CHAPTER 12

AMAZONIAN PALMS: FOOD RESOURCES FOR THE MANAGEMENT OF FOREST ECOSYSTEMS

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INTRODUCTION

Tropical peoples naturally want to profit from their forests, but recent attempts at deriving profit from these ecosystems have resulted mostly in their destruction. We need to learn to rationally exploit these forests, to extract their riches while conserving their economic potential. Timber is undoubtedly the primary product demanded from the forest, but as the processes of tree regeneration are still largely unknown, and sustainable management of tropical forest is currently uneconomic, the extensive extraction of timber species on a commercial scale is often accompanied by the destruction of the forest. Wood is the very body of the forest: its extraction is a mutilation that we do not know how to heal in the tropical environment.

Extracting food is generally less destructive. The fruits of the Amazonian forests are consumed all over the basin (Cavalcante, 1988; Clement, 1993, this volume). Some have been developed into industrial products, like the famous *guaraná*, made into a soda which easily rivals other commercial drinks.

Palms are important among the indigenous plants with food potential. They are one of the major components of Amazonian forest ecosystems, frequently forming dense, species-rich communities. They are represented in the Amazon by 39 genera and about 180 species (the number of species varies from 160 to 200 depending on the points of view of different taxonomists), of which 26 are food producing species, distributed in 15 genera.

Some edible palm species are found at low density in *terra firme* forests, but form dense populations in open areas, and can be successfully introduced into agroforestry systems (Borgtoft Pedersen and Balslev, 1990). However, most species with food potential form dense populations in swamp forests, which are unsuitable for agriculture (Peters *et al.*, 1989). Sustainable extraction of foods from these palm populations may be a solution, bringing the swamp forest into production without causing its destruction.

The management of these forests must begin with identifying plants with economic potential: (1) Their products must be manufacturable (e.g. the canning of palm hearts, oil and sago starch production) or have an exchange value in regional markets; (2) Production must be high in quality and large in quantity; (3) Intraspecific variability must be sufficiently large to allow for genetic improvement of the species by crossing of the best individuals. The economic potential of palms that form spontaneous, dense populations in habitats unsuitable for agriculture is effectively increased by the fact that development of these species will contribute to the development of uncultivated land.

FOOD PRODUCING PALMS AND FOREST MANAGEMENT

The potential value of food producing palms depends both on their product and on their ecology. Three parts of palms are edible or provide edible products such as oil and sago starch: the fruit and seed, the apical meristem (or palm heart) and the stipe. Seven of the Amazonian palms with the highest potential as food resources are presented in Table 12.1 and the uses, economic potential and ecology of twenty species are described in more detail in Appendix 12.1.

Table 12.1 Amazonian palms with high potential as food resources

Species	Product	Population	Habitat	Distribution
Bactris gasipaes	heart, fruit,oil	cultivated	*terra firme*	T
Elaeis oleifera	oil, genetic improvement	sparse to dense	swamp (gleysol)	T
Euterpe oleracea	heart, fruit	dense	swamp (gleysol, histosol) and riparian (fluvisol)	E
Euterpe precatoria	heart, fruit	sparse to dense	swamp (gleysol) in valley bottoms	C & E
Jessenia bataua	fruit, oil	sparse to dense	swamp (gleysol) in valley bottoms white waterlogged sand (gleyic podzol) *terra firme* on well drained soil	T
Mauritia flexuosa	fruit, starch, Coleoptera larvae	dense	swamp (gleysol, histosol)	T
Orbignya phalerata	oil, starch	dense	deforested areas	S & E

T = throughout Amazon; C = central; E = east; S = south

The large palms are dispersed at very low density in *terra firme* forests (Kahn *et al.* 1988; Kahn and Mejia, 1991). They form dense populations only on cleared land and are all species which have been used by people for a long time. This is the case of the *babassu* (*Orbignya phalerata*), *chambira* (*Astrocaryum chambira*), *tucumã* (*Astrocaryum* spp.), and *yarina blanca* (*Aphandra natalia*), which are abundant in habitats occupied by people and can be integrated into agroforestry systems. One of the best known of the Amazon food palms is *Bactris gasipaes*, a multi-stemmed palm which reaches about 15 m, whose fruit is very popular among Amazonians. It is cultivated on *terra firme* and has never been found in its wild state. Some types are suitable for the industrial canning of palm hearts, and can be produced in swidden agriculture, agroforestry, or monospecific plantations (Clement, 1988, 1993).

Many economically important species form dense populations on swampy soils (Table 12.1): *Euterpe oleracea*, *E. precatoria*, *Jessenia bataua*, *Mauritia flexuosa* (Kahn, 1988; Ruiz Murrieta and Levistre Ruiz, 1993, this volume; Castro, 1993, this volume). These soils could not be cultivated without artificial drainage which demands a considerable financial investment, so they are generally ignored in the management plans for Amazonian regions. The exploitation of native palm populations offers an alternative for their development (Kahn, 1991). A major difference between a natural monospecific population and an industrial plantation lies in the amount of genetic variability present in the population: variability is large in natural palm stands and deliberately reduced in plantations. On the other hand, native Amazonian palms are much less productive than the two commonly cultivated species, the African oil palm and the coconut tree, which have been significantly improved in the last fifty years. Also, natural populations, even if heavily dominated by one species, are often composed of several species. So, the exploitation of natural palm stands should follow the practices of agroforestry rather than those of industrial plantations. In particular, it involves using all the products provided by the vegetation, and not being limited to the intensive exploitation of a single product (Anderson, 1988). It will also be necessary to identify "high producers" and control their regeneration so as to increase their density. A parallel programme of genetic improvement should be conducted on a long term basis.

The rational management of the Amazonian swamp forests, based on the exploitation of palm populations, might involve some changes in the behaviour of the local inhabitants. Fruit is generally collected by cutting palms down, so that only one year's production can be used from each individual. People work for themselves and sell their harvests as and when they can. For long term management, palms must be climbed instead. Climbing palms is not a simple matter, but there is now a special instrument which makes it safer (Davis, 1984). The use and sale of these plant products could be organized at the level of a village or a community. Climbing palms to gather fruit would then become a full time job and the purchase of tools and payment of salaries would be taken on by an association which guarantees the sale of the fruit. This is a practical scheme, but the implementation of socio-economic changes like these will undoubtedly involve intensive education campaigns in local communities.

All potential natural resources must benefit local populations to allow equitable development. The sago starch content of *Mauritia flexuosa* stipes is not presently exploited by Amazonian peoples although in South East Asia and the Pacific islands palms have long been used for this purpose (Barrau, 1959; Ruddle *et al.*, 1978). Since *Mauritia flexuosa* populations are dense and widely distributed, particularly in Peru, the swampy forest represents a considerable sago starch reserve.

CONCLUSION

Palms are well represented in Amazonia but very few species have manufacturable products. However, the fact that they form dense and widespread populations on swampy ground otherwise unsuitable for agricultural development gives them a definite potential over and above the food and economic contribution made by these plants.

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Appendix 12.1 Checklist of palm species including vernacular names, description, ecology, food and economic potential and management system

Acrocomia lasiospatha
Vernacular names: mucajá, macaúba (Brazil); moucaya, noix de coyol (French Guiana); palm bong (Suriname); corozo de vino (Venezuela).
Description: Large, single-stemmed palm common on southern edge and Atlantic region of Amazon basin, recently introduced to Manaus.
Ecology: Savanna.
Food potential: Fruit mesocarp.
Economic potential: Production of combustible oil from fruit (Lleras and Coradin, 1983).
Production system: Agroforestry.

Aphandra natalia
Vernacular names: piassaba, yarina blanca (Ecuador).
Description: Medium-sized, single-stemmed palm in Ecuador.
Ecology: It forms dense populations in deforested areas on *terra firme* (Barfod, 1991).
Food potential: The albumen of the young fruit is gelatinous and local people swallow the contents of the seed.
Economic potential: Production of fibre and vegetable ivory (Barfod *et al.*, 1990).
Production system: Agroforestry (Borgtoft Pedersen and Balslev, 1990).

Astrocaryum aculeatum
Vernacular names: chontilla (Bolivia); tucumã, tucum assu, tucum da serra, tucum do matto (Brazil); akuyuro palm (Guyana); amana, toekoemau (Suriname); cumare (Venezuela).
Description: Large, single-stemmed palm common in and around Manaus where it is introduced; natural populations found in south-east Pará, Brazil.
Ecology: Gardens, fields and fallow fields; 'mata de cipó' forest with an irregular, open canopy and understorey invaded by lianas.
Food potential: Fruit mesocarp.
Economic potential: Fruit bought and sold in the towns of central Amazonia.
Production system: Agroforestry.

Astrocaryum chambira
Vernacular names: chambira (Ecuador, Peru).
Description: Arborescent, single-stemmed palm from western Amazon basin, Ecuador and Peru.
Ecology: Low density in *terra firme* forests on well drained soil; in inhabited areas in cultivated stands, fallow fields, pasture.
Food potential: The nuts, 4–6 cm diameter, are eaten like coconuts.
Economic potential: Fruit sold on local markets; an important fibre producer.
Production system: Agroforestry.

Astrocaryum jauari
Vernacular names: jauari (Brazil); guara (Colombia); awarra liba (Guyana, Suriname); huiririrma (Peru).
Description: Multi-stemmed palm up to 20 m high, common throughout the Amazon basin.
Ecology: Riverbanks, subjected to several months flooding each year.
Food potential: Palm heart.
Economic potential: The ecology of this species, partly submerged on river banks, makes exploitation difficult. Leaflets used for basketwork.
Production system: Agroforestry (Borgtoft Pedersen and Balslev, 1990).

(continued)

Appendix 12.1 Continued

Astrocaryum murumuru
Vernacular names: murumuru (Brazil); mouru-mouru (French Guiana).
Description: Medium-sized palm common in the Amazon estuary and French Guiana.
Ecology: Swamp forests.
Food potential: Edible fruit.
Economic potential: Previously used for oil production in the state of Pará, Brazil (Lleras and Coradin, 1983; Pesce, 1985; Lleras and Coradin, 1988), but no longer used.

Astrocaryum vulgare
Vernacular names: chontilla (Bolivia); tucumã, tucum bravo (Brazil); cumare (Colombia, Venezuela); awarra (French Guiana).
Description: Arborescent multi-stemmed palm from eastern Amazon basin and the Guyanas.
Ecology: Savanna, low forest on sand, inhabited areas.
Food potential: Fruit mesocarp edible and used to prepare 'awarra soup', traditionally eaten at Easter in French Guiana.
Economic potential: Fairly active fruit trade in the Belém region, Brazil.
Production system: Agroforestry.

Bactris gasipaes
Vernacular names: chonta fina (Bolivia); pupunha (Brazil); pejibaye (Colombia, Ecuador, Venezuela); chonta, chonta duro (Ecuador); paripi palm, peach palm (Guyana); parépou (French Guiana); pijuayo (Peru); paripoe (Suriname); bobi, cachipaes, macanilla, pijiguao (Venezuela).
Description: Medium-sized, multi-stemmed palm up to about 15 m high. This species has never been found in its wild state in the Amazon, only domesticated.
Ecology: Cultivated on *terra firme*.
Food potential: Fruit eaten in quantity by Amazonians. Some cultivars particularly suitable for industrial canning of palm hearts.
Economic potential: Already improved, highly productive and commonly cultivated.
Production system: Swidden agriculture, agroforestry, and monospecific plantations.

Elaeis oleifera
Vernacular names: caiaué, dendê do Pará (Brazil); corozo, noli (Colombia); poloponta (Peru); sabanna-obé (Suriname); corozo colorado (Venezuela).
Description: Large palm with creeping stem, distributed in the Amazon basin and the Guyanas.
Ecology: Dense populations in swamp forests; found on the Brazilian 'terras roxas', where it was introduced (Ooi *et al.*, 1981).
Economic potential: Hybridizes with *Elaeis guineensis*, the African oil palm. This species produces very good quality oil, is shorter because of its creeping trunk, thus making harvesting the fruit easier, resistant to diseases which ruin oil palm plantations in the Amazon (rotten heart, annular spots). Finally, it grows on waterlogged soils and could widen the ecological spectrum of the cultivated oil palm. Thus it is extremely important for the future of industrial oil palm plantations in Amazonia.

Euterpe oleracea
Vernacular names: açaí do Pará (Brazil); assai, pinot, wassaie (French Guiana); manicola palm (Guyana); pina, prasara (Suriname); manaca, morroque, uassi (Venezuela).
Description: Multi-stemmed palm from the eastern Amazon basin and the Guyanas.
Ecology: Dense populations in lowland forests on organic soils (Oldeman, 1969), coastal swamps and alluvial soils of the Amazon estuary.

(continued)

Appendix 12.1 Continued

Food potential: 'vinho do açai', a beverage prepared from the fruit, is part of the daily diet of peasants in Pará, Brazil, who mix it with manioc flour and sugar (Cavalcante, 1988; Strudwick and Sobel, 1988). Canned palm hearts are exported to many countries.
Economic potential: In 1979, 54 507 tons of fruit were produced in Brazil, representing a value of more than 4.8 million dollars (Coradin and Lleras, 1983). The production of canned palm hearts in the state of Pará represents 93% of the production in Brazil (Johnson, 1982); in French Guiana, several attempts at exploiting the "pinotières" in lower Approuage and Oyapock have been more or less successful. The CAIG (Société d'investissement du Crédit Agricole et Groupe Bourdillon) produced about 800 thousand tins a year over the period 1985-1986, which represents not less than 2 million palm hearts (Ricci, 1990).
Production system: Important in the management of forests on the alluvial soils of the Amazon estuary (Anderson, 1988; Anderson *et al.*, 1985); controlled exploitation of natural populations on swamp forests is viable (Ricci, 1990).

Euterpe precatoria
Vernacular names: asaí, palma de rosario (Bolivia); açaí (Brazil); huasai (Peru); baboen pina, monki-monki pina (Suriname).
Description: Single-stemmed species in central-west Amazon.
Ecology: In lowland swamp forests, associated with *Jessenia bataua* and *Mauritia flexuosa.*
Food potential: fruit eaten in Brazil, though not as important component of the diet as *Euterpe oleracea.* The heart is eaten in the Peruvian Amazon; young, white, tender leaflets are separated for preparation of 'chonta' salad. Fruit prepared as 'vinho de açaí' in Brazil, although on the whole it does not taste as good as the beverage made from *Euterpe oleracea.* A decoction of the roots eases attacks of malarial fever (Schultes and Raffauf, 1990).
Economic potential: Although the heart is eaten in Peru, because this palm is a single-stemmed, it is not very suitable for the palm heart industry. A canning plant has nevertheless opened at Iquitos, and natural populations are becoming rare in the exploited areas; the trunks are used to build rural houses (López Parodi, 1988).
Production system: Controlled exploitation of natural palms; monospecific plantations in swamp areas are a possibility.

Jessenia bataua
Vernacular names: margarita, majo (Bolivia); bataua, pataua (Brazil); bataua, come, milpesos (Colombia); chapil (Ecuador); turu palm (Guyana): patawa (French Guiana); ungurahui (Peru); patawa-koemboe (Suriname); seje (Venezuela).
Description: Arborescent, single-stemmed palm from the Amazon basin, Guyanas and eastern Andean slopes.
Ecology: Seasonal swamp forests and waterlogged sandy soils in the Amazon plain (Kahn, 1988; Kahn and Mejia, 1990); on well drained soil in the Guyanas and on the slopes of the eastern piedmont of the Andes.
Food potential: A chocolate-flavoured drink is made out of the fruit mesocarp; excellent oil, comparable in quality to olive oil (Balick, 1986); and proteins of high nutritional value (Balick and Gershoff, 1981).
Economic potential: One palm produces up to 4 inflorescences a year, and one raceme can carry up to 2 200 fruits. Despite its slow growth (Kahn and Granville, 1992), this species is considered to be one of the most important in terms of economic potential. Several peoples in the north-west Amazon use the oil in the treatment of tuberculosis; the Waraonis indians of the Ecuador region prepare a medicine against worms, diarrhoea, headaches and stomach pain from the roots.
Production system: Controlled exploitation of natural palms.

(continued)

Appendix 12.1 Continued

Mauritia flexuosa
Vernacular names: palma real (Bolivia); burití (Brazil); canangucha (Colombia); acho, aguaschi (Ecuador); aete (Guyana); palmier bâche (French Guiana); aguaje (Peru); maurisie (Suriname); moriche (Venezuela).
Description: Dioecious, arborescent, single-stemmed species abundant throughout the Amazon basin and the Guyana plateau.
Ecology: Swamp stands dominated by *Mauritia flexuosa* are called 'buritizal, cananguchal, achual, aguajal, morichal'. Population density varies from 230 to 350 'aguajes' with stipe ha^{-1} (Kahn, 1988; Gonzalez Rivadeneyra, 1971; Salazar and Roessl, 1977). These densities are remarkable in comparison with an industrial oil palm plantation which can contain only 143 palms ha^{-1}. Moreover their natural regeneration is significant: the density of juvenile palms which have not yet developed a stipe is more than 400 ha^{-1} (even ignoring the legions of seedlings less than one metre high).
Food potential: Fruit pulp eaten and used to prepare drinks, ice creams and cakes (Padoch, 1988; Ruiz Murrieta and Levistre Ruiz, 1993, this volume). Fruit production was estimated at 6.5 tons ha^{-1} in Peru (Peters *et al.*,1989) and 9.07 tons ha^{-1} in Colombia (Urrego Giraldo, 1987). The trunk contains up to 60% starch by dry weight. The male plants can be used for the extraction of sago starch.
Economic potential: The sale of *Mauritia flexuosa* is important in Iquitos region (Padoch, 1988). The petiole is used for decorating walls and ceilings, and the fibre has potential for paper pulp. Once cut down, Coleoptera larvae (*Rhynchophorus palmarum*) develop in the trunk and are a delicacy sold in the markets of Iquitos. One trunk can contain up to 500 larvae (Borgtoft Pedersen and Balslev, 1990). The high density of these populations and their vast distribution in Amazonia makes this palm the most economically important species.
Production system: Controlled exploitation of natural populations.

Mauritiella aculeata
Vernacular names: buritizinho, carana-í (Brazil); aguajillo (Peru).
Description: multi-stemmed, medium-sized to large palm, spread throughout the Amazon basin.
Ecology: Lowland swamp or sandy forests; low forests ('campinarana' Brazil; 'chamizal' Peru) and savanna on white sand.
Food potential: Fruits occasionally eaten.
Economic potential: Limited because dense stands are only very localized.
Production system: Controlled exploitation of natural populations.

Maximiliana maripa
Vernacular names: motacusillo (Bolivia); inajá (Brazil); cucurita, guichire (Colombia); kokerite palm (Guyana); maripa (French Guiana); inayuca (Peru); yagua (Venezuela).
Description: Large, single-stemmed palm from the Amazon basin and the Guyanas.
Ecology : *Terra firme* forests on well-drained soil; inhabited areas; low forests and savannas on sandy soil.
Food potential: Fruit occasionally eaten and sometimes on display in Cayenne market.
Economic potential: Limited, used as a construction material. Oil is extracted in the Colombian llanos (Blaak, 1983).
Production system: Agroforestry.

Oenocarpus spp.:
Vernacular names: tarampabo (Bolivia); bacaba, bacabinha, bacaba de leque (Brazil);
manoco, milpesillo, posuy (Colombia); turu palm (Guyana); comou (French Guiana); sinami, sinamillo (Peru); koemboe (Suriname); mapora, sejito (Venezuela).

(continued)

Appendix 12.1 Continued

Description : Medium to large palms. single- or multi- stemmed. This genus occurs throughout the Amazon basin and the Guyanas.
Ecology: *Terra firme* forests (*O. bacaba. O.distichus. O. minor. O. balickii*); swamp forests and recent alluvial deposits (*O.mapora*).
Food potential: Fruit juice much liked but only rarely drunk.
Economic potential: *Oenocarpus* forms a generic complex with *Jessenia* and represents a source of genes for the improvement of *Jessenia bataua* (Balick. 1986).
Production system: Agroforestry for *terra firme* species. Controlled exploitation of natural dense and spontaneous palm stands for swamp species.

Orbignya phalerata
Vernacular names: babassu (Brazil).
Description: Large. single-stemmed palm in the south of the Amazon basin and very abundant from the south-east in the state of Maranhão.
Ecology: *Terra firme* forests on well drained soil; swamp forests; deforested areas.
Food potential: The kernel is a source of oil; mesocarp for starch.
Economic potential: Because of its wide distribution and high population density. this species has considerable potential for oil production. The fruit is used by the 'seringueiros' as fuel for smoking balls of rubber, and in the food ration of domestic animals (Anderson, 1983); leaves and stipe are used in the construction of rural houses. the petiole for paper pulp; this species is important for many Amerindians and its vast. dense populations are interpreted as a sign of intense use in the past (Balée, 1988).

Phytelephas macrocarpa
Vernacular names: palma marfil (Bolivia. Ecuador); jariná (Brazil); tagua (Ecuador); llarina. piasaba. yarina (Peru).
Description: Multi-stemmed medium-sized palm from the western region of the Amazon basin.
Ecology: Forests on recent alluvial deposits in periodically flooded forests; lowland swamps.
Food potential: The gelatinous albumen of the unripe fruit is eaten like that of *Aphandra natalia*.
Economic potential: The unripe fruits are sold on the the markets of Iquitos. The albumen becomes very hard vegetable ivory, used for making buttons and small objects (Barfod *et al.*, 1990).
Production system: Agroforestry and controlled exploitation of natural populations.

Kahn Francis (1993)

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