FORESTS AND PEOPLE:

THE ROLE OF FOREST PRODUCTION IN FRONTIER FARMING SYSTEMS IN EASTERN AMAZONIA

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DEV Discussion Paper 255

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Acknowledgements

This discussion paper forms part of a collaborative research project between UEA and LASAT on "Modelling the Sustainability of Frontier Farming at the Forest Fringe".

The author is grateful to Kate Brown for her support; to Vincent de Reynal and other LASAT colleagues; for the help received from Socorro Ferreira, Sarah Cornell and Richard Johnson. The author is especially thankful to the farmers of the localities studied, for their contribution and friendship. This work was possible due the financial support received from the Chevening Programme of the British Council and from the ODA Livestock Production Programme and Natural Resources Systems Programme (Agriculture-Forest Interface).

Abstract

Marabá region, a pioneer frontier in Eastern Brazilian Amazonia, is an example of the immense diversity of Amazonia region, which should be understand in order to establish adequate development strategies. The six Marabá localities, focus of this study, show a diversity of social and ecological situations that shape what is possible to do in relation to farming and gathering activities. The forest is very important to colonist farmers living there. They recognise and use a wide range of plant and animal species (respectively 142 and 39 were listed) which provide them food, fuel, raw materials, medicinal plants and represent a source of income. Forest activities are more important to poor families, for whom it represents up to 58% of gross income. Even though, they have been replacing forests by more profitable in short term and less risk land uses, as cattle ranching. One of the problems to increase the forest contribution to farms economy is that markets for forest products are very restrict and experiences with commercialisation in the region do not provide the necessary assurance for farmers to invest more in extractivism. The search for alternatives to decrease forest conversion should recognise that colonist livelihoods encompass diversified strategies, where forest is just one component. These alternatives can be more easily found and tested if farmers can discuss their problems in order to identify possible solutions. Research institutions have an important and challenging role to play to help farmers in this process.

1. Introduction

One of the greatest obstacles to Amazonian development is that this immense region is generally perceived as an homogenous environment (Frechione et al., 1989). From this perception derives the idea that the development proposals or even 'solutions' which may be viable in a particular situation can so be applied to the whole region. This has been the case since the last century, when Amazonia was considered to have the potential to be the 'granary of the world'. In the late 1960s, its potential for cattle-ranching was stressed (CDEA, 1992); whereas in the 1970s this rich environment was considered so ecologically fragile that it should not be threatened by development activities (Goodland and Irwin, 1975). More recently we have seen great efforts to demonstrate the ecological, economic and social viability of the extractivist activities (Shwartzman, 1989; Allegretti, 1990) and the creation of extractive reserves have been publicised as "among the most important strategies for forest conservation" (Hecht, 1989a:53).

However more recently commentators have moved away from these over- generalised prescriptions. "The change of focus from homogeneity to heterogeneity is essential if one is to establish adequate strategies for each Amazonia area" (CDEA, 1992:1). Not only is Amazonia "composed of highly variable 'ecological zones' of enormous complexity" (Frechione et al., 1989:261) but also, there exists high social and economic diversity, embracing populations of distinct cultures, who have evolved different relations with these complex and heterogeneous environments. These populations have developed an accurate knowledge of the environment upon which they depend, and this can be useful to help to understand and generate scientific data about the diversity of the region. This is not the only reason for working together with them however. This is essential because, for the achievement of development and conservation proposals, alternatives should be locally adapted and guided by the desires and aspirations of local people.

Some studies have attempted to show the sophistication of local knowledge and the interdependence of regional biological and human systems in Amazonia. These studies have concerned themselves mainly with Indian groups, such as the excellent Kayapó studies

conducted by Posey and collaborators (Anderson and Posey, 1989; Posey, 1985; Posey, 1993), but also with other groups (Balée and Gély, 1989; Grenand, 1992; Moon, 1989; Prance et al., 1995) and *caboclo*[1] societies (Anderson and Ioris, 1992; Eden and Andrade, 1988; Frechione et al., 1989; Parker, 1989). However an important segment of Amazonian population has been systematically excluded from this kind of study: the colonists.

The colonists represent an important part of the rural population in the Brazilian states of Rondônia, Mato Grosso and Pará (Fearnside, 1990), where they began to arrive in the late 1960s, due to government initiatives (Mahar, 1989; Smith, 1982). Colonists are perceived as victims of governmental policies and at the same time as protagonists of accelerating deforestation in the area. Some studies have shown that, compared to the other Amazonian populations, their knowledge about the ecological environment is less developed (Morán, 1981) and they demonstrate less efficient use of natural resources (Hecht, 1989b). Nevertheless, little interest or research has attempted to verify if the colonists view the forest as an homogenous resource, only a source of nutrients for crops and pasture. To what extent colonists recognise forest diversity? In what circumstances does the forest also fulfils other roles for them? What are the determinant factors for the way they have been using forest resources?

These questions are the starting point of this work. Conducted in six localities of the Marabá region, South-eastern Pará, the study has the following objectives:

• To demonstrate that at the micro-regional level there is a range of ecological, social and economic situations that should be considered in the search for regional development and conservation strategies.

• To verify the roles of the forest in family-based agriculture in the region and to understand the ecological and economic reasons determining their relative importance and the logic behind forest use.

• To explore the conditions necessary for better integration of forest in colonist farming systems and so to provide incentives for slower deforestation and conservation of natural resources.

This study would be unimaginable outside the institutional framework in which it was carried out, so the second section explains this and discusses the field work methodology, which was influenced by the work carried out in the region in recent years.

The third section presents an overview of the region and introduces the localities studied, with special emphasis on the ecological diversity. The likewise diverse farming systems in the region are also introduced. The following part discusses the interactions between ecological, social and economic aspects, describing forest uses: which species are used and under which conditions these uses are more or less important. It also highlights how forest is integrated in farming systems, and the consequences of this integration for land management.

In order to further examine forest integration, the fifth section evaluates the economic contribution of forest resources to different farmers and compares it with other land uses. Whether this contribution can be enhanced through improvement of marketing conditions and if this improvement can help to decrease forest conversion is the focus of the following section. Finally, the concluding section discusses some points that merit attention in the search for alternatives to encourage more sustainable use of natural resources in the region.

Note

1. All the Brazilian terms are explained in the Glossary. Latin names for plant and animal species are presented in the Appendix .

2. Methodology and Institutional Framework

2.1 Institutional framework which supported field work

The work presented here was conducted under the institutional framework of the Tocantins Agro-environmental Centre (CAT). Co-ordinated by the University of Pará, the CAT programme aims to participate in setting up a strong family-based agriculture, implementing systems with a sustainable use of natural resources, based on a close collaboration between researchers and small farmers' organisations. The programme is constituted of two different autonomous bodies: the Agrarian Foundation of Tocantins Araguaia (FATA) controlled by 5 farmers' unions of the Marabá region, whose purpose is to provide support to development activities related to farming, marketing and organisational assistance; and the Socio-Agronomic Laboratory of Tocantins (LASAT), a research group linked to the University, where I worked for four years. Created in 1989, CAT is responsible for a diversified range of development and research activities. Since 1991, LASAT researchers have been involved in a graduate course (DAZ- Amazonian Familial Agriculture and Agro-ecological Development) for agriculture and forestry students, whose research work has been conducted mainly in the Marabá region.

2.2 Methodology

The research methodology was in part inspired in Ethnobotanical research methods, in the sense that this discipline is the "study of the contextualized plant use" and considers that "plant use and plant-human interrelationships are shaped by history, by physical and social environments, and by the inherent qualities of the plants themselves" (Alcorn, 1995: 24). In order to understand to what extent forest roles in Marabá region are dependent on the locality's ecological and socio-economic conditions, six localities are compared. This approach illustrates the diversity of situations in the region, although representativeness in a statistical sense was not a stated objective. The main selecting criteria were the following:

a) colonisation age - the six localities studied range from very recent (2 years old) to one of the oldest ones (22 years) - and facility of physical access to the markets (from very far and isolated localities to those very close to the urban centre).

b) the existence of work already carried by LASAT and DAZ students, which could provide a data base about farming systems in the area.

c) the existence of CAT plans for development activities concerned with forestry or agroforestry, so the data generated could eventually provide some useful information for these actions.

The main body of the field work consisted of semi-structured interviews with farmers. Considering that forest uses can be differentiated in relation to the farmers' socio-economic conditions and emphasising the qualitative rather than quantitative data, families ranging from the poorest to the comparatively wealthy were interviewed, guided by a typology of farms established by LASAT work in the area[1] (de Reynal et al., 1995). In each locality six to eight families were interviewed, trying to cover these different situations. Field work was carried out during May-June 1995 and all the interviews were conducted by the author[2], using a interview guide, where just some questions about the presence of pre-selected species were closed[3].

Given the existence of detailed information about farming systems of the majority of farms selected, interviews concentrated on forest issues: ecological diversity, forest uses and land planning, although information about the family, crops and other features were also updated. Normally the interview was carried out with the head of the family present and with the participation of other family members. Many interviews included a walk through the farm forest area.

Due to my stay for at least one week in each locality and previous visits to the areas, it was possible also to conduct non-structured and very informal interviews with other actors (union leaders, intermediate traders, big landowners) and with small groups (women washing clothes together in a stream, men at the bar, informal visits to families at night, etc.) which of course provided very useful information.

The methods described above were applied to all localities expect Pedrolândia, where field work was carried out in October, 1994, as part as of research activity, monitoring an alternative timber commercialisation test. The data presented are the result of semi-structured interviews[4] using a different guide and it was complemented by a survey undertaken by farmers themselves. Since the locality was not the focus of any previous study, in general there are less data available for this locality, which however does not hinder a general comparison with the others.

Beside interviews, other works were also conducted, such as the direct measurement of small forest plots (10 x100 m) where, together with a farmer, all the trees over 10 cm of breast height diameter (DBH) were identified and measured (height and DBH). Part of this work had already been done by DAZ students and it was completed during field work, when possible. This kind of data is not available for Consulta and Pedrolândia. In other localities two to five plots were sampled.

This research also benefited from the outputs of many CAT/LASAT activities, for example different types of farmers' meetings, research-actions about marketing of forest products, and a farmers' network for collecting prices of agricultural and forest products on a monthly basis in different places.

Notes

1. This typology identifies 5 types of family farms : type 1 -landless or tenants; type 2- farms without cattle; type 3 farmers up to 10 cattle; type 4 up to 35 cattle; and type 5 more then 35 cattle, but still having the family as principal workforce.

2. With participation of Socorro Ferreira in some Sítio Novo interviews.

3. In order to have a better basis for comparison between localities all the interviewees were asked about the presence of same plant species in their farms. These species were already listed by farmers in participatory appraisals conducted in an early phase of CAT activities, or found to be present in some transects conducted by students. With just spontaneously cited species, it would not be possible to know if the species does not exist at one locality or was forgotten. Anyway, the farmers were asked about these species just in a final phase of the interview, when they had already talked spontaneously about species they use. As a result, the final list is much bigger than the previous one, posing again some, although much fewer, difficulties, for comparison .

4. Conducted by the author and Socorro Ferreira.

3. Diversity and Farming Systems at Marabá region

3.1 The region

The Marabá region is one of the most impressive examples of how 'development' has taken place in Brazilian Amazonia. Until the end of the last century, the region was occupied by Indian groups. From this time the region was the focus of different extractivist activities, first of latex and precious stones and then Brazil-nut. Brazil-nut extractivism was the main economic activity in Marabá up to the 1970s (Wambergue and Guerra, 1991). Agriculture and cattle have always been there, but not on extensive areas and not too far from the then small urban centres (Velho, 1972). In the 1960s this picture began to change, with the building of roads linking this isolated region to other parts of Brazil. In the early 1970s, the construction of the Trans-amazonian road was accompanied by colonisation projects, stimulating the arrival of families from different parts of the country (Smith, 1982). Without support, very soon a process of land-re-concentration took place, where small holdings were replaced by cattle ranches.

In the 1980s the arrival of large government projects, such as the iron mine of Serra dos Carajás and the building of Tucuruí dam, and the discovery of the gold mine of Serra Pelada, attracted waves of migrants seeking jobs (Hall, 1993). The population density changed from 0.1 to 1 inhabitant per square kilometre in less than three decades (Hébette and Colares, 1990). The pressure over land resources, until then concentrated in few hands, gave birth to many conflicts involving the *posseiros* and big landowners. Supported by their newly born organisations, the new settlers succeed in appropriate small *lotes*. Actually, the small holders, around 15 000 families, occupy 25 per cent of the total regional area of 40 000 km^2 (de Reynal et al., 1995), dispersed in more than one hundred localities.

3.2 The localities studied

The six localities which form the focus of this study - Pedrolândia, Sapecado, Consulta, Floresta, Sítio Novo and Santa Maria - represent just part of the diversity of Marabá region, but illustrate how diverse this region is.

One of the elements these localities have in common is that each is the result of spontaneous colonisation by farmers. When these farmers first arrived the areas were completely covered by forest. Due to their different lengths of colonisation, these localities demonstrate the evolution of farming systems. However, this evolution has not been linear and has been conditioned by many factors. These include environmental diversity, mainly with regard to soils and vegetation; access to urban centres, with its important impacts on the infra-structure, land and crop prices; and the many social factors that shaped the relationship between the families: means of colonisation, farmers' origin, kin or other ties amongst them, and migration and turn over of families in the localities. Table 3.1 summarises this information for all the localities and Figure 3.1 presents a map of the region, illustrating the localities studied.

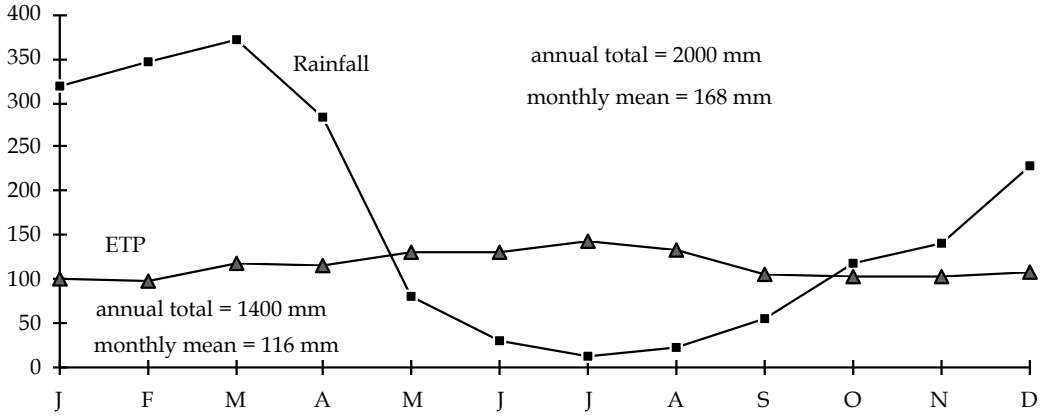
3.3 Environmental diversity

Soil types, climate and natural vegetation together shape what it is possible to do in each locality: the crops and forest products available for gathering, their respective yields, and the calendar for all the activities.

3.3.1 Climate

The region has a tropical humid climate, characterised by very clearly defined rainy and dry seasons. The temperature and the relative air humidity present little variation during the year. The former is around 26°C, with an inter-annual variation less than 2°C, and the humidity oscillates between 77 and 88 per cent (de Reynal et al., 1995). The rainfall, around 2000 mm by year, presents a stronger variation (Figure 3.2) (de Reynal et al., 1995). The rainy season starts in October and continues until April-May. This climate, with a 5 month dry season, allows the development of just one rainfed annual crop cycle and is very favourable for a farming system based on slash and burn cultivation.

Figure 3.2: Pluviometry and potential evapotranspiration at Marabá region (monthly average 1973-86)



Source: de Reynal et al., 1995

3.3.2 Soils

As can be seen in Table 3.2, there is an important variation of soil types between the localities and sometimes within them, as is the case for Sapecado. Farmers are always striving to obtain the highest returns from the natural resources available to them, and with reference to soil resources two criteria are important in determining land use: fertility and moisture. As the Table 3.2 shows, the wetter soils are better suited to rice production. In sandy areas where the risks of hydric deficit are significant, farmers plant rice mainly for household consumption, and cassava is the chief crop.

3.3.3 Forests

The studies of vegetation in the region (the principal one is reported in RADAMBRASIL, 1975) do not offer enough detail to capture the forest diversity between different areas of Marabá, and there is no classification for forest types for the region.

A first important difference in the structure of forests was revealed by forest transects undertaken in four localities. As shown in Figure 3.3 the tree height in Sapecado and Floresta is smaller than at Sítio Novo and Santa Maria; similarly tree diameters are smaller in Sapecado and Floresta, and this strongly reflects the total timber volume of these forests.

Another important difference is forests species diversity, perceived through the farmers' testimony about the existence and frequency of species at their localities (Table 3.3). Although many species are present in all localities, some of them have a very restricted occurrence, amongst them certain species of economic importance such as *babaçu*, *cipó titica* or some timber species.

3.4 Farming systems development

The use of forest should be contextualised in relation to all other activities performed by farmers. These activities change as the farming systems evolve. A 'standard' evolution sequence of the farming systems in Marabá region could be described like this:

First phase - installation: a farmer (sometimes alone -he would bring his family one or two years later) occupies a lote completely covered by forest, in a recently opened locality (for this reason without any kind of infra-structure). There, he will clear a plot in the forest (around three ha on average), close to a source of water, and will install the first rice *roça*. At this time, the family will be very dependent on the forest resources: almost everything in the house will be made by themselves, using forest products. In terms of food, game meat and fish are very important, as well as the use of edible plants and the fuel for cooking. Depending on the forest composition they could sell Brazil-nuts or *cupuaçu*. The sale of timber, at very low prices, is less important for the revenue provided, than for the fact that to collect the timber, the logger has to build a precarious road, until now not existent. Another important cash source can be labour, sold to neighbour *fazendeiros.* Given the instability of land tenure, the lote boundaries are not clearly defined and need to be protected. Moreover, many farmers are not sure whether they will stay in the area long-term, so they will try to sell as much timber as possible and establish pasture to add value to the land.

Second phase: system diversification: after four-five years of settlement the lote picture changes significantly. The family have improved their house and built structures to produce cassava flour; they also produce beans and maize, mainly for household consumption but they sell any surplus. They may start a small but diversified orchard around the house and have some poultry and pigs. In exceptional conditions, if the locality is close to the city, they are able to sell bananas and gathered or cultivated cupuaçu, as is the case in Consulta. At this stage the forest roles can be very different in relation to the economic and environmental situation of the locality. Although the forest cover remains important, practically all the lotes have some pasture around the house and, depending on the farmers' strategy, there will be also some fallow land. Farmers who had more capital initially may have acquired cattle.

The role of cattle is central to the regional farming systems: they represent a source of revenue which is not so climate and price seasonally dependent as crops; they are a highly liquid investment and can be easily transported for sale whatever the road conditions. Furthermore, the productivity of cattle breeding is high, and the peak of activities for pasture maintenance is not concurrent with other farming activities[1].

Third phase: the system specialisation: if there are no significant economic constraints, due to the advantages enumerated above, cattle are the main activity and the farm is dominated by pasture[2]. Crops like rice or cassava remain for subsistence, if at all, and the forest's role remains as a nutrient reserve. This imposes serious restrictions on the sustainability of the farming systems, as the forest is being reduced each year.

Table 3.4 compares some characteristics of these different phases, situating farms of each locality in accordance to their different stages. It illustrates the changes in agro-ecosystems and how some activities, vital at the early phases, lose importance over time, which is particularly true in the case of forest related activities .

The Marabá region evolved from a situation where extractivism was its most important activity. This was slowly replaced by other activities, with dramatic consequences for forest cover. The high variability of forest composition coupled with the diverse way farming systems is organised helps to explain the actual use of forest by farmers and the different strategies they have to manage these resources. These uses and strategies will be detailed in the following section.

Notes

1. Detailed discussion about the role of cattle in Amazonian farming systems can be found in Hecht, 1985, 1989c, 1992a; about its role in Marabá region see de Reynal et al. 1995 and Topall, 1992

2. Due to the natural growth of cattle and the current pasture management practices there is a need to constantly increase pasture area, once its carrying capacity decreases every year.

Table 3.4: Farming Systems phases characteristics at Marabá region and frequency of farmers in different phases at six localities

Phase	Installation	Diversification	Specialisation
years	0-4	4-15	over 15
annual crops	very important	very important	not important
perennial crops	absent	can be important in some localities	not important
livestock	just poultry	poultry, pigs and few cattle	cattle very important
extractivism	very important	important	almost absent
labour force	may be selling	selling or buying just for some tasks	very often buying, for pasture maintenance
lote ecological diversity	high	high/medium	low
susceptibility to climatic or economic hazards in the short term	high	medium	medium or low (has been low in last 10 years)

Farms in this position at:

Pedrolândia	all	none	none
Sapecado	many	some	few
Consulta	few	many	few
Floresta	some	many	few
Sítio Novo	some	many	few
Santa Maria	none	some	many

4. Forest Uses and Farming Systems

"Many trees with economic value are destroyed because colonists are often unfamiliar with useful species… Extension programs and development projects in areas where the colonist front is advancing into new forest should focus on identification and utilisation of economic valuable species" (Butler, 1992:90). The objective of this section is to challenge this kind of assertion and demonstrate that farmers do know and use many forest products, but that their importance can vary as a function of ecological, social and economic conditions.

4.1 Forest products

Forests play different roles in the regional farming systems: they are an important source of food, both vegetable and animal; fuel for cooking, building and fencing materials; raw materials for utensils and medicinal plants. These products have mainly consumptive values to families, but of course some can be a source of revenue.

4.1.1 Edible produce

Edible species represent the most visible use of forest products in farming life. Amongst them Brazil-nut and cupuaçu are particularly important, because they are sources of income . Table 4.1 shows the edible species used in the six localities.

Brazil-nut, as a product that can be stored for some months, was very important in the early economies of places like Sítio Novo, Floresta and particularly in Consulta, due to the high density of the species in these areas of forest[1]. In Sítio Novo it remains of some significance, due to the possibility to exploit it not only on individual farms (as is the general practice in other localities) but in a wider neighbouring forested area, where farmers have free access. In the other areas it is losing its importance, due to forest clearance and even commercialisation of its timber[2]. Cupuaçu marketing has grown significantly in the last five years. But it is perishable, making marketing difficult. At the local level both products, as well as all the others listed in Table 4.1, are used as a diet complement, mainly for children.

Other important products are babaçu, used to produce oil for cooking and to produce soap. It is harvested mainly by the poorest families who otherwise would have to buy commercial oil[3]. But it does not occur in all the areas. *Açai*, a staple in other parts of Amazonia (Anderson and Jardim, 1989; Anderson and

Ioris, 1992) is not consumed in large quantities in either rural or urban areas of Marabá. Due to its very quick perishability it has a restricted marketing (just Santa Maria related the sale of fruits). At Floresta and Sapecado, its palm heart is eventually sold to middle-men, who also harvest the products themselves[4].

4.1.2 Utensils

Table 4.2 lists the plants and the kind of utensils manufactured by farmers. Although for the most part, they are essential for day-to-day life, not all the farmers know how to make them. Some people are more specialised, and they can sell small amounts of these products. In any locality this represents an alternative income source for someone.

Cipó titica[5], a raw material used to produce wicker furniture and other handicraft, is not often used locally, and is more often gathered for sale by poor farmers in areas where it is a common occurrence (Santa Maria).

4.1.3 Medicinal plants[6]

Forest, home garden and even weed plants are the primary 'pharmacy' for rural people, given the distance and the precarious state of health services, as well as the high price of industrialised medicine. Table 4.3 lists some of the forest medicinal plants used by farmers. All of them are processed at household level. Amongst them just *andiroba* and *copaíba* have a regional market and can eventually be sold. Copaíba, although present at all localities, is not often extracted, due a need for specialist knowledge.

Table 4.3: Some medicinal plants used at six localities

Species	Disease	Part of the plant	Where the use was reported
Almescão	rheumatism		SN
Amoreira	tooth-pain		P
Andiroba	skin problems, muscular pains	oil extracted from seeds	C,F,SN,SM
Araçá	cough		SM
Buriti	inflammation		S
Caju de janeiro	toothache	bark	S
Canela		bark	SN
Cedro	malaria		S
Cipó-escada	diarrhoea		SM
Copaíba	throat pain, ear-pain, flu,cough	oil, extract as a liquid resin	J,S,C,F,SN,SM
Cupuaçu	ear-pain	oil extracted from seeds	C,F,SN,SM
Cumaru		oil-extracted from seeds	SN
Gameleira	intestinal worms		SN
Inharé	gynecological problems	leaves	P,S, SN
Jaborandi		leaves	SM
Jatobá	inflammation	barks and seed oil	S
	fortificant	bark	P,S
Jururarana	snake bite		S
Marinheiro	'clean' the blood		P,S
Mumbaca			S
Muraré			S
Pau-piranha	snake bite		S
Quina	malaria	bark	S,C,F,SN
Tatajuba			SN

P= Pedrolândia	F= Floresta
S= Sapecado	SN= Sítio Novo
C= Consulta	SM= Santa Maria

4.1.4. Building and fencing

Building is the first activity for farmers when they arrive at a new lote. At this time, they will use any kind of wood and will cover the first *barraco* with the most easily available palm leaves. With time these structures will be improved and materials which have a certain durability are chosen. A list of building and fencing material used in different localities can be found in Table 4.4. Table 4.5 lists the material needed to build an average size house, demonstrating the significant amount and diversity of materials utilised. Wealthier farmers do not depend on their own forest reserves for housing, since they can buy planks from a woodmill to use in their construction [7]

Table 4.4: Species used for building and fencing at five localities and their characteristics

	Sapecado	Consulta	Floresta	Sítio Novo	Santa Maria	Characteristics of the material
Roof	bacaba leaves castanha's tile cedro's tile estopeiro's tile ipê's tile najá leaves pitiúba's tile	babaçu leaves ubim leaves	babaçu leaves castanha's tile cedro's tile	babaçu leaves bacaba leaves castanha's tile cedro's tile najá leaves	bacaba leaves cedro's tile guajará's tile maçaranduba's tile ubim leaves	leaves: durability and facility to process (babaçu is easier) wood: maleability to crack
stays	atameju canela maçaranduba quariquara taúba	almescão jutaí maçaranduba sapucaia	canela jarana jutaí matá-matá pau-santo quariquara taúba	canela cumaru jarana orelha de macaco pau terra quariquara taúba	maçaranduba quariquara	Resistance to humidity caused by soil contact
crosspieces	açai atameju casca seca louro matá-matá	café bravo goiabinha taiquara	bacuri d'anta cabeça-de-arara castanha lacre	castanha cedro pindaíba	atameju conduru mangue matá-matá pindaíba	straight woods, which can support weight
ties	cipó-amarra cipó-escada cipó-jaboti pente-de-macaco	cipó-amarra cipó-escada	cipó-amarra cipó-escada	cipó-amarra cipó-escada cipó-jaboti cipó-timbó	cipó-escada cipó-titica	maleability
fences (definitive)	almescão jutaí maçaranduba quariquara taúba	almescão jutaí maçaranduba sapucaia quariquara	almescão jarana maracatiara melancieiro sapucaia taúba	braúna canela jarana melancieiro taúba	canela inhaíba maçaranduba	Resistance to humidity caused by soil contact maleability to crack
fences (provisional)	gema-de-ovos louro	andiroba				

Given the continuous demand for wood for building and fencing, many farmers avoid cutting suitable species, and maintain them inside the roças and pastures. This guarantees a supply of raw material even when forest reserves have been completely depleted.

Table 4.5: Forest material used to build a 5 x 6 house at Sítio Novo

Use	Species	number	Unit
Ties	Cipó-amarra	15	kg

Stay	Jarana	3	tree
Stay	Orelha de macaco	1	tree
Stay	Cumaru	1	tree
Stay	Taúba	3	tree
Stay	Pau terra	1	tree
Crosspiece	Pindaíba	6	tree
Joist	Pindaíba	16	tree
Joist	Pindaíba	1	tree
Joist	Paxiba	1	stem
Filling	various timber	50	pieces of wood
Roof	babaçu	230	leaves
Wall	clay		

Source: Machado, 1992

4. 1.5 Fuel

As can be seen in Table 4.6, rural families use three types of fuel for cooking. Industrialised gas is an option only for wealthier families who live relatively close the city. Other farmers have to collect wood or produce charcoal. Almost all wood species could be used for these purposes, but Table 4.6 presents the preferred species, which would be used in the first instance, depending on their gathering distance. Farmers gather wood in the forest mainly to produce charcoal, since fire-wood can be easily collected from old roças (not completely burnt wood), so this activity does not have an immediate impact on consumption of forest resources.

4.1.6 Game and fishing [8]

Game meat and fish are very important sources of protein for the rural population in the region, especially in newly colonised areas. The main cause of decreasing hunting in older areas is the decrease in animal population due to deforestation and hunting pressure, and hence the need to invest more time to obtain the same result. In areas like Sítio Novo, still surrounded by forest, game remains essential. Game meat is more highly valued by the farmers than poultry and

hunting is viewed as a kind of leisure activity. Normally a successful catch, mainly of big animals, is shared with relatives and neighbours. In contrast to other Amazonian areas, game in the region is not commercialised, not even for the sale of skins [9].

Table 4.7 shows the animals hunted. In the past almost all species listed were present in all localities, so the list also reflects the local extinction of some species, sometimes before the arrival of first settlers. Table 4.8 shows the result of one year of hunting by farmers in different areas. It illustrates how similar efforts can yield more and bigger animals in the area with more forest cover and less hunting pressure (Sítio Novo), and also the great importance of food provided through hunting in both situations.

Table 4.7: Animals hunted at six localities

Species	Pedrolândia	Sapecado	Consulta	Floresta	Sítio Novo	Santa Maria
Mammals						
Anta	•				•	
Caititu	•			•	•	•
Capivara		•				•
Cotia	•	•	•	•	•	•
Gato Maracajá	•				•	
Macaco Capelão	•	•	•	•	•	•
Macaco Prego	•		•	•		
Onça	•				•	
Paca	•	•	•	•	•	•
Porção	•					•
Tatu	•	•	•	•	•	•
Veado Mateiro	•	•			•	•
Veado Fuboca	•				•	
Birds						
Azimbra (macuco)					•	
Jacu	•	•			•	
Mutum	•				•	•
Nhambu	•	•				
Reptiles						
Jaboti	•	•			•	•
Jacaré					•	•

Table 4.8: Animals hunted during one year for one farmer from Sapecado and one farmer from Sítio Novo

Species	**Sapecado**	**Sítio Novo**	**Average weight of the animal (kg)**
Caititu	0	9	18
Cotia	1	19	4
Jaboti	5	17	2
Macaco Capelão	4	0	5
Nhambu	1	7	2
Paca	4	8	5
Tatu	11	7	5
Veado	6	12	25
Total (number of animals)	32	70	
Total (kg)	**261**	**661**	

Sources: Machado, 1992; Pereira, 1992

Although some farmers claim to hunt only inside lote domains, the majority exploit a territory up to five kilometres away. Hunting is a task performed only by men, and requires a specialised knowledge about techniques and the territory. For example they need to know the kind of plants which attract game and when they fruit, as is presented for Sítio Novo case in Figure 4.1. This illustrates one farmer's knowledge of the interactions between different plant species and associated game.

Fish are one of the wild resources used by settlers, and are very important to the family diet. Farmers fish in small streams or in large rivers, if there are any close to the locality (as in Consulta, Sapecado and Floresta). Fishing in streams is a task performed mainly by women

and children throughout the year; in big rivers it is done mainly by men, at the beginning of the dry season. Table 4.9 presents a list of some species caught.

The forest clearance has had different impacts on fishing activities: at Sítio Novo, Floresta and Santa Maria farmers relate a decrease in fishing populations since their arrival. At Consulta and Sapecado they relate an increase in population[10].

Table 4.9: Fish species caught at five localities

Specie	Sapecado	Consulta	Floresta	Sítio Novo	Santa Maria
Fish in streams					
beré	•		•	•	
cacunda				•	
cará		•	•		
cuiu-cuiu	•				
jeju				•	
joão duro				•	
mandi		•		•	
maria-doce	•				
piaba	•		•	•	
piau		•	•	•	•
piranha	•	•		•	
porquinho		•			
sabão				•	
surubim				•	
traíra		•	•	•	
Fish in medium/large rivers					
branquinho					
corimatá		•	•		
jaú		•			
surubim	•				
tucunaré			•		•

4.1.7 Timber

As said earlier, timber sales are especially important in newly settled localities, once loggers open roads. However, the presence of logging companies can be detected at different times in any area with some forest cover (see Table 4.10). These companies develop selective logging, exploiting not more than 20 species (see Table 4.10), but very often just four (*mogno*, *cedro, ipê* and *angelim*), whereas farmers relate the existence of another 20 species that could be used for timber. Loggers buy trees at very low prices, so there are few benefits to farmers, and the sales of timber are important mainly for the poorest families.

4. 2 Distribution of farming and extractive activities: time and gender

In order to understand how forest uses are integrated with other farming activities is important to examine how these various activities are distributed during the year and which members of the family are responsible for these different tasks.

As can be seen in Figure 4.2, agricultural activities are concentrated in the wet season (October-April). Gathering activities are dependent on the species production and are distributed throughout the year, but with a concentration also in the wet season, thus competing with agriculture.

Figure 4.2 also shows the gender division of the work. Most of the tasks are performed by both men and women, but many are gender specific. In relation to forest products, whereas men are more concerned with wood harvesting and processing, women and children are involved in gathering of non-wood products, an activity more affected by forest conversion (remember that much wood remains in pasture).

4.3 Land management and its relation to forest

One of the best ways to understand the importance of forest resources to different farmers is through an analysis of the way farmers plan and execute their land management. Just a few farmers in two localities (Consulta and Sítio Novo) are trying to avoid deforestation in areas of significant forest resources (mainly marketable products). It means that although the contribution of forest is significant, its main function remains as a nutrient reserve for crops and pasture. Farmers have different strategies and the following patterns of land use management were identified:

a) After forest clearance and roça, there is always a fallow re-growth; there is no pasture planting, due to lote size (too small), and the farmer will use fallow areas to grow annual crops.

b) After forest clearance and roça, there is always a fallow re-growth. The pasture establishment will happen only after a second roça in the same place. Some areas will always remain as fallow.

c) After deforestation, roça and pasture are planted in the same season.

d) a mix of patterns b and c.

The decisions about the size and the subsequent use of forested areas are very dependent on the available labour and capital. The decisions about the area to be cleared will depend on a number of factors: very often farmers just start the *aberturas* as close as possible to a road (normally the front of the lote) or a stream, and continue this process straight-away, without strong considerations to other aspects. But other socio-political and physical factors can influence the lote geography: aberturas can be placed to protect boundaries, principally at localities where land conflicts were important; fire control can be also considered, whether it is to avoid or to profit from neighbours fire; and soil types. Table 4.11 presents some of the reasons for choosing aberturas and Figure 4.3 presents some sketches exemplifying the land use patterns. These show the diverse patterns of land uses and illustrate some of the factors determining land use.

Table 4.11: Reasons for the choosing of abertura areas at six localities

Pedrolândia	Sapecado	Consulta	Floresta	Sítio Novo	Santa Maria
protect boundaries	protect house and crops from fire	protect boundaries	cope with pasture land use	opening straight away from the front (road) to end of the lote	opening straight away from the front (road) to end of the lote
	use of certain types of soil	protect house and crops from fire	front to end	make fire together with a neighbor	use of wetter soils
	protect boundaries	profit from fences	use of wetter soils	install roça close to village	past land use
	front to end	avoid destruction of important forest resources	avoid animals (pigs) in fields	avoid destruction of important forest resources	crops surrounded by forest to avoid weed
		use of wetter soils	avoid malaria close to river		
		implant pasture in area of risk of fire			

4.4. Evolution of farming systems and the consequences of forest conversion

Farmers have different individual objectives and strategies, but of course their decision making process is part of a social construction, embedded in the local social, economic and environmental conditions, which are constantly evolving.

In localities where cattle become important, it will be very difficult for a farmer to continue to rely on the forest for gathering activities: the general decrease in forest cover associated with past or present pressure over resources (game, fruits, etc.) does not allow the remaining forest to maintain the same productivity, moreover fire penetration into forests (and crops as well) becomes more frequent in a landscape dominated by pasture. With the local shortage of production, buyers of forest products do not have an incentive to visit the locality, therefore decreasing marketing opportunities. In this situation the poorest families, without cattle and more dependent on the forest, will be severely penalised by environmental degradation. The tendency is that just the wealthiest will remain in localities where cattle keeping is really advanced, because the need to increase pasture areas will provide an incentive for them to buy neighbours land. Poorer farmers will be impelled to move as a result of shortage of forest and subsequent difficulties to practising a diversified system. This is what is actually happening in Santa Maria.

As demonstrated in this section, it is not the lack of knowledge about forests that hinders colonists to better use them and their products. Although it could be said that farmers' knowledge certainly increases with time, even in young localities, like Sapecado, the forest species are known and are used for many purposes. This study reports the use of 142 plant species. If a comparison is valid between studies using different methodologies, this number could be compared with the 209 species listed for Prance et al. (1995) in a study reporting plant uses for 4 different Indian groups[11]. If one considers that these groups live in three different Amazonian countries (where the diversity amongst forest types should be greater than that of the between the six Marabá region localities), it is possible to perceive that the colonists demonstrate significant knowledge and use of forest resources.

Although knowledge is essential to manage natural resources, ignorance is not the reason forest has been cleared by colonists, thus other factors should be considered, such as the integration of extractivism with other activities or the way markets play a role in influencing the manner in which forest is used. An examination of the economy of the pioneer frontier will certainly help to elucidate this issue.

Notes

1. A result of the work of indigenous population in the area (Balée, 1989)

2. The tree is legally protected and its timber marketing is forbidden, although currently in the region.

3. Oil is an essential part of the families' diet, where the consumption level can be around 18 l per capita per year. In pre-Amazonian areas babaçu is also an important source of revenue for women, who sell the nuts to oil industries (Hecht et al., 1988, May, 1992a). Although it occurs in forests, it is a pioneer species, whose germination is stimulated by fire, so its very common in pasture, where sometimes it becomes a weed.

4. The açai palm is a plant with multiple stems, so the exploitation of the palm heart can be managed in a sustained way (Jardim and Anderson, 1987, Pollack et al, 1995) , which is not the case of middle-men practice. There is a growing national and international market for palm-heart and an important exploitation in Northern Pará ('região das ilhas'). At Marabá there is just one palm-heart mill (probably not legal).

5. The sale of cipó-titica is a more recent phenomenon, due to the demand for this product in urban centres. At the localities studied, its sale was found just in Santa Maria, but this is an important source of revenue in some new localities near Jacundá. The way it is gathered today does not allow a sustainable use, although it is technically feasible.

6. In order to explore this issue in detail other interview techniques would be required. The species discussed here represent just a small sample of the medicinal plants known to farmers.

7. Generally using Brazil-nut timber.

8. Although fishing is not directly related to forest, it was included here because it is an extractive activity .

9. For more details of commercial hunting activities focusing on skins and leather in other Amazonian regions see Robinson and Redford, 1991.

10. ' The men civilised the fishes' in the words of a Consulta farmer. I could not find any study about changes in fish population in Amazonian streams. I hypothesise that due to the poor nutrient level of some rivers' waters (as is the case for many rivers and streams in Amazon basin, Sternberg, 1995) sediments can improve the nutrient level of the river, with an impact on fish population. Notice that it is the youngest localities that report increases in fish population. It should be considered that fishing pressure in older localities is considerable.

11. The Indian groups were the Ka'apor and Tembé, living in Brazil; Chácobo, from Bolivia and Panare, from Venezuela. Prance et al. consider the same categories of use as utilised in this study, excluding fuel and species attractive to game animals, because in their opinion the majority of fruits fall into one or both categories (Prance et al., 1995: 157). The methodology used by them was a direct inquiry of Indians about the species uses found in one hectare plot in each area.

5. Economy of forest resources at Marabá region

Forests bring many benefits to society. These benefits include direct consumptive uses- for example the use of forest products for food and timber; and indirect uses, such as the ecological and environmental services provided by forests, for instance protecting watersheds and nutrient cycling. However people also derive less tangible benefits from forests and from the species which live in them. For example, in the case of Amazonia, people in other parts of the world may place a value on the existence of forest without even visiting or consuming products from it. The different values associated with forests are shown in Table 5.1.

Table 5.1: Values attached to forests

Direct values	Consumptive use value	Value placed on forest's products that are consumed directly, without passing through the market: • source of food for local people • building materials • raw materials for local manufacture • medicinal products • fuelwood
	Production use value	Value on products that are commercialy harvested, i.e., the products above which enter the market, plus contributions to the production of domesticated resources: • wild resources as source of new domesticate species or genetic resources to improve already domesticated ones • wild pollinators (essential for many crops) • natural pest control
Indirect values	Non-consumptive use value	Generally, the value of benefits accruing to society in the form of services which are not consumed or traded • leisure pursuits • aesthetic value of seeing or beeing in a forest • environmental maintenance functions: regulation of macro- and micro-climates maintaining carbonic gas-oxigen balance storage and cycling of nutrients, water and materials soil formation and prevention of erosion • protection of water catchments • protection from natural environmental variability and buffering extreme events • photosynthetic fixation of solar energy
	Option value	A value based upon the uncertainty of the future and the need to avert risk. This is the 'option' of having future acess to the forest or a forest species (which can be used as medicine, for example)
	Existence value	Ethical, moral and aesthetic value; a value attributable to nature by simply being there, unesed or unvisited

Source: Stocking et al., 1995

In recent years there has been a growing interest in quantifying the economic benefits generated by tropical forests. The assumption underlying this attention is that if forests can generate a significant revenue without being cut down, then there is an incentive for forest conservation (Nepstad and Shwartzman, 1992). This section discusses the different approaches used in forest valuation and assesses the economic value of forest contribution to colonist farming systems in Marabá region. It does so in order to evaluate the economic logic behind current forest uses.

5.1 Valuing forests: problems with the current approaches

Estimating economic values of forest is not a simple task, firstly because "there are no absolute economic values - other than in the perceptions of individuals, and these perceptions tend to be dynamic, changing as circumstances change" (Gregersen et al., 1995:1). Secondly, because individuals can have different values attached to natural resources, which are difficult to translate to a monetary measure, such as forest existence value. And finally, because even establishing a monetary value for goods like fruits or timber is a complex pursuit, due to the lack of ecological data about forest production and the absence of market prices for many of them, let alone the difficulties to establish other indirect forest values, for example to determine the stored carbon and how to attach a monetary value to this forest function (Brown and Pearce, 1994).

Given these obstacles, until now few studies have attempted to present an economic valuation of Amazonian forests. We have also to consider that these studies incorporate the values of whoever carried them out. Such studies have often been undertaken by scientists from developed countries, for whom existence and non-consumptive forest values are very important, and who may use these studies to convince society and policy makers of the economic benefits of standing forests.

One of the most important limitations of some studies is the kind of scenario they envisage. For example, in the most publicised study about the valuation of Amazonian forest (Peters et

al., 1989), researchers measured all timber and non-timber production , finding a financial worth of $ 6 820 per hectare. But under Amazonian infra-structure conditions, most perishable fruits will never reach the market. Even if it were possible to transport all these products to market, the impact of a massive increase in amount of marketed products would result in a significant drop in price. It is unlikely that the projected returns to harvest could ever be realised.

Godoy et al. (1993), reviewing 24 forest valuation studies around the world, identified the major methodological problems as the incompatibility of their results, and a tendency to examine either flora or fauna, but not both. Some of these problems are illustrated by some valuations conducted in Amazonia, presented in Table 5.2. Another common limitation is that many studies do not consider production without market price. Godoy et al. also pointed out that many authors do not fully explain their assumptions or methods, and they noted a lack of attention to sustainability. One of the few studies to address the question of sustainability was that conducted by Hecht (1992b, see Table 5.2), which compared production values and recuperation costs of land degradation for different land uses, i.e., the costs to maintain the same productivity level plus the costs of extractive products lost, over a period of 15 years. Hecht concludes that although incomes for colonist agriculture and livestock are twice as high than extraction for the same area, extraction is more profitable considering that it presents no need for land recuperation. However, it could be argued that Hecht only considered crop production for colonist agriculture (when they have a diversified system, including extractivism) and costs presented for land recuperation for colonist land, using fertilisers, are probably too high[1].

For Browder (1992), the failure of studies to convince either policy makers or rural households that extractive models are viable in Amazonia is largely due to the kind of limitations discussed above, which do not heed what is "possible within a given, clearly defined and actual social context"(ibid.:38). Although many other reasons could explain why academic research does not reach the forest decision makers, it is true that if one wants to use research results as a tool for dialogue with them, these studies have to address issues that are of material importance for farmers and other forest dwellers, who have the final decision about land use. Instead of simulations, the evaluation of the viability of extractive activities requires information on the forms of extraction and other land uses that already exist in the

region (Anderson and Ioris, 1992). Also, analyses of forest financial returns should be carried out considering income per work day. Whilst for an environmentalist the area of land is relevant, from a farmer's point of view "land is abundant but labour is not, so he tries to maximise the scarce resource" (Gregersen et al., 1995:16), although we can expect the yield per area to be somewhat correlated with return to labour (Phillips, 1993).

Table 5.2: Examples of forest and other land use valuation studies in Amazonia

Location	Findings	Comments	Source
Mishana- Peru	Forest net present value is $ 6820. Fruit gross income can be $650/ year.	It considers all timber and non-timber production of 1 ha in a sustainable basis, by direct measurement and interviews. Market prices were attributed to production . A discount rate of 5% was applied. It does not consider the practical difficulties to realise this worth through market	Peters et al., 1989
Jatun Sacha Biological Station Ecuador *(terra firme)*	Average net present value of the $ 2380, for 3 non-timber exploited plots. Net present value of $188 for timber exploitation in 1 plot and cattle ranching of $57 to $287/ha.	It was conducted in three 1ha plots, considering species with market value . Different groups of collectors evaluated the sustainable harvest of each tree. Timber value was estimated just for one plot. Discount rate of 5%. The study states that forests actualy used for collection earn more than other land use, but does not clarify if there is anybody exploiting all forest's potentials, incurring in the same problem as the Mishana study.	Grimes et al., 1994
Combú Island (floodplain), Pará State, Brazil	$3171 gross income per family, where more than 90% is accrued from extractive production, including fish and game.	Data from 5 closed monitored households, during 1 year. The study includes just market goods. Study site very close to the most important Amazonian market (Belém)	Anderson and Ioris, 1992
Acre State (Brazil) in areas of extractive reserves and neigbourhood.	For colonist (3 households) gross income over 15 years = $65 793, less recuperation costs, return over 15 years is -$28217. For cattle the income is $58800 and return = -$58800. For extraction the gross income is $29685 and, without need for recuperation, this is the total return in 15 years.	It considers colonist farming, cattle ranching and extractivism land uses, in a area of 300 ha each. Whereas cattle ranch and agriculture for colonist are considered exclusive activities, extractivism by rubber-tappers also includes agriculture. Consider costs for land recuperation, i.e., costs to maintain the same productivity level for the period of 15 years plus the value of extractive products lost.	Hecht, 1992

5.2 Valuing forest production in Marabá

The forest production valuation presented here aims to evaluate actual forest contribution to farming systems. To do so, it considers the specific decision context of farmers and the values assessed here are those recognised by them: consumptive and production use values. However, it is has to be stressed that during interviews farmers acknowledged the non-consumptive use values of the forests, for example changes in micro-climate, river flows or

in aquatic fauna associated with deforestation, the forest's importance as buffer zones for strong winds and fires, and even its aesthetic value.

The data submitted here attempt to overcome some of the problems discussed above, although others still remain. It should be clear that the analysis carried out here does not represent a valuation of forest, in the sense that to do so, it would be necessary to calculate its net present value, for which production costs should be considered, and an arbitrary discount rate, assumed.

5.2.1 Methods

The valuation is presented here for just two of the localities studied, Floresta and Sítio Novo. Not only were the data for these localities more detailed, but also these localities are in the same price zone (60% of the price of Marabá, see Table 3.1), facilitating the calculations. Production estimates presented are those reported by farmers, for the whole cropping year 1994/95. In all cases it considered production harvested, instead of species production, which would be expected to be higher for the majority of commodities and also much more diversified. Nevertheless not all harvested products were calculated, due to the fact that farmers were not able to estimate harvest when gathering is very irregular.

Prices (presented in US$) were attributed as a function of market prices in the localities at the time of the study, but take account of price fluctuations during the year. For products not actually marketed, price was estimated using various surrogates. For example, to assess fuelwood prices, the equivalent gas consumption for cooking during the same period was estimated, and the fuelwood attributed an equivalent gas price. Values assigned and assumptions made for different products are presented in Table 5.3.

Production costs comprise almost exclusively the work-force (a workday for common tasks was quoted at $3.50), given the general absence of external inputs in the regional farming. They were not considered for every individual farm, but average income per work day (return to labour) was estimated cross-checking different farmers reports about total production harvested, amount of days required, and the total value of this production (Table 5. 4).

Table 5.4: Return to labour to different commodities

Crops and Livestock			Forest Products	
Commodity	income/ workday		Commodity	income/ workday
			açai	$ 12.00
			babaçu	$ 2.16
		edible	Brazil nut	$ 16.00
			cupuaçu	$ 25.00
rice	$ 4.00		fish	$ 2.00
cassava	$ 3.50		game	$ 4.50
maize	$ 3.60	medicinal	andiroba	$ 1.80
beans	$ 5.00		copaíba	$ 45.00
cattle	$ 4.60	raw materials	broom	$ 10.00
		and	cipó-titica	$ 8.70
		utensils	jacá	$ 5.00
			quibane	$ 3.30
		fuel	charcoal	$ 3.00

5.2.2 The economic contribution of forest products to farming systems at Sítio Novo and Floresta

The evaluation of forest products harvested at Sítio Novo and Floresta confirms the importance of these to the lote economy and substantiates earlier affirmations of the different contribution of some products in different localities related to distinct forest composition and socio-economic situation at the areas (Table 5.5). For example, game represents the most important product in Sítio Novo, because of the existence of 'undisturbed' forest surrounding the area. At Floresta, given the constant migration of families in the area, there is a tendency to exploit resources in a less renewable manner. For example, this comprises the sale of timber, including Brazil-nut trees, and over-exploitation of palm-hearts. Babaçu and andiroba harvesting are more important in Floresta due to their natural occurrence, but these are important just for poor families without other options, since the return on labour for these activities is very low (Table 5.4).

If conducted in other localities an evaluation of production would show stronger

differences in the contribution of different products. The results presented here are similar to those reported in a detailed study conducted by Philips (1993) in the Peruvian Amazon, which compared the different harvesting potential of forest in relation to soil types and farmers' preferences.

The monetary value of forest products varies from US$ 336 to US$ 1105 per family in Floresta and from US$ 364 to US$ 1185 in Sítio Novo. As total household income increases, the economic importance of forest decreases, given the economic weight of crops and livestock (Figures 5.1 to 5.4). For poorer families, forest can contribute up to 58% of income, whereas for wealthier households it represents less than 10% of total income. Generally the more diversified farms (with some but not too many cattle) have the most significant absolute forest income. The poorest families tend to have less access to forest resources (they are generally tenants or farm smaller plots) and have to dedicate time to selling their labour, not allowing time for gathering activities, although this activity is more vital to them. Wealthier farmers become more specialised, and are able to purchase forest and even crop products in the market. These tendencies might be further amplified if it were possible to measure all the forest products used in each area.

Farmers' "decisions are dictated by their responses to the whole, rather than by assessments of the costs and benefits of each part separately" (Gregersen et al., 1995). Even if the returns per workday can be higher for some forest products (see Table 5.4), such as Brazil-nut or cupuaçu, than for crops and cattle, there is no incentive for farmers to increase (or at least not decrease through deforestation) forest production for many reasons. Firstly, because the production levels for many products are low, due to low natural concentration of species in the forest. Since the exploitation occurs mainly in lote domains, the production potential is very restricted, so there is no possibility to dedicate more time to these tasks. Farmers at Sítio Novo can raise higher income from non-wood products because they can exploit larger areas. Secondly, although farmers

do not explore all the forest potential and it should be possible to increase yield for some products, the majority are perishable or have very irregular markets. Crops not only have well established markets but more importantly, they are the staple food. If a farmer has to decide about land use, the crops option is less risk than forest gathering, where he can exert almost no control. There is also some competition between tasks. Whereas the most time-consuming work for pasture maintenance can be done in any time, forest harvesting has to be concentrated in short periods, but at the same time dispersed during this interval. For example, the cupuaçu production can not be collected in just a few whole days, but occupies one or two hours everyday, interfering with other tasks.

Farmers aim to decrease risks and have more stable production and this can be better provided in more diversified farming systems, which include cattle, and so at the same time forest and other land uses are complementary but to an extent they are also conflicting. Crops need the nutrient reserve of forest or fallow, and cattle need increasing pasture areas. When farmers consider all the problems listed above, forest gives way to other land uses.

The finding that crop and sometimes livestock production represents a more profitable land use in the short term was a conclusion of valuation exercises in other Latin American sites, including those conducted by Godoy et al. (1995) in Nicaragua, by Pinedo-Vasquez et al. in Peruvian Amazonia (1992), and by Hecht in Western Amazonia (1992b). The extractive activity can compete with other uses in the case of oligarchic forests, normally present in inundated floodplains (Philips, 1993), such as the ones reported by Anderson and Ioris (1992) and Peters (1989).

Through the valuation conducted here it was possible to evaluate the comparative importance of forest resources in the lote economy in two localities. This contribution proved to be particularly important for poorer households. The analyses carried out, however, is partial because it does not include the totality of farmers' production, such as some medicinal plants or minor crops and orchards yields. It also does not consider production costs, and so the net present value for different land uses was not calculated, although return to labour was computed, and this is for some a 'better guide to understanding people's economic behaviour than its return from land' (Martin, 1995:189).

The valuation of some products remains problematic, and the use of market or surrogate prices does not fully reflect the importance of some products to families. One example is the low price found for building materials, a reflection of the very low prices received for timber in the areas. In another opportunity it would be interesting to use other methods, such as contingent valuation, the farmers' willingness to pay for some products, used in other studies, for example that conducted by Godoy et al. (1995).

The section also concludes that the ecological and economic environment make it difficult for extractivist activities to compete with other land uses. One of the possibilities to increase forest participation in farming systems and so provide an incentive for a more sustainable land use should be through the improvement of market conditions, which is the focus of the discussion in the following section.

Note

1. Hecht considers that to recuperate, land will need to be left fallow and be fertilised for one year. Other works in Amazonia (Thiele, 1991 and de Reynal et al, 1995) showed that three years fallow or more can present the crop yields as forest, at least once, so in this case recuperation costs should be smaller than presented by Hecht.

6. Improving the market for forest products: evaluation of a conservation and development strategy

"Until society begins to reward landholders for maintaining their tropical forests, the fate of these ecosystems will depend on their value in the market place" (Nepstad, 1992:143). The improvement of market conditions for forest products has been recommended by researchers, environmentalists and even the local organisations (for example, the rubber-tappers movement in Brazil) as one of the most important strategies to link conservation with development in the Amazonia. If local populations receive better prices for gathered products from the forest areas, and perhaps if there is the possibility to introduce new products in the market, then there will be an incentive for not converting forest to other land uses (Corry, 1993, Pedenton, 1992, Prance, 1989). This is the rationality behind, for example, the promotion of 'extractive reserves'.

Earlier chapters have shown that colonists in the Marabá region already sell some forest products, and part of the obstacle to increasing the contribution of forest products to farming systems has been identified. But what are the opportunities to add more value to forest products? Is there room for local people to develop and control this type of initiative? Can the improvement of market conditions really help to reduce the rates of deforestation in the region?

This section explores these issues, first presenting an analysis of the economic dynamics of forest product extraction in Amazonia. The section then examines the opportunities to increase the value of forest products in the market place, and which sort of products can benefit from a market improvement. It does so by reviewing this challenge in practice and by studying the obstacles faced by initiatives already underway. Finally, the possible impacts of these improvements on the rate of deforestation are discussed.

6.1 The dynamics of extractivism in Amazonia

Historically, Amazonia has guaranteed itself an important role in the Amazonian countries' economies due to the exportation of a wide range of forest products (Homma, 1992, Padoch,

1992, Southgate et al., 1996). The Marabá region is one example: the objective of the first colonisation, at the end of the last century, was latex extraction (Velho, 1972), and Brazil nuts were the most important commodity in the local economy up to the 1960s. Private capital has played a central role in the organisation of extractive activities. This was usually contingent upon the existence of high world-market prices or government subsidies for forest commodities (Browder, 1992). Even though extractivism is perceived today as a way to link conservation with development, this activity has often been associated with over-exploitation of natural resources and of human beings as well.

A four phase process in the evolution of extractive activities in Amazonia has been proposed by Homma (1982, 1992) and reviewed by May (1992b). The first phase is characterised by the growth of extraction due to the existence of untapped reserves, or as a result of the monopolistic position of the commodity in the market. In the second phase, the expansion of extractive activities leads to the development of infra-structure in the area, which enhances the marketability of products and reduces production costs. This is the stabilisation phase. The following phase is the decline of the extractive activity, due to the shrinkage of the resource base and an increase in production costs or the existence of cheaper substitutes. A fourth phase, cultivation, can be developed during stabilisation, if the technology to do so is available, and if substitutes have not yet been found and prices remain high. Cultivation can also lead to the decline of extraction. Extractivism is thus a very unstable economic activity (Anderson, 1992).

The cycle described above is an useful tool for analysing how markets evolve and understanding what the needs are for adapting extractive activities to new market demands, without risking economic or ecological sustainability. The opportunities to interfere in market conditions are very dependent on the phase of products in this cycle. If in the early phase, it demands a strong effort to build markets and infra-structure for transportation and processing. Once the product is in the stabilisation phase the challenge is to improve conditions and at the same time identify harvest levels, so avoiding the decline phase. This is the condition where market improvement could also help to slow forest conversion. From a preservationist point of view, cultivation can have advantages and disadvantages. Cultivation can hinder the expansion of non-sustainable harvest into new areas. On the other hand it can contribute to a decrease in prices, in turn decreasing forest value and thus increasing pressure

on forests. Agriculture, even under an agroforestry scheme, can never reproduce all the forest functions.

Different forest products are now in different phases of this cycle, in different parts of Amazonia. In Marabá, for example, Brazil-nut extraction is entering the decline phase, because the richest Brazil nut groves have been rapidly eroded by forest conversion. Even if cupuaçu trees have also been depleted by cattle-ranching or shifting cultivation, the extractive activity has seen an expansion, due to the increasing demand and improvement in marketing structures[1]. This condition provides an incentive for a move to cupuaçu cultivation in some localities. Products like andiroba or copaíba and açai, despite the existence of markets in other regions, are in the very early stage of the expansion phase, since the absence of market structures in Marabá, provides no incentives for gathering. Undoubtedly, the most important marketed forest product in the Marabá region now is timber. The constant expansion of this market can be measured through the number of wood-mills registered in the region, 172, of which 76 were registered since 1990 (IBAMA, 1995)[2]. Timber is in the stabilisation phase, although some species, such as mahogany (*mogno*), have entered the decline phase due to over-exploitation. A scheme illustrating the phase of extractive cycle of some products of Marabá can be found in Figure 6.1.

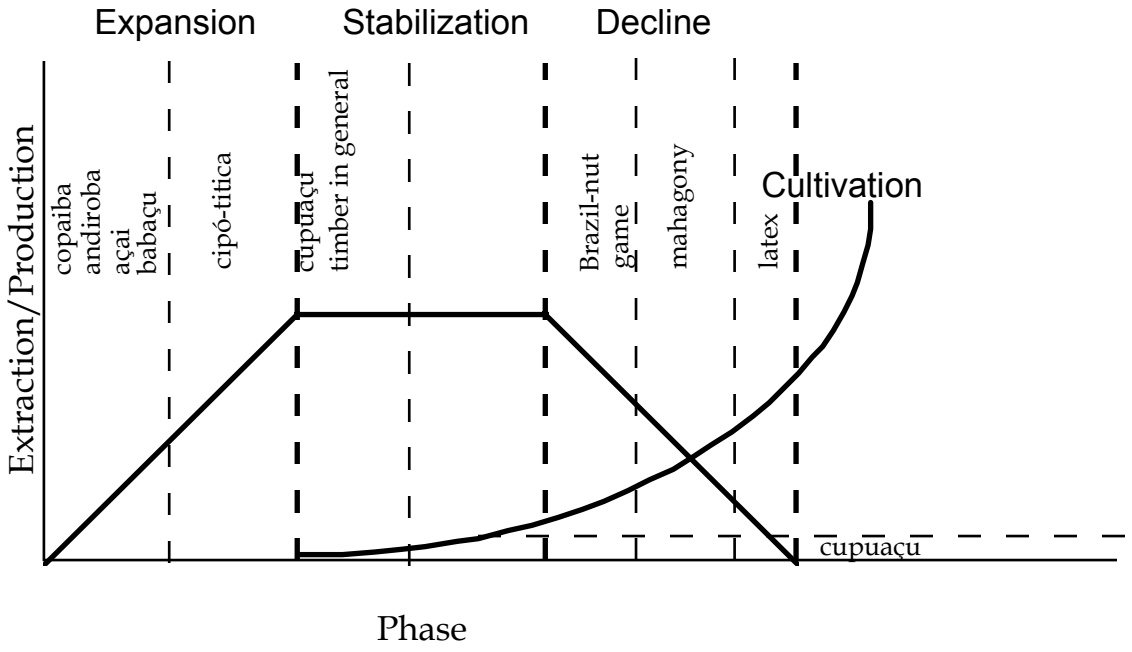


Figure 6.1 : Present status of some forest products in Marabá region
Modified from Homma, 1992

6.2 Adding value to forest products : constraints and perspectives

The different phases of forest production and extraction are determined by both local and external conditions. External factors include the demand for products, the competition with other products, producers or areas, and their relative prices. However if a product does not have an important market, how can demand be increased? How can a market for a delicious but highly perishable fruit that only local people appreciate be created? Once a market exists, what sort of mechanism should be developed to guarantee sustainable harvests at different sites ? Although many products are already marketed at a local scale, many papers emphasise the need to identify new products that could be marketed in order to increase the commercial value of forest. Many researchers have cited the potential for developing forest products to produce new medicinal drugs (King 1992, Martin, 1995, Naranjo, 1995). However although the benefits from the development of such products may be large, often only a very small part of the value is retained by local people. This has been the case with many products, in the past and today.

At the local level, the high degree of diversity of the forest, which demands complex and costly management directed to different products, causes impediments to the development of extractive activities (Browder, 1992). Another problem common in many areas is the poorly

developed transportation and communication network and the lack of storage and processing structures. In addition there exist "enormously long, complex, and changing marketing chains… where marketing is a very risky business" (Padoch, 1992:49). Given these circumstances, the difference in prices received by producers at gate and those paid for the same products in regional urban centres, not to say outside the region, are enormous. Table 6.1 shows some examples from Marabá, exhibiting differences of up to 1600%.

Table 6.1: Prices of some forest products in Floresta and in the urban centre (Marabá)

Product	**Maximum Price received in Floresta**	**Maximum price at Marabá**	**Difference**
cupuaçu (1 fruit)	$ 0.60	$ 1.80	1:3
Brazil-nut (1 hectolitre)	$ 14.00	$ 26	1:1.85
timber (1 cedro tree)	$60,00 (1 tree = 8m3)	$120 (m3) or $960 per tree	1:16

The trade of forest products in many areas of Amazonia can be "criticised as inefficient, inequitable, and extremely underdeveloped" (Padoch, 1992:49). However, "if simple answers were available, the enterprising, risk-taking, and knowledgeable local people would long ago have found them" (ibid., 49).

The challenge of overcoming so many obstacles has been attempted by some groups in Amazonia, such as farmers' unions, farmers and forest dwellers associations and co-operatives at the local or regional levels. They are involved in the market of vegetable ivory in Ecuador (Calero-Hidalgo, 1992; Ziffer, 1992); Brazil nuts and latex in Western Amazonia (Butler, 1992; Clay, 1992a); babaçu (May, 1992a, Reilly, 1992), cupuaçu (Barreto and Muchagata, 1995; Butler, 1992, CEPASP, 1992) and Brazil nuts (Wambergue and Guerra, 1991; Richards, 1993) in Eastern Amazonia; and palm-hearts in the Amazon estuary region (Oliveira and Nascimento, 1991). All these experiences were able to develop because they received financial support from international NGOs. But the problems faced by local organisations go far beyond capital constraints or these others discussed above: even with

help, in local conditions it is very difficult to obtain accurate information about markets and prices; and normally these organisations lack managerial skills.

Intermediate traders are omnipresent throughout the region, and although normally they are not the rich and exploitative people as often perceived (Padoch, 1992), they develop relationships with farmers and buyers that are very difficult to break: the middle-men have been there for a long time, whereas these organisations are generally new and inexperienced. Finally, for organisations to establish themselves in the market they should provide products with quality, offer a reasonable price and a reliable supply. Local producer's organisations are small, and it is difficult for them to achieve these conditions. Most of them are struggling to accrue benefits from the sale of one or two products which already have a established market, and it is very difficult to foresee whether they will be able to deal with the wide range of products that would be necessary to realise a greater proportion of the potential of Amazonian forests in the future. This leads to the questioning of the findings of some valuation studies which do not take account of market restrictions, as discussed in the last section.

International conservation organisations, donor agencies and even local groups have supported the notion of extraction and increased trade of non-timber forest products (NTFPs) as an alternative to deforestation (Godoy and Bawa, 1993). Nevertheless, probably the most important product extracted from Amazonia presently is timber. Its market continues to grow at regional and international level. However farmers are seriously exploited when they try to sell timber. It is a product that does not suffer from seasonality of production and timber is not perishable. Timber, however, does not have the same 'appeal' as NTFP, and some organisations involved in so-called 'green' and 'fair' market refuse to participate in initiatives involving timber (see for example Clay, 1992b for the case of Cultural Survival). Timber exploitation is supposed to destroy the resource base that should be conserved.

Although the environmental damage actually caused by logging in direct (through the over exploitation of some species and the destruction of others; Uhl and Vieira, 1989) and indirect ways (through the opening of roads that help to colonise new forest areas) is considerable, studies have demonstrated that timber harvesting can be sustainable under certain conditions (Hartshorn, 1992; Gómez-Pompa and Burley, 1991, de Graaf, 1991). Entering in the timber

market, however, does not mean that local organisations will not encounter the same problems reported earlier. Quite the opposite, given the economic power of logging companies, the conflicts and inequity can be even worse than for other products. Even if the sustainable management of forest for timber production is technically feasible, few experiences exist to demonstrate if local producers organisations can successfully initiate and control the process.

6.3 Market improvement: a successful tool for linking forest conservation and development?

The promotion of market improvement as a strategy to provide incentives for forest conservation has become an ideological issue, and very few evaluations have been undertaken to assess the economic, social and ecological impact of such experiences. Nevertheless there are some issues which are apparent.

There is no doubt that small and localised experiences have harvested economic benefits for local people. Most of the experiences cited earlier have been able to generate a greater profit for local producers involved, even if sometimes the economic sustainability of the enterprise itself can be called into question. An important issue is that even if just a few producers are receiving higher prices, this is an incentive for other producers to negotiate better prices with intermediate traders and have a influence over the local market (Clay, 1992b).

However, it is unclear whether economic gains from extractive activities will have a positive influence over the rates of forest conversion. Price rises have historically been an incentive for resource depletion. In the present scene, where local organisations can not work with such a wide range of products, it is very difficult for forest to compete with other land uses. For colonist farmers, probably it does not matter if an extra gain accrues due to the sale of rice, timber or Brazil-nut. They will use the profit to improve their livelihoods and this will not necessarily drive them to invest in forest activities.

If marketing of forest products is to be encouraged, management plans are necessary and must account not only for ecological sustainability but also for all variables affecting both household and marketplace use of the resource (Godoy and Bawa, 1993). In the colonist

case, it implies to recognise that extraction is just one component of diversified livelihood strategies, as this study has attempted to show in earlier sections. Actions looking for increasing the farmers' gains through extractivism have possibilities to help to decrease forest conversion rates only if these initiatives are part of a wider strategy to make other colonist land use also more sustainable.

Notes

1. A survey involving 10 intermediate traders in Marabá showed that just 2 of them have been involved in this activity before 1990. Their storage capacity increased by 56 per cent from 1994 to 1995. They estimate that more than 90 per cent of the products they buy are gathered from the forest (Tcatchenco, 1995).

2. This is official data. This does not mean, however, that there are just 172 wood-mills in the region and that they started to work in the year in which they have been registered.

7. Conclusion

This work set out to understand the importance of forest products to colonist farming systems in a pioneer Amazonian frontier, and to examine the determinants of this contribution.

The first element that could influence forest use, the ecological diversity, proved to be very important. The region embraces an enormous diversity where forest composition is highly variable, determining the farmers' possibilities of use. Farmers use the forest and forest products for many purposes, and the exhaustion of forest resources represents more than a constraint to increasing agriculture or livestock areas. It also means the loss of income sources, food and many other products critical for livelihood of farming households.

The poorest families are precisely those who most depend on forest and are the most affected by its depletion. However, both poor and better established families contribute to resource degradation. More specialised farming systems are responsible for faster forest conversion, while the poor farmers often exploit timber and non-timber resources in a non-sustainable way.

Looking for alternatives to increase forest contribution to colonist farming systems, this work attempted to evaluate the opportunities to do so through a market-oriented strategy for forest products. It concludes that in the actual scenario the chances to realise forest worth through the sale of multiple products are meagre. The market dynamics for extractive products and the perspectives demonstrated by the few experiences involving marketing do not provide the necessary assurance or incentives for farmers to divert resources from other income generating activities to invest in forest extraction.

Other alternatives have not been analysed here, but there is room to refine some activities already carried out by farmers, like the processing of andiroba and babaçu, improving harvest techniques for copaiba and cipo titica, or açai management for improving palm-heart production. In relation to timber, this is not only one of the products that could have its value increased through commercialisation improvement, but actions to increase processing wood

at local level would add more value to this product and have a significant impact on the quality of buildings and furniture used by farmers.

An analysis of products that have been used by colonists also suggests clues for their use in agroforestry. For example the fact that farmers usually do not fell many building and fencing tree species when clearing new areas suggests that these species can be more easily adopted by farmers in agroforestry trials.

It is important to stress, however, that colonist livelihood strategies encompass a wide range of activities. The chances to decrease forest conversion rates lie in a better integration of extractivism, annual and perennial crops and livestock and in the capacity to make not only forest use, but also these other land uses more sustainable, and so decrease pressure over forest. Although actually much research has been conducted in order to intensify land uses in Amazonia[1], very often just one component of the farming systems is considered, not taking into account how to integrate sustainable land-use practices into existing farms.

This study concentrates on the way individual families manage their resources, mainly because it is at this level that decision making about these resources are made. The opportunity to improve the situation lies, however, in the ability to create mechanisms were farmers can discuss, mainly amongst themselves, the impact of their activities on forest and other natural resources. Issues like management of game, fire control or watershed protection can be handled only at a collective level.

The conditions imposed by the way colonisation took place, where farmers are forced to clear the lote and to develop strategies to rapidly appropriate it, like pasture establishment, did not favour the spontaneous creation of such mechanisms. Researchers and development workers have an important role to support localities to develop such processes and mechanisms. With the use of adequate methodologies there is a possibility to help farmers in establishing a process where they can express their views and expectations, identify common problems and discuss possible actions.

I suggest that these mechanisms can be easier developed in localities where families turn-over are less important and where family ties are stronger, because its facilitate or

demonstrate a will for developing more sedentary farming practices. Of course, the limits and possibilities of rural people to work together in different conditions should be analysed. Similarly to the environmental and economic conditions, the social organisation at the locality level has also been evolving and embraces an important diversity and the determinants of social cohesion in Amazonian frontiers should be clarified.

The establishment of this kind of process in not easy, nor a tranquil one. On the contrary, farmers, and other external actors as well, are in different social positions and have different interests, which will lead to conflicting views about resource management. Researchers can have an important and not neutral role in making some environmental problems resulting from actual practices more visible (Röling, 1994).

Such a process can be triggered off once there exists a demand from farmers for technical and organisational support, as is the case in Marabá. It implies a need for changes in the way research and development organisations have been working in Amazonia in order to engage themselves in a learning process and the adoption of more participatory approaches.

Note

1 This includes many experiences, mainly in the field of agroforestry systems (some examples are Bishop, 1982; Peck, 1982, 1990; Smith et al., 1995; Subler and Uhl, 1990;) but also with pasture management (Mattos and Uhl, 1994; Serrão and Toledo, 1990;) and including diverse strategies to increase land and labour productivity for annual crops systems (Sanchez et al., 1982;Valverde and Bandy, 1982).

Glossary

abertura: a clearance in the forest, that can be occupied by crops, pasture or even fallow.

barraco: a temporary house, made with straw or pieces of wood.

caboclo: The term refers to Amazonian backwoods men. Initially it was used to refer to detribalised Indians and various racial mixtures that include Indian blood.

castanhal: Brazil-nut grove. From the end of last century the government of Pará State accorded concessions of up to 3000 ha to exploit Brazil nut, naming them castanhal/

fazenda: Ranch or large holding

fazendeiro: Owner of a fazenda.

lote: a small farm (generally around 50 ha, but larger then 200 ha) normally appropriated through official colonisation projects or squatting.

posseiro: Squatter; someone who lives on land without legal title.

roça : a crop field, result of slash and burn cultivation, where normally farmers plant rice, mixed with maize and cassava.

terra firme: on the opposite of *várzea* (floodplain), upland not subject of floods.

Appendix - Latin names of plants and animal species

A- Plant species

Brazilian vernacular name	Latin name	Family
Timber		
Almescão	*Trattinickia burseraefolia* Sw.	Burseraceae
Amapá	*Brossimum* sp. Hub	Moraceae
Amarelão	*Euxylophora paraensis* Hub.	Rutaceae
Angelim	*Hymenolobium* sp. Ducke	Leguminosae
Angico	*Piptadenia* sp.	
Achichá	*Sterculia* sp.	Sterculiacea
Bacuri-D'anta	*Moronobea coccinea* Aubl.	Clusiaceae
Canela	*Nectrandra cuspidata* Nees	Lauraceae
Cedro	*Cedrela odorata* L.	Meliaceae
Cedroarana	*Cedrelinga catenaeformis* Ducke	Leguminosae
Cumaru	*Dipteryx* sp.	Leguminosae
Cupiúba	*Goupia glabra* Aubl.	Goupinaceae
Estopeiro	*Cariniana strellensis* (Raddi) O. Ktze.	Lecythidaceae
Favão	*Parkia* spp.	Leguminosae
Faveira	*Parkia pendula* Benth.	Leguminosae
Freijó	*Cordia goeldianea* Hub.	Boraginaceae
Ipê-amarelo	*Tabebuia* sp.	Bignoniaceae
Ipê-roxo	*Tabebuia* sp.	Bignoniaceae
Jacarandá-do-Pará	*Dalbergia spruceana*	Leguminosae
Jatobá	*Hymenaea* sp	Leguminosae
Jequitibá	*Cariniana legalis* (Mart.) O. Ktze	Lecythidaceae
Louro	*Ocotea* spp.	Lauraceae
Maçaranduba	*Manilkara* sp.	Sapotaceae
Mangue	*Calophyllum brasiliense* Camb.	Guttiferae
Maracatiara	*Astronium* sp. Ducke	Anacardiaceae

Marfim	*Agonandra brasiliensis* Miers	Olacaceae
Marinheiro	*Guarea trichiliodes* L.	Meliaceae
Marupá	*Simarouba amara* Aubl.	Simaroubaceae
Melancieira	*Alexa grandiflora* Ducke	Leguminosae
Mogno	*Swietenia macrophylla* King	Meliaceae
Orelha-de-macaco	*Eutreopobium schomburgkii*	Mimosaceae
Piquiá	*Caryocar villosum* (Aubl.) Pers	Caryocaraceae
Pitiúba	?	
Pitomba-de-Leite	?	
Quaricara	*Minquartia* sp.	
Sapucaia	*Lecythis usitata* Miers.	Lecythidaceae
Sucupira	*Bowdichia* sp.	Leguminosae
Sumaúma	*Ceiba petandra* (L.) Gaertn.	Bombaceae
Tamburi	*Enterolobium sp.*	Leguminosae
Tatajuba	*Bagassa guianensis* Aubl.	Moraceae
Taúba	*Mezilaurus itauba* (Meissn.) Taub.	Lauraceae

Brazilian vernacular name	**Latin name**	**Family**
Fruits		
Açaí	*Euterpe oleracea*	Palmae
Ata	*Anona* sp.	Anonaceae
Babaçu	*Orbignya martiana*	Palmae
Bacaba	*Oenocarpus bacaba*	Palmae
Bacuri	*Platonia insignis* Mart.	Clusiaceae
Cacau-da-mata	*Teobroma cacao* L.	Sterculiaceae
Cajá	*Spondias mombin* Urb.	Anacardiacea
Caju-de janeiro	*Anacardium giganteum* Engl.	Anacardiacea
Castanha	*Bertholletia excelsa* H.B. K.	Lecythidaceae
Cupuaçu	*Teobroma grandiflorum* (Wild. ex Spreng) K. Schum.	Sterculiacea

Frutão	?	
Genipapo	*Genipa americana* L.	Rubiaceae
Ingá	*Inga* spp.	Leguminosae
Jambo	*Eugenia* sp.	
Mamuí	?	
Mutá	?	
Uxi	*Endopleura uchi* Cuatr.	Humiriaceae

Building and fencing

Atameju	*Rollinia* sp.	
Beiju de Coco	*Dialium guianensis*	
Braúna	*Melanoxylon braunia*	Leguminosae
Cabeça-de-arara	?	
Casca seca	?	
Goiabinha	?	
Jarana	*Holopyxidium jarana* (Hub.) Ducke	Lecythidaceae
Jutaí	*Hymenaea* sp.	Leguminosae
Lacre	*Vismea* sp.	
Mumbaca		Palmae
Najá	*Maximiliana martiana*	Palmae
Pau-terra		
Paxiba	*Socrotea exorrhiza* Mart.	Palmae
Pindaíba	*Xylopia* sp.	Leguminosae
Ubim	*Geonoma* sp.	Palmae

Tieing and wicker

Cipó-amarra-curral	?	
Cipó-de-anta	?	
Cipó-escada	*Bauhinia madiata*	Leguminosae
Cipó-jabuti	*Bauhinia macrostachya*	Leguminosae
Brazilian vernacular name	**Latin name**	**Family**

Cipó-timbó	*Derris* sp.	
Cipó-titica	*Heterospsis* sp.	
Guarimã	*Ischsoriphos obliquus*	Marantaceae
Taboqui	?	

Fire wood and charcoal

Amarelinho	*Pognophora schomburgkiana*	Euphorbiaceae
Café-bravo	*Cordia* sp.	Borraginaceae
Embaúba	*Cecropia* sp.	Cecropiaceae
Girote	?	
Goiabão	*Planchonella pachycarpa* Pires	Sapotaceae
Gonçalo-Alves	?	
Guajará	*Macrolobium sp.*	Bignoniaceae
Inharé	*Helicostylis podogogyne*	
Jitó	?	
João-Mole	*Clavapetalum elatum* Ducke	
Matá-matá	*Eschweilera odora*	Lecythidaceae
Mominha	?	
Mutamba	*Guazuama ulmiflora* Lam.	
Pau Santo	*Zollernia paraensis* Hub.	
Pau-roxo	*Peltogyne* sp.	Leguminosae
Taxi	*Sclerobium* spp.	Leguminosae
Taiquara	?	
Toari	*Couratari guianensis* Aubl.	Lecythidaceae

Medicinal

Amoreira	*Chlorophora tinctoria* Gaud.	Moraceae
Andiroba	*Carapa guianensis* Aubl.	Meliaceae
Araçá	*Myrcia fallax*	Myrtaceae
Buranjica	?	

Buriti	*Mauritia fluxuosa*	Palmae
Conduru	*Brosimum paraense* Hub.	Moraceae
Copaíba	*Copaifera reticulata* Ducke	Leguminosae
Gameleira	?	
Jaborandi	?	
Janaúba	?	
Juruarana	?	
Muraré	*Trymatococus amazonicus* P&E.	
Pau-piranha		
Quina	*Couratea exandra* Schum.	

Brazilian vernacular name	**Latin name**	**Family**
Other		
Amará	?	
Ananim	*Symphonia globulifera* L.F.	Guttiferae
Atraca	?	
Bapeba	?	
Camurim	?	
Canela-de-velho	*Richardella glomerata*	
Carne-de-galinha	?	
Carvão-Vermelho	*Pouteria macrocarpa*	
Chuveiro	?	
Creoli	?	
Feijão-bravo	?	Leguminosae
Folha -morta	?	
Garra-branca	?	
Guabiraba	?	

Imbira-cheirosa	?	
Indiratanha	?	
Jambre	?	
Mamalu	?	
Mangaba-branca	*Pseudobombax munguba* Mart. et Zucc.	Bombaceae
Maria Preta	*Zizyphus* sp.	
Murici-do-Mato	*Byrsonima amazonica* Griseb	Malphigiaceae
Oco-de-rato	?	
Olho-de-boi	?	
Pau-branco	?	
Pé-de-anta	*?*	
Pinho	*Schilozobium amazonicum* Huber	Leguminosae
Tamarindo	?	Leguminosae
Tucum	*Astrocaryum vulgar*	Palmae
Velame	?	
Xita	?	

B-Animal species

Brazilian vernacular name	**Latin name**
Mammals	
Anta	*Tapirus terrestris*
Caititu	*Tayassu tacaju*
Capivara	*Hydrochoerus hydrochaeris*
Cotia	*Dasyprocta leporina*
Gato maracajá	*Felis pardalis*
Macaco capelão	*Alouatta belzebul*
Macaco prego	*Cebus apella*
Brazilian vernacular name	**Latin name**

Onça	*Panthera onca*
Paca	*Agouti paca*
Porcão	*Tayassu pecari*
Preguiça	*Brayipus variegatus*
Tatu (galinha)	*Dasypurus nomencinctus*
Tatu (canastra)	*Priodontes maximus*
Veado mateiro	*Mazama americana*
Veado fuboca	*Mazama gouazoubira*

Birds

Azimbra (macuco)	*Tinamus tao*
Jacu	*Penelope spp.*
Mutum	*Crax mitu*
Nhambu	*Tinamus major*

Reptiles

Jaboti	*Geochenolne carbonaria*
Jacaré	*Caiman spp.*

Fishes

Beré	*?*
Branquinho	*Curimata latior*
Cacunda	*?*
Cará	*Chatobranchopsis* sp.
Corimatá	*Prochilodus nigricans*
Cuiú-cuiú	*Oxydoras niger*
Jaú	*?*
Jeju	*?*
João-duro	*?*
Mandi	*?*
Maria-doce	*?*

Piaba	*?*
Piau	*Leporinus piau*
Piranha	*Serrasalmus* sp.
Porquinho	*?*
Sabão	*?*
Surubim	*Pseudoplatysoma fasciata*
Traíra	*Hoplias malabaricus*
Tucunaré	*Cichla ocelalaris*

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