia de Chagas na Amazônia: ocorrência de seis casos suspeitos, autóctones, sorologicamente positivos. Acta Amazon 7 (3):438–440

Ferreira AR (1971) Viagem filosófica pelas capitanias do Grão Pará, Rio Negro, Mato Grosso e Cuiabá, 1783–1792: iconografia, volume I: geografia-antropologia. Conselho Federal de Cultura, Rio de Janeiro

Ferreira AR (1972) Viagem filosófica pelas capitanias do Grão Pará, Rio Negro, Mato Grosso e Cuiabá, memórias zoologia, botânica. Conselho Federal de Cultura, Rio de Janeiro

Ferreira LV, Prance GT (1998) Structure and species richness of low-diversity floodplain forest on the Rio Tapajós, eastern Amazonia, Brazil. Biodivers Conserv 7:585–596

Ferreira LV, Stohlgren TJ (1999) Effects of river level fluctuation on plant species richness, diversity, and distribution in a floodplain forest in central Amazonia. Oecologia 120(4):582–587

Field DV (1996) Richard Spruce's economic botany collections at Kew. In: Seaward MRD, FitzGerald SMD (eds) Richard Spruce (1817–1893): botanist and explorer. Royal Botanic Gardens, Kew, pp 246–264

Flores C, Ashton PMS (2000) Harvesting impact and economic value of *Geonoma deversa*, Arecaceae, an understory palm used for roof thatching in the Peruvian Amazon. Econ Bot 54 (3):267–277

Fock N (1963) Waiwai: religion and society of an Amazonian tribe. National Museum, Copenhagen

Fonseca L (1895) No Amazonas. Companhia Geral Typographica Editora, Lisbon

Fonseca ET (1924) O Babassú (*Attalea speciosa* Mart., *Orbignia martiana* Barb. Rodr.). Ministerio da Agricultura, Industria e Commercio, Serviço de Informação, Rio de Janeiro

Fragoso JMV (1997) Tapir-generated seed shadows: scale-dependent patchiness in the Amazon rain forest. J Ecol 85:519–529
Fragoso JMV (1998) Home range and movement patterns of white-lipped peccary (*Tayassu pecari*) herds in the northern Brazilian Amazon. Biotropica 30(3):458–469
Fragoso JMV (1999) Perception of scale and resource partitioning by peccaries: behavioral causes and ecological implications. J Mammal 80(3):993–1003
Fragoso JVM, Silvius KM, Correa J (2003) Long-distance seed dispersal by tapirs increases seed survival and aggregates tropical trees. Ecology 84(4):1998–2006
Fraser JA, Junqueira AB, Clement CR (2011a) Homegardens on Amazonian dark earths, non-anthropogenic upland, and floodplain soils along the Brazilian middle Madeira River exhibit diverging agrobiodiversity. Econ Bot 65(1):1–12
Fraser JA, Junqueira AB, Kawa NC et al (2011b) Crop diversity on anthropogenic dark earths in central Amazonia. Hum Ecol 39(4):395–406
Freitas JG (1926) Os índios Parintintin. Journal de la Société des Américanistes (Paris, N.S.) 18:67–73
Frikel P (1978) Áreas de arboricultura pré-agrícola na Amazônia: notas preliminares. Revista de Antropologia (São Paulo) 21(1):45–52
Fuerst R (2006) Xikrin hommes oiseaux d'Amazonie. 5 Continents Editions, Milan
Fujisaka S, Escobar G, Veneklaas EJ (2000) Weedy fields and forests: interactions between land use and the composition of plant communities in the Peruvian Amazon. Agric Ecosyst Environ 78:175–186
Galeano JC (2005) Cuentos Amazónicos. Literalia Editores, Zapopan
Galetti M, Guimarães PR (2004) Seed dispersal of *Attalea phalerata* (Palmae) by crested caracaras (*Caracara plancus*) in the Pantanal and a review of frugivory by raptors. Ararajuba 12(2):133–135
Galotta AL, Boaventura MAD, Lima LARS (2008) Antioxidant and cytotoxic activities of açaí (*Euterpe precatoria* Mart.). Quim Nova 31(6):1427–1430
Gálvez D, Jansen PA (2007) Bruchid beetle infestation and the value of *Attalea butyracea* endocarps for Neotropical rodents. J Trop Ecol 23:381–384
Gammage B (2011) The biggest estate on earth: how aborigines made Australia. Allen & Unwin, Sydney
Gasché J (1972) L'habitat Witoto: "progrès" et tradition. Journal de La Société des Americanistes 61:177–214
Gascon JP, Noiret JM, Meunier J (1989) Oil palm. In: Röbbelen G, Downey KR, Ashri A (eds) Oil crops of the world: their breeding and utilization. McGraw-Hill, New York, pp 475–493
Gasson RA (2002) Orinoquia: the archaeology of the Orinoco River Basin. J World Prehist 16:237–311
Gates RR (1927) A botanist in the Amazon valley: an account of the flora and fauna in the land of floods. H. F. & G. Witherby, London
Gertsch J, Stauffer FW, Narváez A, Sticher O (2002) Use and significance of palms (Arecaceae) among the Yanomamï in southern Venezuela. J Ethnobiol 22(2):219–246
Ghesquière M, Barcelos E, Santos MM, Amblard P (1987) Polymorphisme enzymatique chez *Elaeis oleifera* H.B.K. (*E. melanococca*): analyse des populations du bassin amazonien. OléAgineux 42(4):143–154
Giacone A (1949) Os Tucanos e outros tribus do Rio Uaupés, afluente do Negro-Amazonas: notas etnográficas e folclóricos de um missionário Salesiano. Imprensa Oficial do Estado, São Paulo
Gilbert B (1995) Economic plants of the Amazon: their industrial development in defense of the forest. In: Seidl PR, Gottlieb OR, Kaplan MAC (eds) Chemistry of the Amazon: biodiversity, natural products, and environmental issues. American Chemical Society, Washington, DC, pp 19–33
Gilmore MP, Eshbaugh WH, Greenberg AM (2002) The use, construction, and importance of canoes among the Maijuna of the Peruvian Amazon. Econ Bot 56(1):10–26

Gilmore MP, Endress BA, Horn CM (2013) The socio-cultural importance of *Mauritia flexuosa* palm swamps (aguajales) and implications for multi-use management in two Maijuna communities of the Peruvian Amazon. J Ethnobiol Ethnomed 9:29–52

Glenboski LL (1983) The Ethnobotany of the Tukuna Indians, Amazonas, Colombia. Universidad Nacional de Colombia, Bogotá

Gomes DMC (2008) O uso social da cerâmica de Parauá, Santarém, Baixo Amazonas: uma análise funcional. Arqueología Suramericana 4(1):4–33

Gomez-Beloz A (1997) Tamihara: a spinning top made from the dried palm fruit shells of *Manicaria saccifera* (Arecaceae). Econ Bot 51(4):406–407

Gonçalves MA (2001) O mundo inacabado: ação e criação em uma cosmologia Amazônica. Editora UFRJ, Rio de Janeiro

González-Pérez SE, Robert P, Coelho-Ferreira M (2013) Seed use and socioeconomic significance in Kayapó handicrafts: a case study from Pará state, Brazil. Econ Bot 67(1):1–16

Gordon BL (1957) Human geography and ecology in the Sinú Country of Colombia, Ibero-Americana 39. University of California Press, Berkeley

Gordon A, Cruz APG, Cabral LMC et al (2012) Chemical characterization and evaluation of antioxidant properties of açaí fruits (Euterpe oleraceae M.) during ripening. Food Chem 133:256–263

Goulding M (1980) The fishes and the forest: explorations in Amazonian natural history. University of California Press, Berkeley

Goulding M, Smith NJH (2007) Palms: sentinels for Amazon conservation. Amazon Conservation Association (ACA)/Missouri Botanical Garden, Lima

Govoni G, Fielding D, Paoletti MG (2004) Rodent farming in the Amazon: experience with Amerindians in Venezuela. In: Paoletti MG (ed) Ecological implications of minilivestock: potential of insects, rodents, frogs and snails. Science Publishers, Enfield, pp 47–71

Gragson TL (1992) The use of palms by the Pumé Indians of southwestern Venezuela. Principes 36(3):133–142

Gragson TL (1995) Pumé exploitation of *Mauritia flexuosa* (Palmae) in the llanos of Venezuela. J Ethnobiol 15(2):177–188

Granville J (1999) Palms of French Guiana: diversity, distribution, ecology and uses. Acta Botanica Venezuelica 22(1):109–125

Gruber JG (1997) Ticuna: o livro das árvores. OGPTB (Organização Geral dos Professores Ticuna Bilíngües), Benjamin Constant, Amazonas

Grünberg G (2004) Os Kaiabi do Brasil central: história e etnografia. Instituto Sociambental, São Paulo

Guerra AT (1955) Estudo geográfico do território do Acre. Instituto Brasileiro de Geografia e Estatística. Conselho Nacional de Geografia, Rio de Janeiro

Guix JC (2005) Evidence of old anthropic effects in forests at the confluence of the Caurés and Negro Rivers, NW Amazonia: the role of Indians and caboclos. Grupo de Estudos Ecológicos (São Paulo), Série Documentos 8(1):1–27

Guyot M (1972) La maison des indiens Bora et Miraña. Journal de La Société des Américanistes 61:141–176

Hada AR (2010) O buriti (*Mauritia flexuosa* L. f.) na terra indígena Araçá, Roraima: usos tradicionais, manejo e potencial produtivo. Doctoral dissertation, INPA, Manaus

Hammen MC (1992) El manejo del mundo: naturaleza y sociedad entre los Yukuna de la Amazonia colombiana. Tropenbos, Bogotá

Hardenburg WE (1913) The Putumayo, the devil's paradise; travels in the Peruvian Amazon region and an account of the atrocities committed upon the Indians therein. T. Fisher Unwin, London

Hardon JJ (1969) Interspecific hybrids in the genus *Elaeis* II. vegetative growth and yield of F1 hybrids in *E. guineensis* x *E. oleifera*. Euphytica 18:380–388

Hartley CWS (1988) The oil palm. Longman/Wiley, New York

Hartman G (1967) Masken südamerikanischer naturvölker. Museum für Völkerkunde, Berlin

Hartt CF (1875) Amazonian tortoise myths. William Scully, Rio de Janeiro
Hecht SB (2003) Indigenous soil management and the creation of Amazonian dark earths: implications of Kayapó practices. In: Lehmann J, Kern DC, Glaser B, Woods WI (eds) Amazonian dark earths: origin, properties, management. Kluwer, Dordrecht, pp 355–372
Heckenberger MJ (2005) The ecology of power: culture, place, and personhood in the southern Amazon, A.D. 1000–2000. Routledge, New York
Heckenberger MJ, Neves EG (2009) Amazonian archaeology. Annu Rev Anthropol 38:251–266
Heckenberger MJ, Peterson JB, Neves EG (1999) Village size and permanence in Amazonia: two archaeological examples from Brazil. Lat Am Antiq 10(4):353–376
Heckenberger MJ, Kuikuro A, Kuikuro UT et al (2003) Amazonia 1492: Pristine forest or cultural parkland? Science 301:1710–1712
Heckenberger MJ, Russell JC, Toney JR, Schmidt M (2007) The legacy of cultural landscapes in the Brazilian Amazon: implications for biodiversity. Philos Trans R Soc 362:197–208
Heinen HD, Ruddle K (1974) Ecology, ritual, and economic organization in the distribution of palm starch among the Warao of the Orinoco Delta. J Anthropol Res 30(2):116–138
Henderson A (1990) Arecaceae. Part 1. Introduction and the Iriarteinae, Flora Neotropica, monograph 53. The New York Botanical Garden Press, New York
Henderson A (1995) The palms of the Amazon. Oxford University Press, New York
Henderson A (2000) *Bactris* (Palmae), Flora Neotropica monograph 79. New York Botanical Garden, Bronx
Henderson A (2002) Evolution and ecology of palms. The New York Botanical Garden Press, New York
Henderson A (2011a) A revision of *Desmoncus* (Arecaceae). Phytotaxa 35:1–88
Henderson A (2011b) A revision of *Leopoldinia* (Arecaceae). Phytotaxa 32:1–7
Henderson A, Beck HT, Scariot A (1991) Flora de palmeiras da Ilha do Marajó, Pará, Brasil. Boletim do Museu Paraense Emílio Goeldi, Série Botanica 7(2):199–221
Henderson A, Galeano G, Bernal R (1995) Field guide to the palms of the Americas. Princeton University Press, Princeton
Hernández JA, Mora-Urpí J, Rocha O (2008) Diversidad genética y relaciones de parentesco de las poblaciones silvestres y cultivadas de pejibaye (*Bactris gasipaes*, Palmae), utilizando marcadores microsatelitales. Rev Biol Trop 56(1):1–29
Hernández JA, Mora-Urpí J, Rocha O (2011) Genetic relationships among wild and cultivated populations of peach palm (*Bactris gasipaes* Kunth, Palmae): evidence for multiple independent domestication events. Genet Resour Crop Evol 58:571–583
Herndon WL, Gibbon L (1853) Exploration of the valley of the Amazon, made under the direction of the Navy Department, vol 1. Robert Armstrong, Washington, DC
Hiraoka M (1993) Mudanças nos padrões econômicos de uma população ribeirinha do estuário do Amazonas. In: Furtado LG, Leitão W, Mello AF (eds) Povos das aguas: realidade e perspectivas na Amazonia. Museu Paraense Emílio Goeldi, Belém, pp 133–157
Hiraoka M (1999) Miriti (*Mauritia flexuosa*) palms and their uses and management among the ribeirinhos of the Amazon estuary. In: Padoch C, Ayres JM, Vasques M, Henderson A (eds) Várzea: diversity, development, and conservation of Amazonia's whitewater floodplains, Advances in economic botany 13. New York Botanical Garden, Bronx, pp 169–186
Hiraoka M, Hida N (1998) Human adaptation to the changing economy and ecology on the estuarine floodplain of the Amazon estuary. Geogr Rev Jpn 71(1):45–58
Hiraoka M, Yamamoto S, Matsumoto E et al (2003) Contemporary use and management of Amazonian dark earths. In: Lehmann J, Kern DC, Glaser B, Woods W (eds) Amazonian dark earths: origin, properties, management. Kluwer, Dordrecht, pp 387–406
Hoch GA, Adler GH (1997) Removal of black palm (*Astrocaryum standleyanum*) seeds by spiny rats (*Proechimys semispinosus*). J Trop Ecol 13:51–58
Hoehne FC (1923) Phytophysionomia do estado de Matto-Grosso e ligeiras notas a respeito da composição da sua flora. Companhia Melhoramentos, São Paulo

Hoffman B (2013) Exploring biocultural contexts: comparative woody plant knowledge of an indigenous and Afro-American Maroon Community in Suriname, South America. In: Voeks R, Rashford J (eds) African ethnobotany in the Americas. Springer, New York, pp 335–393

Holmberg AR (1969) Nomads of the long bow: the Siriono of eastern Bolivia. Natural History Press, New York

Hooker WJ (1849) Some account of the vegetable ivory palm (*Phytelephas macrocarpa*). In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 1. Reeve, Benham, and Reeve, London, pp 204–212

Huber J (1902) Contribuição à geographia physica dos furos de Breves e da parte occidental de Marajó. Boletim do Museu Paraense de Historia Natural e Ethnographia 3:129–154

Huber J (1904) Notas sobre a patria e distribuição geographica das arvores fructiferas do Pará. Boletim do Museu Goeldi (Museu Paraense) de Historia Natural e Ethnographia 4(2–3):375–406

Huber J (1906) Plantas vasculares colligidas e observados no baixo Ucayali e no Pampa del Sacramento, nos mezes de outubro a dezembro de 1898. Boletim do Museu Goeldi de Historia Natural e Ethnographia 4:510–619

Huber J (1910) Mattas e madeiras amazonicas. Boletim do Museu Paraense de Historia Natural e Ethnographia 6:91–225

Hugh-Jones S (1979) The palm and the pleiades: initiation and cosmology in northwest Amazonia. Cambridge University Press, Cambridge

Humboldt A (1849) Aspects of nature. Longman, Brown, Green, and Longmans, London

Humboldt A, Bonpland A (1818) Personal narrative of travels to the equinoctial regions of the new continent during the years 1799–1804, vol 4. Longman, Hurst, Rees, Orme, and Brown, London

Iaderoza M, Baldini VLS, Draetta IS, Bovi MLA (1992) Anthocianins from fruits of açaí (*Euterpe oleracea*, Mart) and juçara (*Euterpe edulis*, Mart). Trop Sci 32(1):41–46

Izaguirre B (1927) Descripción histórico-etnográfica de algunas tribus orientales del Perú. Boletín de la Sociedad Geográfica de Lima 44:5–36

Janzen DH, Martin PS (1982) Neotropical anachronisms: the fruits the gomphotheres ate. Science 215:19–27

Jaramillo-Arango J (1952) Relación historica del viage, que hizo a los reynos del Peru y Chile el botanico d. Hipolito Ruiz en el año de 1777 hasta el de 1788, en cuya epoca regreso a Madrid. Real Academia de Ciencias Exactas, vol 1. Fisicas y Naturales, Madrid

Jatunov S, Quesada S, Díaz C, Murillo E (2010) Carotenoid composition and antioxidant activity of the raw and boiled fruit mesocarp of six varieties of *Bactris gasipaes*. Arch Latinoam Nutr 60(1):99–104

Jensen OH, Balslev H (1995) Ethnobotany of the fiber palm *Astrocaryum chambira* (Arecaceae) in Amazonian Ecuador. Econ Bot 49(3):309–319

Jerozolimski A, Ribeiro MBN, Martins M (2009) Are tortoises important seed dispersers in Amazonian forests? Oecologia 161:517–528

Johannessen CL (1966a) The domestication process in trees reproduced by seed: the pejibaye palm in Costa Rica. Geogr Rev 56(4):363–376

Johannessen CL (1966b) Pejibayes in commercial production. Turrialba 16(12):181–187

Johannessen CL (1967) Pejibaye palm: physical and chemical analysis of the fruit. Econ Bot 21 (4):371–378

Johnson A (2003) Families of the forest: the Matsigenka of the Peruvian Amazon. University of California Press, Berkeley

Jordan OC, Munn CA (1993) First observations of the blue-throated macaw in Bolivia. Wilson Bulletin 105:594–595

Jorge MLS, Howe HF (2009) Can forest fragmentation disrupt a conditional mutualism? A case from central Amazon. Oecologia 161:709–718

Junqueira AB, Shepard GH, Clement CR (2010a) Secondary forests on anthropogenic soils in Brazilian Amazonia conserve agrobiodiversity. Biodivers Conser 19:1933–1961

Junqueira AB, Shepard GH, Clement CR (2010b) Secondary forests on anthropogenic soils of the middle Madeira River: valuation, local knowledge, and landscape domestication in Brazilian Amazonia. Econ Bot 65(1):85–99

Kahn F (1991) Palms as key swamp forest resources in Amazonia. For Ecol Manage 38:133–142

Kahn F, Granville J (1992) Palms in forest ecosystems of Amazonia, Ecological studies 95. Springer, Berlin

Kahn F, Mejía K (1986) The American oil palm, *Elaeis oleifera*, in Peruvian Amazonia. Principes 30:182

Kahn F, Moussa F (1994) Las palmeras del Perú: colecciones, patrones de distribución, nombres vernáculos, Utilizaciones. IFEA (Instituto Francés de Estudios Andinos), Lima

Kahn F, Mejía K, Castro A (1988) Species richness and density of palms in terra firme forests of Amazonia. Biotropica 20(4):266–269

Kalliola R, Puhakka M, Salo J et al (1991) The dynamics, distribution and classification of swamp vegetation in Peruvian Amazonia. Ann Bot Fenn 28:225–239

Kang J, Li Z, Wu T et al (2010) Anti-oxidant capacities of flavonoid compounds isolated from acai pulp (*Euterpe oleracea* Mart.). Food Chem 122:610–617

Kang J, Xie C, Li Z et al (2011) Flavonoids from acai (*Euterpe oleracea* Mart.) pulp and their antioxidant and anti-inflammatory activities. Food Chem 128:152–157

Kang J, Thakali KM, Xie C et al (2012) Bioactivities of açaí (*Euterpe precatoria* Mart.) fruit pulp, superior antioxidant and anti-inflammatory properties to *Euterpe oleracea* Mart. Food Chem 133:671–677

Karadimas D (2005) La Raison du corps: idéologie du corps et représentations de l'environnement chez les Miraña d'Amazonie Colombienne. Peeters, Paris

Keller F (1874) The Amazon and Madeira rivers, sketches and descriptions from the note-book of an explorer. Chapman & Hall, London

Kern DC, D'Aquino G, Rodrigues TE et al (2003) Distribution of Amazonian dark earths in the Brazilian Amazon. In: Lehmann J, Kern DC, Glaser B, Woods WI (eds) Amazonian dark earths: origin, properties, management. Kluwer, Dordrecht, pp 51–75

Kerr WE, Clement CR (1980) Prácticas agrícolas de consequências genéticas que possibilitaram aos índios da Amazônia uma melhor adaptaçao às condiçoes ecológicas da região. Acta Amazon 10(2):251–261

Keuroghlian A, Eaton DP, Desbiez ALJ (2009) The response of a landscape species, white-lipped peccaries, to seasonal resource fluctuations in a tropical wetland, the Brazilian Pantanal. Int J Biodivers Conser 1(4):87–97

Kiltie RA (1981a) Distribution of palm fruits on a rain forest floor: why white-lipped peccaries forage near objects. Biotropica 13(2):141–145

Kiltie RA (1981b) Stomach contents of rain forest peccaries (*Tayassu tajacu* and *T. pecari*). Biotropica 13(3):234–236

Koch-Grünberg T (1995) Dos años entre los indios: viajes por el noroeste Brasileño 1903/1905, vol 1. Editorial Universidad Nacional, Bogotá

Kristiansen T, Svenning J, Pedersen D et al (2011) Local and regional palm (Arecaceae) species richness patterns and their cross-scale determinants in the western Amazon. J Ecol 99:1001–1015

Kronborg M, Grández CA, Ferreira E, Balslev H (2008) *Aphandra natalia* (Arecaceae), a little known source of piassaba fibers from the western Amazon. Rev Peru Biol 15(Suppl 1):103–113

Kubitzki K, Ziburski A (1994) Seed dispersal in flood plain forests of Amazonia. Biotropica 26 (1):30–43

Kugel S (2010) Acai a global super fruit, is dinner in the Amazon. The New York Times, 24 February, pp D1, D10

Kumu UP, Kenhíri T (1980) Antes o mundo não existia: a mitologia heróica dos índios Desana. Livraria Cultura Editora, São Paulo

Kvist LP, Holm-Nielsen LB (1987) Ethnobotanical aspects of lowland Ecuador. Opera Botanica 92:83–107

Landolt G (2005) El Ojo que Cuenta. IKAM, Lima

Lange A (1914) The lower Amazon. Macmillan, New York

Lau P (1975) Tipos e aspectos do Brasil. Fundação Instituto Brasileiro de Geografia e. Estatística, Rio de Janeiro

Le Cointe P (1922a) L'Amazonie Brésilienne: le pays–ses habitants, ses resources, notes et statistiques jusqu'en 1920, vol 1. Augustin Challamel, Paris

Le Cointe P (1922b) L'Amazonie Brésilienne: Le Pays–ses Habitants, ses Resources, Notes et Statistiques jusqu'en 1920, vol 2. Augustin Challamel, Paris

Lebbie A, Guries RP (2008) The role of sacred groves in biodiversity conservation in Sierra Leone. In: Sheridan M, Nyamweru C (eds) African sacred groves: ecological dynamics and social change. James Currey, Oxford

Lehmann J, Kern DC, Glaser B, Woods WI (eds) (2003) Amazonian dark earths: origin, properties, management. Kluwer, Dordrecht

Leitão AM (2008) Caracterização morfológica e físico-química de frutos e sementes de *Astrocaryum aculeatum* Meyer (Arecaceae), de uma floresta secundária. Doctoral dissertation, INPA/UFAM Programa Integrado de Pós-Graduação em Biologia e Recursos Naturais, Manaus

Lent H, Wygodzinsky P (1979) Revision of the Triatominae (Hemiptera, Reduviidae), and their significance as vectors of Chagas' disease. Bull Am Mus Nat Hist 163(3):123–520

León J (1987) Botánica de los cultivos tropicales. Instituto Interamericano de Cooperación para la Agricultura (IICA), San José

Lescure J, Emperaire L, Franciscon C (1992) *Leopoldinia piassaba* Wallace (Arecaceae): a few biological and economic data from the Rio Negro region (Brazil). For Ecol Manage 55:83–86

Levis C, Souza PF, Schietti J et al (2012) Historical human footprint on modern tree species composition in the Purus-Madeira interfluve, Central Amazonia. PLoS One 7(11):1–10

Lévi-Strauss C (1952) The use of wild plants in tropical South America. Econ Bot 6(3):252–270

Lévi-Strauss C (1994) Saudades do Brasil. Companhia das Letras, São Paulo

Lima D (2006) Vamos cuidar da nossa terra. Universidade Federal do Minas Gerais, Belo Horizonte

Lindeman JC, Mori SA (1989) The Guianas. In: Campbell DG, Hammond HD (eds) Floristic inventory of tropical countries. New York Botanical Garden, New York, pp 375–390

Lisboa PLB (1997) Florística e estrutura dos ambientes. In: Lisboa PLB (ed) Caxiunã. Museu Paraense Emílio Goeldi, Belém, pp 163–183

Lisboa PLB, Silva ML (2009) O manejo dos recursos biológicos. In: Lisboa PLB (ed) Aurá: comunidades & florestas. Museu Paraense Emílio Goeldi, Belém, pp 91–174

Lizot J (1984) Les Yanõmami centraux. Éditions de l'École des Hautes Études en Sciences Sociales, Cahiers de l'Homme, Nouvelle Série XXII, Paris

Lleras E, Coradin L (1988) Native Neotropical oil palms: state of the art and perspectives for Latin America. In: Balick MJ (ed) The palm, tree of life: biology, utilization and conservation, Advances in economic botany 6. New York Botanical Garden, Bronx, pp 201–213

Lopez-Parodi J, Freitas D (1990) Geographical aspects of forested wetlands in the lower Ucayali, Peruvian Amazonia. For Ecol Manage 33:157–168

Lorenzi H, Souza HM, Medreiros-Costa JD et al (1996) Palmeiras no Brasil, nativas e exóticas. Editora Plantarum, Odessa

Lorenzi H, Kahn F, Noblick LR, Ferreira E (2010) Flora Brasileira: Arecaceae (palmeiras). Instituto Plantarum de Estudos da Flora, Nova Odessa, São Paulo

Lugones I, Daneri ML, Conejeros WM et al (2009) *Acrocomia aculeata* as an unreported case of tricupsid regurgitation. Ann Thorac Surg 88(3):983–985

Lukesch A (1976a) Bearded Indians of the tropical forest: the Asuriní of the Ipiaçaba, notes and observations on the first contact and living together. Akademische Druck und Verlagsanstalt, Graz

Lukesch A (1976b) Mito e vida dos índios Caiapós. Editora da Universidade de São Paulo, São Paulo

Lustosa AA (1976) No estuário Amazônico: “à margem da visita pastoral”. Conselho Estadual de Cultura do Pará, Belém

Macía MJ (2004) Multiplicity in palm uses by the Huaorani of Amazonian Ecuador. Bot J Linn Soc 144:149–159

Macía MJP, Armesilla J, Cámara-Leret R et al (2011) Palm uses in northwestern South America: a quantitative review. Bot Rev 77:462–570

Mans J (2012) Amotopoan trails: a recent archaeology of Trio movements. Sidestone Press, Leiden

Manzi M, Coomes OT (2009) Managing Amazonian palms for community use: a case of aguaje (*Mauritia flexuosa*) in Peru. For Ecol Manage 257:510–517

Marcoy P (1873) A journey across South America from the Pacific Ocean to the Atlantic Ocean, vol 3. Blackie and Son, London

Mariath JGR, Lima CC, Santos LMP (1989) Vitamin A activity of buriti (*Mauritia vinifera* Mart) and its effectiveness in the treatment and prevention of xerophthalmia. Am J Clin Nutr 49 (5):849–853

Markham C (1861) The Province of Caravaya, in Southern Peru. J Roy Geogr Soc 31:190–203

Markley KS (1971) The babassú oil palm of Brazil. Econ Bot 25(3):267–304

Maroni P (1988) Noticias autenticas del famoso rio Marañón y misión apostólica de la Compañia de Jesús de la Provincia de Quito en los dilatados bosques de dicho rio, escribialas por los años de 1738. IIAP, Iquitos

Martins RC, Filgueiras TS, Albuquerque UP (2012) Ethnobotany of *Mauritia flexuosa* (Arecaceae) in a maroon community in central Brazil. Econ Bot 66(1):91–98

Martius CFP (2010) The book of palms. Taschen, Plon

May PH (1992) Babassu palm product markets. In: Plotkin M, Famolare M (eds) Sustainable harvest and marketing of rain forest products. Island Press, Washington, DC, pp 143–150

May PH, Anderson AB, Balick MJ, Frazão JMF (1985) Subsistence benefits from the babassu palm (*Orbignya martiana*). Econ Bot 39(2):113–129

Maybury-Lewis D (1967) Akwê-Shavante society. Clarendon, Oxford

Mayer WE (2006) The piassaba palm: conservation and development in the buffer zone of Peru’s Cordillera Azul National Park. Doctoral dissertation, Duke University, Durham

Mayle FE, Power MJ (2008) Impact of a drier early-mid-Holocene climate upon Amazonian forests. Philos Trans R Soc 363:1829–1838

Mayle FE, Langstroth RP, Fisher RA, Meir P (2007) Long-term forest-savannah dynamics in the Bolivian Amazon: implications for conservation. Philos Trans R Soc 362:291–307

Mee M (1988) In search of flowers of the Amazon forests. Nonesuch Expeditions, Woodbridge, Suffolk

Mejía K (1992) Las palmeras en los mercados de Iquitos. Bulletin de l’Institut Français d’Études Andines 21(2):75–79

Melatti JC (1976) Corrida de toras. Atualidade Indígena 1(1):38–45

Mesa LI (2011) Etnobotánica de palmas en la Amazonia Colombiana: comunidades indígenas Piapocos del río Guaviare, como estudio de caso. Masters’ thesis, Universidad Nacional de Colombia, Facultad de Ciencias, Bogotá

Mesa LI, Galeano G (2013) Uso y manejo de las palmas (Arecaceae) por los Piapoco del norte de la Amazonia Colombiana. Acta Bot Venez 36(1):15–38

Métraux A (1948) Tribes of the Juruá-Purús basins. In: Steward JH (ed) Handbook of South American Indians, vol 3. Smithsonian Institution, Washington, DC, pp 657–686

Meunier L (1975) Le palmier à huile américain (*Elaeis melanococca*). OléAgineux 30:51–61

Miller RP (1994) Estudo da fruticultura tradicional dos índios Waimiri-Atroari: base para a extensão agroflorestal. In: Montoya LJ, Meldrado M (eds) Anais do I Congresso Brasileiro sobre sistemas agroflorestais, Porto Velho, 3–7 Julho 1994, vol 2. EMBRAPA (Centro

Nacional de Pesquisas de Florestas/Centro de Pesquisa Agroflorestal de Rondônia), Colombo, pp 449–462
Miller C (2002) Fruit production of the ungurahua palm (*Oenocarpus bataua* subsp. *Bataua*, Arecaceae) in an indigenous managed reserve. Econ Bot 56(2):165–176
Miller RP, Proctor J (1998) A small area of young secondary forest on the Ilha de Maracá: structure and floristics. In: Milliken W, Ratter JA (eds) Maracá: the biodiversity & environment of an Amazonian rainforest. Wiley, Chichester, pp 130–134
Miller-Weisberger J (2000) A Huaorani myth of the first Miiyabu (ayahuasca vine). In: Luna LE, White SF (eds) Ayahuasca reader: encounters with the Amazon's sacred vine. Synergetic Press, Santa Fe, pp 41–45
Milliken W, Albert B (1999) The construction of a new Yanomami round-house. J Ethnobiol 17 (2):215–233
Milliken W, Ratter JA (1998) The vegetation of the Ilha de Maracá. In: Milliken W, Ratter JA (eds) Maracá: the biodiversity & environment of an Amazonian rainforest. Wiley, Chichester, pp 71–112
Milliken W, Miller RP, Pollard SR, Wandelli EV (1992) The ethnobotany of the Waimiri Atroari Indians of Brazil. Royal Botanic Gardens, Kew
Miranda VC (1903) Os campos de Marajó e a sua flora considerados sob o ponto de vista pastoral. Boletim do Museu Goeldi (Museu Paraense) de Historia Natural e Ethnographia 5(1):96–151
Miranda IP, Faria DS (2008) Guia de identificação das palmeiras de Porto Trombetas, PA. EDUA/Editora INPA, Manaus
Mitja D, Ferraz IDK (2001) Establishment of babassu in pastures in Pará, Brazil. Palms 45 (3):138–147
Moi FP (2007) Xerente: Um enfoque etnoarqueológico. Annablume Editora, São Paulo
Montagner D (1996) A morada das almas: representações das doenças e das terapêuticas entre os Marúbo. Museu Paraense Emílio Goeldi, Belém
Montúfar R, Pintaud J (2006) Variation in species composition, abundance and microhabitat preferences among western Amazonian terra firme palm communities. Bot J Linn Soc 151:127–140
Montúfar R, Laffargue A, Pintaud J et al (2010) *Oenocarpus bataua* Mart. (Arecaceae): rediscovering a source of high oleic vegetable oil from Amazonia. J Am Oil Chem Soc 87:167–172
Mora S (2001) Suelos negros y sociedad: un sistema agrícola de entonces, un sistema agrícola de ahora? In: Hiraoka M, Mora S (eds) Desarrollo sostenible en la Amazonía: ¿mito o realidad? Ediciones Abya Yala, Quito, pp 31–45
Moraes M, Sarmiento J (1992) Contribución al estudio de biología reproductiva de una especie de *Bactris* (Palmae) en el bosque de galería (Depto. Beni, Bolivia). Bulletin de l'Institut Français d'Études Andines 21(2):685–698
Moraes M, Sarmiento J, Oviedo E (1995) Richness and uses in a diverse palm site in Bolivia. Biodivers Conserv 4:719–727
Moraes M, Borchsenius F, Blicher-Mathiesen U (1996) Notes on the biology and uses of the motacú palm (*Attalea phalerata*, Arecaceae) from Bolivia. Econ Bot 50(4):423–428
Mora-Urpí J (1999) Origen y domesticación. In: Mora-Urpí J, Gainza EJ (eds) Palmito de pejibaye (*Bactris gasipaes* Kunth): su cultivo e industrialización. Editorial de la Universidad de Costa Rica, San José, pp 17–24
Mora-Urpí J, Weber JC, Clement CR (1997) Peach palm (*Bactris gasipaes* Kunth). International Plant Genetic Resources Institute (IPGRI), Rome
Morcote-Ríos G (2008) Antiguos habitantes en ríos de aguas negras: ecosistemas y cultivos en el interfluvio Amazonas, Putumayo Colombia-Brasil. Instituto de Ciencias Naturales, Facultad de Ciencias, Universidad Nacional de Colombia, Biblioteca José Jerónimo Triana, Bogotá, no 19
Morcote-Ríos G (2012) Las terras pretas del igarapé Takana: un sistema de cultivo precolombiano en Leticia, Amazonas, Colombia. Instituto de Ciencias Naturales, Instituto de Estudios Ambientales, Universidad Nacional de Colombia, IDEAS 22, Bogotá

Morcote-Ríos G, Bernal R (2001) Remains of palms (Palmae) at archaeological sites in the New World: a review. Bot Rev 67(3):309–350

Moskovits D (1998) Population and ecology of the tortoises *Geochelone carbonaria* and *G. denticulata* on the Ilha de Maracá. In: Milliken W, Ratter J (eds) Maracá: the biodiversity and environment of an Amazonian rainforest. Wiley, Chichester, pp 263–284

Muñiz-Miret N, Vamos R, Hiraoka M et al (1996) The economic value of managing açaí palm (*Euterpe oleracea* Mart.) in the floodplains of the Amazon estuary, Pará, Brazil. For Ecol Manage 87:163–173

Narváez A, Stauffer F (1999) Products derived from palms at the Puerto Ayacucho markets in Amazonas State, Venezuela. Palms 43(3):122–129

Nascimento ART, Santos AA, Martins RC, Dias TAB (2009) Comunidade de palmeiras no território indígena Krahò, Tocantins, Brasil: biodiversidade e aspectos etnotânicos. Interciencia 34(3):182–188

Navarro G, Maldonado M (2004) Geografía ecológica de Bolivia: vegetación y ambientes acuáticos. Centro de Ecología Simón I Patiño, Cochabamba

Navarro JA, Galeano G, Bernal R (2011) Impact of leaf harvest on populations of *Lepidocaryum tenue*, an Amazonian understory palm used for thatching. Trop Conserv Sci 4(1):25–38

Nebel G, Kvist LP, Vanclay JK et al (2001) Structure and floristic composition of flood plain forests in the Peruvian Amazon I. overstorey. For Ecol Manage 150:27–57

Neves EG (2007) El Formativo que nunca terminó: la larga historia de estabilidad en las ocupaciones humanas de la Amazonía central. Boletín de Arqueología 11:117–142

Neves EG, Peterson JB (2006) Political economy and pre-Columbian landscape transformations in central Amazonia. In: Balée W, Erickson CL (eds) Time and complexity in historical ecology. Columbia University Press, New York, pp 279–309

Neves EG, Petersen JB, Bartone RN, Silva CA (2003) Historical and socio-cultural origins of Amazonian Dark Earths. In: Lehmann J, Kern DC, Glaser G, Woods W (eds) Amazonian dark earths: origin, properties, management. Kluwer, Dordrecht, pp 29–50

Nimuendajú C (1924) Os índios Parintintin do Rio Madeira. Journal de La Société des Americanistes (Paris, N.S.) 16:201–278

Nimuendajú C (1939) The Apinayé. Catholic University of America Press, Washington, DC

Nimuendajú C (1948a) The Cawahib, Parintintin, and their neighbors. In: Steward JH (ed) Handbook of South American Indians, vol 3. Smithsonian Institution, Washington, DC, pp 283–297

Nimuendajú C (1948b) The Mura and Piraha. In: Steward JH (ed) Handbook of South American Indians, vol 3. Smithsonian Institution, Washington, DC, pp 255–269

Nimuendajú C (1952) The Tukuna. University of California Press, Berkeley

Nimuendajú C (1963a) The Maué and Arapium. In: Steward JH (ed) Handbook of South American Indians, vol 3. Cooper Square Publishers, New York, pp 245–254

Nimuendajú C (1963b) The Cawahib, Parintintin, and their neighbors. In: Steward JH (ed) Handbook of South American Indians, vol 3. Cooper Square Publishers, New York, pp 283–297

Nimuendajú C (1983) Os Apinayé. Museu Paraense Emílio Goeldi, Belém

Nimuendajú C (2004) In pursuit of a past Amazon: archaeological researches in the Brazilian Guyana and in the Amazon region, Etnologiska Studier 45. Världskulturmuseet, Göteborg

Normand S, Vormisto J, Svenning J et al (2006) Geographical and environmental controls of palm bet diversity in paleo-riverine forests in Amazonian Peru. Plant Ecol 186:161–176

Oberg K (1953) Indian tribes of northern Mato Grosso, Brazil, Smithsonian Institution, Institute of Social Anthropology, Publication 15. National Government Publication, Washington, DC

Oboh FOJ (2009) The food potential of tucum (*Astrocaryum vulgare*) fruit pulp. Int J Biomed Health Sci 5(2):57–64

Oboh FOJ, Oderine RA (1988) Analysis of the pulp and pulp oil of the tucum (*Astrocaryum vulgare* Mart) fruit. Food Chem 30:277–287

Odonne G, Valadeau C, Alban-Castillo J et al (2013) Medical ethnobotany of the Chayahuita of the Paranapura basin (Peruvian Amazon). J Ethnopharmacol 146:127–153

Oliveira AE (1970) Os índios Jurúna do Alto Xingu. Dédalo 6(11–12):7–291

Oliveira AG (1995) O mundo transformado: um estudo da cultura de fronteira no Alto Rio Negro, Coleção Eduardo Galvão. Museu Paraense Emilio Goeldi, Belém

Oliver J (2001) The archaeology of forest foraging and agricultural production in Amazonia. In: McEwan C, Barretto C, Neves E (eds) Unknown Amazon: culture and nature in ancient Brazil. British Museum Press, London, pp 50–85

Onore G (2004) Edible insects in Ecuador. In: Paoletti MG (ed) Ecological implications of minilivestock: potential of insects, rodents, frogs and snails. Science Publishers, Enfield, pp 343–352

Ooi SC, Silva EB, Müller AA, Nascimento JC (1981) Oil palm genetic resources: native *E. oleifera* populations in Brazil offer promising sources. Pesq Agrop Brasileira 16(3):385–395

Oren D (1993) Did ground sloths survive to recent times in the Amazon region? Goeldiana Zoologia 19:1–11

Orton J (1870) The Andes and the Amazon: or, across the continent of South America. Harper & Brothers, New York

Osculati G (1854) Esplorazione delle regioni equatoriali lungo il Napo ed il fiume delle Amazzoni, frammento di un viaggio fatto nelle due Americhe uegli anni 1846-47-48. Preso I Fratelli Centenari e Comp., Milan

Oyuela-Caycedo A (2004) The ecology of a masked dance: negotiating at the frontier of identity in the northwest Amazon. Baessler-Archiv Beiträge zur Völkerkunde 52:54–74

Oyuela-Caycedo A (2010) The forest as a fragmented archaeological artifact. In: Dean RM (ed) The archaeology of anthropogenic environments, Occasional paper 37. Center for Archaeological Investigations, Southern Illinois University, Carbondale, pp 75–94

Pacheco-Palencia LA, Duncan CE, Talcott ST (2009) Phytochemical composition and thermal stability of two commercial açai species, *Euterpe oleracea* and *Euterpe precatoria*. Food Chem 115:1199–1205

Padoch C (1988) Aguaje (*Mauritia flexuosa* L. f.) in the economy of Iquitos, Peru. In: The palm-tree of life: biology, utilization and conservation, Advances in economic botany 6. New York Botanical Garden, Bronx, pp 214–224

Padoch C, Inuma JC, Jong W, Unruh J (1985) Amazonian agroforestry: a market-oriented system in Peru. Agrofor Syst 3:47–58

Paniagua-Zambrana NY (2005) Diversidad, densidad, distribución y uso de las palmas en la región del Madidi, noroeste del departamento de La Paz (Bolivia). Ecología en Bolivia 40(3):265–280

Paniagua-Zambrana NY, Byg A, Svenning J et al (2007) Diversity of palm uses in the western Amazon. Biodivers Conserv 16:2771–2787

Parolin P, Waldhoff D, Piedade MTF (2010) Fruit and seed chemistry, biomass and dispersal. In: Parolin P (ed) Amazonian floodplain forests: ecophysiology, biodiversity and sustainable management. Springer, Dordrecht, pp 243–258

Pechnik E, Mattoso IV, Chaves JM, Borges P (1947) Possibilidade de aplicação do buriti e tucumã na indústria alimentar. Arquivos Brasileiros de Nutrição 4(1):33–37

Pedersen HB (1992) Uses and management of *Aphandra natalia* (Palmae) in Ecuador. Bull Inst fr études andines 21(2):741–753

Pedersen HB (1996) Production and harvest of fibers from *Aphandra natalia* (Palmae) in Ecuador. For Ecol Manage 80:155–161

Pedersen HK, Balslev H (1992) The economic botany of Ecuadorian palms. In: Plotkin M, Famolare M (eds) Sustainable harvest and marketing of rain forest products. Island Press, Washington, DC, pp 173–191

Penn JW (2008) Non-timber forest products in Peruvian Amazon: changing patterns of economic exploitation. Focus Geogr 51(2):18–25

Pereira N (1954) Os índios Maués. Organização Simões, Rio de Janeiro

Pérez-Emán JL, Paolillo A (1997) Diet of the pelomedusid turtle *Peltocephalus dumerilianus* in the Venezuelan Amazon. J Herpetol 31(2):173–179

Pesce C (1985) Oil palms and other oilseeds of the Amazon. Reference Publications, Algonac

Peters CM, Balick MJ, Kahn F, Anderson AB (1989) Oligarchic forests of economic plants in Amazonia: utilization and conservation of an important tropical resource. Conserv Biol 3 (4):341–349

Pezzuti J, Chaves RP (2009) Etnografia e manejo de recursos naturais pelos índios Deni, Amazonas, Brasil. Acta Amazon 39(1):121–138

Pickersgill B (1969) The archaeological record of chili peppers (*Capsicum* spp.) and the sequence of plant domestication in Peru. Am Antiq 34(1):54–61

Piedade MTF, Parolini P, Junk W (2006) Phenology, fruit production and seed dispersal of *Astrocaryum jauari* (Arecaceae) in Amazonian black water floodplains. Rev Biol Trop 54 (4):1171–1178

Pinagé P, Mehinaku K, d'Alessio V (2000) Mehinaku: message from Amazon. Dialeto Latin American Documentary, São Paulo

Pinard M (1993) Impacts of stem harvesting on populations of *Iriartea deltoidea* (Palmae) in an extractive reserve in Acre, Brazil. Biotropica 25(1):2–14

Pinedo-Vasquez M, Zarin D, Jipp P, Chota-Inuma J (1990) Use-values of tree species in a communal forest reserve in northeast Peru. Conserv Biol 4(4):405–416

Pinheiro CUB, Frazão JMF (1995) Integral processing of babassu palm (*Orbignya phalerata*, Arecaceae) fruits: village level production in Maranhão. Econ Bot 49(1):31–39

Pinto GP (1951) O óleo de patauá. Boletim Técnico do Instituto Agronômico do Norte 23:67–77

Pires-O'Brien MJ (1993) Local distribution and ecology of "palha preta"- a pioneer and invasive palm in Jari, lower Amazon. Principes 37(4):212–215

Plotkin M, Balick MJ (1984) Medicinal uses of South American palms. J Ethnopharmacol 10:157–179

Poeppig E (2003) Viaje al Perú y al Río Amazonas 1827–1832. CETA (Centro de Estudios Teológicos de la Amazonía), Iquitos

Politis G (1996a) Moving to produce: Nukak mobility and settlement patterns in Amazonia. World Archaeol 27(3):492–511

Politis G (1996b) Nukak. Instituto Amazónico de Investigaciones Científicas, Bogotá

Politis G (2001) Foragers of the Amazon: the last survivors or the first to succeed? In: McEwan C, Barretto C, Neves E (eds) Unknown Amazon: culture and nature in ancient Brazil. British Museum Press, London, pp 26–49

Politis G (2007) Nukak: ethnoarchaeology of an Amazonian people. Left Coast Press, Walnut Creek

Pool CA (2007) Olmec archaeology and early Mesoamerica. Cambridge University Press, New York

Popenoe W (1920) Manual of tropical and subtropical fruits. Macmillan, New York

Porro R, Miller RP, Tito MR et al (2012) Agroforestry in the Amazon region: a pathway for balancing conservation and development. In: Nair PKR, Garrity D (eds) Agroforestry- the future of global land use, Advances in agroforestry 9. Springer, Dordrecht, pp 391–428

Posey DA (1983) Indigenous knowledge and development: an ideological bridge to the future. Ciência e Cultura 35(7):877–894

Posey DA (1985) Indigenous management of tropical forest ecosystems: the case of the Kayapó Indians of the Brazilian Amazon. Agrofor Syst 3:139–158

Posey DA (1998) Diachronic ecotones and anthropogenic landscapes in Amazonia: contesting the consciousness of conservation. In: Balée W (ed) Advances in historical ecology. Columbia University Press, New York, pp 104–118

Pott A, Oliveira AKM, Damasceno-Junior GA, Silva JSV (2011) Plant diversity of the Pantanal wetland. Braz J Biol 71(1):265–273

Prance GT (1972) An ethnobotanical comparison of four tribes of Amazonian Indians. Acta Amazon 2(2):7–27

Prance GT (1988) Indigenous non-timber benefits from tropical rain forest. In: Goldsmith FB (ed) Tropical rain forest: a wider perspective. Chapman & Hall, London, pp 21–42

Preuss KD (1994) Religíon y mitología de los Uitotos, vol 2. Editorial Universidad Nacional, Bogotá

Putz FE (1979) Biology and human use of *Leopoldinia piassaba*. Principes 23(4):149–156

Quiroga-Castro VD, Roldán AI (2001) The fate of *Attalea phalerata* (Palmae) seeds dispersed to a tapir latrine. Biotropica 33(3):472–477

Ramírez BH, Parrado-Rosselli A, Stevenson P (2009) Seed dispersal of a useful palm (*Astrocaryum chambira* Burret) in three Amazonian forests with different human intervention. Revista Colombia Florestal 12:5–16

Ramos JB (2012) Passaros-adornos dos filhos da cobra de pedra (Tuyuka). Instituto Sociambental, São Paulo

Reichel-Dolmatoff G (1971) Amazonian cosmos: the sexual and religious symbolism of the Tukano Indians. University of Chicago Press, Chicago

Reichel-Dolmatoff G (1996) The forest within: the world-view of the Tukano Amazonian Indians. Themis Books, Darlington

Reichel-Dolmatoff G (1997) Chamanes de la selva pluvial: ensayos sobre los indios del noroeste Amazónico. Themis Books, Darlington

Reyes-García V, Ledezma JC, Paneque-Gálvez J et al (2014) Presence and purpose of nonindigenous peoples on indigenous lands: a descriptive account from the Bolivian lowlands. Soc Nat Resour 25(3):270–284

Reynel C, Pennington RT, Pennington TD et al (2003) Árboles útiles de la Amazonía Peruana. Tarea Gráfica Educativa, Lima

Rezaire A, Robinson J, Bereau D et al (2014) Amazonian palm *Oenocarpus bataua* ("patawá"): chemical and biological antioxidant activity- phytochemical composition. Food Chem 149:62–70

Rezende JBA, Lima J, Meira FT et al (2010) Manejo de caraná no Alto Tiquié. In: Cabalzar A (ed) Manejo do mundo: conhecimentos e práticas dos povos indígenas do Rio Negro. Instituto Socioambiental, São Paulo, pp 146–155

Ribeiro D (1976) Uirá sai à Procura de Deus: Ensaios de Etnologia e Indigenismo. Paz e Terra, Rio de Janeiro

Ribeiro BG (1979) Diário do Xingu. Paz e Terra, Rio de Janeiro

Ribeiro D (1996) Diários índios: os Urubus-Kaapor. Companhia das Letras, São Paulo

Rindos D (1984) The origins of agriculture: an evolutionary perspective. Academic, Orlando

Rival L (1998) Domestication as a historical and symbolic process: wild gardens and cultivated forest in the Ecuadorian Amazon. In: Balée W (ed) Advances in historical ecology. Columbia University Press, New York, pp 232–250

Rival L (2002) Trekking through history: The Huaorani of Amazonian Ecuador. Columbia University Press, New York

Rodrigues JB (1903) Sertum palmarum brasiliensium: relation des palmiers nouveaux du Brésil, découverts, décrits, et dessinés d'après nature, vol 1. Imprimerie Typographique Veuve Monnom, Brussels

Rodrigues DP (2007) Diversidade genética e sistema de reprodução em progênies elites de pupunheira inerme (*Bactris gasipaes* Kunth) com marcadores microssatélites: implicações para o melhoramento do palmito. Doctoral dissertation, Universidade Federal do Amazonas, Manaus

Rodrigues I, Oliveira AE (1977) Alguns aspectos da ergologia Mura-Pirahã. Boletim do Museu Paraense Emílio Goeldi, Nova Série Antropologia 65:1–47

Rodrigues DP, Astolfi-Filho S, Clement CR (2004) Molecular marker-mediated validation of morphologically defined landraces of pejibaye (*Bactris gasipaes*) and their phylogenetic relationships. Genet Resour Crop Evol 51(8):871–882

Rodríguez AM (2011) Musical voices in the Piaroa world. In: Hill J, Chaumeil J-P (eds) Burst of breath: indigenous ritual wind instruments in lowland South America. University of Nebraska Press, Lincoln, pp 147–169

Roe PG (1982) The cosmic zygote: cosmology in the Amazon Basin. Rutgers University Press, New Brunswick

Romanoff S, Jiménez DM, Uaquí FS, Fleck DW (2004) Matsesën nampid chuibanaid: la vida tradicional de los Matsés. Centro Amazónico de Antropología y Aplicación Práctica (CAAAP), Lima

Roncal J (2006) Habitat differentiation of sympatric *Geonoma macrostachys* (Arecaceae) varieties in Peruvian lowland forests. J Trop Ecol 22:483–486

Rondon CMS (1916) Missão Rondon: apontamentos sobre os trabalhos realizados pela commissão de linhas telegraphicas estrategicas de Matto-Grosso ao Amazonas. Typ. do Jornal do Commercio, Rio de Janeiro

Rondón JA (2003) Vocablos Piaroa de algunas artesenías de origen forestal del Estado Amazonas, Venezuela. Rev For Lat 34:71–86

Roosevelt AC (1991) Moundbuilders of the Amazon: geophysical archaeology on Marajó Island, Brazil. Academic Press, San Diego

Roosevelt AC (1999) Twelve thousand years of human-environment interaction in the Amazon floodplain. In: Padoch C, Ayres JM, Pinedo-Vasques M, Henderson A (eds) Várzea: diversity, development, and conservation of Amazonia's whitewater floodplains, Advances in economic botany 13. New York Botanical Garden, Bronx, pp 371–392

Roosevelt AC, Costa ML, Machado CL et al (1996) Paleoindian cave dwellers in the Amazon: the peopling of the Americas. Science 272:373–384

Roosmalen MGM (1985) Fruits of the Guianan flora. Institute of Systematic Botany, Utrecht University/Silvicultural Department, Wageningen Agricultural University, Utrecht

Roquette-Pinto E (1950) Rondônia. Companhia Editora Nacional, São Paulo

Rostain S (2013) Amazonía aérea: escultores precolombinos del paisaje. 3er Encuentro Internacional de Arquelogía Amazónica y Repsol, Quito

Ruddle K, Johnson D, Townsend PK, Rees JD (1978) Palm sago: a tropical starch from marginal lands. East–west Center, Honolulu

Rull V (1992) Successional patterns of the Gran Sabana (southeastern Venezuela) vegetation during the last 5000 years, and its responses to climatic fluctuations and fire. J Biogeogr 19 (3):329–338

Rull V (1999) A palynological record of a secondary succession after fire in the Gran Sabana, Venezuela. J Quat Sci 14(2):137–152

Sá L (2004) Rain forest literatures: Amazonian texts and Latin American culture. University of Minnesota Press, Minneapolis

Saffirio G, Scaglion R (1982) Hunting efficiency in acculturated and unacculturated Yanomama villages. J Anthropol Res 38(3):315–327

Salgado S, Shoumatoff A (2013) The last Eden. Vanity Fair, December, pp 182–196

Salm R (2005) The importance of forest disturbance for the recruitment of the large arborescent palm *Attalea maripa* in a seasonally-dry Amazonian forest. Biota Neotropica 5(1):35–41

Salm R, Jalles-Filho E, Shuck-Paim C (2005) A model for the importance of large arborescent palms in the dynamics of seasonally-dry Amazonian forests. Biota Neotropica 5(2):1–6

Sampaio MB, Schmidt IB, Figueiredo IB (2008) Harvesting effects and population ecology of the buriti palm (*Mauritia flexuosa* L. f., Arecaceae) in the Jalapao region, central Brazil. Econ Bot 62(2):171–181

Santos LMP (2005) Nutritional and ecological aspects of buriti or aguaje (*Mauritia flexuosa* Linnaeus Filius): a carotene-rich palm fruit from Latin America. Ecol Food Nutr 44:345–358

Santos AM, Mitja D (2011) Pastagens arborizadas no projeto de assentamento Benfica, Município de Itupiranga, Pará, Brasil. Revista Árvore 35(4):919–930

Santos EJL, Silva SP, Mendonça CC et al (2010) Parâmetros biométricos dos cachos, frutos e sementes de *Bactris concinna* Martius (Arecaceae), encontrada na area de proteção ambiental

Lago do Amapá, em Rio Branco, Acre. In: X Congresso de Ecologia do Brasil, 16 a 22 de Setembro de 2011, São Lourenço, MG, pp 1–2
Sauer CO (1952) Agricultural origins and dispersals. American Geographical Society, New York
Saunaluoma S (2012) Geometric earthworks in the state of Acre, Brazil: excavations at the Fazenda Atlântica and Quinauá sites. Lat Am Antiq 23(4):565–583
Saunaluoma S, Schaan D (2012) Monumentality in western Amazonian formative societies: geometric ditched enclosures in the Brazilian state of Acre. Antiqua 2(1):1–10
Scariot A (1998) Seed dispersal and predation of the palm *Acrocomia aculeata*. Principes 42(1):5–8
Schaan D (2010) Long-term human induced impacts on Marajó Island landscapes, Amazon estuary. Diversity 2:182–206
Schaan D, Pärssinen M, Sannouma S et al (2012) New radiometric dates for Precolumbian (2000–700 B.P.) earthworks in western Amazonia, Brazil. J Field Archaeol 37(2):1–11
Schackt J (2013) A people of stories in the forest myth. Instituttet for Sammenlignende Kulturforskning, Oslo
Schmeda-Hirschmann G (1994) Plant resources used by the Ayoreo of the Paraguayan Chaco. Econ Bot 48(3):252–258
Schmidt MJ, Py-Daniel AR, Moraes CP et al (2014) Dark earths and the human built landscape in Amazonia: a widespread pattern of anthrosol formation. J Archaeol Sci 42:152–165
Schomburgk RH (1840a) Journey from Esmeralda, on the Orinoco, to San Carlos and Moura on the Rio Negro, and thence by Fort San Joaquim to Demerara, in the spring of 1839. J R Geogr Soc Lond 10:248–267
Schomburgk RH (1840b) Journey from Fort San Joaquim, on the Rio Branco, to Roraima, and thence by the rivers Parima and Merewari to Esmeralda, on the Orinoco, in 1838–9. J R Geogr Soc Lond 10:191–247
Schroth G, Mota MSS, Lopes R, Freitas AF (2004) Extractive use, management and in situ domestication of a weedy palm, *Astrocaryum tucuma*, in the central Amazon. For Ecol Manage 202:161–179
Schultes RE (1974) Palms and religion in the northwest Amazon. Principes 18:3–21
Schultes RE (1977) Promising structural fiber palms of the Colombian Amazon. Principes 21:72–82
Schultes RE (1980) De plantis toxcariis e mundo novo tropicale commentationes XXIX: a suspected new Amazonian hallucinogen. Bot Mus Leaflets (Har) 28(3):271–275
Schultz H, Chiara V (1971) Mais lendas Waurá. Journal de la Société des Américanistes 60:105–135
Seemann B (1856) Popular history of the palms and their allies. Lovell Reeve & Co., London
Seibert RJ (1948) The uses of *Hevea* for food in relation to its domestication. Ann Mo Bot Gard 35:117–121
Shanley P, Rosa NA (2004) Eroding knowledge: an ethnobotanical inventory in eastern Amazonia's logging frontier. Econ Bot 58(2):135–160
Silva JAM, Pereira-Filho M, Oliveira-Pereira MI (2003) Valor nutricional e energético de espécies vegetais importantes na alimentação do tambaqui. Acta Amazon 33(4):687–700
Silvius KM, Fragoso JMV (2003) Red-rumped agouti (*Dasyprocta leporina*) home range use in an Amazonian forest: implications for the aggregated distribution of forest trees. Biotropica 35 (1):74–83
Simões MF (1963) Os "Txikão" e outras tribos marginais do Alto Xingu. Revista do Museu Paulista, Nova Série 14:76–105
Sirén AH (2007) Population growth and land use intensification in a subsistence-based indigenous community in the Amazon. Hum Ecol 35:669–680
Smith HH (1879) Brazil, the Amazons and the coast. Charles Scribner's Sons, New York
Smith NJH (1974) Agouti and babassu. Oryx 12(5):581–582
Smith NJH (1980) Anthrosols and human carrying capacity in Amazonia. Ann Assoc Am Geogr 70:553–566

Smith NJH (1996) The enchanted Amazon rain forest: stories from a vanishing world. University Press of Florida, Gainesville

Smith NJH (1999) The Amazon river forest: a natural history of plants, animals, and people. Oxford University Press, New York

Smith NJH (2002) Amazon sweet sea: land, life, and water at the river's mouth. University of Texas Press, Austin

Smith NJH, Williams JT, Plucknett DL, Talbot JP (1992) Tropical forests and their crops. Cornell University Press, Ithaca

Smith NJH, Vásquez R, Wust WH (2007) Amazon river fruits: flavors for conservation. Amazon Conservation Association (ACA)/Missouri Botanical Garden, Lima

Smole WJ (1976) The Yanomama Indians: a cultural geography. University of Texas Press, Austin

Snethlage E (1910) A travessia entre o Xingú e o Tapajoz. Boletim do Museu Goeldi (Museu Paraense) de Historia Natural e Ethnographia 7:49–92

Sosnowska J, Balslev H (2009) American palm ethnomedicine: a meta-analysis. J Ethnobiol Ethnomed 5:43–54

Souza FB (1873) Lembranças e curiosidades do valle do Amazonas. Typ. do Futuro, Pará

Spix JB, Martius CFP (1938) Viagem pelo Brasil, vol 3. Imprensa Nacional, Rio de Janeiro

Spruce R (1850a) Journal of an excursion on the Amazon River, to Obidos and the Rio Trombetas. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 2. Reeve and Benham, London, pp 193–208

Spruce R (1850b) Botanical excursion on the Amazon. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 2. Reeve and Benham, London, pp 65–76

Spruce R (1851) Journal of a voyage from Santarem to the Barra do Rio Negro. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 3. Reeve and Benham, London, pp 270–278

Spruce R (1853a) Botanical objects communicated to the Kew Museum, from the Amazon River, in 1851. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 5. Lovell Reeve, London, pp 169–177

Spruce R (1853b) Journal of a voyage up the Amazon and Rio Negro. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 5. Lovell Reeve, London, pp 187–192

Spruce R (1853c) Botanical objects communicated to the Kew Museum, from the Amazon River, in 1851 and 1853. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 5. Lovell Reeve, London, pp 238–247

Spruce R (1854a) Extract of a letter relating to vegetable oils, etc.; from Richard Spruce, esq.; dated San Carlos del Rio Negro, Venezuela, 19th March, 1854. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 6. Lovell Reeve, London, pp 333–337

Spruce R (1854b) Journal of a voyage up the Amazon and Rio Negro. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 6. Lovell Reeve, London, pp 33–42

Spruce R (1855) Botanical objects communicated to the Kew Museum, from the Amazon or its tributaries in 1853. In: Hooker WJ (ed) Hooker's journal of botany and Kew Garden miscellany, vol 7. Lovell Reeve, London, pp 273–278

Spruce R (1859) On *Leopoldinia Piassaba*, Wallace. J Proc Linn Soc Lond Bot 4(14):58–63

Spruce R (1871) Palmae Amazonicae, sive Enumeratio Palmarum in itinere suo per regiones Americae Equitoriales lectarum. J Linn Soc Lond Bot 11:65–183

Spruce R (1908) Notes of a botanist on the Amazon and Andes, vol 1. Macmillan, London

Stang C (2009) A walk to the river in Amazonia: ordinary reality for the Mehinaku Indians. Berghahn Books, New York

Steege H et al (2013) Hyperdominance in the Amazonian tree flora. Science 342:325. doi:10.1126/science.1243092

Steere JB (1903) A narrative of a visit to Indian tribes of the Purús River, Brazil. Report of the U.S. National Museum for the Year Ending June 30, 1901. Government Printing Office, Washington, DC

Stergios B (1993) La etnobotanica del arbol 'chiga' (*Campsiandra*, Leguminosae, Caesalpiniaceae) en la región llanera de la cuenca del medio Rio Orinoco en el suroeste de Venezuela. Biollania 9:71–90

Steward A (2013) Reconfiguring agrobiodiversity in the Amazon estuary: market integration, the açaí trade and smallholders' management practices in Amapá, Brazil. Hum Ecol 41:827–840

Steward JH, Métraux A (1948) In: Steward JH (ed) Handbook of South American Indians, vol 3. Smithsonian Institution, Washington, DC, pp 727–736

Stone AI (2007) Responses of squirrel monkeys to seasonal changes in food availability in an eastern Amazonian forest. Am J Primatol 69:142–157

Stradelli E (1889) Dal Cucuhy a Manàos. Bolletino della Societa Geografica Italiana 26:6–26

Strudwick J, Sobel GL (1988) Uses of *Euterpe oleracea* Mart. in the Amazon estuary, Brazil. In: Balick MJ (ed) The palm, tree of life: biology, utilization and conservation, Advances in economic botany 6. New York Botanical Garden, Bronx, pp 225–253

Surrallés A (2009) En el corazón del sentido: percepción, afectividad y acción en los Candoshi (Alta Amazonía). Instituto Francés de Estudios Andinos, Lima

Svenning J (2002) Non-native ornamental palms invade a secondary tropical forest in Panama. Palms 46(2):81–86

Svenning J, Macía MJ (2002) Harvesting of *Geonoma macrostachys* Mart. leaves for thatch: an exploration of sustainability. For Ecol Manage 167:251–262

Tapia EM (1992) The origins of agriculture in Mesoamerica and Central America. In: Cowan CW, Watson PJ (eds) The origins of agriculture: an international perspective. Smithsonian Institution Press, Washington, DC, pp 143–171

Tastevin C (1922) Les Makú du Japurá. Journal de la Société des Américanistes 14–15:99–108

Tastevin C (1923) Les indiens Mura de la région de l'Autaz (Haut-Amazone). Anthropologie (Paris) 33:509–533

Teixeira JF (1953) O arquipélago de Marajó. Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro

Terborgh J (2004) Requiem for nature. Island Press, Washington, DC

Tessmann G (1999) Los indígenas del Perú nororiental: investigaciones fundamentales para un estudio sistemático de la cultura. Ediciones Abya Yala, Quito

Thomas E, Van Damme P (2010) Plant use and management in homegardens and swiddens: evidence from the Bolivian Amazon. Agrofor Syst 80:131–152

Thomas E, Semo L, Morales M et al (2011) Ethnomedicinal practices and medicinal plant knowledge of the Yuracarés and Trinitarios from indigenous territory and national park Isiboro-Sécure, Bolivian Amazon. J Ethnopharmacol 133:153–163

Ucko PJ, Dimbleby DJ (1969) The domestication and exploitation of plants and animals. Aldine/ Atherton, Chicago

Urquhart GR (1997) Paleoecological evidence of *Raphia* in the Pre-Columbian Neotropics. J Trop Ecol 13(6):783–792

Uzendoski M (2005) The Napo Runa of Amazonian Ecuador. University of Illinois Press, Urbana

Valle PD (2010) Proteções das malocas (casa cerimoniais). In: Cabalzar A (ed) Manejo do mundo: conhecimentos e práticas dos povos indígenas do Rio Negro. Instituto Sociambental (ISA)/ Federação das Organizações Indígenas do Rio Negro (FOIRN), São Gabriel da Cachoeira, Amazonas, pp 20–23

Van den Bel M (2009) The Palikur potters: an ethnoarchaeological case study on the Palikur pottery tradition in French-Guiana and Amapá, Brazil. Boletim do Museu Paraense Emílio Goeldi, Ciencias Humanas 4(1):39–56

Van den Berg MA, Silva MH (1986) Plantas medicinais do Amazonas. In: Anais do Primeiro Simpósio do Trópico Umido, 12 a 17 de novembro de 1984, Belém, Brazil. Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Brasília, vol 2, pp 127–133

Vann JH (1959) Landform-vegetation relationships in the Atrato delta. Ann Assoc Am Geogr 49 (4):345–360
Vásquez R (1997) Flórula de las reservas biológicas de Iquitos, Perú, vol 63, Monographs in systematic botany. Missouri Botanical Garden, St. Louis
Vásquez R, Gentry AH (1989) Use and misuse of forest-harvested fruits in the Iquitos area. Conserv Biol 3(4):350–361
Vásquez J, Delgado C, Couturier G et al (2008) Pest insects of the palm tree *Mauritia flexuosa* L.f., dwarf form, in Peruvian Amazonia. Fruits 63(4):227–238
Vásquez R, Rojas R, Werff H (2010) Flora del Río Cenepa, Amazonas, Perú, vol 1. Missouri Botanical Garden, St. Louis
Vavilov NI (1997) Five continents. International Plant Genetic Resources Institute, Rome
Vebrova H et al (2013) Tree diversity in cacao agroforests in San Alejandro. Peruvian Amazon Agrofor Syst. doi:10.1007/s10457-013-9654-5
Velasco J (1977) La historia natural del reino de Quito en la América meridional, vol 1. Edit. Casa de la Cultura Ecuatoriana, Quito
Veléz GA, Veléz AJ (1999) Sistema agroflorestal de las chagras indígenas del medio Caquetá, vol 17. Tropenbos, Estudios en la Amazonia Colombiana, Bogotá
Velthem LH (1998) A pele de Tuluperê. Museu Paraense Emílio Goeldi, Belém
Verswijver G (1995) Kaiapo: material culture-spiritual world. Museum für Völkerkunde, Frankfurt
Verswijver G (1996) Mekranoti: living among the painted people of the Amazon. Prestel, Munich
Vickers WT (1994) The health significance of wild plants for the Siona and Secoya. In: Etkin NL (ed) Eating on the wild side: the pharmalogic, ecologic, and social implications of using noncultures. University of Arizona Press, Tucson, pp 143–165
Vidal L (1977) Morte e vida de uma sociedade indígena brasileira. Editora Hucitec/Editora da Universidade de São Paulo, São Paulo
Villas Boas O, Villas Boas C (1975) Xingu: the Indians, their myths. Souvenir Press, London
Visser MD, Muller-Landau HC, Wright J et al (2011) Tri-trophic interactions affect density dependence of seed fate in a tropical forest palm. Ecol Lett 14:1093–1100
Viveiros de Castro E (1992a) From the enemy's point of view: humanity and divinity in an Amazonian society. University of Chicago Press, Chicago
Viveiros de Castro E (1992b) Araweté: O povo do Ipuxuna. Centro Ecumênico de Documentação e Informação (CEDI), São Paulo
Vormisto J (2002a) Making and marketing chambira hammocks and bags in the village of Brillo Nuevo, northeastern Peru. Econ Bot 56(1):27–40
Vormisto J (2002b) Palms as rainforest resources: how evenly are they distributed in Peruvian Amazonia? Biodivers Conserv 11:1025–1045
Vormisto J, Tuomisto H, Oksanen J (2004) Palm distribution patterns in Amazonian rainforests: what is the role of topographic variation? J Veg Sci 15:485–494
Wagley C (1977) Welcome of tears: the Tapirapé Indians of central Brazil. Oxford University Press, New York
Wagley C, Galvão E (1961) Os índios Tenetehara: uma cultura em transição. Ministério da Educação e Cultura, Serviço de Documentação, Rio de Janeiro
Wake TA (2006) Prehistoric exploitation of the swamp palm (*Raphia taedigera*, Arecaceae) at Sitio Drago, Isla Colón, Bocas del Toro Province, Panama. Caribb J Sci 42(1):11–19
Wallace AR (1853) Palm trees of the Amazon and their uses. John Van Voorst, London
Wallace AR (1889) A narrative of travels on the Amazon and Rio Negro, with an account of the native tribes, and observations on the climate, geology, and natural history of the Amazon Valley. Ward, Lock & Co., London
Walschburger T, Hildebrand P (1988) Observaciones sobre la utilización estacional del bosque humedo tropical por los indígenas del Río Mirití (Amazonas, Colombia). Colombia Amazónica 3(1):51–74

Weinstein S, Moegenburg S (2004) Açaí palm management in the Amazon estuary: course for conservation or passage to plantations? Conserv Soc 2(2):315–346
Welch JR (2014) Xavante ritual hunting: anthropogenic fire, reciprocity, and collective landscape management. Hum Ecol 42:47–59
Wheeler MA (1970) Siona use of chambira palm fiber. Econ Bot 24(2):180–181
Whiffen T (1915) The north-west Amazons: notes of some months spent among cannibal tribes. Constable and Company, London
Whitehead NL (2003) Three Patamuna trees: landscape and history in the Guyana highlands. In: Whitehead NL (ed) Histories and historicities in Amazonia. University of Nebraska Press, Lincoln, pp 59–77
Wilbert J (1976) *Manicaria saccifera* and its cultural significance among the Warao Indians of Venezuela. Bot Mus Leafl Harv Univ 24(10):275–335
Woodroffe JF, Smith HH (1915) The rubber industry of the Amazon and how its supremacy can be maintained. John Bale, Sons & Danielsson, London
Woods WI, Teixeira WG, Lehmann J et al (2009) Amazonian dark earths: Wim Sombroek's vision. Springer, Heidelberg
Works MA (1990) Continuity and conversion of house gardens in western Amazonia. Yearbook Assoc Pac Coast Geogr 52:31–64
Wright RM (2013) Mysteries of the jaguar shamans of the northwest Amazon. University of Nebraska Press, Lincoln
Yamashita C (1997) Anodorhynchus macaws as followers of extinct megafauna: an hypothesis. Ararajuba 5(2):176–182
Yuyama L, Aguiar JPL, Yuyama K et al (2003) Chemical composition of the fruit mesocarp of three peach palm (*Bactris gasipaes*) populations grown in Central Amazonia, Brazil. Int J Food Sci Nutr 54(1):49–56
Zaki NM, Ismail I, Rosli R et al (2010) Development and characterization of *Elaeis oleifera* microsatellite markers. Sains Malays 36(6):909–912
Zent EL, Zent S (2004) Amazonian Indians as ecological disturbance agents: the Hotï of the Sierra de Maigualida, Venezuelan Guayana. In: Carlson TS, Maffi L (eds) Ethnobotany and conservation of biocultural diversity, vol 15, Advances in economic botany. New York Botanical Garden, Bronx, pp 79–112
Zent S, Zent EL (2012) Jodï horticultural belief, knowledge and practice: incipient or integral cultivation? Boletim do Museu Paraense Emílio Goeldi, Ciencias Humanas 7(2):293–338
Zona S, James A, Maidman K (2003) The native palms of Dominica. Palms 47(3):151–157