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# EXTRACTION AND DEPLETION OF FRUITS AND FIBERS IN PERUVIAN AMAZONIA: A COEVOLUTIONARY PERSPECTIVE

by

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For Bill Denevan

From your last Master's Student?

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-JMM, December 15, 1993.

# ABSTRACT

Using a historical, coevolutionary approach, this thesis examines the relationship between the commercialization and depredatory extraction of rain forest species in the Iquitos, Peru region, and the subsequent human responses to that depredation. Individual extractors respond to market-induced scarcity of wild populations by extending the spatial dimensions of extraction, switching to more abundant species or alternative activities, and intensifying the management of the species. Analysis of the extraction of several species (including palms, herbs and epiphytes) on a regional scale reveals patterns of differential susceptibility to extractive pressures and human response to scarcity which are explained by the variation in ecological and life history traits of individual species, methods of extraction, and market conditions. The weedy "chambira" palm (*Astrocaryum chambira*), for example, is still very abundant after 300 years of commercial involvement, while some widely dispersed, mature forest, epiphytic "tamshi" species (*Heteropsis spp.* **Araceae**) may be eliminated from a local area very rapidly. This research demonstrates that if extraction is to make the positive contribution to sustainable development that many believe or hope it will, such attention to the ecology and dynamics of currently extracted species will be necessary.

# CHAPTER 1. INTRODUCTION

Deforestation in the Amazon Basin and the consequent loss of biological and cultural diversity has recently been the focus of much attention and concern world wide, and the destruction continues (Myers 1993; Moran 1993; Hecht and Cockburn 1989; Fearnside 1990). Some of those concerned call for the establishment of large parks and preserves and the strict defense of their boundaries from human encroachment as the only viable response to this crisis. But significant numbers of people do live in Amazonia, and are dependant on the forest for their livelihood. It is with this recognition, and as a response to the more ecologically disruptive land use practices such as cattle ranching, large scale lumbering operations, and planned or spontaneous frontier colonization, that others have promoted extractive and agroforestry systems (Padoch 1988a; Browder 1989; Fearnside 1989; Hecht and Cockburn 1989; Peters, Gentry and Mendelsohn 1989; Allegretti 1990; Nepstad and Schwartzman 1992; Plotkin and Famolare 1992) based on a melding of the best of indigenous and modern know-how (Posey 1983, 1984; Clay 1988; Prance 1989; Anderson 1990; Redford and Padoch 1992). This sentiment is well expressed by Prance (1989:63, 72), who argues that "the challenge for the future is to determine which of the useful plants in the forest are commercially exploitable and develop markets for them", and goes so far as to suggest that "extraction forests, together with agroforestry projects that are closer to the indigenous systems, are probably the only way to save the Amazon forest".

However, it cannot be assumed that once such markets are developed, the ensuing "extraction" of a plant product will be non-destructive or sustainable. This assumption ignores the limitations of extractive economies of the past and present (Browder 1992). Even the terms, "extraction", or "extractivism", are seldom defined in these discussions, and they take on a variety of meanings in different contexts. Bunker (1988), for example, defines extraction in opposition to, and as the necessary precursor to, production. He refers to the removal of animate and inanimate commodities (raw materials) from one place for the commercial production of finished products elsewhere. These raw materials include wild plants and animals, and, most importantly, minerals. At the other end of the spectrum, Fearnside (1989:387) defines extraction more narrowly as the "[removal] of nontimber forest products, such as latex, resins, and nuts, *without felling the trees*, [for commercial sale]". In this discussion, extraction is defined simply as **the removal of wild or semi-domesticated animals or plants, or their parts, for market exchange as raw materials or finished products**. As is the case for Prance, my focus is on biological commodities, and the extraction of minerals is not discussed. But unlike Prance I include in my definition animals and timber species (though they are not emphasized), and I do not assume that extractive methods are not destructive. As I will demonstrate, these methods vary widely depending on the species, the product (part) desired, the level of demand for it, the extractive technology available, and the effort required for extraction, and they are often destructive.

This thesis will examine extractive activities in the Northeast Peruvian Amazon region which have arisen outside the context of any directed "development" project, with the purpose of contributing to the understanding of the dynamics of people-plant relationships in a socio-ecological environment which encourages the marketing of forest products. Using a historical, coevolutionary approach, I will examine the relationship between the commercialization and depredatory extraction of rain forest species and the subsequent human responses to that depredation. Individual extractors respond to market-induced scarcity of wild populations by extending the spatial dimensions of extraction, switching to a more abundant species or alternative activity, and intensifying the management of the species. Analysis of the extraction of several species (including palms, herbs and epiphytes) on a regional scale reveals patterns of differential susceptibility to extractive pressures and human response to scarcity which are explained by the variation in ecological and life history traits of individual species and market conditions.

## EXTRACTION IN AMAZONIA

Commercial extraction is nothing new to Amazonia; the history of the region since the arrival of the Europeans is characterized by a series of boom and bust cycles of "predatory exploitation of material goods, the products of nature" (Reis 1974:35), often resulting in the decimation of those wild-harvested species (Hiraoka 1989; Prance 1989:67; Bunker 1985; Bergman 1974:95-117; Smith 1974; Goulding 1980; Williams 1932; Marcoy 1875 2:6 and others). This has been the case for both plants [e.g. mahogany (*Swietenia macrophylla* King), Brazilian cherry (*Amburana acreana* [Ducke] A.C. Smith), and rosewood (*Aniba roseadora* Ducke)] and animals (e.g. manatee, the giant river otter, several species of cats, crocodilians, and turtles including *Peltocephalus tracaxa* and *Podocnemis expanca*, among others). In addition to depletion, the volatility of market demand has also been a major factor in the collapse or major decline of the extractive economies of many species including sarsaparilla, tagua palm or vegetable ivory, rubber, and others (Coomes 1991).

Despite a clearly unsustainable historical pattern of commercial extraction, much recent attention has been given to the possibility of sustainable extraction today and in the future. New management schemes are now being established and promoted for the extraction of wildlife (Robinson and Redford 1991; Nations and Hinojosa 1989), timber products (Hartshorn 1989; de Graaf and Poels 1990), rubber and Brazil-nuts (Schwartzman 1989; Fearnside 1989; Allegretti 1990), and forest fruits and other products (Peters 1990; Peters et al 1989). These examples show some promise, and have helped to foster an emerging new optimism concerning the prospects and potential of extraction as an economically viable and ecologically and economically sustainable forest management strategy applicable on a large scale.

It is unwise, however, to ignore the historical legacy of destructive and non-sustainable extraction; today's mushrooming frontier populations and the increasing regional and international demands on Amazonian resources present even more formidable obstacles to the development of sustainable extraction regimes. Indeed, as Browder (1992), Gray (1990), and others have recognized, there are serious limitations to "extractivism," and the models which are currently in operation (e.g. extractive reserves) have come under substantial stress. Like their predecessors, current market oriented extractive activities are proving to be destructive or unsustainable (see for example Anderson 1989; Vásquez and Gentry 1989; Gentry and Vásquez 1988; McGrath 1986).

In addition, philosophically and ethically-based objections have been made to the economic measurement and valuation of the plants and animals of the forest, objections which do not rely on the problematic and elusive concept of sustainability (Ehrenfeld 1988; Norton

1988). The value of biodiversity and aesthetics, for example, cannot be measured in dollars and cents, and extinction of species cannot be measured in a cost-benefit analysis. An example of the comparisons which are challenged by this line of reasoning is that of Peters et al. (1989). According to them, the "net present value" of the marketable products of a 1 ha. forest plot near Iquitos was $8,890 for 1987, which compared favorably to potential profits of other land uses. But once a price tag is thus placed on an ecological system, it is essentially for sale. It may be that another forest plot, farther away from the market, for example, is deemed not to be worth much money. What then? According to the logic of growth-oriented economics, any alternative land use which has a higher monetary value, even if only short term, would be perfectly justifiable as a replacement.

## EQUILIBRIUM-BASED ECOSYSTEM MODEL VS. DYNAMIC COEVOLUTIONARY MODEL

It is tempting, and indeed to a certain extent valid, to recognize a dichotomy between the destructive market-driven "mining" of the plants and animals of the forest characteristic of large-scale commercial economies, and what has been called the "ecological rationality" of subsistence-oriented production (Toledo 1990). It is not the aim of this thesis to make such divisions, as reality is much more complex than this simple dichotomy would suggest.

First, in today's world of global communication and economic and political interconnectedness, distinguishing between subsistence and market-oriented peoples is increasingly difficult, if at all possible. It is likely that there is not a single society left on the planet, no matter how remote, that is not somehow influenced by larger-scale market economies, even if not directly involved in production and consumption.

Also, while recent research has documented many ingenious ways which indigenous and "folk" societies have developed over many generations of trial and error to use the resources available to them non-destructively (Anderson 1990; Browder 1989; Posey and Balée 1989; Posey 1983), it can not be assumed that these people will *necessarily* employ ecologically rational resource management activities under all circumstances (Iltis 1989; Redford 1991; Rambo 1985; Martin 1973; Tuan 1970). Nor can it be assumed that local people are managing their resources with the **goal** of conserving natural resources, even when their activities **result** in conservation (Hames 1991; Johnson 1989).

A large body of literature in the social sciences argues that peasant subsistence strategies are based on "*economic* rationality" (Brookfield 1972; Burling 1962; Chayanov 1966; Wolf 1966; Boserup 1965; Jochim 1981) whereby resources are used opportunistically such that the ratio of benefits (calories, protein, income, prestige, etc.) to costs (time, labor, monetary expense, risk, etc.) is satisfactorily high, if not maximized. More recently these conclusions have been supported by the application and empirical testing of optimal foraging theory (developed in the biological sciences, e.g. Krebs 1977) in the study of human societies (see Smith 1983, for review). Much of this work has focussed on hunting, fishing, and gathering (see contributions to Winterhalder and Smith 1981; Yost and Kelley 1983; Werner 1983), but optimising behaviors have also been attributed to pastoralists (De Boer and Prins 1989) and horticulturalists (Keegan 1986). Furthermore, historical trends and changes in the patterns of resource use with changing foraging technologies (e.g. shotguns, motors) have also been interpreted as resulting mainly from economic motivation (Winterhalder 1981; Yost and

Kelley 1983). Hence any tendency toward conservation is likely to be the result of local resource use patterns, not the goal (Johnson 1989).

In this way, Dasmann's (1991) "ecosystem people" differ from the "biosphere people" of the industrialized North not so much in the way the environment is perceived and treated, as in the **scale** and **scope** of interactions with the non-human world. As Raymond Hames observes (1991:182):

> "A preponderance of the evidence indicates that Amazonian tribal populations make no active or concerted effort to conserve fish and game resources. At the same time, it is clear in most cases there may be no need for a conservation policy, because current local subsistence demands on resources have not led to severe resource shortages".

It is true that the economic activities of industrial societies are generally much more environmentally intrusive, resulting in more profound impacts on the landscape and biosphere. This is not to say, however, that there is validity in the romantic notion of an "ecologically noble savage" (Redfield 1991), frolicking with benign innocence in the ecologically pristine and unchanging tropical rain forest (Denevan 1992a).

In fact, recent research in ecology and related fields has brought the homeostatic ecosystem model under question (e.g. Botkin 1990). Change (especially non-deterministic change) is thought to be a more important phenomenon than previously recognized. Holling (1973), for example, argues that resilience processes (which ensure persistence) may be more important than equilibrium processes. Persistent ideas such as the Clementsian model of deterministic succession toward "climax communities" are losing ground to more complex ecosystem models which recognize the possibility of "multiple stable states", the importance of initial conditions and historical events, the spatial and temporal complexity of ecosystems (e.g. Remmert 1991), and finally, the important role which humans have played in the past and continue to play with respect to the evolution and function of ecosystems (Denevan 1992a; Gómez Pompa and Kaus 1990; Posey and Balée 1989; Vale 1982; Hardesty 1977).

Following these trends, Norgaard (1988; 1981) has viewed human-environment interactions in the context of coevolutionary change, whereby "sociosystems" and ecosystems constantly modify each other. New challenges and innovations by people result in changes in the patterns of use of forest resources, with individual species affected in distinct ways. These new use patterns may affect the abundance, distribution, or genetic makeup of populations. The latter can be the result of either conscious (Boster 1985; Johannessen 1970) or unconscious (Rindos 1984) selection pressures. These changes might then provoke further changes in human activities, continuing the process of coevolution of the individual components of the ecosystem, which necessarily includes humans. Indeed, most everywhere humans trod, they are likely the most influential inhabitants of the forest.

## EXTRACTION IN NORTHEAST PERU

This thesis presents several specific examples of commercialization of forest plant products in the Upper Amazonian region of Northeast Peru, and focusses on the dynamic relationship between the desired plants and the people who exploit them. The plants analyzed here include trees, epiphytes, and herbaceous species desired for their fruit or fiber. The people who exploit them are indigenous, *ribereño* (mestizo or detribalized Indian peasants, Parker 1985) or urban peasants.

The precise nature of the relationship between a group of people and a plant or animal at a certain place and time is influenced by the particular characteristics of the species (abundance, distribution, life history traits, fecundity, habitat), the usefulness of the species to humans, the level of demand for the species (influenced by population, markets, technology, and culture), and the history of interactions between the two (which influences all of the above). Because of this variability of plant-human interactions, the regional scale of analysis adopted here, which includes a variety of plant species and cultural elements, provides a more sophisticated and comprehensive understanding of the extractive systems than would a study of a single plant exploited by a single village, for example.

It is clear that in all cases studied here, market-induced extraction has resulted in depletion of the desired species in the wild, as it has elsewhere in the region throughout the historical period. However, the degree and manner of depletion varies, as do the human responses to the depletion. I have identified three main classes of response, which may occur simultaneously or in sequence: 1) **extension** of spatial scale of extraction; 2) **switching** to more accessible related raw material (or discontinuance of the extractive activity); 3) **intensification** of management of the resource, (including cultivation and incipient domestication). Intensification, as referred to in this discussion, is defined simply as the process of increasing human manipulation of a species (in contrast to agricultural system-based definitions which emphasize fallow periods). These observations are consistent with and lend support to the theories of economic rationality of peasants, optimal foraging, and cultural ecological coevolution as discussed above. In addition, they provide insights relating to plant domestication.

Observations are based on analysis of field data gathered on location in the Iquitos region (**Fig. 1**), including both the Ampiyacu and Manití River Basins, and the city of Iquitos itself, between July and December, 1990. Research methods included ecological forest inventories, participant and direct observation, and informal taped interviews. Pertinent government documents at the Ministry of Agriculture in Iquitos and historical and current literature were also reviewed. Plant collections were deposited at the University of Wisconsin Herbarium in Madison and at the Natural History Museum in Lima, Peru.

In the next two chapters, the case of extraction of fiber-bearing plants for the production of handicrafts in the Ampiyacu River Basin will be presented. Chapter 2 will provide an ethnohistorical background, trace the origins of the handicrafts and the development of commercial markets, and will analyze the modern context of extraction. Chapter 3 will analyze in detail the extraction of the most important species for handicraft production. Chapter 4 will discuss the commercial extraction of the fruit of the *aguaje* palm (*Mauritia flexuosa* L.) in the Iquitos region, drawing on information primarily from the Manití River, but also from the Ampiyacu River and from the Iquitos market. Chapter 5 is a discussion and synthesis of the observations concerning extension, switching, intensification and incipient domestication, followed by conclusions.

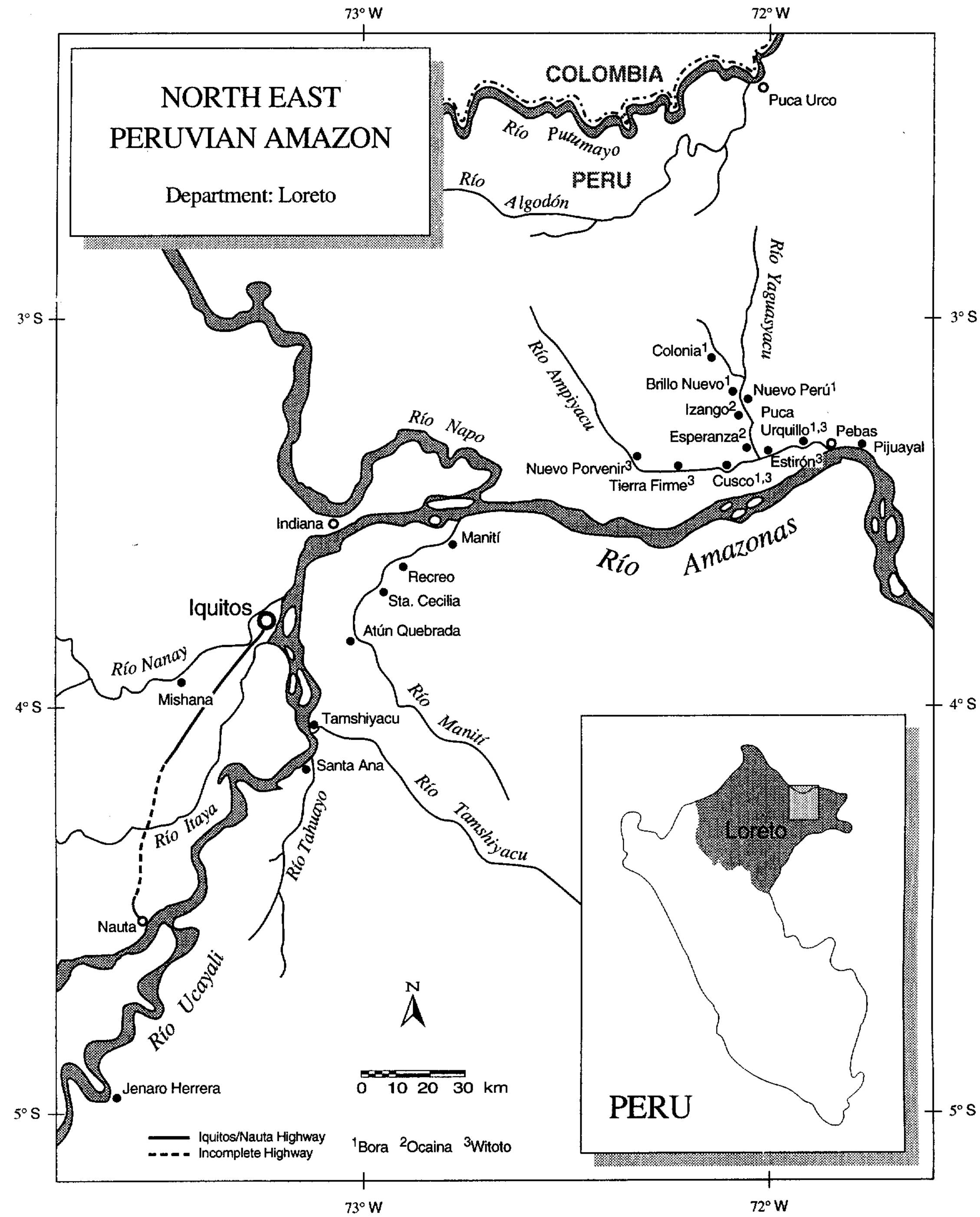


**Figure 1. Study Area.**

# CHAPTER 2: HANDICRAFTS PRODUCTION IN THE AMPIYACU BASIN

History has long been an important element within the cultural ecological and the broader human-environment traditions of geography (Zimmerer n.d.). To understand the relationships between people and their environment today, we must pay attention to the roots of these relationships and how they evolve over time. In this chapter, the current patterns of market-oriented handicrafts production in the Ampiyacu River Basin are described and analyzed in their historical context. What emerges is a story of the transformation of select elements of material culture of disparate Amerindian groups into marketed commodities, or "invented traditions" defined largely by the values of an external economy. In addition, we see a new regional ethnic identity arising in the context of these market activities from the foundations of three, forcibly relocated ethnic groups.

## Physical Setting

The Ampiyacu River empties into the left bank of the Amazon River about 120 km downstream from Iquitos (**Fig. 1**), draining a basin of approximately 116,000 ha. It is considered a "blackwater" river, with relatively low sediment yield and nutrient content. It's biggest tributary is the Yaguasyacu, which tends to carry a higher sediment load. Fourteen villages are located along the banks of the two rivers; five are primarily inhabited by Bora, four by Witoto, two by Ocaina, and one by Yagua.

The climate of the Iquitos region as classified by the Thornthwaite System is: warm and humid, with no pronounced dry season and relatively uniform temperature. The average annual temperature is 26.3°C; humidity is 80%; and rainfall 2,876 mm. Seasons are based mainly on river level, with *invierno* (winter) corresponding to high-water and *verano* (summer) with low-water. Water levels are not very predictable, with sometimes erratic fluctuations from month to month and inconsistency between the same months of different years. In the Ampiyacu, *verano* generally occurs between June and September[1].

## Ethno-Historical Background

The majority of current inhabitants of the Ampiyacu River Basin identify themselves as Bora, Witoto, and Ocaina (Paredes 1979). The three groups can be placed in different ethno-linguistic categories, depending on the classification scheme, but they all fall within Lathrap's grand family Macro-Arawakan (1970), and are generally all considered members of the Witoto family (Chirif and Mora 1976; Paredes 1979:33). The core of the original homelands of all of these groups lies in the territory between the Putumayo and Caquetá Rivers; they did not arrive in the Ampiyacu until the 1920s and 1930s[2] when they were physically translocated there by Peruvian rubber barons (see below).

The well-traveled priest Ferrer visited the Putumayo in 1605, but there was little or no contact with outsiders for most of the region's inhabitants until about 1886, when rubber

[1] Strictly speaking, the southern hemisphere summer corresponds to the period between the solstice of December 22 and the equinox of March 21, the opposite of the perceived seasons of this equatorial region.

[2] Gasche (1983) has shown that the Witoto had probably inhabited the area in the 19th century, though they had disappeared by the time of these relocations.

tappers began to arrive (Chirif and Mora 1976). Through disease, and the abuses of these *caucheros*, which have been described as notoriously brutal (Collier 1968; Hardenburg 1912), the indigenous population was reduced in the first decade of the 20th century from an estimated 50,000 to about 7,000 (Chirif and Mora 1976[3]). Whiffen (1915) estimated that there were 15,000 Bora on both sides of the Caquetá in 1915; they were reduced to 12,000 in 1926, and numbered just 427 by 1940 (Chirif and Mora 1976). The other ethnic groups experienced a similar decline, as did other indigenous peoples throughout the Americas (Denevan 1992b).

While the Bora, Witoto, and Ocaina ancestors of the current inhabitants of the study area were contacted at a relatively late date, the Ampiyacu River region itself and the Yaguas, Kotos (Orejones), Pebas, Shishitas, Cahuachis, and Caumares who once lived there were subject to outside influences from a much earlier period (Paredes 1979:4-19; Villarejo 1988:70). One of the earliest settlements in western Amazonia, San Ignacio de Pebas was founded in 1725 at the mouth of the Ampiyacu (Paredes 1979:10), well before Iquitos, with efforts of its leaders to control, civilize, and Christianize the surrounding inhabitants beginning soon thereafter.

According to archival documents of the 19th century cited by Paredes (1979:14-18), indigenous people of Maynas Province had been forcefully put to work extracting "zarza[4] and other items that these mountains produce". In 1839 the governor of Pebas was

[3] Dr. Carlos A. Valcarcel, the judge of the Putumayo region at the time gives similar numbers (1915: 38, cited in ORDELORETO 1979: 1): 50,0000 in 1906 reduced to 8,000 in 1911.

[4] *Zarza* is Spanish for bush or shrub. It is possible that this is a reference to "Zarzaparilla" (*Smilax sp.*), the root of which was used as an alterative.

sanctioned for leading a raiding party against surrounding inhabitants. An 1848 statement suggested that missionaries were apparently more interested in becoming wealthy than in "saving souls" (1848:16). As people were killed or fled the abuses, the Pebas mission found itself short of labor, and began to "repopulate" the lower Ampiyacu with groups from farther away. In this way 80 members of the "Ajuajo" (aguaje) nation were resettled from the headwaters of the Ampiyacu to the immediate vicinity of Pebas in 1845 and the Shishita experienced similar *reducción* in 1851.

It was not until 1923, following the Soloman-Lozano Accord (1922), which ceded all territories North of the Putumayo River from Peru to Colombia, that many Bora, Witoto and Ocaina from this "lost" territory began to be resettled by the Loayza brothers of the Peruvian Amazon Company in the Ampiyacu Basin, which remained Peruvian territory. In a 1956 letter to the Division of Colonization and Forests, Chief Engineer Ernesto Llanos wrote: "The movement of the tribes to the zone that they now occupy was accomplished by the Loayza brothers by means of their own efforts and at their own expense so that this valuable human capital would not remain under the dominion of the Colombian government..." (Ministry of Agriculture archives, my translation).

According to the Loayzas own figures, 6,719 Bora, Witoto, Ocaina, Andoke, and Muinane people were brought from the Putumayo-Caquetá region, including the tributaries Cahuinari, Caraparaná, and Igaparaná, between 1930 and 1933, culminating a 10 year period in which virtually the entire population of the region was relocated to work for the Loayzas and their associates extracting rubber (*Hevea spp.*), leche caspi (*Couma macrocarpa)*, and animal skins, and growing coffee and fruit trees (Paredes 1979:9-31). The Loayzas may have believed that they were liberating these people from the deprivations inflicted on them by the Colombian House of Lozana (Paredes 1979:28[5]), and indeed they probably were less abusive, but the Indians certainly also suffered under the authority of the Loayzas and their associates. Many returned to their homelands (Chirif and Mora 1976) or dispersed to Pebas, Iquitos, the Rivers Nanay and Napo, and elsewhere, establishing small ethnic enclaves or dissolving into *mestizo*, or *ribereño* Peruvian society.

During the border conflict between Peru and Colombia (1932-33), known as the Leticia incident, indigenous laborers were used to open trails in the border region (based on existent indigenous pathways) for transport and military purposes (Gasché 1983:16). Fifty per cent of those who remained died of measles introduced from the Amazon, or from the effects of forced labor (Paredes 1979:31).

The Loayza Brothers' claim that they had colonized a region which was "until then desolate and dead for the complete lack of inhabitants" (1937, in Paredes 1979:20[6]) is strangely ironic when viewed in historical context. While the area may well have been relatively "uninhabited [and] unproductive, despite its proximity to Iquitos" (1956, in Paredes 1979:29[7]), when the Loayzas arrived in the 1920's, it had not always been so. The relocation of the "valuable human capital" of the Putumayo becomes nothing more than a

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[5] From a 1937 letter to Victor Arevalo, Peruvian delegate of the mixed commission which visited the Putumayo in that year.

[6] Original text: "hasta entonces desolada y muerta por falta absoluta de población" (From an 1937 exposition in the Bogotá *Tiempo*, May, 1937, cited in Paredes 1979:20)

[7] Original text: "deshabitada [y] improductiva, no obstante la proximidad a Iquitos" (Carlos and Miguel de Loayza, February 1956; in Paredes 1979:29)

repetition of the forgotten history of the *reducciones* of the former inhabitants, the Yaguas, Kotos, and Shishitas, almost a century earlier.

Nor is this history entirely unique to the people of the Ampiyacu; many Amazonian villages are made up of people of diverse ethnic backgrounds brought together by *patrones* hungry for bodies to collect rubber, leche caspi, rosewood, and other products during the golden age of forest product extraction from roughly 1880-1940 (Padoch and de Jong 1990; Coomes 1992).

The Loayzas give a population figure for the basin of about 1200 in 1956 (Paredes 1979:28), which is less than 18% of the more than 6,700 which were settled from 1930-33, and an even smaller fraction if the people who were brought before and after this three year period are considered. In 1978, according to Paredes (1979:34) there were 1,512 inhabitants living in 8 villages (**Table 1**), approximately 34% Bora, 22% Witoto, 6% Ocaina, 1% others (Orejon, Yagua, Cocama, Resígaro, and Andoque), 29% of mixed (indigenous) ethnic background, and 7% *mestizos*[8] (Paredes 1979: 43). The most recent population estimates give a smaller number (1,051, ca. 1990[9]), very close to that for 1956, although there are now at least 14 settlements in the basin.

Beginning in 1956, when Wesley Thiesen, a Summer Institute of Linguistics (ILV) missionary successfully solicited land title for the Bora of Brillo Nuevo from the Peruvian Institute of Agriculture, the relatively new residents of the basin were officially recognized

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[8] The category "mestizo" is presumably distinguished from "mixed ethnic heritage" in the inclusion of European or Hispanic blood.

[9] Based on a summation of the Ministry of Agriculture census data for individual villages carried out separately at different times over the past ten years.

**Table 1: Population of the Ampiyacu River Basin (not including Pebas)**

| COMMUNITY | ETHNIC GROUP | Ca. 1932 (Loayza[1]) | Ca. 1956 (Loayza[1]) | 1978 (Paredes 1979) | 1990 (Min. Ag.[6]) |
|---|---|---|---|---|---|
| Ancón Colonia | Bora | | | 149 | 23 |
| Brillo Nuevo | Bora | | 77[2] | 250 | 212 |
| Nuevo Peru[3] | Bora | | | 0 | 71 |
| Puerto Izango[4] | Ocaina | | | 65 | 33 |
| Nueva Esperanza | Ocaina | | | 0 | 61 |
| Tierra Firme | Witoto | | | 84 | 47 |
| Cusco | Bora/Witoto | | | 163 | 125 |
| Estirón del Cusco | Witoto | | | 161 | 44 |
| Nuevo Porvenir | Witoto | | | 0 | 35 |
| Puca Urquillo | Witoto | | | 196 | 227 |
| Puca Urquillo | Bora | | | 224 | 111 |
| Betania | Bora | | | 0 | 88 |
| San Jose de Pirí | Yaguas | | | -- | [200][5] |
| **TOTAL** | | **6719+** | **1200** | **1292** | **1051** |

1. As reported in Paredes (1979).
2. According to Wesley Thiesen of ILV as reported in Paredes (1979), Brillo Nuevo consisted of 71 males and six females in 1956.
3. Established by former inhabitants of Colonia, led by Pedro Silva, early in 1990.
4. In 1940, 808 Ocaina were brought by Loayza to "Oriente" nearby what is now Puerto Izango.
5. FECONA estimate, 1989.
6. Ministry of Agriculture documents, Iquitos.

as the "indigenous" inhabitants of the region (*comunidades nativas*). Gradually, over the subsequent years, individual communities were granted official recognition and communal land title, so that today all have title or, as in the case of Nuevo Peru, are in the process of solicitation.

## Ethnographic Present

Subsistence needs are now met by a combination of the complex "swidden fallow agroforestry" system described by Denevan and Padoch (1988), hunting and fishing, and the sale of products for hard currency to buy such items as machetes, axes, shotguns, shells, kerosene, matches, soap, salt, sugar, clothes, flashlights, batteries, pots and pans, and other simple durable goods. Extraction of forest products in the Peruvian Amazon is said to have declined in the last 50 years, in favor of other activities, especially production for commercial markets in agroforestry settings (Coomes 1991; 1992:118-151; Hiraoka 1986:364; Padoch 1988a). There is certainly significant regional variation to this pattern, and extraction remains a very important income generating activity for many households and communities, including those of the Río Ampiyacu, which is outside the range of effective Iquitos market-oriented agroforestry.

It is very difficult to accurately quantify the amount of income generated by extractive activities, as it varies from year to year and season to season, and among communities, households and individuals. Any numbers presented therefore should be received with caution.

Padoch (1988a: Table IV) estimated that 57% of total cash income for Brillo Nuevo in 1983-84 was provided by the sale of handicrafts, which are fabricated mainly from fibers of "wild" forest plants. Since that time, it appears that the people of the Ampiyacu have become even more dependent on the trade of handicrafts to meet their rising cash needs/demands. In my November 1990 survey of 23 families from four different villages, 71% of cash income was attributed to the sale of handicrafts[10].

The district seat Pebas, at the mouth of the river, and the small villages themselves provide a limited market for perishable products such as fruits, wild meat, and chickens. Iquitos, however, is far enough away to make it unprofitable or even impossible to bring some of these products to the large market there on a regular basis. Transportation is unreliable and expensive when available (from Pebas). Nonperishable handicrafts, which can be stored until an opportunity or necessity to sell arises, are the preferred viable source of cash income in this setting. Indeed, the production of handicrafts is often compared to keeping a bank account to draw on when needed.

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10 This number is the average percentage of income derived from handicrafts in all households. Each household is weighed equally, regardless of its total income and size. In 21 of the 23 households, members were asked to estimate the percentage on a yearly basis. Percentages from the remaining two are based on the estimated actual earnings of the month immediately preceding the interview (October). In most cases the leading man or woman of the household was the source of the information.

## Plants and Derived Products

In an incomplete inventory of plants used by the people of the Ampiyacu in the production of handicrafts I found 83 species (**Appendix 1**), including trees, vines, epiphytes, shrubs, and herbs from a variety of ecological settings, and under varying degrees of management by people. Some were unmanaged mature forest species, others were naturally occurring but encouraged in various ways, and still others were full domesticates not occurring in the wild. The majority can be found in secondary forest, a fact which supports recent evidence that successional vegetation in tropical settings is very important as a source of useful and valuable species (Balée 1992; Kohn 1992). Many had more than one use in handicrafts production and the majority had multiple other uses, such as for food, medicine, and building material.

Over 30 distinct items are marketed (**Table 2**), including: canoe paddles, or *remos* (**Apocynaceae**: *Aspidosperma spp.*); war clubs, or *macanas* (**Moraceae**: *Brosimum rubescens* Taubert. "*macana*"); masks (**Bombacaceae**: *Ochroma pyramidale* (Cav. ex Lam.) Urban.); talking drum replicas, or *manguarés* (*O. pyramidale*); blow-guns, or *pucunas*, also *cerbatanas* (**Myristicaceae**: Iryanthera tricornis Ducke.); *llanchama* cloth paintings (**Moraceae**); head-dresses (feathers and *llanchama* cloth); and necklaces (seeds of many species).

The most important, however (in terms of the amount of raw material extracted, amount of time devoted and amount of income generated) are: 1) hammocks and carrying bags (*jicras*, or *shicras*) made from the fine fiber of the "chambira" palm leaf (**Arecaceae**: *Astrocaryum chambira* Burret); 2) baskets (*shiruy*) and ornamental yuca meal strainers (*cedamas* or *cedazos*) from the stem covering of "bombonaje"[11] (**Marantaceae**: *Ischnosiphon spp.*) and the young rachis covering of "bacabilla" or "cinamillo" palm (**Arecaceae**: *Oenocarpus spp.*); and 3) baskets woven from the split aerial roots of tamshi (several species--**Araceae**: *Heteropsis spp.*, and **Cyclanthaceae**: *Asplundia spp.*) and "huambé" (**Araceae**: *Philodendron spp.*) **Table 3** shows the relative proportions of types of handicrafts produced by value and number of items.

These fiber-bearing plants, which provide the bulk of the raw material for the production of handicrafts items, will be emphasized, and are discussed in the context of three main headings (chambira, bombonaje, and tamshi), based on their use value (leaf fiber, stem fiber, aerial root fiber, respectively), in much the same way they are referred to by local residents. Figures 2 and 3 show the chambira palm and the marketable products derived from it; figures 4 and 5 show bombonaje and its main products; and figure 6 shows a Bora man making a basket from the split aerial roots of tamshi.

Recent discussions of extractive activities have focussed on rubber (Allegretti 1990; Schwartzman 1990), fruits and other foods (Peters 1990; Anderson 1990), wood products (Hartshorn 1990; 1989; de Graaf and Poels 1990) and animals (Robinson and Redford 1991). Plant fibers and the products derived from them are very important elements of the subsistence and market systems of the people of the Peruvian Amazon and elsewhere throughout Latin America, though with the exceptions of the fiber-bearing crops, cotton, agave and maguey, they have received little attention in the academic literature.

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[11] Not to be confused with the "Panama hat plant", *Carludovica palmata* R. et P. (**Cyclanthaceae**).

**Table 2. Río Ampiyacu Handicrafts Purchased by ANTISUYO and Prices Paid ($U.S), 1990.**

| PRODUCT | SIZE | JUNE 18 | AUGUST 23 |
|---|---|---|---|
| CHAMBIRA | | | |
| Hammock | (length) | | |
| Large | 2.5 m | .51 | 10.97 |
| Medium | 2.0 m | .43 | 8.34 |
| Large double weave | 2.5 m | ? | 14.19 |
| Medium double weave | 2.0 m | ? | 11.34 |
| Jicra (loose woven bag) | (height) | | |
| Extra large | 45-50 cm | 1.35 | 2.95 |
| Large | (35-40 cm) | | |
| Medium | (30-34 cm) | | |
| Small | (25-29 cm) | | |
| Cartera (dense woven bag) | | | 6.08 |
| Fan | 30-35 cm | .70 | 1.52 |
| Bracelet | | | |
| Basket | | | |
| Broom | | | |
| Hat | | | |
| BOMBONAJE | | | |
| Shiruy basket | (height) | | |
| Extra large | | ? | ? |
| Large | 40-45 cm | 1.00 | 2.10 |
| Medium | 35-39 cm | .85 | 1.77 |
| Small | 30-34 cm | .70 | 1.52 |
| Large, adorned | 40-45 cm | 1.40 | 3.04 |
| Medium, adorned | 35-39 cm | 1.25 | 2.71 |
| Small, adorned | 30-34 cm | 1.10 | 2.45 |
| Cedazo (manioc sieve) | (diam.) | | |
| Extra large | 80-90 cm | 2.25 | 4.89 |
| Large | 40-55 cm | 1.10 | 2.45 |
| Medium | 30-39 cm | .70 | 1.52 |
| Small | 25-29 cm | .45 | |
| Lampshade | (height) | | .84 |
| Large | 45-55 cm | .72 | |
| Medium | 35-44 cm | .36 | 1.01 |
| Small | 25-34 cm | .24 | .51 |
| Handbag | | ? | .34 |
| | | | ? |

| | | | |
|---|---|---|---|
| **(Table 2. Continued.)** | | | |
| TAMSHI | | | |
| Basket | (height) | | |
| Large | 45-50 cm | 1.10 | 1.84 |
| Medium | 40-44 cm | .80 | 1.10 |
| Small | 35-39 cm | .55 | 1.09 |
| Large, with lid | 45-50 cm | 1.35 | ? |
| Medium, with lid | 40-44 cm | 1.00 | 2.28 |
| Small, with lid | 35-39 cm | .70 | 1.53 |
| LLANCHAMA | | | |
| Flute | | | |
| Painting | | | |
| Skirt | | | 5.18 |
| Mask | | | 3.04 |
| OTHER/COMBINED | | | |
| Manguaré (talking drum) | | | |
| Large | | | |
| Medium | | | |
| Flute | | | |
| Horn | | | |
| Calabash maraca | | | |
| Large | | | |
| Small | | | |
| Crocodile skin drum | | | |
| Drum | | | 2.45 |
| Shacapas (seed rattle) | | | |
| Root carvings | | | |
| Balsa mask | | | |
| Macana (wooden weapon) | | | |
| Blow gun | | | |
| Large | | | 2.45 |
| Small | | | .59 |
| Large, adorned | | | 3.63 |
| Feather fan | | | |
| Feather and llanchama headdress | | | |
| Male | | | |
| Female | | | |
| Tipití (manioc press) | | | |
| Canoe paddle | | | |
| Calabash bowl | | | |
| Necklace (chambira fiber and seed) | | | |
| Fish trap | | | |

**Table 3. Río Ampiyacu Handicrafts Purchases by ANTISUYO 20 June - 17 July 1989 ($1.00 = 2955 Intis, July 2).**

| MATERIAL | ITEMS SOLD | VALUE IN INTIS |
|---|---|---|
| CHAMBIRA | | |
| Hammock (3 sizes) | 12 | 222,300 |
| Jicra (3 sizes) | 65 | 333,860 |
| Fan | 6 | 15,500 |
| Bracelette | 3 | 32,500 |
| **Total** | **88** | **604,160 (68%)** |
| BOMBONAJE | | |
| Shiruy (3 sizes) | 24 | 83,130 |
| Lampshade (3 sizes) | 7 | 6,200 |
| Cedazo (Strainer) (3 sizes) | 17 | 47,700 |
| Handbag | 1 | 2,000 |
| **Total** | **49** | **139,030 (16%)** |
| TAMSHI | | |
| Basket, with lid (3 sizes) | 4 | 17,300 |
| Basket, without lid (3 sizes) | 11 | 48,410 |
| **Total** | **15** | **65,710 (7%)** |
| TOTALS | | |
| **Chambira, Bombonaje, Tamshi** | | **808,900 (91%)** |
| Products from all other species combined | | 82,750 (9%) |
| **All Products** | | **891,650 (100%)** |

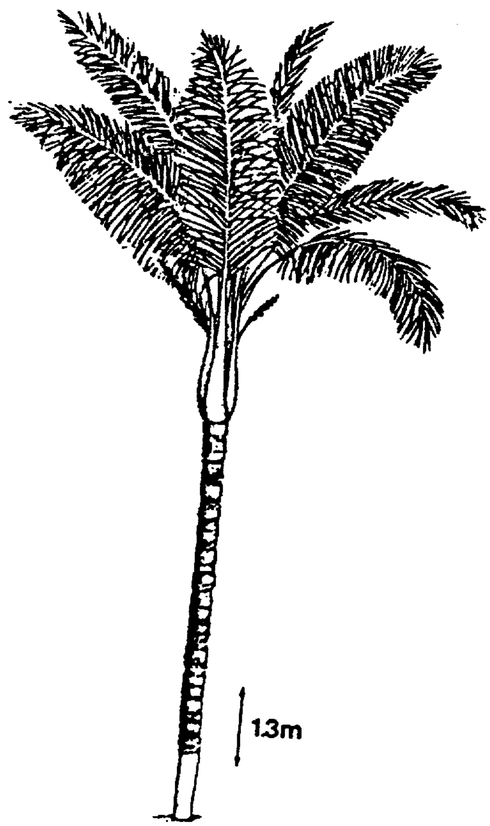


**Figure 2.** ***Astrocaryum chambira*** **Burret.**

Source: Kahn and De Granville 1992:16.

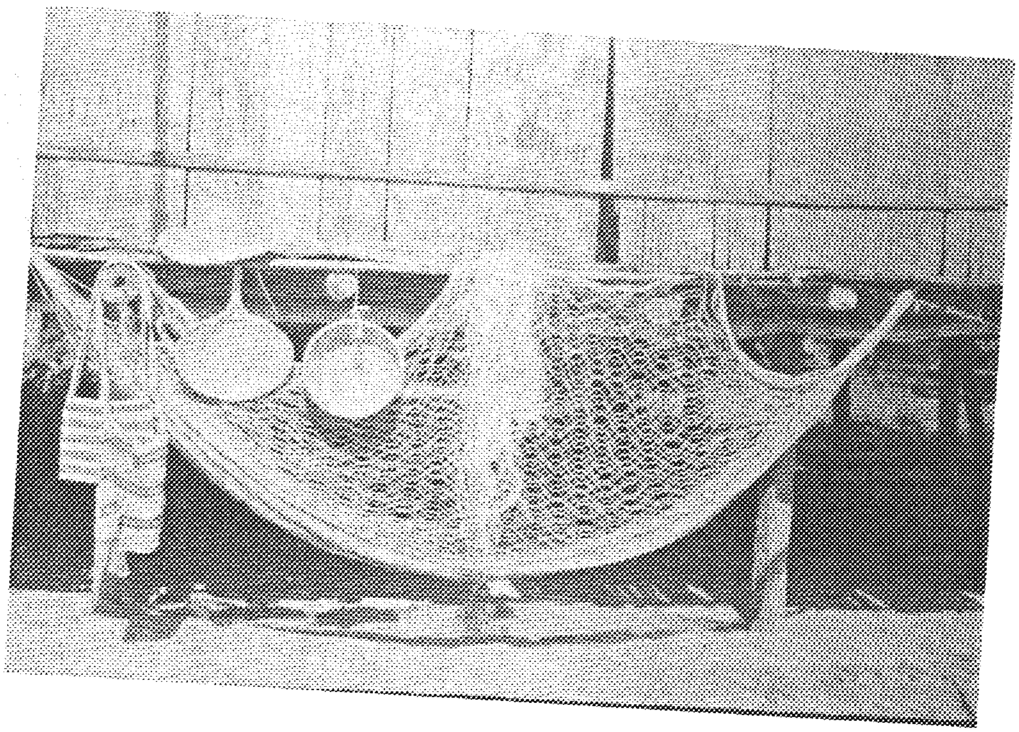

**Figure 3. Chambira Handicrafts. From left to right: *cartera* style bag, *jicra* bag, hat (from whole pinnae), basket (from pinnae midrib), raw untwisted fiber, and hammock.**

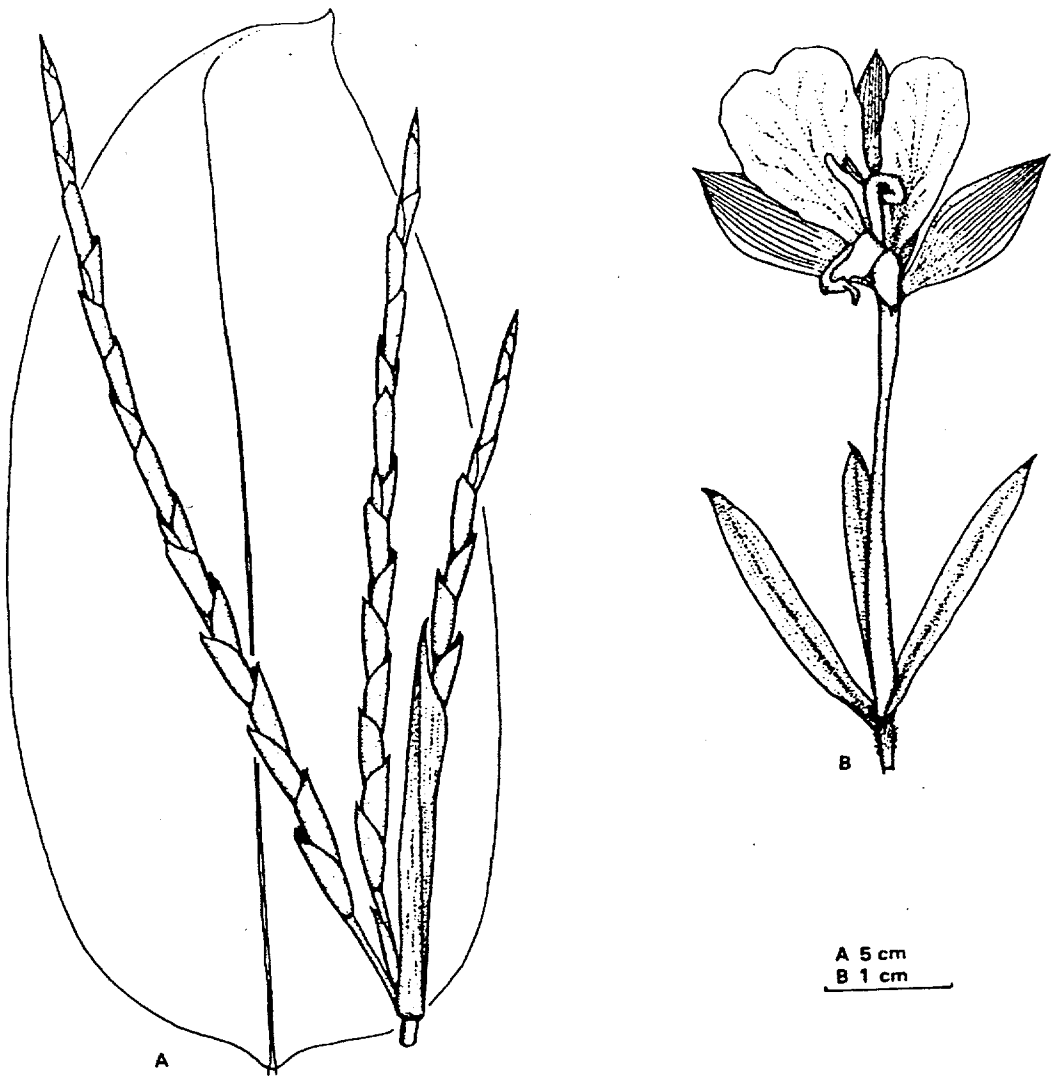


**Figure 4.** ***Ischnosiphon arouma*** **(Aublet) Koernicke, "Bombonaje Legitimo"**

A: Synflorescence and outline of leaf blade (Hitchcock 17126).

B: Flower (Andersson 16). Source: Andersson 1977:40.

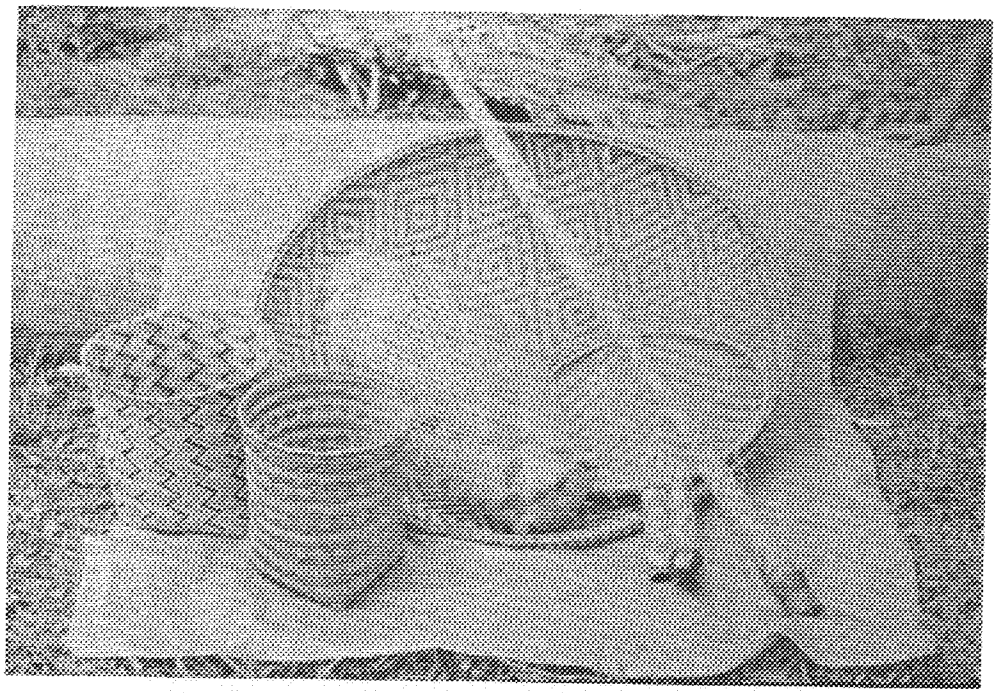

**Figure 5. Bombonaje Handicrafts: large and small replica yuca meal strainers (*cedama*), lamp shade (*globo*), *shiruy* baskets, and blow gun (*pucuna*).**

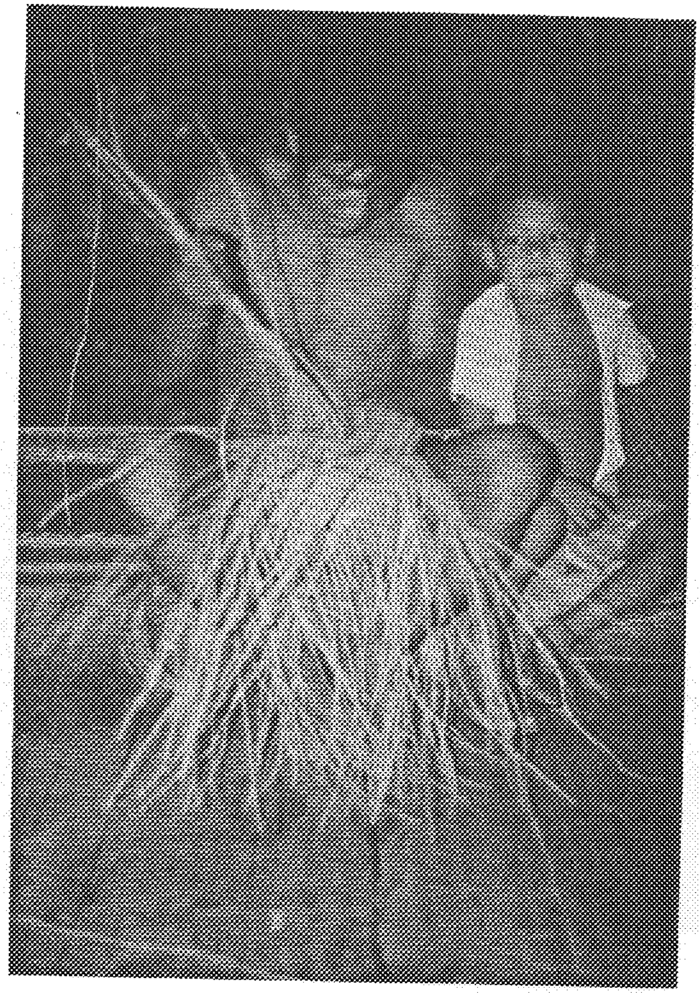

Figure 6. Bora Man Making Basket from the Split Aerial Roots of Tamshi (*Heteropsis sp.*, Araceae).

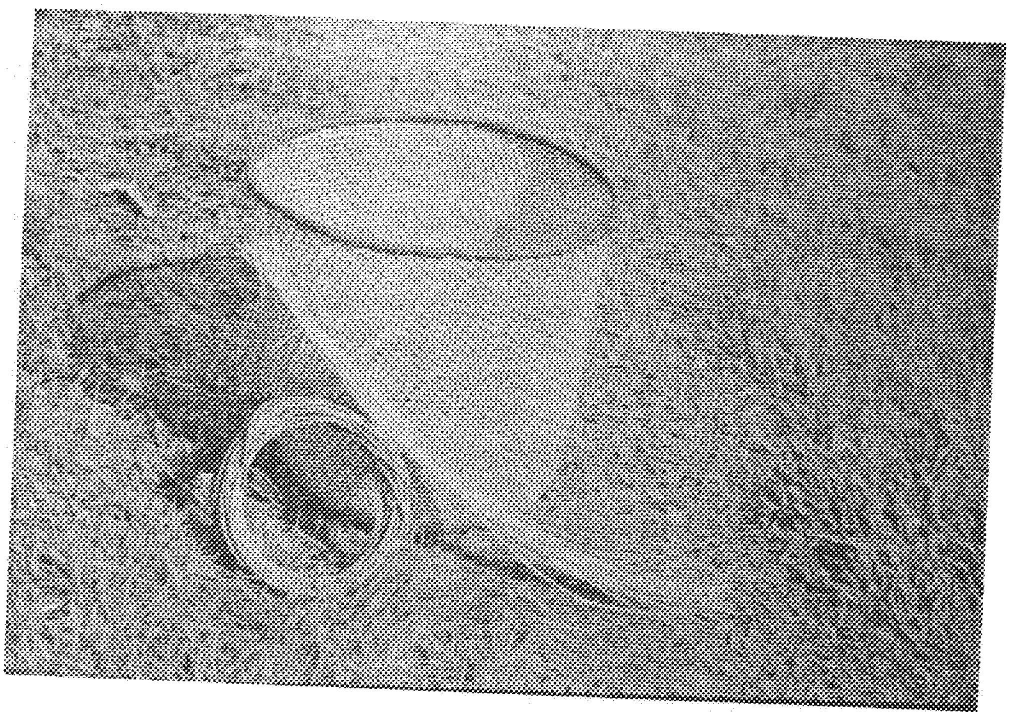

Figure 7. Basket from the Aerial Roots of Tamshi (*Heteropsis sp.*, Araceae).

## History of Trade in Handicrafts

There is a long history of handicrafts trade in the Western Amazon region, especially in the case of the hammock. One of the earliest accounts is that of Hernandez Bello, who in 1799 reported the trade of baskets and hammocks by the Záparo of eastern Ecuador for iron implements from the Quijo (Oberem 1974:350). Orlon (1867:171) also described the manufacture of hammocks and twine from "the twisted fibre of the chambiri-palm" by the Zaparos. He reports that "the women twist 100 yards of twine per day and make a living by selling hammocks for $0.25 apiece". According to Marcoy (1875:265), Iquitos Indians traded chambira hammocks with river traders who sold them to "fashionables at Para [Belem]".

In the Ampiyacu area, the Yagua Indians were known to excel in making chambira fiber hammocks (Marcoy 1875:290; Herndon 1853:225-6) which they and the Orejones traded along with the raw chambira cord, and other extractive products (sarsaparilla, palo de cruz, and uraxí [Strychnos toxifera]) at Pebas and at the San José Mission on the Ampiyacu. Some of the older current residents of the study area recall that during the earlier years of their habitation in the Ampiyacu region such a market in raw chambira cord existed. Along the Tahuayo River during the 1940's, chambira cord sold for 1 penny a pound (Coomes, pers. comm.). In Brazil, the fiber of the related *A. tucuma* palm was also commercialized. In 1958, 50 tons of fiber were produced (Mors and Rizzini, in Schultes 1977:75). Other sources of twine and cordage such as the cultivated jute crop have apparently replaced chambira since that time.

During his travels through the Putumayo region in 1908-9 Whiffen observed the probable ancestors of the current inhabitants of the study area using the palm fiber for hammocks and arm and leg ligatures, and for fishing line and traps, although there were "no recognized native trade routes or trade centers, nor [were] there any markets where the tribes of any language [could] meet and exchange their wares" (Whiffen 1915:84, 91, 112, 61).

Some of the handicrafts products now marketed are derivations of subsistence items which are still produced for personal use (e.g. hammocks, *cedamas*, and tamshi carrying baskets), while others are innovations or introductions developed in response to market opportunities (e.g. *jicras*, bombonaje lamp shades and *shiruy* baskets). *Jicras* as well as hammocks of a distinct weave are said to originate in Yagua culture. The *shiruy* basket, which is named for the fish whose scale patterns its weaving resembles (*Corydoras sp.*), is said to come from the Yagua and/or Ticuna (depending on who you ask). As far as I know, the former use of chambira fiber for arm and leg bands and fishing line has been discontinued, and I observed just one elderly man use it for making small bird snares.

However, the fiber is still used for any number of tying purposes, and to string together seed necklaces and *shacapas*, which are percussion instruments made of the hollowed out seeds of a cultivated Cucurbit (*Cayaponia kathematophora* RE Schultes ex. char.), important in ceremonial dances and celebrations. The use of tamshi to fasten house poles together and for other lashing purposes continues. Blow guns are now produced only for market, as they have been entirely replaced by the rifle for hunting.

*Llanchama* cloth, produced from the pounded inner bark of several trees of the Moraceae family, was traditionally used for clothing, a sort of thin mattress to sleep on, and masks used in traditional celebrations. It is now a relatively important material for the production of marketable handicrafts, used as the "canvas" for paintings, as the outer wrapping of blow-guns (*pucuna*, or *cerbatana*), and as adornment of other handicrafts items.

The traditional *llanchama* loincloth has been replaced by western style cotton shirts, pants or shorts, and skirts. *Llanchama* is still used to make clothing; however, now it is modeled on Western style clothing (with "indigenous" ornamentation) and is worn to evoke the image of the untamed rain forest savage during prepared (fake) dances for the tourists who arrive in Puca Urquillo once a week to see the "wild" Indians. (It could be argued that this is "ethno-tourism" at its basest, but who is really the "zoo animal" in this case, one may wonder?) The masks are still used in certain traditional festivals and rites (when tourists are not present).

By the time of the writing of Chirif and Mora (1976) some Ocaina and Witoto had begun producing handicrafts for market in Pebas (hammocks, bags, baskets), though according to the authors, the Bora continued to do so mainly for subsistence use. Current residents recall that the marketing of chambira products began about 1974 or 75 when school teachers and mothers organized to teach their children how to make handicrafts. The technique for making *shiruy* baskets is said to have been introduced at about the same time by young people who had learned to make them while at the Summer Institute of Linguistics mission in Pucallpa.

In addition to introducing the **idea** of marketing certain products, the Summer Institute also provided the **market outlet** for these goods, immediately placing an order of 1000 *cedamas* (Paredes 1979: 124). By 1975 a company dedicated to the promotion and sale of handicrafts (EPPA--*Empresa Peruana de Promoción Artesanal*) was already operating in the area through what was considered an exploitative intermediary (Paredes 1979: 153). This dramatic shift from nearly 100% subsistence-based handicrafts production to a situation where 87% of households were involved in commercialization of handicrafts (Paredes 1979:124) in such a short time period is remarkable.

## ANTISUYO and the Modern Context

The most recent change in handicrafts marketing activities was initiated in May of 1989 when the Lima based non-profit agency ANTISUYO (*Proyecto de Promoción y Comercialización Artesanal*, or Project for the Promotion and Commercialization of Handicrafts) set up operations in the area in association with the 12-member Federation of Native Communities of the Ampiyacu River (FECONA[12]). The stated goal of the project was to provide additional markets for the artisans of the member communities, and to eliminate the middlemen, in order that a higher price could be received for their products.

ANTISUYO buys only from artisans who are enlisted in the project (**Table 4**), of whom there are about 137, from 11 of the 12 FECONA communities[13]. In 1978 there were a total of 207 households (Paredes 1979:38). Since the population has remained relatively stable, it is reasonable to assume that this number has not changed significantly. Since the

[12] *Federación de Comunidades Nativas del Río Ampiyacu.*

[13] There are none from the Yagua community of San Jose de Pirí. Not included on the map, this village is located slightly inland on the left bank of the Ampiyacu, very close to Pebas, probably on the same site as the San José mission visited by Herndon in the mid 19th century (1853).

Table 4. Río Ampiyacu Artisans Participating in ANTISUYO Project, August 1990.

| COMMUNITY | ETHNIC GROUP | | PLANTS USED | | TOTAL |
|---|---|---|---|---|---|
| | | CHAMBIRA | BOMBONAJE | TAMSHI | |
| Colonia | Bora | 4 | 5 | 2 | 11 |
| Brillo Nuevo | Bora | 19 | 12 | 1 | 32 |
| Nuevo Peru | Bora | 4 | 5 | 0 | 9 |
| Izango | Ocaina | 3 | 0 | 0 | 3 |
| Esperanza | Ocaina | 8 | 6 | 0 | 14 |
| Tierra Firme | Witoto | 8 | 0 | 0 | 8 |
| Cusco | Bora/Witoto | 19 | 3 | 0 | 22 |
| Estirón | Witoto | 7 | 0 | 2 | 9 |
| Porvenir | Witoto | 3 | 0 | 0 | 3 |
| Puca Urquillo | Witoto | 4 | 2 | 0 | 6 |
| Pucaurquillo | Bora | 8 | 2 | 0 | 10 |
| Betania | Bora | 7 | 3 | 0 | 10 |
| **TOTAL** | | **94** | **38** | **5** | **137** |
| **TOTAL NO. COMMUNITIES** | | **12** | **8** | **3** | --- |

enlisted artisan usually represents an entire household, this means that a full two thirds of households in the basin have dealings with ANTISUYO. Many of the remaining 70 households choose to market their goods through other outlets. Some of the enlisted artisans work only with ANTISUYO, which makes orders and collections/payments on a quasi-monthly basis. Others also take advantage of various additional market outlets available to them. There are very few, if any, households in the basin which are not at all involved in handicrafts production, whether with or without ANTISUYO.

Other means of getting handicrafts to market remain, and include personally taking the products to either Pebas or Iquitos (by canoe to Pebas, by paid transport on a riverboat from Pebas to Iquitos), or selling (or trading for durable goods) to an intermediary. This person may be a local resident who specializes in buying local products and selling them in Iquitos (one local *curaka*, or chief, has taken advantage of his position to personally benefit from such activities), anyone who may have special occasion and/or means of getting to Iquitos, or the occasional river-trader (*regatón*). At least one community (Cusco) had a *peque-peque* motor, now unoperational, which could formerly power (slowly) a communal load of goods to Iquitos for sale[14].

For a relatively small number of people, there is also opportunity to sell to tourists who arrive weekly in Puca Urquillo aboard the *Río Amazonas*, a large vessel operated by a touring agency out of Iquitos. Other residents, especially those from more isolated

[14] The outboard motor owned and operated collectively by the FECONA, is used only for emergencies and official business of the Federation.

communities upriver, sell to those in Puca Urquillo who have access to the tourists[15].

The quality control standards of ANTISUYO, which sells the products mainly to demanding international tourists from its store in Lima, are high. The extra expertise and labor costs of production to meet these standards are often formidable, and some individuals perceive that the extra effort is not worth the marginal increase in price they receive. They prefer to produce a lower quality product, faster, for a lower price.

The ordering and collection schedule of ANTISUYO is another reason that other outlets may be sought. Unforseen demands on labor may prevent an artisan from completing an order from ANTISUYO by the time it is to be collected. If this happens, it will be at least a month, and sometimes much longer, until the next collection trip is made by ANTISUYO. In the meantime, after completing the order, cash may be needed, and the handicrafts are sold elsewhere as the opportunity arises. Likewise, if an order is completed before ANTISUYO comes to collect it, it may be liquidated opportunistically or by necessity.

Clearly, a variety of market outlets are important for the artisans of the Ampiyacu. As is commonly the case for people in remote rural settings throughout the world, however, the terms of trade still leave much to be desired. To illustrate: one chambira-fiber *jicra*, the single most important marketed item in the Ampiyacu Basin, requires one day's labor to weave (extraction and preparation of fiber not included). It sells for about $1.00 (which is incidentally also the going rate for a day's wage labor [rarely solicited] in the area), or can be traded for one shotgun shell. The hammock which can take 20 days or more to make and

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[15] Selling directly to tourists is the most lucrative outlet for products. For example, ANTISUYO pays $5.80 for a hammock which could be sold to a tourist for about $20.00 (November, 1990).

sells to ANTISUYO for under $6.00 may fetch $100.00 or more in the United States[16].

## Ethnic, Community, Household, and Individual Variability of Handicrafts Activities

Indigenous groups and peasants are often depicted as homogenous, with virtually all members of the group holding the same knowledge and doing the same things. As Coomes (1992) and others have emphasized, however, the activities and knowledge of Amazonian peasants (*caboclos* and *ribereños*) are far from homogenous. There is often large variation between regions, between communities within regions, and between households and individuals within communities. This certainly holds true also for the people of the indigenous communities of the Ampiyacu.

At the regional level, the large majority of cash income is generated by the sale of handicrafts. From this course-grained perspective, then, it could be said that the people of the FECONA specialize in handicrafts. Without analyzing the situation at a more refined scale, or in historical context, this "specialization" could be interpreted as resulting from some sort of ethnic determination - a homogenous group of people carrying on a longstanding handicraft tradition.

Such an interpretation would be inaccurate, however, considering the diverse ethnic backgrounds of FECONA members, the outside origin of many of the handicrafts products,

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[16] Such unfavorable terms of trade have not always existed, however. Over a 140 years ago Alfred Russell Wallace reported the price for a finely woven fiber hammock from the closely related *Astrocaryum vulgare* Martius palm to be 3 pounds sterling, a substantial sum in those days (1853:106).

and their recent development for commercial markets. Clearly, traditions have not just been handed down unchanging from one generation to another, but have arisen through countless historical events and the active borrowing, sifting, and winnowing, of assorted morsels from many "cultural libraries," indigenous or alien. Over time, this process of "invention of tradition" (see Hobsbawm and Ranger 1983) may result in the incorporation of outside cultural elements into a group's own cultural corpus and history. Thus, the *shiruy* of Yagua origin and the bombonaje lamp shade (there is no electricity in the basin) have made inroads into the basket-making "traditions" of FECONA communities.

Moving down one hierarchical level of analysis, the communities come into focus, and significant variation between villages can be seen. For example, the Witoto of Tierra Firme do not produce *shiruy* baskets or any other bombonaje products (**Fig. 5**), despite its relative abundance in their area (see Chapter 3). They and others explain this curiosity as a result of the absence of *shiruys* (and the technical knowledge to make them) from their cultural heritage. But the fact that this knowledge was absent also from the Bora heritage did not prevent many Bora of Puca Urquillo and Brillo Nuevo to take up *shiruy*-making. Likewise, some Witoto of Puca Urquillo are now making *shiruys*, and some Cusceños said that they were planning to learn how.

Factors other than ethnicity are more important in influencing the differences in activities of residents between villages. Notable among them are the historical and spatial variability of the biophysical environments (species distributions and abundance), access to markets, land and labor availability, and population densities. These factors produce different constraints and opportunities for income generating activities over space.

For example, the highest concentration of accessible fiber-producing chambira plants is found in Izango, one of the least populated villages. The usufruct rights of individuals to forest fallow plots where the chambira fiber is found are well delineated and well respected. It is hardly likely, then, an accident that the primary handicraft activity in the village is making hammocks, not *jicras*. A mid-sized hammock requires about 12 chambira leaf shoots, whereas a jicra requires just one.

In Puca Urquillo, where the supply of usable chambira is perhaps the scarcest and most heavily demanded, the *jicra* is the chambira product most produced. Very few hammocks are produced because of the difficulty in gathering the required amount of raw material. Some Puca Urquillo residents have resorted to purchasing the raw leaf shoots from villages such as Izango and Brillo Nuevo, where supply is less limited (See Chapter 3).

Market activities within the basin are also influenced by the differences in fluvial geomorphology and flooding regimes between sections of the Río Ampiyacu and its tributary, the Yaguasyacu. As can be seen on the map (**Fig. 1**), the lower Ampiyacu runs almost parallel to the Amazon, and judging from satellite images and on-sight inspection, it probably follows a feature created by the Amazon in the past. The area between the two water courses is covered by many backswamps and *cochas* (lakes) subject to floods--hence no communities are located on the right bank of the Ampiyacu. On the left bank in the vicinity of Cusco and the ironically named Tierra Firme ("Solid Ground") there is little high ground either. This situation makes crop cultivation more challenging; suitable land for fields is found a long way from the river's edge towards the interior, or *el centro*, in contrast to the rest of the villages, whose residents can locate their *chacras* on the high ground close to their homes[17].

Other opportunities do, however, arise. This poorly drained environment is well suited for the "chonta" palm (*Bactris ciliata* Mart.) which has been an important source of income for people living here. Palm hearts from this species (and others) are consumed in great numbers in Iquitos restaurants. Buyers come to the area to purchase the hearts, and they are brought to Iquitos to supply the restaurants and a processing factory. Unfortunately, this single-stemmed species, unlike its multi-stemmed counterpart which is sustainably harvested in Brazil, is chopped down for its heart and it cannot regenerate. Consequently, populations have been depleted.

Another unique activity of the people of this floodable black water environment is the collection of ornamental aquarium fish (*piabas*) which are harvested from small pools outside the river channel left when high water is dropping in June and July. The fish are bought in groups of 1000 by traveling traders.

At the household level, variation has little basis in ethnic identity. Rather, it is a function of specialized knowledge, access to land and labor (number of children), family history, and personal preferences that transcend ethnic and community boundaries. In Puca Urquillo, for example, very many people work with bombonaje and chambira, whereas there are just three men and their families who are known for their specialized knowledge of the plants from which the llanchama is extracted (**Moraceae**, see Appendix 1), and the techniques used to fashion its numerous products. One of these men devotes the majority of his time

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[17] Settlement patterns are also less nucleated in these two communities.

to working with llanchama, to the exclusion of most everything else, save the bare minimum subsistence activities.

The finest-grained level of analysis looks inside the household, where significant sexual and age divisions of labor are found. The weaving of hammocks and jicras from chambira fiber is a women's activity which includes extraction of fiber, preparation of fiber (soaking, dying, twisting), and weaving (See Chapter 3). Many adolescent girls spend much of their time weaving jicras, making substantial contributions to household income. Young boys may also help their mothers, though they tend to spend most of their time at play. The harvest of chambira leaf shoots is carried out by both males and females. Likewise, bombonaje and tamshi may be collected by either men or women, though collection is predominantly a male activity, especially in the case of the tamshi species found deep in the forest where women seldom venture. All of the products derived from both bombonaje and tamshi are made exclusively by men.

The final, and most important level to be discussed is the extra-regional, or international. To understand why the market for handicrafts exists, something must be known about the nature of the demand for the products. It is clear that handicrafts are produced primarily for the global culture of Western society, and therefore reflect the values of that culture. The newly formed federation (FECONA) and the ANTISUYO project act as mediators of this process. ANTISUYO has linked the region more directly into the global market economy. Understanding the tastes of the buyers of the handicrafts, the non-profit organization encourages production to meet these tastes, hence shaping and standardizing what is produced. In this way handicrafts "traditions" have been reinvented to appeal to the outsider's concept of what is "Indian".

In the context of these market activities a new regional identity is emerging. Just fifty years ago the Bora and Witoto were warring rivals, placing the heads of their victims on poles as a testament to victory in battle. Now they live peacefully side by side, engaged in similar economic activities. The importance of tribal affiliations is diminished in comparison to a broader **indigenous** identity defined in contrast to the outside Western culture from which cash income is derived[18]. The establishment of the ***Federación de Comunidades Nativas** del Río Ampiyacu*, (and many other federations like it throughout Amazonia) is a manifestation of this transformation in process.

The following chapter discusses the patterns of extraction of the most important raw materials species used to produce marketable handicrafts, the fiber-bearing chambira, bombonaje, and tamshi.

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[18] See Spicer (1971) for a discussion of the importance of oppositional forces in defining ethnic identity.

# CHAPTER 3: FIBERS

## CHAMBIRA (*Astrocaryum chambira* Burret, Arecaceae)

### Taxonomy and Ecology:

*Astrocaryum* is one of the more diversified palm genera in the new world, with 40 species from Mexico to Brazil, and 21 species in Amazonia alone (Kahn and De Granville 1992:6). In addition to *A. chambira*, the subject of this discussion, several species produce a similar fiber (*A. jauari* Mart., *A. murmuru* Mart., *A. tucuma* Mart., and *A. vulgare* Mart.). *A. vulgare*, from eastern Amazonia, and *A. tucuma* are used by native people in the same manner as is chambira, to make hammocks, bags, and cordage of various forms (Wallace 1853: 106; Schultes 1977).

*Astrocaryum chambira* Burret, referred to locally as "chambira", or "niijihe" in Bora ("tucúm", "tucumán" elsewhere) is a tall (30 m), single-stemmed spiny-trunked palm (**Fig. 2**) distributed throughout western Amazonia, sometimes forming dense aggregations in secondary vegetation (Kahn and De Granville 1992: 11, 14, 162). In the Ampiyacu Basin, it is found on upland and more poorly drained soils, in mature forest settings as well as successional forest (**Table 5**). It is by far most abundant, however, in the human-modified zone of forest fallows (*purmas*) which flank the river within a belt of roughly 2 km (see **Fig. 8**). In our survey of 14 plots (4 ha total) of managed and unmanaged forest fallow of various age and soil type (and one pasture) throughout the basin, a total of 363 individuals were

**Table 5. Chambira (*Astrocaryum chambira* Burret) Densities and Utilization by Habitat, Río Ampiyacu Basin.**

| Site | Area $m^2$ | Inds/ha | Usable/ha | Managed |
|---|---|---|---|---|
| **MATURE FOREST (MONTE ALTO), UPLAND (ALTURA)** | | | | |
| Puca Urquillo (Witoto), altura | 6,570 | 9 | | |
| Izango, altura | 3,600 | 11 | 2 | |
| Brillo Nuevo, altura | 3,900 | 13 | | |
| Estirón | 2,850 | 4 | 4 | |
| **TOTALS** | **16,920** | **9.5** | | |
| **MATURE FOREST, POORLY DRAINED** | | | | |
| Tierra Firme, bajial | 2,800 | 53 | 0 | |
| Tierra Firme, tahuampa | 1,800 | 61 | 0 | |
| Izango, "chupadero" | 220 | 0 | | |
| **Totals** | **4,820** | **54** | | |
| **OLD FALLOWS (PURMAS ANTIGUAS)** | | | | |
| Colonia, 60 yrs. | 2,500 | 88 | | |
| Tierra Firme, 50 yrs. | 2,400 | 75 | 12 | |
| Izango, 20 yrs. | 600 | 917 | 167 | |

Table 5 (cont.)

| | | | | |
|---|---|---|---|---|
| Colonia, 20 yrs. | 3,200 | 244 | | |
| Tierra Firme, 11 yrs | 1,800 | 94 | 5 | no |
| Cusco, 15 yrs | 2,500 | 16 | 8 | yes |
| **Totals** | **13,000** | **149** | | |
| **YOUNG FALLOWS (PURMAS JOVENES) AND CHACRAS** | | | | |
| Esperanza, freshly burned chacra from 6 yr fallow | 2,000 | 55 | 35 | yes |
| Cusco, 5 yrs | 2,200 | 27 | 4 | yes |
| Colonia, 5 yrs | 2,710 | 37 | | |
| Tierra Firme, 5 yrs | 1,000 | 180 | 70 | no |
| Experanza, 6 yrs | 1,200 | 150 | 8 | yes |
| Esperanza, 6 yrs | 3,200 | 75 | 12 | no |
| Esperanza, 2 yr chacra + 8 yr fallow boundary | 3,883 | 46 | 25 | no |
| **Totals** | **16,191** | **65** | | |
| Puca Urquillo (Witoto), Pasture | 10,800 | 59 | 13 | |
| **Total, Secondary Forest Zone** | **39,991** | **91** | | |
| **Total, all sites** | **61,733** | **66** | | |

found, for an average density of 91 individuals per hectare. In contrast, an average density of 9.5 individuals per hectare was found in mature, upland forest (4 plots, 1.7 ha).

Palms are well recognized for providing multiple uses from many different plant parts (Balick 1984; 1988), and *A. chambira* is no exception. In addition to the use of the young leaf fiber for handicrafts, as discussed above, the stronger fiber of mature leaves is used to make fishing line, nets, and traps. The small (approximately 5 cm diameter) edible nut-like fruits taste somewhat like coconut, and are eaten by a variety of birds and animals as well as by people. The liquid endosperm is also edible, and monkeys (*Cebus apella*) have been observed cracking open the hard drupe to drink it (Kahn and De Granville 1992:148). The dried nut was formerly used as a small container attached to blowguns to hold dart poison or the cottony material[1] used to support the dart when firing. It is still used in this manner in the production of blowgun replicas for sale. The "bone" of the leaf pinnae is used to make baskets and brooms. The intact pinnae may be used to make hats and fans, though *A. huicungo* is more often used for this purpose. The roots, mixed with the roots of the "chonta" palm, *Euterpe precatoria*, are used as a diarrhea and fever remedy (Jomber Chota I. 1990, pers. comm.), though this was not observed in the Ampiyacu.

[1]From species of the genus *Ochroma*, (Bombacaceae), referred to as "topa" and "balsa".

**Harvest and Preparation of Fiber:**

The fiber for making handicrafts is obtained from the developing leaf shoot (*cogollo*), or palm heart, before it opens up and exposes the pinnae. The shoot is generally between one and three meters long when removed. Due to the relative abundance of acaulescent (i.e. without a trunk) juvenile chambira palms in secondary vegetation and the ease in extracting the new leaf shoot from them, they are the primary source of chambira fiber. While a utilizable shoot appears in seedlings as small as 1.5 m, it is known that removing the shoot at such an early stage of the plant's development will probably kill it. The earliest safe age of harvest is about three years from the time of sprouting, or when the palm reaches 3 m in height.

A new leaf develops once every four to six months. Through many years of experimentation the people have learned that in order to maintain healthy leaf development, and hence a sustained yield of shoots, at least one leaf (some say two or more is preferable) must be left to open and develop fully before the next shoot is taken. In this way a plant may continue producing a harvestable shoot every 8 to 12 months, indefinitely. Of course, if the plant is to grow large and accumulate leaves, the interval between harvests must eventually be extended. The long-term effects of this standard harvest level are not known. Under natural conditions the palm is reported to have about a 20 to 30 year life span.

The machete is the tool of choice for removing the new leaf shoots. If the plant is small enough, the extractor can simply reach into the heart where the shoot is emerging and chop it out. The long black spines which cover the petioles pose a greater and greater obstacle as the plant matures. Although it is believed that cutting away outer leaves will damage the plant and decrease productivity, this is a common means of getting to the desired palm heart more easily. To extract the heart from a trunked mature tree, the palm is felled with an axe.

After the shoot has been removed from the palm, the immature pinnae are then shaken loose, pulled off of the rachis, and tied into a bundle to be carried home[2]. Sometimes the shoots are brought home intact, before removing the pinnae. Shoots are harvested by men or women, but all remaining tasks for preparation of fiber and production of handicrafts are carried out by women and children, primarily girls.

The very thin transparent epidermal band is stripped off by folding over the base of the blade, holding it with one hand, and yanking down sharply with the other. The fiber is then hung on a line overnight or for a day or more to dry. Next it is soaked for about a day to remove the green chlorophyll and hung to dry again.

It is then ready to be twisted into string, which involves rolling the fiber on the thigh with the palm of the hand, and adding new pieces of raw fiber at intervals into the end of the emerging thread. If desired, the string might then be died one of various colors derived from many different plants and inorganic materials[3] (the natural color of the fiber is a yellowish

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[2] Though I did not count the pinnae, Wheeler reports that the shoots collected by the Siona of the Putumayo River for similar purposes yield "20 to 40 blades, about two to three feet long" (1970: 180). For comparison, a 6.5 m long leaf of a trunkless juvenile which I collected had 94 pinnae (both sides of rachis), approximately 75 cm long (McCann No. 56), and leaves of trunked individuals measured by Kahn (1992: table 4) were about the same length, but had between 250 and 300 pinnae per leaf, averaging about 130 cm long.

[3] The most commonly used colors are black, yellow, and various shades of maroon. Some of the most commonly used dye-producing plants are *Arrabidea chica* (H. & B.) Verl. (family Bignoniaceae), which is cultivated solely for its use in making dyes (reddish to maroon), *Cucurma longa* L. (Zingiberaceae), also

white). Fibers can also be dyed before twisting, by soaking and/or boiling the fiber in a mixture of water and the plant part which yields the colorant (e.g. leaves, fruit, bark, or tuber). After dyeing, the fiber must be sun-dried once again.

**Producing Hammocks and *Jicra* Bags:**

After the fiber has been prepared in the manner described above, various items may be produced. In the case of a hammock[4], threads are strung between two poles wedged between the floor slats and tied to the overhead beams of the house; the distance between them depends on the desired length of the hammock under construction. Other threads are then woven between the waft by hand, with all threads coming together and tied at both ends. The *jicra* bag, in contrast, is not really woven, but sewn in large circular stitches wrapped around a flat rachis piece of *Mauritia flexuosa*. This functions as a structural guide for the stitches, which proceed in spiralling rows. The width of the "rows", and thus the size of the bag's mesh, corresponds to the width of the structural guide, which is usually between 1 and 2 cm, but can be up to 4 cm or more wide. The *jicra* may be rectangular or roughly square-shaped, of varying size, but is most commonly about 30 by 30 cm. A small, but probably growing number of *cartera* style bags are also made. These are much more demanding of

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cultivated almost exclusively for the yellow dye it produces, and *Genipa americana* L. (Rubiaceae), a forest fallow species which may also be semi-cultivated. The latter yields a black dye/paint, which is also used in hair coloring and body painting. See also Appendix 1.

[4] This refers to a marketable hammock. Hammocks made for personal use are generally smaller, more simply made (knotted, not woven), and are sometimes constructed using purchased string.

labor and raw material, and are made by means of a dense knotting technique, which is not known by many people. The ANTISUYO buyer encourages people to make this new product, as it is a more attractive product to the consumer.

The most labor intensive stage of the production process is twisting the fiber into string. According to artisans' estimates, twisting the fiber derived from one average-sized shoot takes about one day[5]. A hammock requires between four and twelve leaf shoots, depending on the size of the shoots, the thickness of the thread, and the size of the hammock. For example, a 2.65 m by 30 cm, double weave hammock requires 12 leaf shoots about 1.5 m long, or about 12 days of twisting labor. The actual weaving of the hammock can be accomplished in two days continuous work. An average sized *jicra* is made from a single leaf shoot, and takes about one day to stitch together. In November 1990, the hammock, approximately seven times more labor intensive than the *jicra*, sold to ANTISUYO for about $5.80, while the *jicra* sold for about $1.00.

It should be noted that measuring the labor requirements of handicrafts production is very difficult due to the intermittent nature of the work[6]. For example, a leaf shoot may be harvested opportunistically on the way home from the *chacra*; likewise twisting and weaving are carried out in the home by women intermittently throughout the day, whenever the time can be found. Kept busy tending the fields, preparing meals, washing clothes and dishes, and

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[5] One woman from Colonia, who specializes in hammock making, makes use of *mingas*, or work parties, to twist the necessary amount of fiber. For most, however, all labor for handicrafts production is derived from within individual households.

[6] Considering the difficulty in measurement of labor expenditures and my limited time in the field, a methodology based on the artisans own estimates were favored over any direct measurement, and there was indeed a surprizing level of consensus among estimates.

taking care of children, there is seldom an idle moment for a woman of the Ampiyacu Basin. Nonetheless, she will sneak in a few stitches while dinner is cooking, during a visit by neighbors, or whenever she is able.

According to Wheeler (1970:180), the Siona of the Putumayo River along the Colombia--Ecuador border do not perceive the fashioning of chambira-fiber hammocks and bags (for household use only) as work, "but ... as a leisure-time activity to keep the hands busy". While there may have once been a similar perception among the Bora, Witoto, and Ocaina, the current market demand for these products has turned it into a labor-intensive and demanding business. I have seen young women stitching away at their jicras by the light of tin-can kerosene candles late at night, and even into the early morning. It is fair to say, however, that this sort of work is considered "soft" in comparison with agricultural labor or hunting, for example.

**Overharvest and Depletion:**

With increasing numbers of people responding to the opportunity to market chambira products in recent years, extraction pressures on the palm have risen dramatically. There is widespread concern within the basin that harvestable fiber is becoming scarce, and acquiring it is increasingly difficult and time-consuming. The account of Señora Quévare of Puca Urquillo (pers. comm.) is typical. Until 1975, she recalls, she would harvest 20 to 30 *cogollos* in a day. Now, she manages to find just 2 to 5 small *cogollos*.

Not only are more people involved in pursuit of fiber, but the methods of extraction have become destructive. Concern has been voiced in several town meetings and can be heard in the everyday rumblings of individuals. The most important factors associated with this situation at the village level seem to be human population density, degree of involvement in market production, degree of acculturation, and the breakdown or inadequacy of tenure structures[7].

The indigenous tenure rules which seem to be recognized and shared by all three ethnic groups, hold that a person (or household) retains exclusive use rights to a forest fallow (which once was his agricultural plot) as long as it is managed in some way, or any species is being extracted from it[8]. This period of "use" may exceed 25 years, and if the plot is re-cleared for agriculture, use rights might never be relinquished. In fact, they are often inherited. As long as this system is intact, and respected by all, there is incentive for fallow "owners" to manage their chambira resource in a sustainable manner, taking care not to over-harvest or destructively harvest the plants found on their personal fallows.

Under the current market pressures however, this fallow tenure structure--while still recognized in theory--is seldom respected or enforced in practice. Years ago, remarks Dona Inés of Puca Urquillo (pers. comm.), there was "conciencia" (conscience), the people respected the *purmas* and *chacras*, but not any longer. In areas of greatest competition for raw material resources, all lands, except perhaps home gardens and new *chacras*, are treated

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[7] Coomes (1991:12; 1992) reports a similar pattern of increasing dependency on chambira products for cash income and the resultant decline of raw material stock surrounding the *ribereño* community of Santa Ana, at the mouth of the Tahuayo River (42 km downstream from Iquitos).

[8] The strength of rights does not seem to be uniform over time and with varying levels of management; the older the fallow and the less it is managed, the weaker the claim to its products.

as an unregulated commons. The rightful owner of a fallow has no incentive to conserve, and will extract what he can, when he can, just as any other person who encounters chambira in his fallow would do. The optimal harvest interval is thus reduced, and in many cases a shoot is removed before it has reached one meter in length, despite the inferior quality and reduced amount of fiber that an inadequately developed shoot yields. Even a shoot arising out of the hacked, leafless remains of a stump is subject for removal. True, chambira is "weedy", and can (incredibly) survive repeated removal of leaves over a period of several years, but it will eventually succumb to unrelenting over-harvest.

A relatively dense population of easily accessible individual palms in a community pasture just north of the Witoto side of Puca Urquillo provides a case in point. Fifteen years ago the land was planted in rice, later followed by plantains, and for the past five years has been pasture for the small herd of cattle managed communally by the Witotos of Puca Urquillo.[9] The chambira palms which have grown up here are clearly the dominant, and virtually the only non-herbaceous plant in the pasture. All surrounding vegetation is kept down by the cattle, making the palms easily visible and accessible to a large number of potential extractors. The products of the pasture are officially "owned" by the Witotos of Puca Urquillo (pop. 227), but people from outside the community who pass by here on a well-traveled trail between villages are also likely to take advantage of the chambira found here.

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[9] There are very few cattle in the Ampiyacu Basin. Wesley Thiesen of the Summer Linguistics Institute had established a small herd in Brillo Nuevo which has now disappeared, apparently succumbing to an outbreak of disease. The only other cattle that I saw were grazed near the river-bank of Betania, a Bora village (not shown on the map) located between Puca Urquillo and Pebas. It is likely that there are also some in the immediate vicinity of Pebas.

I found 64 individual (living) plants in an area of 10,800 $m^2$, of which only 14 had a harvestable leaf shoot, and all had been repeatedly harvested in the past. Though informants estimated that most of the individuals were about 15 years old, none had been allowed to develop more than a few leaves, let alone a trunk, which in the absence of extraction pressures would have been well developed by this point. Many leafless stumps (some still living) were testament to the eventual result of such severe extraction pressures. The productivity of the survivors is drastically lower than their potential under optimal conditions.

This pattern is observed in many places throughout the basin, although some notable exceptions do occur. For example, chambira was found in very high density in the fallows very close to the Ocaina village of Izango (**Table 5**, 20 yr. fallow, 917 inds/ha). Also, the proportion of plants with utilizable shoots at the time of survey was far greater here than anywhere else (167 inds/ha), and mature individuals with trunks were found. This may be explained by the fact that only 33 people live in the village, and relatively few of these were engaged in the production of handicrafts (**Table 4**). Many people were not permanent residents and some took advantage of other opportunities for cash income, such as the sale of wild meat, which was also more readily available in the surrounding forests. Another factor which may have contributed to the abundance of chambira was the decrease in size of the village from 65 in 1978 to 33 in 1990 (**Table 1**), which produced a large amount of optimal habitat in the form of *purmas* not returned to *chacra*.

In most of the rest of the Ampiyacu Basin, however, the vast majority of palms which do survive are kept in a permanent state of acaulescence, and do not reach sexual maturity.

Fruiting adults are virtually non-existent in the forest fallow zones (and naturally sparse in mature forest). If an individual does somehow reach maturity, it still faces a high probability of being chopped down for its new leaf shoot. The long black spines on the trunk, which the palm may have evolved as a defense against monkeys, now invite death by one primate, *Homo sapiens*, when armed with a steel axe. This is an ironic consequence of the current situation, considering that chambira fruits are very nutritious, and formerly made a significant contribution to local diet, as they continue to do elsewhere in the Iquitos region where fiber extraction is not as economically important. Indeed, chambira is very important fruit in the Iquitos market (Vasquez and Gentry 1989).

Relative scarcity of chambira fiber and the disregard for traditional management practices are most pronounced in Puca Urquillo, the village with the easiest access to market (24 hours in river-boat, or *lancha*, to Iquitos, 1 hour by canoe to Pebas) and highest degree of acculturation (Gasché 1982). It is also the most populous settlement, with 338 inhabitants[10], and is the only village visited by tourists (mainly North Americans, Europeans, and *Limeños*), who arrive weekly on the river boat *Río Amazonas*. Direct access to tourists provides an additional market outlet for handicrafts that residents of more remote villages lack (See also Gasché 1986). Some Puca Urqueños have resorted to buying unprocessed chambira *cogollos* from Izango and Brillo Nuevo, where supplies are less limited. A few individuals have adopted the production of handicrafts to such an extent that they have

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[10] This value includes the inhabitants of two juxtaposed settlements, one Bora and one Witoto, with 111, and 227 individuals, respectively. The Bora community of Brillo Nuevo is also large in comparison with the other villages of the basin (population 212), but is farther removed from the "cultural frontier" and has maintained more of the traditions of sustainable forest management.

neglected all other activities, including communal work parties and even subsistence food production, and will steal from another's *chacra* (small field, swidden) for food.

**Response to Depletion:**

Extractors' responses to increasing scarcity of a plant are variable, and most influenced by the particular characteristics of the plant. Three possible responses were recognized: 1) **extension** of the spatial dimensions of extraction; 2) **switching** to a more accessible related species or other activity; 3) **intensification** of species management.

In contrast to more evenly dispersed species such as the epiphytic tamshis (see below), the marginal return on effort expended to **extend** the spatial zone of management of the weedy *Astrocaryum chambira* beyond the zone of secondary forest is low. This extension response, therefore, is not very important in this case, except as it occurs within the limited range of secondary forest. It is possible to find chambira in mature forest, but at an average density of just 9 individuals per hectare compared with 91/ha in successional vegetation. In addition, virtually all of the individuals found in mature forest are adults, which must be felled to extract the new leaf shoot, a very costly activity in terms of labor[11], and one which further reduces the abundance of chambira in the primary forest. Occasionally, chambira is in fact extracted from mature forest, but this occurs when the opportunity arises, for example, while on a hunting trip, and is highly unlikely to be the purpose of the trip into the *monte*

[11] Herndon (1861) reported that a whole day was expended in extracting a single chambira leaf shoot. If accurate, this estimate must have been based on extraction without the aid of the steel axe technology.

*alto.*

**Switching** to the related species, "huicungo" (*Astrocaryum huicungo*) was observed in a limited number of cases. While this species is quite abundant and occupies a similar habitat as does *Astrocaryum chambira*, its potential for generating cash income is limited. Hats and fans may be fashioned from the whole pinnae of new leaf shoots of the palm, but there is little demand for these products. The most important marketable items made from chambira, the *jicras* and hammocks, are not made from huicungo due to the unsuitability of its epidermal fibers. Consequently, the "switching" response for chambira is insignificant at present, though increasing demand for huicungo products or the development of new products in the future could change the scenario.

The most important response to demand-driven depletion of *Astrocaryum chambira* is the **intensification** of its management, which includes various forms of protection, promotion, and cultivation. When a new swidden plot is cleared from mature forest or forest in various stages of regeneration, chambira is left standing. After the "slash" material has sufficiently dried, it is burned, and the chambira plants survive. There is some indication that the species is not only fire *tolerant*, but that burning promotes the sprouting of seedlings. In forest fallows, or plots undergoing successional regrowth, weeds are cleared around young individuals to enhance their growth.

It could be argued that these activities may not necessarily be the **result** of depletion, and might be carried out even if the species were not in limited supply. While this may be true, it does not contradict the argument being presented. In fact, scarcity, demand, and value cannot easily be separated; they are all tightly linked with positive feedback relationships.

The important point is that **demand** must be adequate, whether generated by scarcity, market value, or any other factor, to justify the increased labor cost of intensification.

The practice of "cultivation", in the stricter sense of the word (seed collection and planting, or treatment as a full-fledged crop species)[12] does seem to be directly inspired by scarcity. As the problem of declining availability of chambira is increasingly recognized by the collectors of the fiber, cultivation is widely promoted in village meetings and informal conversations. And yet, despite the recognition of an obvious solution, relatively few people have actually adopted what most agree is the appropriate response. The "cultivation" that these few have engaged in involves seed collection and planting and seedling transplantation to swidden plots or "home gardens". What is inhibiting others from cultivating chambira is not so much an unwillingness to supply the additional required labor, but the perception that in light of the current lack of respect for an individual's exclusive usufruct rights, the extra effort will be in vain. 'Why should I break my back toiling for increased production of chambira', the reasoning goes, 'when the fruits of my labor are likely to be reaped by someone else'. When asked when he believed that people would seriously take up the cultivation of chambira, one man from Puca Urquillo responded matter-of-factly, as if it was a ridiculous question, "*cuando se acaba*", or "when it is all gone".

[12] To the indigenous inhabitant of the region, the Spanish verb *cultivar*, or to cultivate, has a much looser meaning. It refers to any action taken by humans to help or encourage a plant, and includes weeding, culling, and transplantation, as well as planting from seed and harvesting.

## BOMBONAJE (*Ischnosiphon spp.*, Marantaceae; *Oenocarpus spp.*, Arecaceae)

### Taxonomy and Ecology:

The Spanish common name bombonaje, as used in the Ampiyacu basin, refers to plants which provide an epidermis (or "bark") fiber used in basket-making. Three closely related species (*Ischnosiphon spp.*; **Fig. 4**) of the Maranta or Arrowroot Family (Marantaceae) are the most important in the region, but the bacabilla and cinamillo palms (*Oenocarpus spp.*) are also used for this purpose, and are sometimes referred to as "bombonaje negro" for the black color of the fiber they yield[13]. *Ischnosiphon* is a relatively large genus (31 sp.) of neotropical distribution consisting of large, perennial, rhizomatous herbs (Andersson 1977). The three species of interest here (*I. arouma* (Aublet) Koernicke, *I. obliquus* (Ridge) Koernicke, and *I. puberulus* Loesnener), are all of wide distribution, approximating the total distribution of the genus.

These "herbs" are very large. The shortest, *I. arouma* ("bombonaje marrón", or "legitimo"), reaches 3.5 m or more in height. According to Andersson (1977:38), *I. obliquus* ("sacha vaca"[14]) can attain a height of up to 6 m, though I saw none larger than 4 m in the area of study. These two species are most similar and tend to grow in clusters of up to 15

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[13] Another plant referred to as bombonaje throughout the Peruvian Amazon but not a part of this discussion is *Carludovica palmata* R. & P. (Cyclanthaceae), well known for its former great importance in the region for providing the raw material for the production of "Panama hats".

[14] The name refers to the origin myth of the plant. It is said by the Bora that long ago the ancestors buried a "sacha vaca," or tapir (*Tapirus terrestris*) in the ground and from that spot the plant grew up taking on the name of the animal that had spawned it.

or more stems, and have the ability to reproduce vegetatively by means of underground rhizomes, or runner roots, though they sometimes occur as solitary individuals. *I. arouma* has a palm-like habit and *I. obliquus* may be palm-like or repeatedly palm-like. According to local informants, the above-ground stems live for at least a year before drying up and dying. Both species were observed in flower during the study period (August - October).

*I. puberulus* ("canilla de trompetero"), the most distinctive of the three species, has a thinner and woodier stem and often takes on a vine-like habit. When there is sufficient structural support from surrounding vegetation, as in a dense, 10 to 15 year old forest fallow, it can "climb" to considerable heights. It is more likely than the other species to occur as a solitary stem and also has the ability to sprout roots from leaf nodes which come in contact with the ground, though it is uncertain if new plants can arise from these. Above-ground stems of *I. puberulus* are perennial, and survive for an unknown number of years. The species was not observed in flower during the study period.

The three species' habitats were similar, somewhat overlapping, yet distinct. Bombonaje legitimo was largely confined to places of poorly drained soils including riversides, *bajiales*, and *aguajales*, whereas sacha vaca was found mainly in agricultural *purma* settings, trailsides, edges of fields, and on upland as well as wet, but not entirely inundated soils. Canilla de trompetero was also found on both upland and low-lying areas[15], and thrived in a more closed, older forest fallow. In addition, all three were found in tree-fall

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[15] Some of the local people distinguish two varieties of canilla de trompetero, one which grows on upland (*altura*) and the other which grows in bottomlands (*bajial*). According to Helen Kennedy (pers. comm.), the taxonomist who made the Marantaceae determinations for this collection, these are a single species, *I. puberulus*.

gaps in more mature forest.

**Production:**

As mentioned in Chapter 2, bombonaje is desired for the epidermal, or "bark" layer of the stem, which is peeled off in strips for the fabrication of basketry and the adornment of other items such as blow guns[16]. Stems are selected on the basis of width and hardness, which are largely functions of maturity. These qualities are assessed by visual inspection and sometimes by scraping the stem with the blade of a machete. The stem must be mature (*maduro*) enough to provide a good quality, durable fiber, but not so mature that the epidermal layer is brittle and covered with lichens and small parasitic plants.

*Ischnosiphon auroma* and *I. obliquus* are the most desired for handicrafts production. The piece of the stem between the ground and the first node is chopped out, typically measuring 1.5 m long (range 1 to 3 m), and about 2 cm in diameter. In the case of *I. puberulus*, multiple internodes of about 1 m each may be extracted from a single stem, though the majority of these tend to be too mature to produce a fiber which is aesthetically acceptable for handicrafts. The fiber of this species is used primarily for the construction of yuca meal strainers (*cedazo* or *cedama*) for household use.

Stems are carried in bundles from the extraction site to home, where they may be

[16] The fiber is wrapped around the replica blow guns for decorative purposes only, replacing the aerial root epidermal fiber of huambé (*Philodendron sp.*), which is used as a structural wrapping on functional blow guns. Blowguns are no longer used in the region.

processed immediately or stored for up to 1 month in the shade before extracting the fiber. The epidermal layer is pealed off from the stem in strips, with the ubiquitous machete used much like a paring knife. An average sized stem yields about 10 flat strips of fiber approximately .5 cm wide. A small *shiruy* basket (20 by 30 cm) requires approximately 80 strips or eight stems, and one-half day to construct[17].

**Extraction:**

Harvest of stems is carried out year round, sometimes as the sole purpose of a trip into the forest, and sometimes opportunistically. A special trip is more likely to be made for extraction from *aguajales* and *bajiales*, where large patches of bombonaje may be found. The amount extracted in such cases may be limited only by the amount one man may carry, which is about 50 stems. In contrast, harvest from *purmas*, *chacras*, and trailsides - where patches are smaller - is more likely done in association with other activities such as working in the fields, and may entail cutting a few stems on the way home from the fields.

Clumps of *Ischnosiphon arouma* and *I. obliquus* generally consist of stems at various stages of maturity. Utilizable stems are cut out of the bunch, leaving the immature ones to develop. Regeneration time varies, and is reported to be decreased with thinning of old, dried- up stems (assuming any reach this stage). It is not known at what level of harvest regeneration will be hampered, but extractors suggest that removal of too many of the mature

[17] Artisans' estimate.

stems of a clump may hinder regrowth.

**Depletion, or Scarcity:**

Data on abundance of harvestable bombonaje was gathered at many sites in the region, mostly within patches of favorable habitat. This data cannot be used to determine the impact of extraction, however, or the region-wide patterns of scarcity without baseline data with which to compare the size, abundance, and spatial patterns of bombonaje habitat patches throughout the basin.

However, as for chambira, the perceptions of the extractors themselves are informative. These are the people who have spent their whole lives in this environment, paying particular attention to the species most important to their livelihood, with ample opportunity to observe change. The perceptions of the people regarding increasing scarcity of bombonaje paralleled those for chambira, though the level of concern was not as great.

Again, depletion is most severe around Puca Urquillo, where extraction pressures are greatest. A much larger proportion of informants from Puca Urquillo complained about the declining availability of nearby sources of raw material and the lack of respect for tenure rights to *chacras* and *purmas*, alike. Some artisans have resorted to purchasing the fiber from communities upriver which do not suffer such a problem. Indeed, a good number of informants from Brillo Nuevo, for example, report no problems in acquiring the necessary raw material.

**Response to Depletion:**

The patterns of market induced extraction and depletion of bombonaje are remarkably similar to those of chambira. Since both the chambira and the bombonaje species are favored in environments modified by humans, one might expect the response patterns to be similar as well. Unlike chambira, however, most of the bombonaje species can be found locally in high abundance in settings outside of the secondary forest fallow vegetation which flanks the river in a band approximately 2km wide.

For this reason, **extension** of the zone of extraction is a viable and commonly practiced response to increasing scarcity for bombonaje. Bombonaje legitimo, for example, prefers poorly drained sites, and can be found in large dense colonies in *aguajales* (swamp forest dominated by the palm *Mauritia flexuosa*) or *bajiales* (low-lying or periodically flooded area), and several types are prevalent in mature forest tree fall gaps.

There are two main ways of extending the spatial dimensions of extraction observed for bombonaje: The first is to venture farther by foot or by canoe but only as far as can be reached and returned from in one day. The second is to embark on extended collecting/hunting trips for several days to up to a month in duration. As sources near settlements are depleted, it becomes more likely that the second option will be chosen.

The **switching** response is relatively important in the case of bombonaje because there are a number of species referred to by this name which are suitable for constructing the various baskets, strainers, and miscellaneous other items. There is some specialization of function of particular varieties, as discussed above, as well as a hierarchy of desirability of varieties according to their particular use value.

The limited natural distribution of particular varieties in the basin also influences which will be harvested and by whom. For example, bombonaje legitimo is found mainly in low-lying forests of the Yaguasyacu River upstream from Nuevo Perú. I heard no reports of shortages of "black" bombonaje palm (*Oenocarpus spp.*), making it a good candidate for substitution when harvesting the tan colored *Ischnosiphon* species is not expedient. The black fibers are used primarily for adornment, though, limiting to some extent the degree to which they can be substituted.

Like chambira, bombonaje is involved in the intensification process. Clumps are encouraged where they grow up in young fallows and along swidden borders and trailsides, by clearing surrounding vegetation to give the desired plants "room" to grow. The option of cultivation is discussed, though I only observed one case of transplantation and heard one other (unconfirmed) report of cultivation or transplantation. The same concern about disrespect of usufruct rights of fallows is expressed. An additional possible factor inhibiting cultivation is an apparent lack of widespread thorough understanding of the reproductive cycle and seed production of the species.

A closely related species, "bijao" (*Ichnosiphon sp.*), the leaves of which are used to wrap food, is cultivated near Iquitos to supply the urban market for wrappers of *huane* (a piece of chicken surrounded by rice) or other food, suggesting that the related *Ischnosiphon* species could be cultivated if the demand/scarcity level warranted. Bijao is found in the Ampiyacu region as well, though there is no impetus for cultivation there, as there is no commercial market for the species and it occurs in sufficient abundance to easily supply household demand.

Bacabilla (*Oenocarpus mapora* Karst), is found wild in *bajiales* and *aguajales* and on upland apparently only where humans have been (see also *Mauritia flexuosa*, Chapter 4). It is also cultivated in home gardens and *purmas*, ensuring a ready supply of suckering stems from which to extract fiber. Its fruit is also desired, and again, in Tamshiyacu, near Iquitos the species is more intensively cultivated for fruit production for the urban market (Padoch et al 1988; Padoch 1988a).

## TAMSHI (*Heteropsis spp.*, Araceae; *Asplundia spp.*, Cyclanthaceae) AND HUAMBÉ (*Philodendron spp., Araceae*)

The epiphytes and hemi-epiphytes referred to in the Peruvian Amazon as "tamshi", or "tamishe", are most well known for the use of their aerial roots in house construction (Villarejo 1988; Vasquez 1989). In the Ampiyacu Basin, tamshi also makes an important contribution to marketable handicrafts production, in the form of baskets (**Fig. 6, 7**), which are very similar to the traditional carrying baskets still in use.

### Taxonomy and Ecology:

At least five varieties of useful tamshi are recognized locally on the basis of shape, color, strength and knottiness of aerial roots, including species of both the "Aroid," or Araceae (*Heteropsis spp.*) and Cyclanthaceae families (*Asplundia spp.*), in addition to huambé

(*Philodendron spp.*) (See Appendix 1). All of these are slow growing epiphytes or hemi-epiphytes found at low densities and widely scattered in mature forest, or *monte alto* (4 to 28 individuals per hectare, **Table 6**). Harvestable age individuals are never found in secondary forest; juveniles of the genus *Heteropsis* were observed on one occasion in an old *purma* near Colonia[18]. The absence of epiphytic vegetation from successional vegetation is typical in tropical forests (Budowski 1970).

Due to their relatively low natural abundance and slow growth rates, these species are the most susceptible to over-extraction. The primary forest of the region is either communally held by a particular village, or under the domain of the State, and extraction is unrestricted[19]. The aerial roots of tamshi are removed by pulling on them from below, which usually does not kill the plant, unless the leaves come down with the roots.

It is recognized by the locals that not all of the roots should be taken, so that the plant does not die. Regeneration is slow in any case, estimated at about 5 to 6 months for a single root to reach the ground. To extract the aerial roots of huambé, which cannot be removed from their host by pulling from below, the host tree is often felled. The alternative - climbing the host to cut the roots from above - is not attractive to most people, considering the danger of climbing these enormous trees. (The topic of tree climbing will be discussed

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[18] These had germinated in the soil, sent a shoot along the ground, and had begun to climb a tree, the leafy part of the plant attached between 1 and 2 meters from the ground. Local legend has it that the tamshi plant is born high in the tree, arising out of the body of the Izula ant, the legs transforming into the aerial roots which descend to the ground. This observation suggests that at least one species may germinate in the soil, climb a tree over many years, and then send down aerial roots. Some species may germinate above ground, on the ground, or either.

[19] The FECONA does however forbid entry of commercial hunters and fisherman from outside of the region, and some communities forbid the extraction of certain species by anyone from outside the community.

**Table 6. Tamshi (Araceae, Cyclanthaceae) in Mature Forest Setting**

| Location and Size of Belt Transects | Plant Variety | Inds. | Inds. per ha | Aerial Roots | Aerial Roots /ha | Utiliz. Aerial Roots | Utiliz. Roots /ha | Attach- ment to host(m) | # small baskets 25-30cm | Aerial Roots |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 hrs. walk (8 km); NW from Pucurquillo (N of Estiron) 2850 m$^2$ | Legitimo | 6 | 21 | 31 | 109.8 | 23 | 80.7 | 13.3 | 5.5 | 19.3 |
| | Shuyo | 1 | 3.5 | 5 | 17.5 | 5 | 17.5 | 15 | 2 | 7.0 |
| | Huambé | 1 | 3.5 | 9 | 31.6 | 9 | 31.6 | 15 | 2 | 7.0 |
| | Total | 8 | 28 | 45 | 158.9 | 37 | 130.8 | 13.7 | 9.5 | 33.3 |
| NW of Tierra Firme 2800 m$^2$ | Legitimo | 1 | 4 | 2 | 8 | 0 | 0 | 18 | 0 | 0 |
| 4-5 km NW from Izango 3600 m$^2$ | Legitimo | 3 | 8.3 | 18 | 50.0 | 18 | 50.0 | 12 | 3 | 7.7 |
| | Shuyo | 3 | 8.3 | (21) | (58.3) | (16) | (44.4) | (18) | (3) | (7.7) |
| | Huambé | 3 | 8.3 | 41 | 113.8 | 38 | 105.5 | 30 | 16 | 41.0 |
| | Total | 9 | 25 | 80 | 222.1 | 72 | 199.9 | 20 | 22 | 56.4 |
| 4 km W of Brillo Nuevo 3900 m$^2$ | Legitimo | 6 | 15.4 | 51 | 130.7 | 27 | 69.2 | -- | -- | -- |
| | Huambé | 3 | 7.7 | 34 | 87.2 | 21 | 53.9 | -- | -- | -- |
| | Total | 9 | 23.1 | 85 | 217.9 | 48 | 123.1 | -- | -- | -- |
| Totals: 13,150 m$^2$ | Legitimo | 16 | 12.2 | 102 | 77.6 | 68 | 51.7 | *13.4* | *8.5* | *9.2* |
| | Shuyo | 4 | 3.0 | 26 | 19.8 | 21 | 16.0 | -- | *5.0* | *5.4* |
| | Huambé | 7 | 5.3 | 84 | 63.9 | 68 | 51.7 | *26.3* | *18.0* | *19.5* |
| | All types | 27 | 20.5 | 212 | 161.2 | 157 | 119.4 | *18* | *31.5* | *34.1* |

Tamshi legitimo = arico (Bora) = sonoó (Ocaina) = *Heteropsis flexuosa.* (HBK) Bunting ARACEAE. See collection numbers 31 and 40 (Salaun and McCann); Tamshi shuyo = llíchiba (Bora) = mohoó (Ocaina) = *Asplundia sp.* CYCLANTHACEAE. See collection numbers 45 and 91 (McCann). One variety is recognized from lowlying habitats (*bajial*) and another from uplands; Huambé = *Philodendron sp.* ARACEAE. See collection numbers 89 and 133 (McCann).

Numbers in parentheses were not recorded from observations; they are based on averages from all other individuals for which the information was gathered. The number of baskets potentially constructed is based on the subjective judgement of the guide; criteria were the quality (knottiness) and thickness as well as the number and length (ht. of attachment) of aerial roots. Italicised figures were based on 9250 m$^2$, instead of 13,150 m$^2$.

in more detail in the following chapter.)

There is concern in the communities that increasing pressure on these plants to supply the handicrafts market is depleting wild populations within a distance from settlement which can be reached and returned from within a single day of extractive and hunting activities. Residents recall a time when good supplies of tamshi were to be found within a 10 to 15 minute walk from home, whereas now it takes at least 2.5 hours.

All transects for quantified data collection for these species were located at least 4 km away from settlements, or at least 2 km from the successional forest - high forest boundary (**Table 6**). The epiphytes were almost entirely absent any closer. This absence is unlikely attributable to an unsuitable habitat for survival, but rather removal by humans. Also, a positive relationship was found between distance from village and density of all species of tamshi. The sample size was too small, however to test significance. There was no relationship between number of roots and distance. It should be noted that these transects were carried out in areas where densities of tamshi were known to be **highest**. Nonetheless, just 27 individuals were observed in a total area of 13,150 $m^2$.

**Response to Depletion:**

For tamshi species, the most commonly reported initial response to depletion is to **extend** the range of exploitation of the plants. People must now travel farther and farther to find them. When the marginal return of increasing the time and effort required to gather the raw material is no longer deemed suitable, the extraction of the plant for commercial purposes is discontinued. Indeed, very few people from the region still engage in this activity. Of the 137 artisans registered with ANTISUYO, just five work with tamshi. There are a few specialists, however, who embark on journeys overland or upriver of several days to a week or more to extract tamshi from unexploited, remote areas, often in association with hunting or extraction of other products.

**Substitution** of less desirable aerial roots for the preferred varieties when they are scarce undoubtedly also occurs but switching to the production of a different handicraft item is a much more important phenomenon (e.g. tamshi baskets to chambira *jicras*). Absolute scarcity of the raw materials is of course not the only factor which influences the decisions of individuals; relative demand and price are also important. For example, prices paid by ANTISUYO for handicrafts may not reflect the relative abundances of the raw materials or the labor required to produce them. Obviously, if a higher price is paid, people will be willing to venture farther in search of raw materials. In this way, the Antisuyo project leader, Jaime Salazar, intentionally set the prices low for tamshi products to discourage production, as he knew that wild populations were being depleted.

The same characteristics which make the tamshi species especially susceptible to depletion (low density, low abundance, slow growth, epiphytic habit, mature forest habitat) also make them less amenable to intensification of management. As Luttge (1988:6) points out, with the exception of ornamental plants, the economic importance of epiphytes worldwide has been minor in comparison with other life forms (grasses, herbs, shrubs, trees), and there are no major crops derived from epiphytes. Attempts were made by one family from Colonia to transplant and cultivate several tamshi species in their home garden, though they reported no success. However, an artisan who lives at km. 7 of the Iquitos-Nauta Highway has successfully propagated huambé, (*Philodendron sp.*) from seed[20]. As in the Ampiyacu region, the aerial roots of these species are sought for the production of handicrafts, and have become scarce near Iquitos, and along the Iquitos-Nauta Highway.

[20] The seeds were acquired from individuals which had continued to grow in soil at ground level after being brought down from the canopy when the host trees were felled to clear land for the man's homestead. He germinated them in the tops of stumps and has had one individual established in the top of a 12 ft. tall dead stump.

# CHAPTER 4. NATURAL MONOCROP

## AGUAJE (*Mauritia flexuosa* L. f., Arecaceae)

The previous two chapters discussed the coevolving relationships between the "indigenous" inhabitants of the Ampiyacu River Basin and the fiber-bearing handicraft plants they depend on for the majority of cash income. It has been shown that market-induced extractive pressures on these species have led to depletion and subsequent extension, switching, and intensification responses by the people. Interesting historical insights, spatial patterns and contrasts between the individual epiphyte, herb, and palm species were revealed.

In this chapter, I will present the case of the commercial extraction of "aguaje"[1] (*Mauritia flexuosa* L.f), a tall (up to 30 m or more), dioecious palm, to supply fruit to the Iquitos market. Similar patterns are found, with interesting parallels and distinctions. I will draw on information primarily from the Manití River, but also from the Ampiyacu and from the Iquitos market, allowing a larger scale of analysis. The extensive historical analysis will not be repeated.

The Manití River is about the size of the Ampiyacu, and is inhabited by ethnic Yaguas, and ribereños, who are distributed in a fairly dipersed pattern along its banks. The Manití empties into the right margin of the Amazon about 70 km downstream from Iquitos

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[1]. Common names used outside of Peru include "ita" (Trinidad), "moriche" (Venezuela), "miriti" and "buriti" (Brazil). Buriti usually refers to the closely related species *M. vinifera* Mart., though the two are often confused (Calzada 1930). *M. flexuosa* grows at elevations less than 500 m, has large masculine flowers, and spherical fruits with small scales. *M. vinifera* grows at elevations greater than 500 m, has small masculine flowers, and ellipsoid fruits with large scales.

(**Fig. 1**), and is accessed approximately once per week by *colectivo*, or "river taxi", as far upriver as Santa Cecilia. Passengers from Recreo, where much of the information was gathered, can reach Iquitos in this way in 12 hours.

## Oligarchic Forests

The most well known extractive regimes in Amazonia are based on high diversity *terra firme* forests (Fearnside 1989; Schwartzman 1989; Allegretti 1990) typified by wide dispersal of economic species which have limited regeneration capacity and are sensitive to over-exploitation and destructive harvesting (Peters 1989; Peters et al 1989). There does exist, however, a substantial amount of Amazonian forests which are dominated by one or two species (Peters 1989; Peters et al 1989; Anderson and Jardim 1989; Peters 1990; Anderson 1990). These "oligarchic" or "monodominant" forests are often found on poor, inundated soils unsuitable for agriculture and comprised of useful species which are exploited on a subsistence and commercial basis. Indeed, among the few examples of relatively benign extractive regimes are those based on monodominant species growing in poorly drained soils (Peters 1990; Anderson 1990). Peters (1990:86) studied the ecology and extraction of fruit of *Myrciaria dubia* (**Myrtaceae**) and *Grias Peruviana* (**Lecythidaceae**) for the Iquitos market and concluded that "intensive exploitation has little impact on long-term regeneration."[2]

Nevertheless, as Peters himself acknowledges (1989:11; 1990), utilization of these

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[2] Based on production of 9.5 - 12.6 MT/ha/year for *M. dubia* and 2.3 MT/ha/year for *G. peruviana*.

forests is not immune to the problems of destructive harvesting, removal of seed supply, limited availability of markets, and the complex nature of land tenure[3].

The tall dioecious aguaje palm in Peru, is one such prominent monodominant species of importance (**Fig. 9**). Widely distributed throughout the Amazon and Orinoco Basins, it has been said to be the most plentiful palm in South America (Myers 1990:268). It is commonly found in swamps or on poorly drained soils, in various low diversity assemblages (see **Fig. 8** for a graphical representation). Species diversity levels of these associations are generally related to the level of inundation stress and range from the relatively more diverse mixed hardwood-palm forests to less diverse palm swamp forest to "palm marsh", in which *M. flexuosa* is the only non-herbaceous species present (Bacon 1990:219-220). *Mauritia* densities likewise are positively correlated with inundation stress (negatively with species diversity) to a point where no woody vegetation is tolerant: I recorded 75 individuals on .244 ha, and 204 individuals on .54 ha of seasonally flooded mixed forest near Recreo, for densities of 307/ha and 377/ha, respectively (**Table 7** and **Table 8**). Kahn found 645 individuals on 1 ha of more homogenous forest on permanently flooded histosol near Jenaro Herrera (1990: Table 3), and Mallaux (1975, in Myers 1990:268) reports densities in palm swamps of unknown hydrological quality of 450 to 500 palms per hectare.

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[3]. See also Kahn (1988) and Vasquez and Gentry (1989).

**Figure 9.** ***Mauritia flexuosa*** **L.f. ("Aguaje")**

Source: Kahn and De Granville 1992:14.

**Table 7: Wild Populations of Aguaje (*Mauritia flexuosa* L.f.), Right Bank Río Manití.**

Within 200 m of riverbank, land titled[1], *restinga* backslope, belt transect perpendicular to river, 152 m long (60 m X 10 m) + (92 m X 20 m) = 2440 m$^2$, mixed forest (not mono-dominant) with **ARECACEAE**: *Scheelea spp.* (shapaja), *Socratea spp.* (casha pona), *Euterpe spp.* (chonta); **BOMBACACEAE**: *Ceiba pentandra* L. (Lupuna); **SIMAROUBACEAE**: *Simarouba amara* Aubl. (Marupá); **MYRISTICACEAE**: *Otoba spp.* (aguanillo) in the canopy and sub-canopy and **MARANTACEAE**: *Ischnosiphon puberulus* Loesener and **ZINGIBERACEAE** in the understory, among the most notable. Evidence of cutting of trunked *M. flexuosa* individuals and petioles of non-trunked juveniles (for *esteras*) was found. (Oct. 1990).

| | **Trunked** | | | **Acaulescent** | |
|---|---|---|---|---|---|
| | Males | Females | ? | >5m | <5m |
| Individuals | 12 | 3 | 8 | 16 | 36 |
| Individuals/ha | 49 | 12 | 33 | 66 | 148 |
| % total trunked | .52 | .13 | .35 | -- | -- |
| % sexually Id'd | .80 | .20 | -- | -- | -- |

| | | |
|---|---|---|
| Total (by life form) | 23 trunked (27%) | 52 acaul (73%) |
| Total/ha | 94 trunked/ha | 214 acaul/ha |
| Totals (all inds.) | 75 inds (307/ha) | |

**Ratio of identified males to females: 4 to 1**

1. Use rights for aguaje are maintained on titled land. Aguaje extraction is not an important activity of the non-indigenous owner ("Lucho") of this plot, who grazes cattle on the highest part of the *restinga*. This theoretical control of the land is hard to enforce, however, and the owner reports that extractors can and do enter his property from where they can not be detected.

**Table 8. Wild Populations of Aguaje (Mauritia flexuosa L.f.), Left Bank Río Manití.**

Approximately 4 km from river[1], belt transect 270m X ~20m = 5400$m^2$, *aguajal*[2], not titled. (Oct. 1990).

| | Trunked | | | Acaulescent | |
|---|---|---|---|---|---|
| | Males[3] | Females[3] | ? | >5m | <5m |
| Individuals | 30 | 8 | 45 | 57 | 67 |
| Individuals/ha | 56 | 15 | 83 | 105 | 124 |
| % total trunked | .36 | .10 | .54 | -- | -- |
| % of sexually Id'd | .79 | .21 | - | -- | -- |

| | | |
|---|---|---|
| Total (by life form) | 83 trunked (41%) | 121 acaul (59%) |
| Total/ha | 154 trunked/ha | 224 acaul/ha |
| Totals (all inds.): | 204 inds (377/ha) | |

**Ratio of identified males to females: 3.76 to 1**

1. Forty-five minutes by canoe (Quebrada Recreo) plus approximately 30 minutes more on foot. Return trip was 70 minutes by foot.

2. Occasionally flooded, otherwise mostly poorly drained rain-fed (also referred to as *bajial* in dry season and *tahuampa* when flooded). Informant (Luiz Armando Malafaya) recalled that in 1985, floodwaters reached a level of 1 m in the *aguajal*, allowing access by canoe.

3. In the absence of flowers at the time of observation, one female was identified by its leaf configuration and two males were identified by examining the fallen inflorescences on the ground under the individuals. If these individuals are placed in the sex unknown category (?), the ratio of identified males to identified females becomes 4 to 1.

N.B.: Density measurements were also made in one plot near Nuevo Peru, left bank Río Yaguasyacu. In 1875$m^2$ of aguajal, there were 15 trunked individuals, or 80 per hectare. Juveniles were not counted and sex ratios were not measured.

## Uses

*Mauritia flexuosa* was long ago recognized as a striking and important palm. Wallace (1853:47) called it "one of the most noble and majestic of the American palms" and Humbodlt was struck by the extent and variety of uses to which this species was employed by the Waraoan Indians in the Orinoco Delta region, whose entire subsistence (including fruit, starch, fiber, and building materials) was based on it (1853:9).

All parts of the plant are useful. The thin fleshy layer (mesocarp) of the small ovoid-shaped fruit (**Fig. 10**) is eaten raw or used to make beverages (fermented or unfermented). It has a high calcium and Vitamin A content (Calzada 1930:100-101), and contains 20% good quality edible oil (Balick 1979; Cavalcante 1977:100). The leaves, separated from the petioles, make a roof thatch of intermediate quality in comparison to other palm species (Balick 1984:19; Anderson 1978:40). The tubular petioles, which are filled with a foam-like pith, are used to construct a variety of products including: rafts, children's toys, bottle corks, mattresses, cribs, baskets, fans, trays, and *esteras* (used as room dividers and for other temporary construction purposes), among others (Balick 1984:19; Padoch 1988b:218; Levi-Strauss 1950; Wallace 1853). The trunk has a high starch content, apparently nearly identical to that of the sago palm (Cavalcante 1977:100), but is not known to be used by any one but the Warao (Heinen and Ruddle 1974). Finally, the trunk can be tapped for its potable sap (Cavalcante 1977:100).

*Mauritia flexuosa* is an important economic and subsistence item in the local economies throughout Amazonia, though perhaps nowhere has it attained such economic

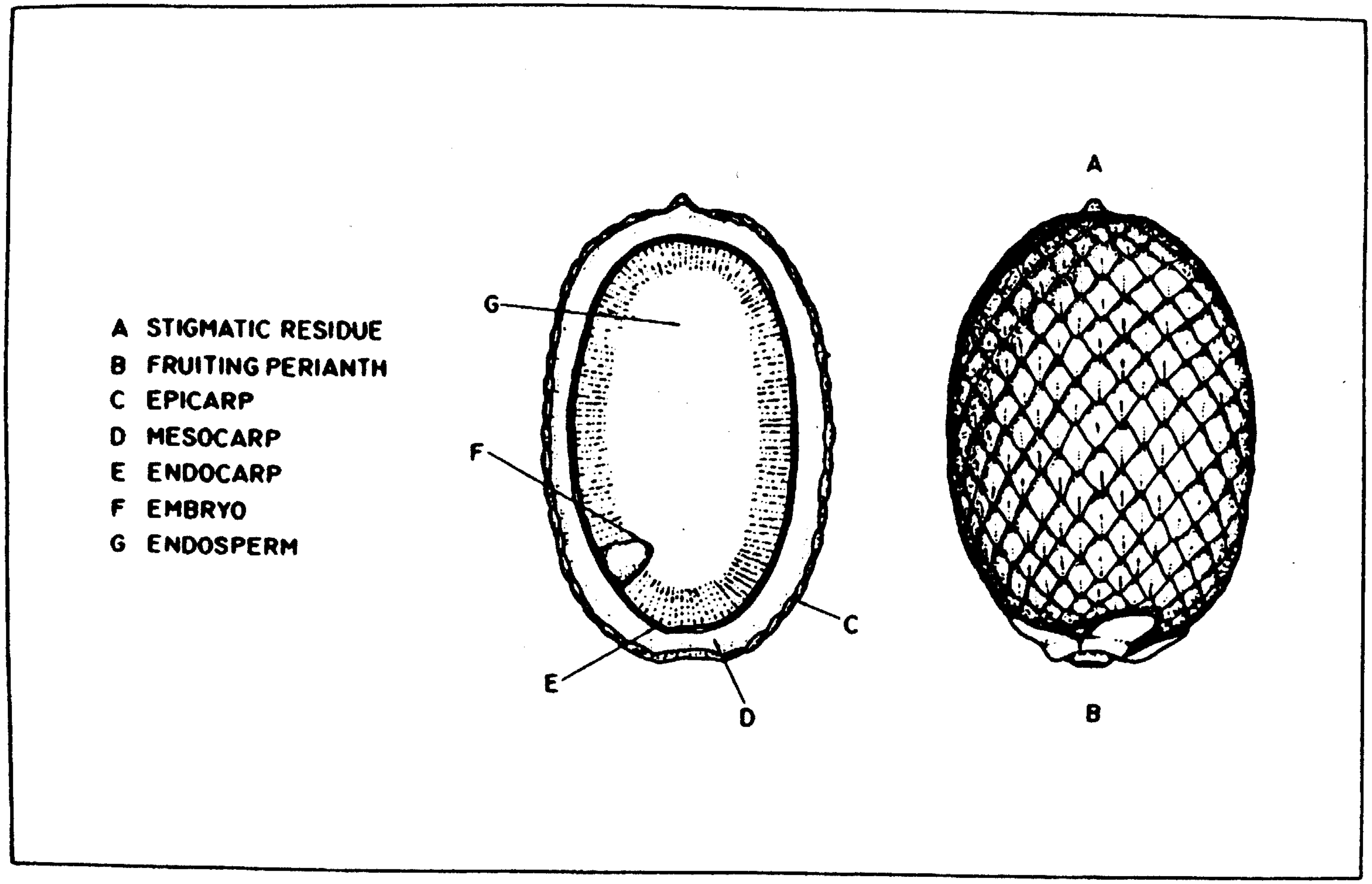


**Figure 10.** ***Muaritia flexuosa*** **L.f.: Exterior and Longitudinal Section (approximate size).**

Source: Padoch 1988b:218.

importance as in the region around Iquitos. Padoch estimates the daily demand for aguaje fruit in Iquitos to be 15 metric tons (1988b:219). The majority of the rapidly growing numbers of Iquiteños[4] have rural links, and for them aguaje is akin to a daily necessity. The fruit is sold in several forms including: raw, as *masa* (mashed pulp), as *aguajina* (a drink), as *curichi* (a frozen drink in a plastic bag), as *chupetes* (popsicles), and ice cream. Secondary products which also reach the urban market include *esteras*, and *suri*, the larvae of the beetle *Rynchophorus palmarum* L. harvested from the decomposing fallen trunks. The various pathways and trade networks by which aguaje products reach the market in Iquitos are documented by Padoch (1988b).

*Mauritia flexuosa* is the most ubiquitous species in the region surrounding Iquitos (Iquitos, Nauta, Requena, and Colonia Arganas). Peru's Oficina Nacional de Evaluación de Recursos Naturales estimated that 1,900,000 hectares of a total of 5,500,000 hectares surveyed (34.6%) was "*aguajal*", a forest type named for the palm, containing 80% *Mauritia* and *Euterpe* (ONERN 1976:87). A more favorable set of circumstances for sustaining an extractive economy is hard to imagine: extensive distribution of high population density of *M. flexuosa*; high and inelastic (at least not declining) market demand; multiplicity of uses of the plant; and unsuitability of *aguajal* soils for agriculture (ONERN 1976; Kahn 1988; 1990).[5]

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[4] The population of Iquitos has mushroomed from approximately 60,000 to 180,000 in the twenty years from 1961 to 1981 (INE 1984:19; in Coomes 1991) and has reached an estimated 250,000 today (ORDELORETO 1981; in Padoch 1988a).

[5] There has been some success reported, however, in cultivating rice on these swampy soils (Bacon 1990:244; Padoch 1988c).

## Destructive harvesting

In spite of what would seem to be ideal conditions for sustainable extraction of aguaje fruits, it is becoming clear that the palm is being overexploited. Vasquez and Gentry (1989) report that the availability of aguaje products in Iquitos has declined, driving the price up dramatically in the past few years[6]. *M. flexuosa* populations in the vicinity of Iquitos are being depleted due to overharvesting and the employment of destructive harvesting methods (Vasquez and Gentry 1989; Kahn 1988; Padoch 1988b). While non-destructive harvest of the fruit is possible (see below), the practice of cutting down the fruiting females for commercial harvest is predominant.

Extractors may be based in Iquitos and venture upriver in search of the fruits, or they may be *ribereños* who extract the fruits from nearby their homes. They may bring their product to market themselves by *lancha*, or sell to river traders. Much of the information that follows is based on observations from the area surrounding Recreo, a dispersed settlement of *ribereños* and Yagua Indians, on the Manití River, twelve hours by river taxi from Iquitos.

The sex ratio in stands of *M. flexuosa* is a good indicator of the human impact suffered by a population. Each of my two belt transects (**Tables 7 and 8**, see above) on either side of the Manití River near Recreo, exhibited a male/female ratio of 4 to 1 (.54 ha and .24 ha), and Kahn (1988: Table VII) found approximately 5 males for every female on

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[6] Inherent volatile yearly, seasonal, and daily fluctuations of supply and prices make this perceived shortage difficult to demonstrate with certainty. Padoch (1988b; 1990, pers. com.) observed no 'shortages' *per se* during her stay in Iquitos in the late 1980's, just wild price fluctuations, and my observations between July and October corroborate this view.

the Ucayali River near Jenaro Herrera (3 plots, 1.5 ha total).

In contrast, ratios on relatively undisturbed plots measured by Urrego Giraldo (1987, in Kahn and de Granville 1992) and Salazar and Roessl (1977, cited by Kahn 1988:47) were .8 to 1 and 1.6 to 1, respectively. Extensive stands just outside of Iquitos are virtually all male (Padoch 1988b; Vasquez and Gentry 1989:359).

Although not much is known about the regenerative capabilities of aguaje, this pattern of removal of females certainly does not bode well for the regeneration and future productivity of the stands. In Guiana, an open grass and reed swamp which had been converted from *Mauritia* and *Mora* forest by fire in 1837, still persisted at the time of Lindeman's (1953) observations in 1933 (Bacon 1990:241). According to Bacon, once herbaceous growth occupies a former *Mauritia* swamp forest, "regeneration of trees is unlikely to occur" (1990:241).

Why do the harvesters chop the trees down? According to Vasquez and Gentry (1989:360), the process of conversion from local consumption to commercial exploitation has caused behavioral changes of the harvesters, which has led to the decimation of aguaje populations surrounding Iquitos. This does not fully explain the situation however; a look at some unique characteristics of the palm provides further explanation. Unlike some of the other commercially harvested monodominant fruit species in the area (e.g. *Myrciaria dubia* and *Grias peruviana*), *M. flexuosa* cannot easily be harvested from the ground.

One method of harvesting fruit from arboreal species is the use of a pole with a hook or cutting edge on the end. As naturally occurring in swamp forests, *M. flexuosa* reaches considerable height, up to 30m or more, so the fruits of most individuals are out of reach of a hooked pole[7]. The dense spacing of individuals in an *aguajal* and the considerable distance that must be traveled to access them present additional problems for the transport and hoisting of tall poles.

Another option is to climb the tree. One informant from the Manití River indicated that less time and effort are expended climbing the tree than chopping it down, and that trees are climbed whenever they are not too big around. Also, if the desired fruit can be reached by climbing a narrower adjacent trunk, it is done. Small diameter trunks (*palos*) are often cut and used as "ladders", as well.

In addition to time and energy (labor) expenditure, the degree of subsistence or economic risk has often been cited as an important factor which influences peasant and folk resource management strategies (Jochim 1981; Keegan 1983; Smith 1983; Toledo 1990, etc.), but (to my knowledge) actual personal bodily risk to the individual has been recognized only in the foraging strategies of animals (Timothy Moermond, pers. comm.). The behavior of the aguaje extractors suggests that **personal** risk can also be a factor considered by humans. Climbing 30 m up a 1 m diameter trunk is very difficult and dangerous. In one year, three people were seriously injured falling from aguaje trees in Tamshiyacu (Coomes, pers. comm.), and in Brillo Nuevo I witnessed a young boy die after falling about 5 m from a dicotyledenous fruit tree, which is less dangerous to climb than a branchless palm.

[7] Even the most advanced telescopic and coupled aluminum poles developed for use in oil palm plantation harvesting in S.E. Asia can reach a maximum of 16 m (Veldhuis and Quencea 1983; Boutin 1981).

Various methods to make climbing palms easier and safer have been developed by local peoples in Amazonia and elsewhere in the world (**Fig. 11**; Corner 1966: 335-338; Hodge 1958; Davis 1977). The aguaje harvesters are not unaware of climbing methods, especially slings and harnesses, but near Iquitos these traditional methods have almost entirely given way to the axe as the technology of choice for the commercial harvest of aguaje[8].

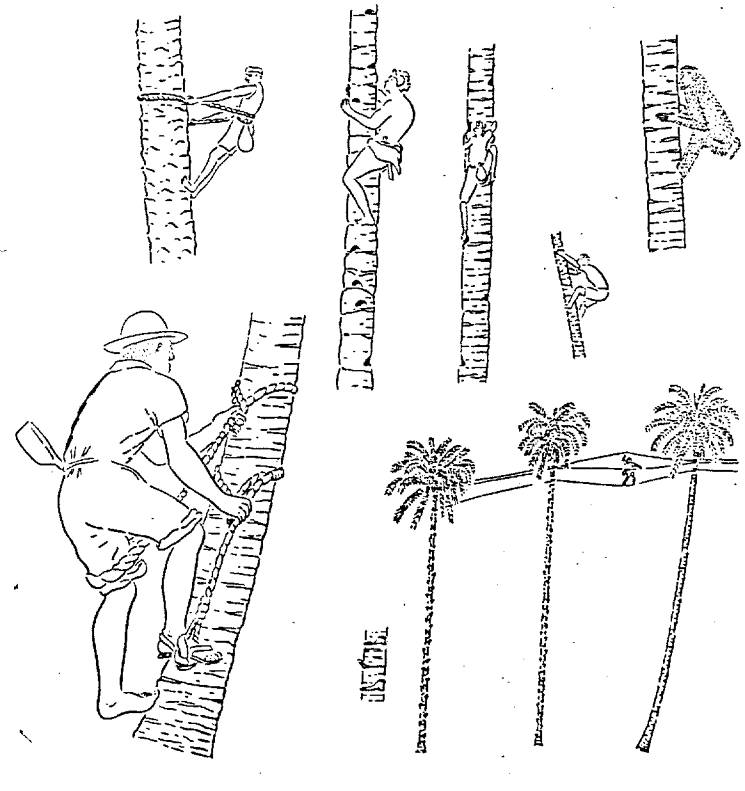

**Figure 11. Palm Climbing Methods for Nondestructive Fruit Harvest, Including Coconut Monkey and Toddy Lattice Work From Southeast Asia.**
Source: Corner 1966:335.

[8] See Hecht, Anderson, and May (1988), and Yost and Kelley (1983) for parallel examples of changes in technology (and social relations) which undermine the bases for sustainability.

## Responses to Depletion

### Extension:

As for the handicrafts species discussed above, responses of extractors to the depletion of *M. flexuosa* include extension, switching, and intensification. The extensive natural distribution and abundance of *M. flexuosa* and the relatively open access to these lands[9] creates a situation where the first logical response to depletion is to extend the zones of extraction. Indeed, as mentioned above, Iquitos vendors report that aguaje is being brought from farther and farther away as stands near Iquitos are depleted.

Similarly, at the local level, villagers along the Manití River recognize that the most easily accessible aguaje has been depleted. Where *M. flexuosa* was once abundant very close to their homes, extractors from Recreo now must travel at least two hours to find productive aguaje stands. Luiz Mulafaya (approximately 30 years old) recalls that he and his father used to be able to extract 15 sacks (50 kg/sack) per day; now just one sack may be extracted if on foot, or four to five sacks per day if water levels are high enough for transport by canoe.[10] This pattern of depletion and extension of the range of harvest is even more

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[9] The Ministry of Agriculture does officially require a license to extract aguaje, and a tax is levied, but this legislation is extremely difficult to enforce, and with the exception of the few large dealers operating out of Iquitos, it is ignored (Padoch 1988:20). The effect is not to limit the amount of fruit extracted or the areal extent of extraction, but rather to limit the number of people who are officially sanctioned as extractors and strengthen urban control over trade.

[10] The main fruiting and extracting season is May, June and July. High water season (from November to May) does not generally coincide with this period of most pronounced fruiting and extractive activities. Degree and timing of flooding is highly erratic in the small tributaries of the high Amazon, however, and water levels in any given month may vary wildly from year to year.

striking elsewhere. For example, in the Tamshiyacu-Tahuayo Basin, intact *aguajales* are reported to be found only beyond 25 km from villages (Bodmer et al. 1990:23).

The need to travel farther to find aguaje has also resulted in a shift in extraction strategies. When aguaje was abundant, nearby extractors in the Manití worked alone or in pairs (as in the case of Luiz Mafaya and his father). They have now begun to work in teams of five to six men, which somehow allow them to compensate for the extra distance that must be covered.

There is a limit, however, to which areal expansion of extraction for the commercial market can occur. The spatial limitations of aguaje extraction do not depend so much on the regional distribution and abundance of *aguajales*, (which are common and widespread throughout the region well beyond the market range of Iquitos), but rather on the perishability of the fruit and the availability, speed, and quality of river transport (Padoch 1988b:216). The ultimate limiting factor is, of course, the duration of freshness of the fruit. According to Iquitos wholesalers I interviewed, the fruits spoil after six or seven days at most. Padoch reports a five or six day life of the fruit under the best of conditions, and considerably less under less than optimal conditions (1988b:216). If the riverine transportation network were uniform, a circle delimiting the theoretical outer limit of extraction could be drawn around Iquitos with a particular radius. For example, assuming boats were similar, operating with equal reliability and traveling at, say 100 km per day, and allowing one day for harvest, one day for disembarking and sale in Iquitos, and a six day maximum freshness period, the outer limit would be 400 km by river from Iquitos.

However, nowhere can transportation be assumed to be uniform, least of all in the western Amazon Basin. In addition to the physical locations and orientations of the various rivers which make up the entire transportation network, there is a great deal of variation in the speed, quality, and reliability of boats, and in the case of public transportation, availability and frequency of operation as well. Some rivers are not accessed by public cargo boats (*lanchas* or *colectivos*) at all, and the frequency and dependability of operation on others is highly variable.[11]

On the Manití River, for example, the *colectivo* ascends upriver no farther than the village of Santa Cecilia. Above this point aguaje is abundant, and large concentrations of females are still present in very accessible stands. Little fruit is harvested, however, because of the absence of *colectivos*. According to Padoch (1988b:216), the actual outer limits of commercial extraction have been reached in some areas (the Chambira River, for example). Market range could be expected to increase with the development of faster and/or less expensive transportation, and limits to the extension of the zones of extraction might then be defined by factors other than perishability, most likely the cost of transport in relation to

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[11] Intending to return to Iquitos from Recreo, I waited for the *lancha* which regularly plies the Manití River, standing on the riverbank on the designated day and at the designated time (3:00 A.M.), but it never arrived. For the next two nights I repeated the ritual of waiting in the pitch darkness with flashlight in hand, ready to signal the boat so that it would not pass me by. On the third night it finally appeared, and picked me up only because I was carrying no cargo. There had been a party somewhere upstream which caused the delay and the boat was especially full, presumably due to the extra time which had elapsed since the last cargo boat had passed (a second boat was apparently out of commission at the time). The boat stopped to pick up selected individuals (if they were few enough or if they had a limited amount of cargo) until, when the gunwales were within an inch of the surface of the water, it no longer stopped at all. Many people with sacks of (spoiling?) produce were simply left standing and waving their arms on the riverbank as the boat passed. This is not an unusual story, the inhabitants of the region report that uncertainty of transport is the rule, not the exception.

the price of the product.[12]

Additional complexity results from the spatial variation of density and accessibility of *aguajales* to rivers. Some aguaje stands are adjacent to rivers and accessible by canoe, especially during periods of high water. To travel during low water periods, or to reach *aguajales* which are located in the interfluvial zones, one must go by foot. The labor and time costs of hauling 50 kg sacks of fruit by foot (usually in very swampy conditions) are much greater than for transporting them by canoe, which has a four to five sack capacity. Informants along the Manití recognize a maximum distance from the their homes and from the river beyond which it is no longer worth the additional effort to extract.

**Switching:**

The substitution or switching response was not directly observed at the harvesting end of the aguaje market, but the actions of the wholesalers and marketers in Iquitos suggest that it might be occurring. There are at least five different "varieties" of aguaje fruit, with a general consensus among wholesalers as to the relative "rank" of the varieties, which is based on taste, perishability, size, and suitability for particular uses (e.g. for ice cream). The most desirable variety is called "shambo". The price paid by wholesalers for the fruits reflects this ranking, as well as its ripeness at the time of purchase (very ripe fruits are less valuable). Buyers prefer the higher ranking types but will expand the range of their purchases to the less

[12] See Bunker (1985) for further discussion of the relationship between the value of an extracted product and its mode of transport in the Amazon Basin.

desirable types, though paying less for them, when the preferred varieties are in limited supply.

Likewise, it is probable that extractors are operating on the basis of the same rationality: when a high ranking variety is depleted, the extractor may begin exploiting a more common, but lower ranking variety, switching entirely, or merely adding it to the list of varieties being exploited. Indeed, extractors report that during the height of fruiting season, they have the luxury of picking and choosing the more desirable shambo variety.

The spatial distribution of fruit types - of which little is known - has important implications for the local and regional manifestations of the scarcity induced switching response. If fruit types are geographically isolated, the switching response could be assumed to be more important for Iquitos based extractors than for rurally based extractors who may not have contact with many varieties. The distribution of fruit types can be expected to reflect the degree and manner in which the variation may be environmentally or genetically determined. Are fruit varieties reflective of genetically distinct, geographically isolated populations? Is there a substantial degree of genetic variation within populations? Does fruit type vary in response to environmental factors such as soil quality and moisture content, light availability, forest structure, and species composition? These questions remain largely unanswered due to the limited taxonomic, ecological, and biogeographical study of this very important and widespread palm (but see Balick 1988; Kahn and Mejia 1990; Kahn and De Granville 1992; Urrego Giraldo 1987).

My own limited observations pertaining to these questions were based mainly on local knowledge. There seemed to be a substantial amount of local variation of fruit quality, and informants did distinguish between more and less desirable types. One Bora man from Puca Urquillo reported that shambo seed collected from the poorly drained and densely packed *aguajal* does not produce shambo when planted in well-drained, more open home gardens, suggesting that environmental factors may be very important.

**Intensification:**

*Mauritia flexuosa* is a species which is found naturally in waterlogged depressions and swamps. It does not normally grow on upland (*altura*), unless as the result of intentional or unintentional human dispersal agents. In ten plots of upland primary forest I did not encounter a single individual. However, aguaje was present in every village I observed, and all villages were situated on *restinga* (levée) or upland. The individuals growing in the *huertos* (house gardens or orchards) of the villages are shorter, with greater diameter, but at least as productive as their cousins in the natural swamp habitat **(Table 9)**[13].

As has already been mentioned, fruits for marketing and consumption are selected for size and other qualities, as are seeds for planting. Kahn (1988) has also suggested that there may be selection for high fruit productivity. Fruits of the shorter village-grown trees are closer to the ground and are easily harvested by using a pole or by climbing a pole "ladder". Fruiting females need never be felled, while nonproductive males are actively felled to make

[13] According to Martin and Guichard (1979), wild *M. flexuosa* produces 2-8 racemes per tree. I counted 8 full inflorescences on a 14 m female, 5 inflorescences on a 6 m female, and 9 inflorescences on a 15 m male, all three on a levée (*restinga*) pasture. Descending the backslope of the *restinga*, the aguajal began. At the edge of the pasture and *aguajal* were two males, 24 m and 27 m, with 6 and 5 inflorescences, respectively, clearly taller, narrower and less productive than the individuals on higher, more open ground.

Table 9. Management of *Mauritia flexuosa* in Village Setting[1]

| | Trunked | | | | Acaulescent | | | Management[2] | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | M | F | ? | Total | >5m | <5m | Plant | Cull Males |
| **R. Ampiyacu** | | | | | | | | | |
| PEBAS | 8 | 2 | 6 | 0 | 10 | 5 | 5 | DIS[3] | NO |
| PUCA[4] (A. Churay) | 3 | 3 | 0 | 0 | 1 | 0 | 1 | YES | YES |
| PUCA (L. Guero) | 0 | 0 | 0 | 0 | 9 | 4 | 5 | YES | ? |
| PUCA (G. Vega) | 2 | 1 | 1 | 0 | 41 | 3 | 38 | YES | ? |
| PUCA (Main St.) | 12 | 5[5] | 5 | 2 | 8[6] | 2 | 6 | YES | ? |
| **Totals** | **25** | **8** | **15** | **2** | **69** | **14** | **55** | | |
| **Sex Ratio**[7] | | **.35** | **.65** | | | | | | |
| **R. Manití**[8] | | | | | | | | | |
| Santa Cecilia | 21 | 6 | 13 | 2 | 22 | 3 | 19 | DIS | ? |
| Recreo-lb (5 houses)[9] | 6 | 3 | 3 | 0 | 23 | 1 | 22 | ? | ? |
| Recreo-lb (2 houses) | 15 | 3 | 7 | 5 | 1[10] | 0 | 1 | ? | YES |
| Recreo-lb (1 house) | 11 | 3 | 5 | 3 | 39 | 28 | 11 | YES? | YES |
| Recreo-rb (1 house[11]) | 1 | 1 | 0 | 0 | 1 | 1 | 0 | NO | NO |
| R. Manití[12] | 14 | 4 | 7 | 3 | -- | -- | -- | ? | ? |
| **Totals** | **68** | **20** | **31** | **17** | **86** | **33** | **53** | | |
| **Sex Ratio** | | **.39** | **.61** | | | | | | |
| **Grand Total** | **93** | **28** | **46** | **19** | **155** | **47** | **108** | | |
| **Overall Sex Ratio** | | **.38** | **.62** | | | | | | |

Notes for Table 9:

1. Does not include agricultural fields and forest fallows, where planting and management of *M. flexuosa (aguaje)* also occurs.

2. Seed selection also occurs though systematic questioning on this topic was not carried out. It is believed that big seeds will produce trees with big fruits, but *shambo* seeds harvested from *aguajal* do not produce *shambos* (the preferred variety of *aguaje*) when planted in the home garden.

3. DIS=seeds discarded. Intent of planting unclear.

4. PUCA=Bora village of Puca Urquillo.

5. Four of these were without flowers, but identified as males by informant according to cap structure.

6. Seedlings less than 2 m not included.

7. Trunked individuals of unknown sex not included in total.

8. Lb=left bank; rb=right bank. All houses inhabited by Yaguas except that of the *teniente gobernador*.

9. *Restinga alta* (high levée), flooded in 1987, no pasture (right bank, which is pastured, had no *aguaje*).

10. Resident explains the near absence of juveniles as the result of two years of pasturing during which the cattle ate all of the new seedlings.

11. Residence of the *teniente gobernador* of Recreo, Ramirez Carbajal.

12. Observations were made from a boat in two locations between Recreo and river mouth. Acaulescent individuals were observed but accurate quantification could not be accomplished.

room for the females, and to produce the edible larvae *suri*. Aguaje merchants in the Belén barrio in Iquitos report that a considerable proportion of the fruit supply now comes from nearby *huertos*.

*Mauritia flexuosa* was included in the National Academy of Sciences (1975) list of underexploited plants of economic value and has been promoted as a potential new plantation and export crop (Balick 1979; Peters et al. 1989). Limited export of aguaje pulp to Japan as a novelty ice cream flavor was begun in 1975, but no longer continues (Peters et al. 1989:358). Aguaje has begun to be grown by the Instituto de Investigaciones de la Amazonia Peruana (IIAP) in experimental plots on upland near Iquitos, and it is reported to be increasingly cultivated in the Pucallpa region as well. Dourojeanni (1990:222) includes a photograph of an aguaje plantation of unknown location in his book, *Amazonia: Quehacer?* In the Tahuayo-Tamshiyacu region, the Amazon Conservation Fund (ACF), a non-profit grass roots conservation and development organization, is promoting increased planting and intensification of management of *M. flexuosa*, even integrating it with fish culture (Penn 1993; Bodmer et al. 1990).

The intensification/domestication process will likely continue in various settings, including locally managed home gardens and plantations of individual entrepeneurs as well as research institutions. Peters (1990) advocates the sustainable management of natural "plantation" species before active domestication, but high yielding plantations on already degraded lands could release the pressure on the wild *aguajales*, which are not only important for the fruit they produce, but also play an important role in the aquatic ecology of the flooded forest (Goulding 1980).

Other products of the aguaje palm could be utilized, such as the good quality oil (20% of fruit, dry wt.), and the starch of the pith of the trunk, which is identical to the sago palm starch, and can be harvested in the same manner (Pesce 1985). The intensification process may spur the development of and/or introduction of sustainable harvesting techniques such as the palm bicycle (Davis 1977), or even a New World equivalent to S.E. Asia's coconut harvesting monkey, the pig-tailed macaque, *Macacus nemestrina* (Azis, Liyanage, and Davis 1980), to replace the most recent introduction, the steel axe.

# CHAPTER 5. DISCUSSION AND CONCLUSIONS

It has been argued that locally coevolved social and ecological systems tend towards sustainability (Posey and Balée 1989; Toledo 1990; Norgaard 1981; 1988), whether or not the socio-system possesses a conservation ethic (Johnson 1989). The transformation of resource management systems with exposure to commercial markets, acculturation, and introduction of new technologies has been observed in many areas at the periphery of the world economy (Nietschmann 1973, 1979; Grossman 1981, 1984 Yost and Kelley 1983). In Amazonia, development of markets for forest products since the arrival of Europeans has often resulted in depredatory, unsustained cycles of extraction (Browder 1992).

All of the plants used by the indigenous peoples of the Ampiyacu Basin for the production of marketable handicrafts have a long history of "traditional" subsistence uses. Some have also had a significant history of extraction for markets (e.g. chambira), while others have not (e.g. tamshi). All have experienced a major surge in extractive pressure with the recent emergence of handicrafts markets, the progressive acculturation of the people, and the concurrent adoption of Western values and demands for the material products of the West. Some of the traditional management mechanisms, including tenure rules, which regulated resource use have been undermined (at least temporarily).

In a similar fashion, the *M. flexuosa* palm has been transformed from a tree which could alone sustainably feed, clothe, and shelter an entire culture such as the Warao (Heinen and Ruddle 1974) into a commodity which is destructively "mined" for a growing urban market.

But the story is not quite so simple. The comparison of multiple species reveals a range of susceptibility of individual species to extraction pressures. For example, the chambira palm, favored in disturbed environments, may survive repeated and frequent removal of leaves. At the other end of the spectrum are the widely dispersed, hemi-epiphytic, mature forest tamshi species, which may be killed upon extraction of their aerial roots, and are slow to regenerate if they do survive.

In addition, the historical and coevolutionary framework applied at a regional scale of analysis reveals interesting patterns of resilience and responsiveness of market-oriented extractors in the face of depletion and rapid change. Three responses identified are **extension** of the spatial dimensions of extraction, **switching** from less to more readily available species (or to another activity), and **intensification** of management of the species.

In theory, these responses somewhat mitigate or dampen the effects of market-induced overextraction. According to optimal foraging theory, switching reduces or entirely removes pressure on a wild population, and extension spreads out the pressure over a larger area, allowing populations to recover (Krebs 1977). Extension can be effective only when the land area which is providing the resource base is not conscripted in some way. There must be room to spread out without running into a juxtaposed neighbor who will compete for the same limited resource. In these cases, intensification is a feasible response, and may lead to incipient domestication. This theoretical model of demand driven coevolutionary change in the relations between plants and people is presented graphically in Figure 12.

All indications suggest these processes do not exist as a result of any inherent conservation ethic of local peoples, but rather as expedient allocation of labor and time for

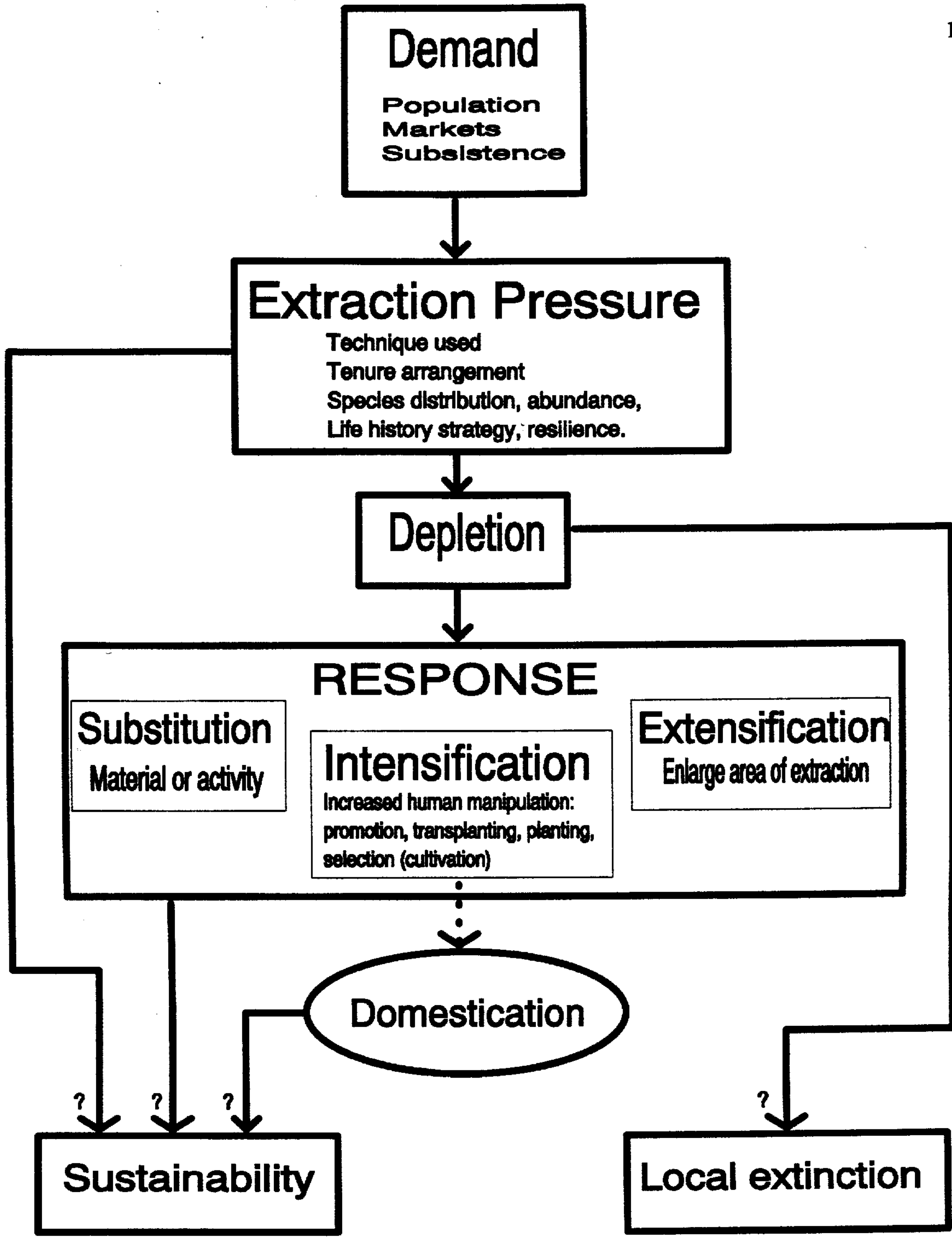


**Figure 12. Demand Model of Plant-Human Coevolution.**

favorable (if not optimal) returns on effort. The same "economic rationality" applies, whether the choice of action is to cut down an aguaje, plant a chambira, or go on a three week trek to hunt and collect tamshi.

The following discussion is a more detailed synthesis of these three processes of extension, switching, and intensification.

## EXTENSION

The most common, and typically the first response to increasing scarcity of, and/or demand for, the marketable forest species studied is the extension of the zone of extraction. The scale of analysis of this study, which focusses on decision-making of individuals with respect to individual species makes visible the variability of manifestations of the extension response. The importance of declining marginal returns was evident in all cases, but threshold distances were observed in the case of chambira and aguaje, beyond which extraction was obviously not an attractive option, whereas for the others no such obvious threshold existed. In the case of the chambira palm, this threshold was the forest fallow-primary forest "boundary" (normally about 2 km from settlement), beyond which the species was found at very low density and only in the undesirable spiny-trunked adult form. For aguaje, the threshold distance is determined by the perishability of its fruit, hence influenced by availability, speed, and quality of transportation, as well as the distribution and density of stands in relation to navigable waterways.

Extensification is often recognized as an important adaptation of rain forest peoples, though referred to in various other terms. Dispersed settlement, trekking (extended foraging trips away from home, [Werner 1983]), and the extreme mobility of individuals and groups are often viewed as adaptations to the wide dispersal and relative scarcity of food items (mainly protein) in rainforest environments (Steward 1948)[1]. While recent criticism has demonstrated that it may be naive to rely on single factors such as protein availability or soil fertility to explain complex cultural characteristics (e.g. Beckerman 1979), the importance of extensification in the Amazon cannot be ignored.

The bulk of Amazonian cultural ecological research which addresses extensification focuses on subsistence-oriented hunting, fishing, and gathering, and horticultural activities. This study demonstrates that the process is also important in the context of market-oriented extraction. In every case presented here, depletion (or scarcity relative to demand) resulted in the extension of the dimensions of extraction, whether in the context of daily village based gathering or long distance trekking.

The Bora and Witoto observed by Whiffen (1915:40-42) in the Putumayo region around the turn of the century fit the familiar description of indigenous populations in interfluvial uplands (Steward 1948; Meggers 1971): sparsely populated, dispersed, and highly mobile. An extended family unit, or "tribe", with about 60 individuals inhabited a large round house (*maloka*) for 2-3 years after which the house was burned and the group moved on. Whiffen (1915:42) explains this frequent movement and the location of houses away from the rivers as strategies to avoid detection by enemies; the *maloka* would be abandoned

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[1] In addition to extensification, population control by means of warfare or cultural limitations on fertility have been described as adaptations to the scarcity of resources (e.g. Chagnon 1968).

periodically "even if the food supply [was] not exhausted".

Food availability, however, may also have been an important reason for moving, as Whiffen's (1915:110) discussion of hunting practices later suggests: "When game is plentiful they will kill and eat, kill recklessly, and eat to repletion... game in the vicinity of any human settlement tends to disappear, the hunter must go farther and farther afield"[2]. In addition to their space in the *maloka*, many families also had smaller private homes in "the bush" up to two days away (1915:48), which allowed them to more easily exploit widely dispersed and faraway resources.

The descendants of these Putumayo peoples who dwell in the Ampiyacu Basin are more sedentary and tend to inhabit larger and more nucleated settlements along the river's edge and not in the interior of the forest. Despite these differences, there are many similarities in the way the geographical dimensions of resource extraction are expanded.

First, the same phenomenon of venturing further from settlement in response to depletion is observed, for handicrafts species as well as food items. A parallel to the remote "second home" is also found. Informants often spoke of individually maintained *tambos*, which are small houses constructed deep in the forest for the purpose of providing shelter to the hunter/extractor who must venture far away from home. When declining marginal yields reach a point where the habitation site might have been moved in previous times, the present system of state-recognized, fixed community boundaries elicits a different type of extension response, that is, a form of trekking (Werner 1983), whereby extended extraction excursions

[2] The Modern day analog to this process has been described as the "empty forest" syndrome (Redford 1992).

are made to more remote and less depleted areas to encounter meat and plant materials. In some cases, *tambos* were used as base camps during these excursions.

Despite these fixed community boundaries, the movement of the community is not unheard of, though certainly less common. Since the publication of Paredes' study in 1979, the communities of Nuevo Perú and Esperanza have arisen (see **Table 1**), the former founded by a family which broke off from Colonia, apparently mainly due to disagreements between rival family groups. The current Nuevo Perú residents mention the relative abundance of resources as positive attributes of their new home. During my visit to the region, the residents of Porvenir were in the process of relocating their community to the headwaters of the Ampiyacu River above Tierra Firme, where resources are abundant. A small number of people remain at the former site, shown in figure 1, but they also intend to leave soon for the new site, which has been given the name Nuevo Porvenir. Sandwiched between Puca Urquillo and Estirón, Porvenir was characterized by a shortage of land; unlike the other communities which have access to a substantial amount of forest in the "interior" lands away from river's edge (*el centro*), it was almost entirely pinched off by its neighbors. It is interesting to note that problems of depletion of handicraft raw materials species were least severe, if at all visible, in the environs of Izango, a village with few inhabitants (33) and more dispersed settlement (Gasché 1982).

## SWITCHING

The switching response occurred at two distinct levels. When perceived marginal returns on expended effort for acquiring a desired species became too low, less desirable, but more readily available plants with similar uses replaced, or were harvested in conjunction with the preferred species. This switching, or widening of extractive species choice most often occurred among or between plants of closely related taxons (*Astrocaryum, Mauritia, Ischnosiphon*). However, in the case of bombonaje, a palm tree (*Oenocarpus spp.*) could also be substituted for herbaceous members of the Marantaceae family. Likewise, the common name tamshi referred to species of two distinct families (Araceae and Cyclanthaceae) and several genera, all used for the aerial root fiber.

The second type of switching response occurred when the activity itself was discontinued, with labor redirected elsewhere. This phenomenon was most important in the case of the widely dispersed, slow growing, mature forest tamshi species, which were easily depleted within several hours walk of villages. When the production of marketable baskets was no longer deemed worthwhile due to the increasing costs of traveling farther and farther to collect tamshi, the extractive activity was discontinued altogether. The time saved from discontinuing this activity could then be used for other activities, including, but not limited to increasing or initiating the production of other handicrafts products.

Though I describe the harvest of forest plants for commercial rather than subsistence purposes, the switching pattern observed here is qualitatively consistent with optimal diet breadth models developed in biology and applied to human hunter and gatherers (Smith

1983), which suggests that the theory may have wider applicability than heretofore recognized.

It has been suggested that market involvement leads to specialization, and thus increasing vulnerability and dependance on outside forces as fewer activities become more and more attractive in relation to the others in a peasant's suite of economic opportunities (Toledo 1990). This may be so, but does not necessarily mean that the discontinued activities have been permanently abandoned. For example, if prices paid for tamshi baskets increase, or if wild plant populations within reasonable distance from habitations rebound sufficiently, people might once again engage in basket-making.

Such a re-emergence of favorable market conditions has occurred in the case of chambira, which has had a long history of market involvement, though this involvement has not been at a uniform level over time and space. A robust market throughout Amazonia in raw fiber during the 1940s and 50s has since declined, but the emergence of new market outlets for handicrafts in the last 15 years (e.g. ANTISUYO, EPPA) has resulted in a dramatic increase in extraction of chambira fiber in the Ampiyacu Basin.

The commercial production of "tagua" palm (*Phytelephas spp.*) nuts (vegetable ivory) in Ecuador has undergone similar fluctuations. In the first half of this century, tagua was a very important source of material for making buttons, but with the advent of plastic buttons, demand for tagua almost disappeared. In the past few years, however, several button factories have been established (Hidalgo 1992; Ziffer 1992) to cash in on the new demand among Westerners for "sustainably harvested" products of the rain forest, what might be called the "rain forest crunch effect".

## INTENSIFICATION

Again, as with the extension and switching responses, the multiple species approach of this research has revealed interesting contrasts with respect to intensification. Attempts at intensification of management (i.e. increasing level of human manipulation beyond simple harvest) were observed for all species studied, and included thinning and weeding (bombonaje), transplanting and/or planting (tamshi, chambira, aguaje, bombonaje?), and seed selection (aguaje). However, the frequency of these activities and their relative success varied between species. For example, transplantation of the slow-growing hemi-epiphytic tamshis (*Heteropsis spp., Asplundia spp.*) was rare, and no one from the Ampiyacu reported a successful transplantation. On the other hand, the palms (*Astrocaryum chambira, Mauritia flexuosa*, and *Oenocarpus spp.*) were most commonly and most intensively manipulated.

Boserup (1965; 1970), Brookfield (1972), Grigg (1979) and others have argued that demand- or population-driven **agricultural** intensification can increase production locally and raise the carrying capacity of the land. The process of intensification of management of single species as presented here is also driven by demand (or scarcity), mainly to supply markets, and could likewise increase production and carrying capacity for that species, or at least increase the convenience of harvest. If the desired plant products begin to be acquired primarily from cultivated individuals, the extractive pressure on wild populations should decrease.

While I acquired no physical or genetic evidence of domestication, I assume that intensification may spur the domestication process. I define domestication as "the evolutionary process whereby humans modify, either intentionally or unintentionally, the genetic makeup of a population of plants or animals" (from Blumler and Byrne 1991:23). As Harlan (1975:63) observed, "there will be found all degrees of plant and animal associations with man and a range of morphological differentiations from forms identical to wild races to fully domesticated races." A fully domesticated species is completely dependant on humans for survival. The term "semi-domesticated" may refer to a plant at any stage of modification short of full domestication, though it is most often used to describe those "wild" species which are also cultivated.

Any level of manipulation may influence the genetic makeup of a population, though it may not be intentional (Rindos 1984) or discernible. Populations of both the chambira and aguaje palms have likely undergone some genetic modification under human influence. At Araracuara, Colombia, on the Caquetá River, *Astrocaryum* and *Mauritia* pollen was found in an archaeological context in association with crops such as maize and sweet potatoes, the latter below a strata $C^{14}$-dated at 4645 BP (Herrera et al. 1992: Fig. 8), suggesting that the palms were part of a very early agroforestry system.

The occurrence of chambira at higher density in association with humans and its cultivation by *ribereños* and indigenous people for fruit (Salick 1989; Padoch and deJong 1991) are further indications that human influence has been important in the past. However, selection pressures on chambira in the context of fiber harvest of juveniles may be very different than for fruit harvest of adults. In the case of the former, individuals most able to withstand repeated removal of leaf shoots may be selected. A long time may be necessary to fix such traits in the population, however, especially if heavy extraction pressures prevent surviving individuals from reaching sexual maturity.

In the case of aguaje, the level of human manipulation has been perhaps even greater. Throughout the Peruvian Amazon region today, the palm grows outside its "natural" swamp habitat in open upland environments in association with humans, mainly in village settings. According to Anderson's (1952) "dump heap" hypothesis, the campsite or village is a prime setting for domestication to take place. Distinct varieties of a species, otherwise isolated, repeatedly come into contact here with the possibility for introgression and hybridization (Stebbins 1985). Exceptional individuals or mutants which may occasionally spring up in this environment may then easily be recognized and selected by humans, with potential for rapid modifications to take place. The home garden is also a place of intentional experimentation with the cultivation of wild plants and cultivars, some of which are introductions through trade from other locations (Kimber 1979). As has been true for the date, acera, and oil palms (Clement 1992), such hybridization and introgression may have been an important process in the evolution of aguaje.

The palm is also grown in various plantation, agroforestry and plantation settings. In addition to the Yagua, Bora, Witoto, Ocaina and *ribereño* people whom I observed, indigenous groups which cultivate *Mauritia flexuosa* include the Amuesha and Aguaruna of Peru (Salick 1989), the Napo Quichua of Ecuador, the Kayapó of Brazil (Posey 1985), and the Karinya of the Venezuelan llanos (Denevan and Schwerin 1978). The considerable variation in morphology and productivity, the existence of numerous distinguishable fruit types, and the intentional selection of aguaje seeds (see also Kahn 1988; Penn 1993) provide further indication that the domestication process is underway.

While the diversity reducing effects of human agency are currently well recognized both in academia (Wilson 1989) and the popular media, the human role in **enhancing** diversity is seldom recognized. In time, if the domestication process set in motion through demand-induced intensification continues, the development of new races could actually enhance diversity while relieving pressure on the wild crop relatives (but see below). Plant domestication has typically been viewed as something that occurred only in the distant past, to be understood by studying morphological changes in plant parts preserved in archaeological settings, or by genetic and phytogeographic analysis of a crop and its wild relatives. With a few notable exceptions (Nabhan et al 1991; Clement 1990; 1988; Nabhan and Rea 1987; Kimber 1987; Bye 1979; Johannessen 1966a; 1966b; Brücher 1989), currently ongoing plant domestication has been ignored. De Candolle (1886) observed long ago that we have completely domesticated just a handful of species, and many more are found at various stages along the continuum of domestication.

To illustrate: According to Vasquez and Gentry (1989: Table 1), out of 193 species of fruit consumed in and around Iquitos, at least 54 are cultivated and 19 come from both wild and cultivated sources. Striking as these numbers are, the proportion of semi-domesticates is surely an underestimate, as *Astrocaryum chambira, Mauritia flexuosa, and Oenocarpus mapora* are all listed as exclusively wild-harvested. Palms, in particular, make up an important component of these fruiting incipient domesticates, as they do throughout the Amazon Basin (D. Johnson 1983).

This study illustrates the potential for investigating these important processes as they continue in the modern world. Though the highest level of agricultural biodiversity may be found in settings of longstanding traditional subsistence oriented resource management (Oldfield and Alcorn 1991), the potential for evolution of new crops certainly exists in the context of extraction and market involvement[3]. I have shown here that demand generated by market opportunities has resulted in scarcity of particular resources, and subsequent intensification which, if maintained, could lead to genetic differentiation.

The same market impetus for intensification resulted in the domestication of a desert plant, the Devil's claw (*Proboscidea parviflora* var. *nohokamiana)* in the U.S.-Mexico border region (Nabhan and Rea 1987), perhaps the only convincing documented case of *in situ* domestication in recent times. In Amazonia, market-induced cultivation of many "wild" species is now ongoing. Among the most notable are *guaraná* (*Paullinia cupana*), which is grown in plantations for its seeds, and supplies a large and growing soft drink market (Homma 1989), and Brazil nut (*Bertholletia excelsa*), the main complement to rubber in Brazil's extraction reserves, which is now also grown in plantation inside as well as outside of Brazil (Mori 1992). Rubber and Cinchona are examples of ongoing *ex citu* domestication, wild Amazonian species removed long ago from their natural habitat through market impetus to cultivate, select, and breed in foreign lands.

This potential for human plant coadaptation throws a provocative, though cautious, caveat into the scenario of market-induced depletion as discussed above. The idea that

[3] Zimmerer (1992) has observed that among Peruvian Andean peasants, the wealthiest and most well connected into the commercial market system are the ones who strive to maintain native cultivar diversity. This observation runs counter to the common view of modernization as a threat to biodiversity and "traditions."

penetration of market economics into the traditional setting could actually induce an increase in biodiversity, even if small, is counterintuitive. First, we must make sure to distinguish between depletion and genetic erosion or extinction. In some cases depletion may lead to the protection and subsequent domestication of a plant as was the case for the Devil's claw.

It is also possible, however, that a cultivar is created at the same time its wild progenitor is driven to local extinction. It appears that this may in fact be happening in the case of *Chamaedorea* palms, which have been extinguished from the wild in some parts of Mexico and Central America due to collection of seeds and adults for establishment of cultivated fields (Omaya 1992).

Intensification and domestication are not only natural responses to demand for wild-harvested rainforest plants by small-scale indigenous extractors of Amazonia; the process has gone on around the world among diverse societies for a long time, and continues today. Indeed, nearly every one of today's domesticated plants originated from a wild precursor variety or species. The majority of these precursors must have initially been recognized as valuable for some reason and "extracted" from the wild. In addition to markets, the source of demand for the species may have derived from its value as food, medicine, building material, ornament or from a religious or spiritual importance. Depletion or perceived scarcity in relation to level of demand is also likely to have been important in many of the cases. After all, if a desired plant is abundantly available near a person's house, why would they bother to invest the extra effort to cultivate it?

This model also applies to the high-tech Western world, where modern plant breeders and genetic engineers have followed the lead of the ravenous British "plant hunters" of the

19th century as they tinker with the products of nature to satisfy the demands of the consumer society. At the same time, farmers in central Wisconsin have recently responded to high prices and declining wild populations of Ginseng to set up intensive cultivation of this "magical" plant. Again, lest I give the impression that Laissez-faire capitalist forces are inherently good for biodiversity, it should be pointed out that these processes can reduce biodiversity when only a small fraction of the plant's initial germplasm is selected, or if extractive pressures persist.

In attempts to satisfy increasing demands for resources by a rapidly increasing world population with increasing per capita consumption, one after another of the global "commons" has been closed or regulated, with intensification an inevitable response to increasing demand and depletion in the wild. In addition to increasing the productivity of existing domesticates we are bringing more into the realm of the domesticated. These newcomers include entire forests which are cultivated by Western lumber companies in monotypic stands, just like a corn or wheat crop, as well as such diverse creatures as shellfish, shrimp, trout, salmon, iguanas, pacas, and venomous spiders.

The process is not unidirectional, however. If demand for a species for some reason declines or evaporates, disintensification is the result. The fate of the species or variety then depends on the level of its dependance on humans. If it is a fully domesticated cultivar, for example, that is no longer planted, it may perish. If it has retained its ability to survive without humans, which a large number of cultivated plants do, it may lose some of the traits it acquired during the domestication process as it becomes "feral". A good example of this may be the "wild" populations of "ramon" trees (*Brosimum alicastrum*) at Tikal, which show evidence of domestication by the former Mayan inhabitants (Peters 1983).

## CONCLUSION

Ranchers, loggers, miners, settlers: These are widely considered to be the main "destroyers of the Amazon" (Hecht and Cockburn 1989). The "extractors", on the other hand, have been looked at to provide a sustainable development alternative to wholesale clearing of forests for cattle ranches or frontier colonization, for example. Recently, cautionary voices have been raised in an attempt to temper the optimism for the potential of extraction of non-timber forest products (e.g. Browder 1992), yet it continues to be promoted as a viable alternative to these prevailing destructive land use practices (e.g. Allegretti 1992). The results of this research suggest such caution is warranted, but two things must be recognized.

First, extraction will continue to be an important part of life in Amazonia in the foreseeable future. Its importance as an economic activity may ebb and flow as it has in the past (Coomes 1991), but it's here to stay. If all extractive reserves were eliminated and all international markets were to suddenly disappear, informal commercial extraction would nonetheless take place to supply regional markets such as Iquitos, Manaus, and Belém with fruits, fibers, medicines, resins, latexes, and poisons. In addition, wild plants will continue to be harvested for subsistence.

The second thing I recognize is that despite all the problems of extraction of forest products in Amazonia, the resultant degradation is relatively benign when compared with other land use practices such as wholesale conversion of forest for cattle ranching and frontier agricultural settlement, and gold mining. Where setting aside large blocks of land in parks and preserves is not feasible, responsible extraction of some appropriate species in association with other activities such as agroforestry is one of the only promising strategies for gaining a livelihood in Amazonia with relatively little destructive impact on the environment.

Most of the species analyzed here are not being reduced to numbers that may threaten their survival, though local genetic variants may be threatened, and the ability to supply a market demand may be undermined. In most cases, selected removal of desired plants does not severely alter the *functioning* of the ecosystem (but see Terborgh 1986). Aboriginal peoples have for centuries modified the species composition of their forests to suit their needs, actually enhancing the ability of the forest to sustain them without necessarily reducing biodiversity (Gómez-Pompa and Kaus 1990; Alcorn 1984; 1990; Posey 1983)[4]. Indeed, any definition of *natural* forest which excludes or ignores the presence of humans is problematic.

Also, this research has shown that expedient extractors respond to relative scarcity by extending the spatial dimensions of extraction, switching to a substitute plant or activity, or intensifying management -- processes which may mitigate depletion.

It must not be forgotten, however, that these mitigating effects may in fact be overwhelmed by stronger forces. The *modus operandi* of economic rationality is blind to ecological integrity. It is plausible that the price and demand for a species might become so high as to induce extractors to harvest every last individual. Even large populations of abundant, fast-growing species may be decimated, such as occurred in the case of bamboos

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[4] While the overall number of species may not be reduced, it is possible that certain species such as slow growing mature forest types may be displaced by more vigorous successional type vegetation which favors disturbed sites.

(*Otatea sp.*) in northern Mexico (Iltis 1989). Likewise, as this research also illustrates, the life history characteristics, ecological requirements, methods of extraction, and many other factors determine how a species is affected by extraction pressures and whether or not it may recover, assuming extractive pressure is relieved.

For example, the weedy qualities of the chambira palm and the fact that its fiber may be extracted without killing the plant explain why it is still abundant after at least 3 centuries of commercialization of its fiber. Ironically, even under heavy extractive pressures, this palm is still found in greatest density in human disturbed secondary forest habitat. Both the aguaje palm and some of the tamshi and huambé species are destructively harvested. Aguaje swamp forests may become locally depleted, but the species is unlikely to be threatened throughout its entire enormous range. Furthermore, due to its affinity for humanized landscapes and its suitability to cultivation, its range has been **extended** ecologically into managed upland settings, and geographically over large areas (Heinen and Ruddle 1974; Kahn and de Granville 1992:11,109).

In contrast, ááhyau, a tamshi species (*Heteropsis sp. nov.* Croat) occurs in naturally low abundance, is not suitable for intensification/domestication, and probably has a very small range. It is conceivable that this yet to be named species could be extirpated, and had I not collected the plant, no one would have ever noticed its absence. Destructive harvest of such species as balata latex (*Manilkara bidentata* and other spp.) and pashaco bark tannins (*Parkia verutina*) in the 1920's resulted in the local depletion of these widely dispersed species from upland forest in a matter of a few short years (Coomes 1992:138-139). Elsewhere, outside of Amazonia, other plants, such as desert cacti, are also highly susceptible to extractive pressures, and actual extinctions have resulted at least in part from over-collection in the past (Nabhan et al. 1991).

There are literally thousands of individual species in the Amazon Basin which are actually or potentially extracted for commercial market, many of which are not yet known to science (Myers 1983; Gentry 1992). As for the effect of extractive pressures on plant populations, very little is known, except for a few species such as Brazil nut, *Bertholletia excelsa* (Mori and Prance 1990) and babassu palm, *Orbignya phalerata* (Anderson 1990). If extraction is to make the positive contribution to sustainable development that many believe or hope it will, such attention to the ecology and dynamics of currently extracted species will be necessary. It is not good enough simply to call for the commoditization of rain forest species; something must be known of the potential of those species to withstand the sort of pressure that supplying a commercial market entails. I hope that this study has in some small way contributed to such an understanding.

# APPENDIX 1: SPECIES USED FOR HANDICRAFTS IN THE AMPIYACU BASIN

## Appendix 1a: Alphabetical List of Handicrafts Species (See Appendix 1b for detail).

*Aspidosperma spp.* (**Apocynaceae**)
*Asplundia spp.* (**Cyclanthaceae**)
*Astrocaryum chambira* Burret (**Arecaceae**)
*Astrocaryum huicungo* Burret (**Arecaceae**)
*Bactris gasipaes* H.B.K. (**Arecaceae**)
*Bixa orellana* L. (**Bixacaceae**)
*Bixa sp.* (**Bixacaceae**)
*Brosimum rubescens* Taubert (**Moraceae**)
*Byrsonima poeppigiana* Adv. Juss. (**Malpighiaceae**)
*Canna warzviciana* A. Dietr. (**Cannaceae**)
*Carapa guianensis* Aubl. (**Meliaceae**)
*Cayaponia kathematophora* RE Schultes ex char. (**Cucurbitaceae**)
*Cedrela hissilits* Willd. (**Meliaceae**)
*Cedrela odorăta* L. (**Meliaceae**)
*Ceiba pentandra* (L.) Gaertn. (**Bombacaceae**)
*Coutarea hexandra* Schum. (**Rubiaceae**)
*Curcuma longa* L. (**Zingiberaceae**)
*Desmoncus spp.* (**Arecaceae**)
*Eschweilera spp.* (**Lecythidaceae**)
*Euterpe precatoria* Mart. (**Arecaceae**)
*Ficus insipida* Willd. (**Moraceae**)
*Ficus maxima* P. Miller (**Moraceae**)
*Genipa americana* L. (**Rubiaceae**)
*Gossypium sp.* (**Malvaceae**)
*Heteropsis sp. nov.* Croat (**Araceae**)
*Heteropsis flexuosa* (HBK) Bunting (**Araceae**)
*Heteropsis spruciana* Schott (**Araceae**)
*Himatanthus sucuuba* (Spruce) Woods
*Ischnosiphon cf. arouma* (Aublet) Koernicke
*Ischnosiphon arouma* (Aublet) Koernicke (**Marantaceae**)
*Ischnosiphon obliquus* (Ridge) Koernicke (**Marantaceae**)
*Ischnosiphon puberulus* Loesnener (**Marantaceae**)
*Iriartea sp.* (**Arecaceae**)
*Iriartella setiqera* (Mart.) H. Wendl. (**Arecaceae**)
*Iryanthera tricornis* Ducke. (**Myristicaceae**)
*Jessenia bataua* (Mart.) Burret (**Arecaceae**)
*Lasiacis sorghoidea* (Desv.) Hitchc. & Chase (**Poaceae**)
*Maximiliana venatorum* (Poepp.) Wendl. (**Arecaceae**)
*Miconia spp.* (**Melastomataceae**)

*Mucuna huberi* Ducke (**Fabaceae**)
*Ochroma pyramidale* (**Bombacaceae**)
*Ochroma lagopus* Sw. (**Bombacaceae**)
*Oenocarpus mapora* Karsten (**Arecaceae**)
*Oenocarpus minor* Mart. (**Arecaceae**)
*Oenocarpus multicaulis* Spruce (**Arecaceae**)
*Olmedia spp.* (**Moraceae**)
*Olyra cf. latifolia* L.
*Ormosia spp.* (**Fabaceae**)
*Orthoclada laxa* (L. Rich.) Beav. (**Poaceae**)
*Palicourea triphylla* D.C. (**Rubiaceae**)
*Pariana sp.* (**Poaceae**)
*Parkia spp.* (**Mimosaceae**)
*Passiflora sp.* (**Passifloraceae**)
*Phaseolus sp.* (**Leguminosae**)
*Philodendron spp.* (**Araceae**)
*Picramnia sp.* (**Bignoniaceae**)
*Pithocellobium lactum.* (R. & P.) Benth. (**Mimosaceae**)
*Pollalesta discolor* (HBK) Aristeguieta (**Asteraceae**)
*Protium spp.* (**Bursuraceae**)
*Rauvolfia macrantha* K. Schum. ex Mgf. (**Apocynaceae**)
*Realmia alpinia* (Rottb.) Maas (**Zingiberaceae**)
*Scheelea sp.* (**Arecaceae**)
*Selysia prunifera* (Poepp. and Endl.) Cogn. (**Cucurbitaceae**)
*Simira tinctoria* (H.B.K.) K. Schum. (**Rubiaceae**)
*Siparuna guianensis* Aubl. (**Moniniaceae**)
*Sorocea muriculata* Miq. (**Moraceae**)
*Stizophyllum riparium* (H.B.K.) Sandw. (**Bignoniaceae**)
*Strychnos guianensis* (Aubl.) Mart. (**Loganaceae**)
*Uncaria guianensis* (Aubl.) J. Gmelin (**Rubiaceae**)
*Vanilla sp.* (**Orchidaceae**)

**Appendix 1b. Descriptions and Uses.**

**Collections:**

| | |
|---|---|
| ^ | J. McCann, University of Wisconsin Herbarium (WIS) |
| ^^ | J. McCann, (WIS) and Museo de Historia Natural, Universidad de San Marcos, Lima (USM) |
| + | P. Salaun and J. McCann, (USM) |
| ++ | P. Salaun and J. McCann, (WIS) and (USM) |
| * | J. Treacy and J. Alcorn (WIS) |
| ** | J. Treacy and J. Alcorn, (WIS) and Field Museum of Natural History, Chicago (F) |
| ~ | S. Flores Paitán (F) |

Collections by J. McCann and P. Salaun were made between August and December 1990 throughout the Ampiyacu-Yaguasyacu Basin. Determinations that have been made by taxonomists are specified (WA=William Alverson, HK=Helen Kennedy, AG=Alwyn Gentry, HI=Hugh Iltis, TC=Thomas Croat, EJ=Emmet Judziewicz). Others have been tentatively made by J. McCann and Herbarium staff pending specialist confirmation. Parentheses (surrounding genus and species or species name only) indicate uncertainty in identification or a correlation of common names with lists compiled by Vasquez (1989), Villarejo (1979), Denevan and Treacy (1987), and Flores Paitán (1987). Collections by J. Treacy and J. Alcorn, (July-November 1981) and S. Flores Paitan (1981-1983) were made mainly in Brillo Nuevo in association with an interdisciplinary study of Bora forest fallow management (Denevan and Padoch, eds. 1987). Common names, both indigenous (B=Bora, W=Witoto, O=Ocaina) and Spanish are listed immediately following the scientific names. Additional uses of plants for purposes other than handicrafts production are indicated by enclosure in parentheses (), and uses not necessarily observed or reported by residents of the Ampiyacu but known from the Iquitos region are also included (with source), distinguished by brackets []. This list is as complete as possible but there is no doubt that many species are not included. Plants are grouped by family, in alphabetical order.

# PLANTS:

## APOCYNACEAE

(*Aspidosperma spp.*): remo caspi; canoe paddles, [lumber (Vasquez 1989:13; Villarejo 1988:106)].

(*Himatanthus sucuuba* (Spruce) Woods): bellaco caspi; tree, forest fallow; stem or branch for blow-gun ("pucuna"); [latex poultices for hernia and lower back pain; bark for gastric ulcer treatment (Vasquez 1989: 75)].

*Rauvolfia macrantha* K. Schum. ex Mgf. (527**): mutsíjkeu (B); forest fallow; leaves mixed with *Palicourea triphylla* D.C. for black dye and body paint (Denevan and Treacy 1987: table 2-IV).

## ARACEAE

*Heteropsis flexuosa* (HBK) Bunting (40+,31+ Det. TC): arico (B), sonoó (O), tamshi (tamishe) legitimo; hemi-epiphyte, mature forest; aerial roots for basketry and fastening, including house construction[1].

*Heteropsis flexuosa* (HBK) Bunting (117^^ Det. TC): tamshi (tamishe) tablacho ancho; hemi-epiphyte, mature forest; aerial roots for basketry and fastening, including house construction.

*Heteropsis (spruciana* Schott) (80^^): mihiché (B), tamshi (tamishe) tablacho, tamshi negro; hemi-epiphyte, mature forest; aerial roots for basketry and fastening, including house construction.

*Heteropsis sp. nov.* Croat (93^^ Det. TC): ááhyau (B), tamshi (tamishe); hemi-epiphyte, mature forest; aerial root fiber in house construction.

*Philodendron sp.* (89^^, 133^): huambé; hemi-epiphyte, mature forest; aerial roots for basketry and fastening, bark of aerial roots as wrapping for blowguns (pucuna); (leaf extract to remove penetrating insect larvae from skin); [aerial root extract for toothache remedy (Chota I. 1990, personal communication)].

*Philodendron sp.* (126^^, 132^): huambé macho, corona del neron; hemi-epiphyte; aerial roots for basketry and fastening, bark of aerial roots as wrapping for blowguns (pucuna).

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[1] It is also reported that fibers of tamshi (*Heteropsis sp.*, of unknown species) are used to prepare a treatment which prevents premature births.

## ARECACEAE

*Astrocaryum chambira* Burret (56^): niijihe (B), chambira; fiber of apical meristem (palm heart) pinnae for hammocks, jicras (bags), necklaces, etc., midrib ("bone") of pinnae for baskets, dried fruit for blow gun poison and/or dart-cotton container, (edible fruit, fibers of mature leaf for fishing lines, nets, traps, etc.); [roots--in mixture with roots of *Euterpe precatoria*--for treatment of diarrhea and fever (Chota I 1990, pers. comm.)].

*Astrocaryum huicungo* Burret (38~): dsúhsába (B), huicungo; whole pinnae for weaving hats and fans (abanicos), (also edible fruit, apical meristem; trunks as house posts; [roots, combined with *Euterpe precatoria* for diarrhea and fever remedy (Chota I. 1990, personal communication)].

*Bactris gasipaes* H.B.K.: méénе (B), pijuayo, pejibaye, peach palm; leaf for green colorant--sky blue when mixed with extract of fruit of *Realmia alpinia*--for painting bark cloth (llanchama) and balsa wood masks (*Ochroma pyramidale*); (also edible fruit).

*Desmoncus spp.* (75^^): stem for tamshi basket borders (and for carrying cord and general tying purposes); [used in small furniture manufacturing industry in Iquitos (Padoch 1987[2]; Kahn 1992: 156)], very much like the stems of rattan (*Calamus spp.*), its Asiatic ecological counterpart.

*Euterpe precatoria* Mart. (615**): tóóllíujɨ (B), huasai, chonta, palmito; single stemmed small palm, forest fallows; split raquis for blow-gun darts; bark fibers used in weaving of handicrafts of unspecified nature (Denevan and Treacy 1987: table 2-IV)[3]; (terminal bud, "palm heart", edible, with Iquitos-based commercial market; split trunk for interior wall construction ["rifas"]); [fruit for soft drink (Vasquez 1989: 64)].

*Iriartea sp.* (576*): táataco iíwajkyo, cashapona[4]; seeds for necklaces; (also trunk split into slats for house floors and walls, and as the base for fashioning roof thatch sections [crisnejas]).

(*Iriartella setiqera* (Mart.) H. Wendl.): ponilla; stem for blowgun barrel, [house wall construction (Vasquez 1989: 85)].

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[2] Identified as *Desmoncus prunifer*, but includes no voucher.

[3] Not specified, but it is probably the bark of the young stem used for weaving baskets in the manner of *Oenocarpus spp.*.

[4] *Socratea exorrhiza* (Mart.) H. Wendl.: huacrapona; probably also used for similar purposes.

*Jessenia bataua* (Mart.) Burret: ungurahui; large, single stemmed palm, poorly drained soils; young rachis covering as substitute for "black bombonaje" (*Oenocarpus*) for making "shiruy" baskets; (leaves as temporary carrying baskets; fruit edible); [fruit for soft drinks and ice cream flavoring in Iquitos; leaves for thatching, house walls, chicken coops; stem for house construction; "suri" (*Coleoptera* larvae) from stem; ripe fruit mesocarp yields high quality oil (very similar to olive oil) used in cooking, as hair tonic, laxative, treatment of tuberculosis, cough, asthma, and other respiratory ailments; leaf sheath spines as blow-gun darts; wood for arrow points (Balick 1972; Vasquez 1989: 89)].

(*Maximiliana venatorum* (Poepp.) Wendl.): inayuga; leaf vein for blow-gun dart; (leaf ash for distillation of salt [sal del monte]).

*Oenocarpus mapora* Karsten (108^, 39+, 175**, 340**): chiicyorahiiba (B), bacabilla, cinamillo, bombonaje negro, ungurahui chico; multistemmed medium-sized (6-12m) palm, swiddens and fallows; outer covering of young stems (raquis) in association with other "bombonaje" species (*Ischnosiphon*) for basketry (mainly for color contrast in "shiruy" baskets, but also lamp shades, and yuca (*Manihot esculenta*) meal strainers; crushed stem for brown or white dye (Denevan and Treacy 1987: table 2-IV); (stem fiber for bird trap; fruit edible); [apical meristem (palm heart) edible; leaves for roof thatch; split stems for house walls (Vasquez 1989:115)].

(*Oenocarpus minor* Mart.): bacabilla, cinamillo; multistemmed medium-sized (6-12m) palm, swiddens and fallows; young rachis covering for baskets, lamp shades, and strainers; (also edible fruit, apical meristem, leaves for roof thatch, split stems for house walls [Vasquez 1989:82,115]).

(*Oenocarpus multicaulis* Spruce): bacaba, cinamillo; known to be used as the two previous species but not verified by voucher specimen from the Ampiyacu Basin.

*Scheelea sp.*: shapaja; seeds for necklaces; leaves for dart quiver; (seeds edible; seeds used to make pipes, or "cashimbo," and maracas).

## ASTERACEAE

*Pollalesta discolor* (HBK) Aristeguieta (57~): dyéhpíyihe (B), ocuera negra, yanavara; tree, old forest fallows; for use in handicrafts of unspecified nature (Flores Paitán 1987: table 4-1); [also round wood for house poles (Vasquez 1989: 132)].

## BIGNONIACEAE

*Arrabidea chica* (H. & B.) Verl. (47++, 63^^, 468**): cúúrihyuuho (cúríjkyeúúho, in Denevan and Treacy 1987: table 2-IV) (B), joxañoñóóhoncó (O); climbing shrub, cultivated in house garden, young fallows[5]; soaked and/or cooked leaves produce marroon/reddish tint for dying chambira fiber.

*Crescentia cujete* L.[6] (26++ Def AG, 29++): tecepa (B), pate, calabash; tree, cultivated; dried fruit exocarp fashioned into decoratively carved bowls, containers ("carteritas"), and maracas for market (also household use); [also wood for drums, fruit edible and as anti-diarheal, fruit juice as asthma remedy, ripe pulp as abortive agent, leaves as purgative (Vasquez 1989:47)].

*Picramnia sp.* (110^^ Det AG): dáálliyhe (B), pelejo caspi; tree, riverside, old fallow; leaves produce maroon dye for chambira fiber, sometimes mixed with huito (*Genipa sp.*) to make more permanent.

*Stizophyllum riparium (H.B.K.) Sandw.* (104^^ Det AG): Climbing vine, trailside forest fallow; hollow stem for musical instruments (flauta).

**BIXACACEAE**

*Bixa orellana* L. (54++): achiote; small tree, cultivated; seeds for reddish dye mainly for painting bark cloth (llanchama); (also used as body paint, food coloring, birth control, "five-day-after" abortive agent); [leaf buds used medicinally for skin, liver, kidney, and gastrointestinal ailments, fever, and as an aphrodisiac; leaf poultice as scarifacient (Vasquez 1989:19); insect bite remedy, antidote for yuca (*Manihot esculenta*) poisoning (Villarejo 1988)].

*Bixa sp.* (95^^): achiote del monte; small tree, house garden (huerto); yellow dye from crushed bark.

**BOMBACACEAE**

*Ochroma pyramidale* (Cav. ex Lam.) Urban., (87^^ Det. WA): topa, balsa; tree, encouraged and cultivated in swiddens and forest fallows; wood used to make "manguare" (drum) replicas, masks, blow-gun mouth-piece, etc for market; (also used to construct flotation devices for children and formerly "balsas" (rafts); bark for large cahuana (yuca beverage) barrels during special celebrations; [cottony seed fluff for pillows and stuffed animal filling (Vasquez 1989:113)].

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[5] According to Denevan and Treacy (1987: table 2-IV), also found in young fallows, though I did not observe its occurrence there. Older residents can identify the first plants brought from the Putumayo (and the names of the people who brought them) from which clones were subsequently established by cuttings transferred to house gardens throughout the basin.

[6] The Bora distinguish three distinct varieties, based primarily on size of fruit.

*Ochroma lagopus* Sw.: hiíñujuícyo (B), balsa; swiddens, fallows; as above (Denevan and Treacy 1987: table 2-IV).

*Ceiba pentandra* (L.) Gaertn. (492**): lupuna; cottony wadding for blow darts (Denevan and Treacy 1987: table 2-IV); [also highly desired for lumber (Vasquez 1989:36)].

**BURSERACEAE**

(*Protium spp.*): copal, umarisa, brea caspi; tree, (mature forest?); tar-like latex for attaching llanchama (**Moraceae**) to blow-gun (pucuna); (burned in palm leaf lamp for lighting [largely replaced by kerosene], for patching canoes and boats.)

**CANNACEAE**

*Canna warzviciana* A. Dietr. (61^^): achira; cultivated in house gardens (huertos)[7]; seeds used for necklaces; (also planted as an ornamental).

**CUCURBITACEAE**

*Cayaponia kathematophora* Schultes ex char. (97^ Det HI): shacapa: forest fallow, cultivated; climbing vine; seeds strung together as "shacapas", percussion instrument tied to lower leg for dancing (for sale and personal use).

(*Selysia prunifera* (Poepp. and Endl.) Cogn. (105^^): shacapa del ratón; climbing vine, forest fallows; seeds for necklaces.

**CYCLANTHACEAE**

*(Asplundia sp.)* (45++): mohoó (O), tamshi shuyo; hemi-epiphyte, mature forest (and old forest fallows?); aerial roots for basketry and also lashing and house construction.

*(Asplundia sp.)* (91++): llííchiba (B), tamshi shuyo del altura; hemi-epiphyte, mature forest (and old forest fallows?); aerial roots for basketry and also lashing and house construction (possibly same species as above).

**FABACEAE**

*Mucuna huberi* Ducke (7*): téwatacaá (B), navémújkeúúho (B); vine, trailside; seeds for necklaces.

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[7] According to one informant, this species was introduced to the Ampiyacu River area from one plant twenty years ago.

*Ormosia sp.* (131^^): huayruro; tree, forest fallow, mature forest; red and black seeds[8] for necklaces, chaquinas, and cortinas, (and to ward off malevolent spirits); [wood for lumber (Vasquez 1989:116-117)].

*Ormosia sp.* (128^^): huayruro de purma; tree, forest fallow; uses similar to the previous species.

*Ormosia sp.* (98^^): paucar caspi; tree, floodable zone (bajial); seeds for necklaces and children's toys; (fruits edible).

**MARANTACEAE**

*Ischnosiphon arouma* (Aublet) Koernicke, (48++, 49++) det HK: bombonaje legitimo; clumped herb, to 3 m, swiddens, fallows, upland tree fall gaps, poorly drained soils (bajeal); stem covering used to weave baskets and ornamental yuca meal strainers (cedazos), and lamp shades for market; non-ornamental yuca meal strainers for personal use.

*Ischnosiphon cf. arouma* (Aublet) Koernicke (33++) det HK: bombonaje marron; used as the previous species (which may be the same).

*Ischnosiphon obliquus* (Ridge) Koernicke (22++, 28++, 36++, 99^^ det HK): ohajibaji (B), pájpayu (B) (294*?), bombonaje sacha vaca, bombonaje blanco; clumped herb, to 3+ m, swiddens, fallows, disturbed or open ground, upland or lowland (bajial); used as the previous two species.

*Ischnosiphon puberulus* Loesnener (35++, 48++ det HK, 264*, 320*, 499*): pájpayu (B), bombonaje canilla de trompetero; erect or semi-woody vine; mainly forest fallow and disturbed ground; stem covering used as in the above three species, though mainly for weaving yuca meal strainers for market and personal use; (sap of stem to treat eye infection).

**LECYTHIDACEAE**

*Eschweilera sp.* (111^^): machimango; tree, mature forest; bark yeilds black dye for coloring chambira fiber.

*Eschweilera sp.* (121^^): machimango blanco; tree, mature forest; bark yeilds black dye for coloring chambira fiber.

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[8] *Erythrina ceralifera* L., *Ormesla ceccina*, and *Batesia floribunda* are also known as huayruro, producing the distinctive, poisonous red and black seeds; the leaves and seed pods are used as sedatives (Villarejo 1988: 365).

*Eschweilera sp.* (122^): machimango rosado; tree, mature forest; bark yeilds red dye for coloring chambira fiber.

**LEGUMINOSAE**

(*Phaseolus sp.*): bacabaleta; seeds for necklaces (observed in Iquitos, not in Ampiyacu); (seeds edible).

**LOGANIACEAE**

*Strychnos guianensis* (Aubl.) Mart. (225**): bohdónehe, remo caspi; tree, (coppice regrowth in 5 year fallow); wood for canoe paddles, often taken from buttress roots (Denevan and Treacy 1987: table 2-IV).

**MALPIGHIACEAE**

*Byrsonima poeppigiana* Adv. Juss. (67~): dáállihye, pelejo caspi; tree, old forest fallow, mature forest; dye (Flores Paitán 1987: table 4-1).

**MALVACEAE**

*Gossypium sp.*: algodón, (cotton); bush, cultivated; fibers used for blow-gun dart packing; [ash of burnt fiber for treating infected wounds and burns; decoction of leaves as "ocitocica"; decoction of flowers to treat hepatitis; flower buds to treat ear-ache (Vasquez 1989: 70)].

**MELASTOMATACEAE**

*Miconia spp.* (50++, 109^^, 129^^ one or more species): cúúpiyhe (B), purma caspi; tree, forest fallow; crushed and boiled leaf and bark yields dye for coloring chambira fiber, from maroon to bluish gray to black (when mixed with mud).

*Miconia sp.* (77~): hémúújahe, rifarí; tree, old forest fallows; leaves and bark yield black dye (Flores Paitán 1987: table 4-1).

*Miconia sp.* (78~): hémúújahe, rifarí blanco; tree, old forest fallows; dye (Flores Paitán 1987: table 4-1).

*Miconia sp.* (79~): hémúújahe, rifarí colorado; tree, old forest fallows; dye (Flores Paitán 1987: table 4-1).

**MELIACEAE**

(*Carapa guianensis* Aubl.) (120^): andiloba, andiroba; large tree, mature forest, sap yields purple dye; (wood for canoe building), [wood for carpentry; crushed bark infusion for fever; seed oil applied to wood prevents insect attacks; sold in Brasil as ?antiflogosico and arthritis remedy (Vasquez 1989:30)].

(*Cedrela odorata* L.: cedro rojo; tree, wood for carving "manguaré" (talking drum) replica; (highly prized for lumber, especially for boatmaking).

(*Cedrela hissilits* Willd.): cedro blanco; tree, used in the same way as the previous species.

## MIMOSACEAE

*Pithocellobium lactum.* (R. & P.) Benth.: remo caspi; wood used for canoe paddles (Padoch 1987 Table 6-11)

*Parkia sp.* (55^): tubóóroba; large tree, mature forest; seeds for necklaces and adornments.

*Parkia sp.* (70^, 79^): pashaca; large tree, mature forest; seeds for necklaces and adornments.

## MONINIACEAE

(*Siparuna guianensis* Aubl.): picho huayo, isula huayo, asna huayo; viny shrub, forest fallow; stem for blow gun; [leaves for aphrodisiac, skin fungus remedy, abortifacient, ocitoxico, febrifuge, wound healer, hypotensive; leaves and bark for "refrescante y febrifugo"; flower and leaf tea as carminitive, dyspesia, and spasm relief (Vasquez 1989: 150)].

## MORACEAE

(*Brosimum rubescens* Taubert): palosangre, palisangre; tree, mature forest; wood for "macanas", clubs formerly used in warfare, agriculture, now sold as handicraft; [wood for posts, railroad ties; heartwood shavings to strengthen body after birth (Vasquez 1989: 22)].

(*Ficus insipida* Willd.)? (68^^): páácámico (B), oje, llanchama; tree, mature forest, forest fallow, orchard; pounded inner bark for "llanchama" cloth for paintings, blow gun coverings, masks, some clothing[9]; black dye from bark; resin mixed with tar to make stick better; purgative; (formerly for blankets, clothing, esteras [wall partition]).

(*Ficus maxima* P. Miller)(51++, 65^^): páácámico (B; 237**, 332**), oje, "llanchama"; similar to previous species; formerly large market for this as antihelminthic.

[9] The main indigenous clothing material of the Putumayo - Napo region, now largely replaced by manufactured cotton clothing, except for ceremonial and marketing use.

(*Olmedia sp.*) (66^^): tsiivúruco (B), llanchama; similar to previous species.

(*Olmedia sp.*) (67^^): úwąhllójíp paacámico (B), llanchama golondrina; similar to previous species.

*Sorocea muriculata* Miq. (62~): mááhowa (B), pampa remo caspi: tree, old forest fallows (> 20 years); dye mixed with herbs makes blacker.

NOTE: *Poulsenia armata* (Miq.) Standl. also produces the llanchama cloth (Vasquez 1989: 134), though it is not known whether or not it is used by the inhabitants of the Ampiyacu.

**MYRISTICACEAE**

(*Iryanthera tricornis* Ducke.) (116^^): pucuna caspi; tree, mature forest; young stem and branches hollowed out for blow gun ("pucuna"); resin for orange dye; [lumber, firewood (Vasquez 1989: 86)].

**ORCHIDACEAE**

(*Vanilla sp.*): vainilla; seed for necklaces (observed in Iquitos, not in Ampiyacu Basin).

**PASSIFLORACEAE**

(*Passiflora sp.*): granadilla de montaña; small black seeds for necklaces (observed in Iquitos market).

**POACEAE**

*Andropogon bicornis* L. (106^ Det HI): rabo de caballo, cola de caballo; grass, young fallows; stem for necklaces; [also natural forage, flowers as stuffed animal filling, stem for brooms and "esteras", fiber for paper, roots as diuretic and sudorific agent (Vasquez 1987: 10)].

*Lasiacis sorghoidea* (Desv.) Hitchc. & Chase (102^^ EJ): chiiyóro; grass, young fallows; dried hollow stem for musical insruments.

*Olyra cf. latifolia* L. (202**): chiiyóro, carricillo, huasca maronilla; grass, forest fallows; stem for musical instruments (flutes); [leaves for skin fungus and sore throat remedies (Vasquez 1987: 116)].

*Orthoclada laxa* (L. Rich.) Beav. (119**, 260*, 297*, 311*): ocajiníímuhe (B); grass, young fallows; white dye (Denevan and Treacy 1987: table 2-IV).

*Pariana sp.* (132**, 187**, 358**, 407*, 632*): piiyihííba (B); grass, young fallows; stem for flutes (Denevan and Treacy 1987: table 2-IV)

**RUBIACEAE**

(*Coutarea hexandra* Schum.): huacamayo caspi; bark yields red dye for chambira fibers; [also for lumber (Villarejo 1988: 243)].

*Genipa americana* L. (70^^): cáátuú (B) huito; tree, swiddens, fallows; pulverized leaves and stems (also unripe fruit acc. Vasquez 1989: 67) for black chambira fiber dye, other colors when mixed with other species/materials, (body paint, hair dye, skin infection remedy); Vasquez 1989:67-68: ripe fruit edible, for bronchitis remedy, spiritual drinks; unripe fruit as abortifacient; boiled fruits and seeds as feminine genital tract inflamation remedy, respiratory inflamation remedy, tooth extractor (pericarp); wood for carpentry, kitchen utensils; purgative, anti-diarheal, anti ulcer agent.

*Palicourea triphylla* D.C. (127**): huito, purma sisa; tree, fallows; used as colorant as with *Genipa americana* L., above; [also a "semicultivated" ornamental (Vasquez 1989: 119)].

(*Simira tinctoria* (H.B.K.) K. Schum.): huacamayo caspi, guacamayo caspi, puca quiro; tree, mature forest; bark yields red dye for chambira fiber.

*Uncaria guianensis* (Aubl.) J. Gmelin (94^^, 329**, 330**): pijyúwámyúúho (B), paraguay, uña de gato, uña de gavilán, garabato: vine, forest fallows; stem for rims of baskets and yuca meal strainers (cedazos); hooked thorns as fasteners for baskets and strainers; (leaf extract for measles, allergy, and gonorrhea remedies; [also used as "anticarcerigeno"?, anti-arthritic, gastritis and cirrhosis (Vasquez 1989: 165)].

**ZINGIBERACEAE**

*Curcuma longa* L. (53+, 83^^, 125^^): guisador, azafran, palillo; herb, cultivated, home gardens; tubers for yellow dye, (food colorant, seasoning; leaf bath for fever); [also used to treat hepatitis, bruises (Vasquez 1989: 48-49)].

*Realmia alpinia* (Rottb.) Maas (52++, 127^^): cúróvahɨɨba, huitillo, mishquipanga; herb, disturbed vegetation, fallows, trailside; ripe fruits for purple, black (mixed with mud), reddish, and sky blue (mixed with leaf of *Bactris gasipaes* HBK) dyes; (condiment in traditional Bora and Witoto soup).

**UNIDENTIFIED TAXA**

Arutiñée (B); tree of bottomlands; bark for pink dye.

Boa bejuco; (two varieties); vine; stem for basket rims; white fiber for fastening the rim to the basket.

Cumaca; tree; bark used for dark maroon colorant, known as canoe paddle paint but also used on wooden handicrafts and llanchama cloth.

Curiíkee (B); dye from (leaves?), red, or maroon when boiled.

Érimɨhe (B), loreto caspi, cashu caspi, quinasisa; tree; bark for brown dye.

Inipaúhoo (B); vine extract for "painting" (treatment) of canoe paddles.

Meniɨba (B); vine; resin for maroon dye.

Ojo de bacalau; seeds for necklaces.

Ojo de vaca; mature forest tree; seeds for necklaces.

Purbrau; tree of very light wood; uses similar to *Ochroma pyramidale*, above.

Totkiae (B); vine for cedazo rim.

Tupuroku or tuúpor (B); seeds for necklaces.

Vaca de muchacha; seeds for necklaces (observed in Iquitos, not known whether used in the Ampiyacu Basin).

(134^ and 135^): Mature forest trees of unknown name; bark yields purple die (bark only collected).

## NON-PLANT HANDICRAFT MATERIALS:

### BIRDS

Many species: feathers for necklaces, as adornments of blow-guns and other handicraft items.

### FISH

*Arapaima gigas*: paiche; scales for necklaces; [hanging room partitions, nail files].

*Serrasalmus sp.*: piraña; jaws as blow-gun accessory (traditionally used to weaken the tip of the dart so that poisoned tip will break off in the body of the prey); [whole body shellacked for decorative table ornaments sold in Iquitos].

**MAMMALS**

*Coendu spp.*: puerco espín, casetutilla (porcupine); spines for necklaces, ear-rings, bracelets (little used in the Ampiyacu).

*Felis pardalis*: tigrillo, canaguaro (ocelot); spotted pelt for blow-gun adornment.

*Felis tigrina*: tigrillo (margay); spotted pelt for blow-gun adornment.

*Pantera onca*: tigre, otorongo (jaguar); spotted pelt for blow-gun adornment.

**REPTILES**

Various species of the family Alligatoridae: skins for drums.

# GLOSSARY

**Aguajal**: Palm swamp forest dominated by aguaje *Mauritia flexuosa*.

**Altura**: Upland, or *terra firme* (Port.), not subject to seasonal flooding.

**ANTISUYO** (*Proyecto de Promoción y Comercialización Artesanal*, or Project for the Promotion and Commercialization of Handicrafts.

**Bajial**: Low-lying area subject to periodic flooding and/or perpetual sogginess.

**Cedama**: Yuca meal strainer made from the stem covering of *bombonaje* (**Marantaceae**: *Ischnosiphon spp.*) and the young rachis covering of *bacabilla* or *cinamillo* palm (**Arecaceae**: *Oenocarpus spp.*)

**Cedazo**: See *cedama.*

**Chacra**: Agricultural plot, or swidden, up to three years old.

**Chupadero**: Small poorly-drained depression surrounded by upland (*altura*).

**Cocha**: Lake.

**Cogollo**: New leaf shoot, or "heart of palm", which emerges spike-like from the center of the *Astrocaryum chambira* palm and is harvested in order to extract the epidermal fiber of the pinnae for handicrafts production (juveniles preferred).

**Colectivo**: "River taxi", small commercially operated boats with outboard motors. Major method of transport of goods to Iquitos market for the people of the Manití River. *Colectivos* do not venture as far as the Ampiyacu (see *lancha*).

**Curaka**: Chief of village, mainly figurehead.

**Domestication**: The evolutionary process whereby humans modify, either intentionally or unintentionally, the genetic makeup of a population of plants or animals.

**El Centro**: Mature forest zones between rivers and far from villages.

**EPPA**: *Empresa Peruana de Promoción Artesanal*, Peruvian Company for the Promotion of Handicrafts.

**Estera**: Room partition or temporary wall fashioned from the petioles of immature aguaje palms (*Mauritia flexuosa*).

**Extraction**: the removal of wild or semi-domesticated animals or plants, or their parts, for market exchange as raw materials or finished products.

**FECONA**: *Federación de Comunidades Nativas del Río Ampiyacu* (Federation of Native Communities of the River Ampiyacu), consisting of 12 communities, five of which are predominantly Bora, four Witoto, two Ocaina, and one Bora and Witoto.

**Huerto**: House garden, or orchard.

**Intensification**: Increasing manipulation of a plant, including weeding, culling, transplantion, cultivation, seed selection.

**Invierno**: Period of high river levels, generally between October and May.

**Jicra** (also **shicra**): carrying bag made for market from the fine fiber of juvenile chambira palm leaves (**Arecaceae**: *Astrocaryum chambira* Burret).

**Lancha**: Large diesel powered vessels which ply the larger rivers carrying passengers and produce (Pebas is visited weekly by at least one *lancha*.

**Llanchama**: Cloth-like material produced from the pounded inner bark of several trees of the Moraceae family, traditionally used for clothing, a sort of thin mattress to sleep on, and masks used in traditional celebrations; now used in the production of commercialized handicrafts (as the "canvas" for paintings, as the outer wrapping of blow-guns, *pucuna*, or *cerbatana*, and as adornment of other handicrafts items. Also refers to the trees themselves.

**Maloka**: Communal round house typical of the tribes of the Putumayo River region, including the Bora, Witoto, and Ocaina.

**Monte Alto**: "High forest", mature forest.

**Patrón**: Boss, owner.

**Peque-Peque**: Small motor with long drive shaft, propels boat very slowly.

**Purma**: A former *chacra* in various stages of secondary forest succession, or forest fallow, may be managed or unmanaged. Many useful plants are found here, providing fruits, medicines, and raw materials for the production of handicrafts (e.g. chambira, bombonaje).

**Reducción**: Concentration of widely dispersed indigenous peoples by Spanish authorities during colonial period.

**Regatón**: Traveling river trader.

**Restinga**: River levée.

**Ribereño**: Mestizo or detribalized Indian peasant, also caboclo (Brazilian Portuguese).

**Shacapa**: Percussion instrument used in traditional Bora dance, made from the large seeds of a cultivated cucurbit (*Cayaponia kathematophora* RE Schultes ex. char.).

**Shiruy**: Basket made for market from the stem covering of bombonaje (**Marantaceae**: *Ischnosiphon spp.*) and the young rachis covering of bacabilla or cinamillo palm (**Arecaceae**: *Oenocarpus spp.*), named for the fish whose scale pattern its weaving resembles (*Coryadoras sp.*).

**Tahuampa**: Black-water river flooded forest. The same piece of land may be referred to as *bajial* when not inundated.

**Tambo**: Temporary shelter, used during hunting and extracting expeditions of one night to a month or more.

**Verano**: Season of low river levels, generally between June and September.

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