Uses of wood and non-wood forest products by amazon forest dwellers

J. C. L. Dobois

Jean C.L. Dubois is President of the Brazilian Agroforestry Network, a nonprofit-making non-govern mental organization based in Rio de Janeiro. Brazil.

Some observations on the use of wood and non-wood forest products by Indians and riverain populations in the Amazon region.

For centuries, Amazonian Indians have lived from shifting agriculture, fishing, hunting and harvesting forest products. In the transition region between the Amazon forest and the cerrado (savannah) some afforestation, using native species, has even been performed by the Kayapó Indians, with the objective, among others, of increasing their sources of wood and non-wood products (Anderson end Posey, 1987; Posey, 1985).

The Portuguese occupation of Brazil started around 1500. A long time after the arrival of the Europeans, rubber and Brazil nuts became the first non-wood Amazon forest products to be exploited on a large scale for cash. The labour required for rubber extraction from *Hevea brasiliensis* in native forests was recruited mainly from northeastern Brazil. From 1840 onwards, more than 500 000 people immigrated to the Amazon region to work as rubber tappers. Interbreeding by these colonizers and their descendants with the Indians, and their adaptation to local conditions, led to the development of distinct new communities in the Amazon, mainly of *caboclos* or riverain peoples (Franco, 1995). Notwithstanding the recurrent fighting between the new communities and Indians in the past, these communities have learned various techniques and acquired knowledge from the Indians on such aspects of the forest as plants, crops, wildlife, fish, shifting cultivation and forest medicinal plants.

Some major wood and non-wood products used in the amazon region

Even nowadays. Amazonian rural populations (mainly *caboclos* and Indians) are highly dependent on forest resources, particularly non-wood products, for their food, clothing, shelter, etc. In pre-Colombian times. Indians had only primitive tools which limited their capacity to cut trees. To build their dwellings, Indians used a minimum of hardwood with larger quantities of poles, split (rather than sawn) palm trunks, palm leaves, palm fibre and thin lianas (Parodi, 1988). With the arrival of the first Portuguese, Indians obtained access to better tools such as machetes and axes and, more recently, even motor saws. Using these superior tools, Indians and *caboclos* significantly increased the number of tree species they exploited both for subsistence use and for sale.

As regards non-wood resources, the Box on p. 9 lists a limited number of the uses of some of the most important forest plant species. It is interesting to note that many of these species may be even more important today than in the past, particularly for riverain people who are often too poor to buy market products.

Many aquatic populations are dependent on the riverain forests for nutrients (fruits, leaves, etc.) as well as the maintenance of suitable environmental conditions (FAO, 1986; Ribeiro, 1995). In both lowland and upland forests, wild animals and birds find part of their sustenance in edible fruits and seeds or nuts (e.g. *Bagassa guianensis, Lecythis pisonis, Bertholletia excelsa* and many palm species), flowers (e.g. of various Lecythidaceae) and forest insects. Many Amazonian communities - particularly those that retain their old traditions - rely heavily on hunting and fishing while respecting the principles of sustainability. When these traditions are lost or ignored, hunting and fishing become more and more deprecatory and destructive of the resource base (Dubois, 1989).

From "gathering" to more intensive management of major forest crops

Traditional Amazonian communities practice shifting cultivation. Some examples follow to illustrate how the fallow period between cultivation cycles may be managed for the production of the goods desired.

Some Amazonian plant non-wood products collected by traditional forest-based communities

Plant species and family	Plant characteristics	Medium-sized tree
Acrocomia spp. Palmae (Arecaceae)	Medium- to large-sized palm	Oil from seeds; mature fruit eaten by humans and fed to livestock
Aniba duckei A. rosaeo-dora Lauraceae	Medium-sized tree	Wood and leaves rich in linalol (essential oil) used in perfumes
Astrocaryum spp. Palmae (Arecaceae)	Palm	Food for humans, domestic and wild animals (fruit); roof thatch; oil, fibre for hammocks, fishing nets and other handicrafts
Attalea speciosa (syn. Orbignya phalerata) Palmae (Arecaceae)	Large palm	Large-scale exploitation of fruit (oil, soap, charcoal); food for humans, locally dominant component of tree fallow;; handicrafts (basket work); roof thatch; animal feed
Bactris gasipaes Palmae (Arecaceae)	Large palm, very rarely found native date; generally planted by humans	Food for humans (fruit, hearts); oil; feed for domestic and wild animals (fruit, young leaves)
Bertholletia excelsa Lecythidaceae	Large, emergent tree	Nub eaten by humans, domestic and wild animals
Carapa guianensis Meliaceae	Medium to large tree	Oil extracted from seeds used mainly as a medicinal ointement but also to make soap
Caryocar villosum Caryocaraceae	Large tree	Edible nuts collected from d trees; mesocarp used locally as a butter substitute
Caryodendron spp. Euphorbiaceae	Large forest tree:	Food for humans (nuts, oil); feed for domestic and wild as
Copaifera spp. Leguminosae	Large tree	Oily resin extracted without killing the tree teas a steady market in Brazil as medicinal product
Couma spp. Apocynaceae	Large/small trees	Fruit eaten by humans and wild animals, milky latex for chewing-gum an caulking canoes
Derris spp *Lonchocarpus*	Bushes, shrubby vines,	Processed roots producing ichthyotoxic substances

spp., Tephrosia toxicaria Clathrotopis spp. Leguminosae	vines	used in fishing;, some vines produce rotenone (insecticide)
Desmoncus spp. Palmae (Are caceae)	Climbing palm	Used to attach arrow points to arrows; handicrafts;; potential rattan substitute
Dipteryx odorata Leguminosae	Large tree	Coumarin,, extracted from the seeds (tonka beans), used in perfumes
Erisma japura Vochysiaceae	Large tree	Food for forest dwellers (fruit, fat extracted from seeds)
Euterpe oleracea Palmae (Arecacese)	Slender, high palm	Twenty-two different uses including all plant parts
Euterpe precatoria Palmae (Arecacea)	Slender, hight palm (dryland)	Roof thatch; food and soft drinks for humans (fruit, palm hearts)
Heteropsis spp Philodendron imbe (Araceae)	Vine	Used by forest dwellers in handicrafts; potential rattan substitute
Ischnosiphon spp., Thalia spp. Maranthaceae	Vine	Used by forest dwellers for handicrafts
Jessenia bataua Palmae (Arecaceae)	Large palm	Soft drinks; oil of the quality of olive oil; bunting equipment; handicrafts (basket)
Lecythis pisonis Lecythidaceae	Large tree	Edible nuts; eaten mainly by bats, parrots and monkeys
Mauritia flexuosa Palmae (Arecaceae)	Large palm	Food and drink for humans (fruit, young flowers, hearts), starch from the stem; roof thatch; sugar (crystallized sap); handicrafts
Oenacarpus spp. Palmae (Arecaceae)	Large and smaller palms	Soft, vitamin-rich drinks from fruit; oil
Paullinia cupana var. *sorbilis* Sapindaceae	Busby vine	Processed seeds used as stimulant
Protium spp. Burseraceae	Medium to large tree	Resin (elemi = breu) tapped from the bark and used to caulk canoes; fruit attracts wild birds and apes
Theobroma cacao Sterculiaceae	Small tree	Fruit (pulp) for humans and wild animals, seeds used by forest dwellers to prepare chocolate, liqueurs, sweets
Theobroma grandiflorum Sterculiaceae	Medium to large tree	Traditional uses as for *Theobroma cacao*

The house of a riverain family with assai palm trees (Euterpe oleracea) In secondarized tidal flood plain forest of the Amazon estuary

Indian communities with a wide range of cultural habits live in the middle reaches of the Putumayo River in the Peruvian Amazon and the Caquetá River in the Colombian Amazon. Among them? the Matsé are a typical nomadic group: their forest fallows are invariably spontaneous with little or no evidence of manipulation. Fruit-tree cultivation is limited to species which bear fruit in the first or second year, such as papaya *(Carica papaya)* and precocious varieties of peach palm *(Bactris gasipaes)* that are unknown among the more sedentary tribes (Gasche, 1980).

In the same region, the Secoya change village sites less frequently. In their swidden plots, they plant fruit-trees and palms that produce fruit it after three or four years. These trees continue growing in the fallow, and the Secoya return there, periodically, to hunt and to gather the fruit. This practice is a first step in tree-fallow management. (Casanova, 1975; Casanova, 1980; Gasche, 1975; Gasche, 1980).

For certain tribes, planting trees (for example, peach palm) in swidden plots or young fallows is one way of obtaining usufruct rights, which give preference to the person who planted the trees to cut, burn and use the old fallow for a new cycle of agricultural crops.

The Bora Indians of the Peruvian Amazon (Dubois, 1990; Treacy, 1982) enrich some of their swidden plots with long-lived fruit and multipurpose trees *(Bactris gasipaes, Pourouma cecropiifolia, Poraqueiba sericea, Chrysophyllum cainito, Inga spp.)*. The Bora also practice occasional selective weeding and thinning to favour the growth of valuable timber species in these fallows, such as natural regeneration of mahogany *(Swietenia macrophylla)* and Spanish cedar *(Cedrela odorata)*. These fallows are visited from time to time to gather products for local consumption. Commercial timber and excess fruit production are sold for cash.

Not far from Iquitos in the Peruvian Amazon, the riverain people of Tanshiyacu intensively manage tree fallows which are designed to provide perennial cash crops (Denevan and Padoch. 1987; Padoch et al., 1985). Enrichment plantings in the swidden plots involve some species used by the Bora Indians (see above), and additional perennials such as Brazil nut *(Bertholletia excelsa)*, cashew *(Anacardium occidentale)* and assai *(Euterpe precatoria)*. Fruits, palm hearts, meat and skins of hunted animals and charcoal are sold in Iquitos. Charcoal is produced when the old fallow (25 to 50 years of age) is cleared for temporary agriculture.

In the Cajari watershed (western Amapá, Brazilian Amazon), traditional riverain farmers sow Brazil nuts in their temporary fields, at a short distance from their own dwelling places (author's personal field observation). This practice allows them to avoid travelling long distances to the large, much older Brazil nut tree stands located beyond the river rapids.

In general, however, destructive forest exploitation is becoming more and more frequent in the Amazon. Some tree species can already be considered endangered or subject to severe genetic erosion. This is particularly the case of linalol-rich *Aniba* spp. *(pau rosa)*, trees with medicinal bark (e.g. *Croton cajucara* - sacaca, cajussara) and trees that produce commercial resins or resinous oils (e.g. *Copaifera* spp. copaíba; *Couma* spp. - sorvas; *Manilkara* spp. massaranduba). Stands of assai palm *(Euterpe oleracea)* are often locally overexploited and sometimes entire groves are clear-felled for palm-heart exploitation. On the other hand. increasingly more research and development work is being done in Amazonia, especially in the States of Papá and Amapá where various nongovernmental organizations (NGOs) and university-based projects are promoting the sustained yield management of secondary tidal marshland forest with a predominance of *Euterpe* spp. palms.

The adoption of improved tree fallows, resulting from the selective enrichment planting of perennial species in swidden plots, should be encouraged as much as possible in Amazonian frontier zones (Dubois, 1988) where newcomers are unaware of the productive potential of improved fallows. The Figure below illustrates the spontaneous and improved tree-fallow sequences.

Since the 1960s, flood plain forests in the Amazon delta and adjoining flooded lowlands have been exploited for their commercial timber resources such as *Virola surinamensis Carapa guianensis and Ceiba pentandra.* Timber exploitation has opened up small and larger gaps that have been colonized by the assai palm *(Euterpe oleracea)*. This is a species that is much appreciated by the local people for its seeds, oil and palm fronds. Detailed studies have been made in these secondary stands of management practices developed by local riverain communities, together with an assessment of their social and economic relevance and sustainability (Anderson. 1988; Anderson' 1990: Anderson and Jardim. 1989).

In the State of Maranhão and in southern Pará, the babassu palm *(Attalea speciosa)* plays a strategic role in the regional economies. This species has formed nearly pure secondary stands over more than 100 000 km^2 in areas where the primary forest was destroyed by fire on upland soils with moderate fertility but good to excellent structure. Such sites are the prime targets for shifting cultivation but' although babassu density is significantly reduced in this process (to about 50 palms per hectare), they are not eliminated entirely. The burning of felled palms provides a large quantity of ash. Good yields are then obtained from temporary agricultural crops. The babassu fruit is used in households as well as being sold on the market. On an industrial scale, oil is extracted from the kernels for direct use or for conversion into soap or margarine. The babassu vegetable oil industry is the largest industry in the world which is based entirely on a wild species. The babassu palm provides other products including high-quality charcoal and feed for cattle and other domestic animals (Anderson, May and Balick, 1991; Balick. 1988). Secondary forests with a significant predominance of babassu also exist in other parts of the Brazilian Amazon (e.g. Tocantins and Tapajós regions, Rondônia) (Anderson, 1994).

FIGURE Spontaneous and improved tree-fallow sequences

Multipurpose forest management by forest dwelling communities in the amazon: Brazil nut oligarchic forests

Traditional Amazonian communities (Indians and *cabaclos*) have caused significant changes in the forest landscape (both in primary and secondary forest formations). The planting of annual crops for short periods in gaps opened in the forest has, in many instances, promoted the formation of oligarchic forests forests dominated by a very limited number of tree and palm species. Most of these species arc good colonizers and can regenerate easily in forest gaps.

In many parts of the Amazon, there is a frequent occurrence of old, high forests with a significant predominance of the Brazil nut tree *(Bertholleria excelsa)*. The nuts have a high food value and pleasant taste, characteristics which must have made it a preferred forest food very early in the human occupation of the region (Clay and Clement in FAO, 1993). Many researchers suggest that most "natural" stands of dominant Brazil nut trees (the *castanhais silvestres* are the result of Amerindian intervention. Agoutis (Dasyprocta sp. are local agents of Brazil nut tree dispersal. but viable seeds would have great difficulty in crossing major rivers (Clay and Clement in FAO, 1993). Some *castanhais silvestres,* for example, in the region around Maraba (southern Pará), seem to he the result of a more sophisticated manipulation of native forest by humans. In these stands, all existing Brazil nut trees are emergent but, On the other hand, most free species in the dominant, codominant and dominated storeys produce edible fruits for humans and wild game, and a high proportion of the understorey species are medicinal (Dubois, 1992).

A traditional agroforestry combination in the Amazon estuary: a spontaneous grove of buriti palm (Mauritia flexuosa) and planted cacao trees in the understorey

Extractive reserves

Until quite recently, thinking about development models for the Amazon involved making a choice between a very limited number of highly divergent alternatives: to maintain native forests in their present state in the form of conservation units; to cut and burn these forests to make room for agricultural crops or cattle farming: to convert native forests into managed, but less diverse, timber production stands, based on natural regeneration and enrichment planting; and to convert native forests into plantation forests with native or exotic species (e.g. the Jari large-scale, industrial plantation forest for pulp and paper).

The difficulty in trying to maintain and protect native Amazonian forests comes from inadequate human and financial support. Native protection costs can he reduced if local populations are involved in the process and accept to play a major role in conservation. The extractive reserves created by the Brazilian Government in the Amazon are public forested lands designated for sustainable use of forest resources by resident populations (Allegretti, 1990). They are established as public lands for which long-term collective rights are granted to groups engaged in non-wood forest product activities. The extractive reserves integrate respect for historical forms of' land occupation and use with development efforts that seek to advance residents' social and economic conditions while retaining permanent public control and responsibility for conserving the forest. More than 3 million ha of the Brazilian Amazon have been designated as extractive reserves, and approximately 25 percent of the Brazilian Amazon offers adequate conditions for the establishment of such reserves.

Before the rise of extractive reserves, extraction was being developed by large entrepreneurs to respond to the commercial demand for forest products. These activities yielded large profits for a restricted number of powerful families and commercial companies, but only minimal benefits for the forest-dwelling communities involved in the process (Allegretti, 1990; Allegretti, 1995; Anderson, 1994; Anderson et al., 1994).

With the progressive establishment of extractive reserves, supported by a large coalition of governmental and non-governmental organizations, some progress has been made in ensuring that more of the benefits accrue to local people. The Agro-Extractivist Cooperative of Xapuri (Acre), founded in 1989 by rubber tappers, is an example of this (Anderson et al., 1994). The cooperative pays adequate prices to local forest dwellers for Brazil nuts. The first stage of Brazil nut processing is done by the forest dwellers themselves and the final stage by the cooperative, which also employs local people. The final product, selected dried nuts in vacuum-sealed, metallized packages, is sold in Brazil and overseas.

At present, the economic viability of extractive reserves in the Amazon depends on an excessively limited number of products - basically rubber and Brazil nuts. The long-term survival of the extractive reserves will depend on diversification of market-oriented extractive activities (including timber exploitation); training of resident populations in sustained yield management of forests and agroforests; and increasing local involvement of resident populations in product processing and marketing. In this regard, some rubber tappers have been prompted by price decreases for unprocessed latex to convert latex into a "vegetable leather" from which finished products are then made. The various articles produced (travel hags, wallets, etc.) are providing significant added value but sales are limited

Currently, according to Schwartzman (1994), only Brazil nut production and rubber extraction are being carried out on a sustainable basis. Even this limited success can only he affirmed in forests that are under the relative control of traditional communities. In the State of Rondônia) where large areas of forest have been opened up to colonization, many legally protected Brazil nut trees have been cut down and sold under the false name of *cedrinho* by immigrants from outside the Amazon region, and the land has been converted to cattle farms.

A riverain woman preparing a nutritious soft drink from assai palm fruit (Euterpe oleracea)

The fruit of the pupunha (peach) palm (Bastris gasipaes) is important in the diet of farmers and forest dwellers in me Amazon

Conclusion

A wide range of non-wood products is supplied by the Amazonian forests. Many have long been harvested by the Indians and, later, in the second half of the last century, by the colonizers of Amazonia. Knowledge of the species, various products and their use represents an important resource in itself, and there is an urgent need to save neglected traditional knowledge and recognize its potential importance for contemporary Amazonian development. Native and popular knowledge, long tested and adjusted to local conditions, should be sought and used to the benefit of current development activities. Native knowledge and approaches might be of special value to increase production sustainability and to maintain environmental quality.

Many errors that were committed in past and present attempts to develop the Amazon region could have been avoided if more thought had been given to combining native traditions and techniques with scientific knowledge and technologies. "Everyone can learn a little or a lot from cultural anthropology before commending the arrival of an impossible or unpractical modernity', (Ab'Saber, 1995)

Bibliography

Ab'Saber, A.N. 1995. Elements for a strategy for territorial settlement and ecodevelopment in the Amazon. *In* M. Clüsenier-Godt et I. Sachs, eds, *Brazilian perspectives on sustainable development of the Amazon region*. Man and Biosphere Series, Vol. 15, p. 287-303. Paris, UNESCO-MAB.

Allegretti, M.H. 1990. Extractive reserves: an alliterative for reconciling development and environmental conservation in Amazonia. *In*: A. Anderson, ed., *Alternatives to deforestation: steps toward sustainable use of the Amazon rainforest*, p. 252-264. , New York Columbia University Press.

Allegretti, M.H. 1995. The Amazon and extracting activities. *In* M. Clüsenier-Godt et I. Sachs, eds, *Brazilian perspectives on sustainable development of the Amazon region*. Man and Biosphere Series, Vol. 1, p. 157-174. Paris, UNESCO-MAB.

Anderson, A.B. 1988. Use and management of native forests dominated by açaí palm (*Euterpe oleracea*) in the Amazon estuary. *In* M.J. Balick, ed., *The palm-tree of life: biology, utilization and conservation. Advances in economic botany,* Vol. 6, p. 144-154. , New York New York Botanical Garden.

Anderson, A.B. 1990. Extraction and forest management by rural inhabitants in the Amazon estuary. *In* A. Anderson, ed., *Alternatives to deforestation: steps toward sustainable use of the Amazon rain forest,* p. 65-85., New York Columbia University Press.

Anderson, A.B. 1994. Extrativismo vegetal e reservas extrativistas: limitações e oportunidades. *In* A. Anderson *et al*., eds, *O destino da floresta: reservas extrativistas e desenvolvimento sustentável na Amazônia*. Rio de Janeiro, Brazil, IEA/KAS c.o. Dumará Distribuidora de Publicações Ltda. 276 pp.

Anderson, A.B. & Jardim, M.A.G. 1989. Cost and benefits of flood plain forest management by rural inhabitants in the Amazon estuary: a case-study of açaí palm production. *In* J.O. Broeder, ed., *Fragile lands in Latin America: strategies for sustainable development*, p. 114-129. Westview Press, Boulder, Colorado, Etats-Unis.

Anderson, A.B. & Posey, D.A. 1987. Reflorestamento indígena. *Ciência Hoje*, 6(31): 44-50.

Anderson, A.B., May, P.H. & Balick, M.J. 1991. *The subsidy from nature: palm forests, peasantry and development on an Amazon frontier*. New York, Columbia University Press. 233 pp.

Anderson, A.B., Allegretti, M., Almeida, M., Schwartzman, S., Menezes, M. et Mattoso, R., (éds), 1994. *O destino da floresta: reservas extrativistas e desenvolvimento sustentável na*

Amazônia. Rio de Janeiro, Brazil, IEA/KAS c.o. Dumará Distribuidora de Publicações Ltda., 276 pp.

Balick, M.J. 1988. The use of palms by the Apinayé and Gaujarara Indians in northeastern Brazil. *In*: M.J. Balick, ed., *The palm-tree of life: biology, utilization and conservation. Advances in economic botany,* Vol. 6, p. 65-90. , New York New York Botanical Garden.

Casanova, J. 1975. El sistema de cultivo Secoya. In *Cultures sur brûlis et évolution du milieu forestier en Amazonie du Nord-Ouest*, p. 129-141. Genève, Switzeland, Société suisse d'ethnologie.

Casanova, J. 1980. Estudios de corte y quema en la Amazonia Peruana. In *Consulta Subregional sobre las Actividades de Corte y Quema en el Ecosistema Bosque Tropical,* p. 21-36. UNESCO-MAB, Lima.

Denevan, W.M. et Padoch, C.-:1987. *Swidden-fallow agroforestry in the Peruvian Amazon. Advances in economic botany*, Vol. 5. New York Botanical Garden, New York.

Dubois, J.C.L. 1988. Alô! Alô! Extensionistas! Promovem o uso de capoeiras melhoradas. REBRAF, Rio de Janeiro, Brazil *Informativo Agroflorestal*, 1(2-3): 4-5.

Dubois, J.C.L. 1989. Animal and vegetal extractivism (extractive exploitation of animal and vegetal natural resources) in the Amazon. In: *Amazonia: facts, problems and solutions. Proc. Workshop*, p. 49-53. University of Sao Paulo. Sao Paulo, Brazil, 31 July-2 August 1989.

Dubois, J.C.L. 1990. Secondary forests as a land-use resource in frontier zones of Amazonia. *In* A. Anderson, ed., *Alternatives to deforestation: steps toward sustainable use of the Amazon rain forest,* p. 183-194. , New York Columbia University Press.

Dubois, J.C.L. 1992. Os castanhais silvestres da região de Araras (Pará) como modelo de desenvolvimento sócio-econômico. Rio de Janeiro, Brazil. REBRAF, *Informativo Agroflorestal,* 4(2-3): 1-3.

FAO. 1986. *Food and fruits-bearing forest species. 3. Examples from Latin America.* Etude FAO Forestry Paper 44/3. Rome.

FAO. 1993. Selected species and strategies to enhance income generation from Amazonian forests. FAO Working Paper FAO Misc/93/6. Rome. 260 pp.

Franco, R.M. 1995. Development and management plans for the Amazon region: lessons from the post, proposals for the future. *In* M. Clüsenier-Godt et I. Sachs eds. *Brazilian perspectives on sustainable development of the Amazon region.* Man and Biosphere Series, Vol. 1, p. 23-51. Paris, UNESCO-MAB.

Gasche, J. 1975. Le système cultural Witoto. In *Cultures sur brûlis lis et évolution du milieu forestier en Amazonie du Nord-Ouest*, p. 111-128. Geneva, Switzerland, Société suisse d'ethnologie.

Gasche, J. 1980. El estudio comparativo de los sistemas de cultivo nativos y su impacto sobre el bosque amazónico. In: *Consulta Subregional sobre las Actividades de Corte y Quema en el Ecosistema Bosque Tropical*, p. 61-74. Lima UNESCO-MAB.

Nepstad, D.C. & Schwartzman, S., eds. 1992. *Non-timber products from tropical forests: evaluation of a conservation and development strategy. Advances in economic botany,* Vol. 9, p. 164. New York Botanical Garden, New York.

Padoch, C., Chota Inuma, J., de Jong, W. et Unruh, J. 1985. Amazonian agroforestry: a market system in Peru. *Agrofor. Syst.*, 3(1): 47-58.

Parodi, J.I. 1988. The use of palms and other native plants in non-conventional, low-cost rural housing in the Peruvian Amazon. *In* M.J. Balick, (éd.). *The palm-tree of life: biology, utilization and conservation. Advances in economic botany*, Vol. 6, p. 119-129. New York, New York Botanical Garden.

Posey, D.A. 1985. Indigenous management of tropical forest ecosystems: the case of the Kayapó Indians of the Brazilian Amazon. *Agrofor. Syst*., 3(2): 139-158.

Ribeiro, B.G. 1995. Os Índios das Águas Pretas. Editora da Universidade de São Paulo, Companhia das Letras, São Paulo, Brésil. 270 pp.

Schwartzman, S. 1994. Mercados para produtos extrativistas da Amazônia brasileira. *In* A.B. Anderson *et al*., eds., *O destino da floresta: reservas extrativistas e desenvolvimento sustentável na Amazônia*, p. 247-257. Rio de Janeiro, Brazil, IEA/KAS c.o. Dumará Distribuidora de Publicações Ltda.

Treacy, J. 1982. Bora Indian agroforestry: an alternative to deforestation. *Cultural Survival*, 6(2): 15-16.