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ETHNOBOTANY OF RIVERINE POPULATIONS FROM THE RIO NEGRO, AMAZONIA (BRAZIL)

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ABSTRACT.—This paper presents a comparative study of plant knowledge and use in rural and urban areas in the municipality of Barcelos in the Rio Negro, Amazonas, Brazil, based on a total of 81 interviews. Using diversity indices (Shannon-Wiener), plant knowledge is compared among communities (urban-rural population), and between sex (male-female) and age (older or younger than 40 years) categories within each community. Among our informants, we found quantitative differences concerning the knowledge of medicinal plants between sex and age categories. Some individuals play a key role relating to medicinal plant knowledge, and steps should be taken in order to include them in management and conservation plans.

Key words: ethnobotany, diversity indices, plant knowledge and use, Rio Negro, Brazilian Amazon.

RESUMO.—Com base em um total de 81 entrevistas, nós apresentamos um estudo etnobotânico comparativo entre populações urbanas e rurais na municipalidade de Barcelos no Rio Negro, Amazonas, Brasil. Usando índices de diversidade (Shannon-Wiener), o conhecimento de plantas é comparado entre as comunidades estudadas (população urbana e rural), gênero (masculino e feminino) e categorias de idade (menos que 40 anos e mais que 40 anos de idade). Nós encontramos diferenças quantitativas no conhecimento sobre plantas medicinais entre as categorias de gênero e idade. Alguns indivíduos têm um papel chave com relação ao conhecimento de plantas medicinais e medidas deveriam ser tomadas a fim de incluí-los em planos de manejo e conservação.

RÉSUMÉ.—Cet article présente une étude comparative du savoir botanique ainsi que de l'utilisation des plantes dans les régions rurales et urbaines de la municipalité de Barcelos située sur le Rio Negro (Amazonie, Brésil). Elle est basée sur un total de 81 interviews. Un index de diversité (celui de Shannon-Wiener) est utilisé afin de comparer le savoir botanique entre les communautés (populations rurales *contra* urbaines) et, également, entre les genres (mâle *contra* femelle) et entre les différents groupes d'âges (en bas *contra* en haut de 40 ans) à l'intérieur de chaque communauté. Parmi nos informateurs, des différences quantitatives ont été identifiées pour le genre et l'âge quant au savoir touchant les plantes médicinales. Certaines personnes jouent un rôle important dans le domaine des plantes médicinales et des mesures devraient être prises pour les inclure dans l'élaboration des projets de gestion et de conservation.

INTRODUCTION

Ethnobotanical studies have shown that Amazonian populations have a detailed and a diversified knowledge of their environment, including plants, animals and agroforestry management (Anderson 1990; Anderson and Ioris 1992; Anderson et al. 1995; Balick 1985; Posey 1983, 1986, 1987; Posey et al. 1984), which can contribute to management and conservation purposes (Alcorn 1995; Berkes et al. 2000; Cohen et al. 1991). Currently, folk knowledge erosion has been observed in many studies, especially where native populations are influenced by economic and cultural transformations produced by national society and economy market trends (Plotkin 1988; Shanley and Rosa 2004).

This study reports aspects of plant knowledge maintained by urban and rural riverine populations in the Rio Negro region of Amazonia. Considering the diversity of citations on plants as a measure of knowledge of the environment and as an estimate of the density of resource use, we investigate: a) general patterns of plant use, along with variations among and within communities, according to sex and age; b) specific patterns of use, such as the categorization of plants used (medicine, food, construction); and c) data that might contribute to biodiversity conservation of Amazonia, since this study deals with plant extracted from the environment. In a larger context, this study is a part of fieldwork research of the first author's doctoral project, which includes an analysis of economic and subsistence activities of urban and rural riverine populations in the municipality of Barcelos (Rio Negro) (Silva 2003).

STUDY SITE AND INHABITANTS

Physical Environment.—The Rio Negro is the most significant blackwater contributor to the Amazon system, which extends from the Colombian lowlands in the west to the Venezuelan portions of the Guiana Shields in the east. As catchment areas, the blackwater rivers in Brazil have the Tertiary shields of Guiana and central Brazil, which are among the oldest geological formations on Earth.

The blackwater ecosystems of Central Amazonia are renowned for their oligotrofic (nutrient-poor) status and lesser productivity than terrestrial, aquatic and human ecosystems (German 2004; Herrera 1985; Hill and Moran 1983; Moran 1991; Sioli 1985). The primary sources of biomass for these aquatic systems arise mostly from riparian forest (Goulding 1980; Goulding et al. 1988). Although termed ''rivers of hunger,'' in reference to the area's extremely low level of nutrients (oligotrophy) and poor autochthonous primary productivity of the Upper Rio Negro, the input of nutrients from tributaries of clearwater rivers (e.g., Padauiri, Jufaris, Demene, and Branco rivers) contributes to increase the productivity and diversity of the Middle-Lower Rio Negro region.

The level of water in the Rio Negro basin fluctuates significantly with the seasonality of rain, and it rises approximately 10 to 11 m per year. The annual temperature averages approximately 26°C, and the rainfall ranges from 2,500 to 3,000 mm per year (IBGE 1995). There are two major seasons: the dry season (*verão*) and the rainy season (*inverno*). The former extends from September to February and the latter from March to August.

Blackwater ecosystems are themselves heterogeneous, including a wide array of vegetation that reflects the patchy nature of the regions drained by these rivers (Moran 1991). Spodosols (white-sand soils) and oxisols are predominant in this area, and have a direct impact on vegetation patterns. In a broad ecological division, the mosaic of vegetation stretches from flooded forest (*floresta de igapó*) to upland high forest (*floresta de terra-firme*) and varied types of Amazonian savannas (*caatinga*, *campinarana*), all of which are associated with differences in soil composition (Clark and Uhl 1987; Huek 1972; Pires and Prance 1985; Sioli 1985). The term *igapó* is used to define forest inundated by blackwater and clearwater rivers, contrasting with *várzea*, which refers to forests inundated by whitewater rivers (Irmler 1978; Pires and Prance 1985).

Population.—This study was carried out in the Barcelos municipality, Rio Negro, Amazonas State, Brazil (Figure 1), including Barcelos town proper and the rural communities of Carvoeiro, Cumaru, and Piloto. The city of Barcelos was a Carmelite mission founded in 1728, and was the capital of the Amazonas State from 1758 to 1791 and 1798 to 1803 (Leonardi 1999). According to Diegues (2002), the total population of the Barcelos municipality is 24,121 inhabitants, with 67 percent (16,168) living in urban areas and 33 percent (7,953) in rural riverine communities. There are approximately 159 residents in Carvoeiro, 150 in Piloto, and 72 in Cumaru.

Most residents of research sites were born within the Basin. Nearly 80 percent of interviewed inhabitants are either native or have migrated from nearby communities or close municipalities, including the Upper Rio Negro (Santa Isabel do Rio Negro and São Gabriel da Cachoeira), and Rio Negro tributaries (e.g., Padauiri, Preto, and Aracá rivers), and 20 percent are migrants from other Amazonian regions or Brazilian states. The Upper Rio Negro is characterized by a multi-ethnic and multilingual regional system with up to 22 indigenous groups belonging to four linguistic families (Tukano, Maku, Aruak and Yanomami) (Ribeiro 1995; Veríssimo et al. 2004). There are several emergent indigenous groups in the Barcelos municipality, descendents of Indians who have partially or fully lost their language, and who are attempting to reassert indigenous identity.

Residents of this central research are Amerindian descendents and mestizos, who would by default make them ''caboclos'' or ''ribeirinhos.'' Caboclos are the largest non-Indian peasantry population in the Amazon region (Moran 1974; Nugent 1993; Parker 1985). Although the term *caboclo* has been widely used, it should be considered as an analytical tool without implying any quality or social identity (Murrieta and WinklerPrins 2003).

Migration of peasants to Amazonian cities intensified in recent decades due to a decline in the extractive value of forest products, such as rubber, gums, and

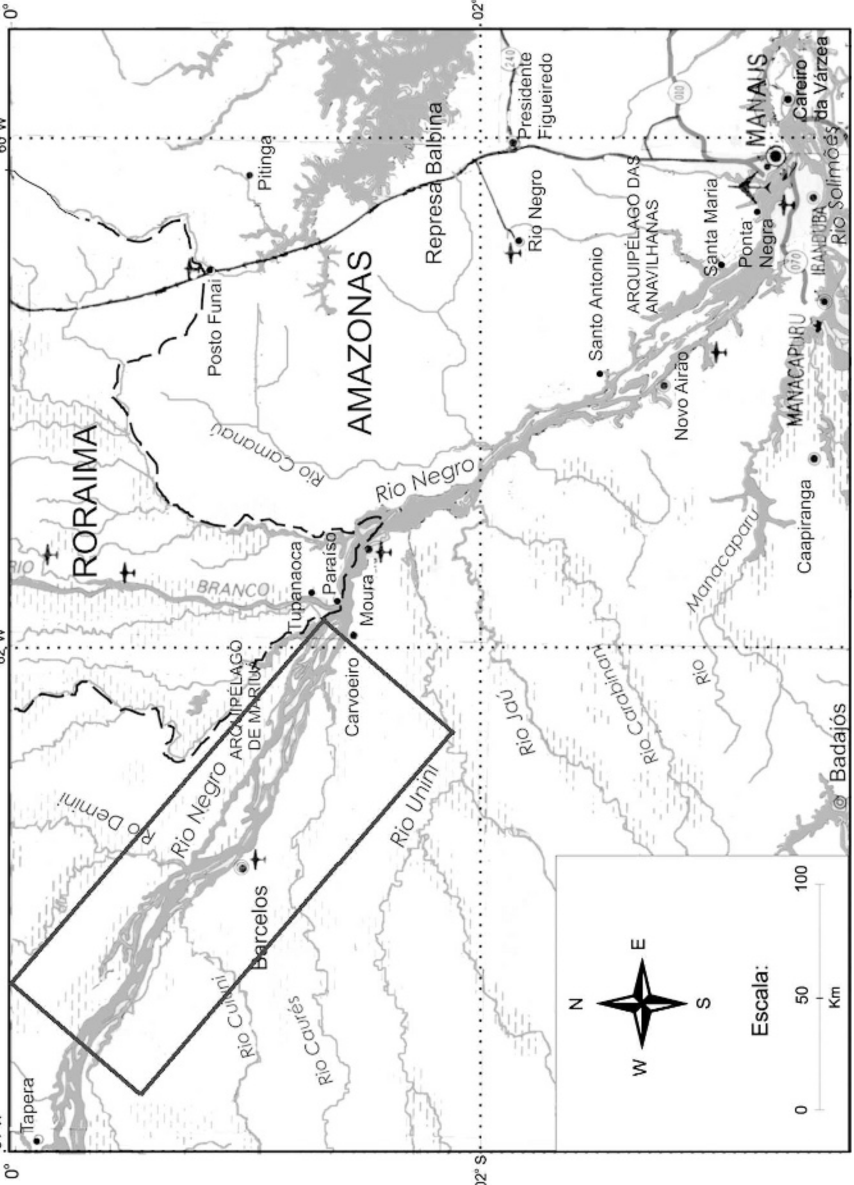

FIGURE 1.—The Barcelos municipality, Rio Negro, Amazonas State, Brazil (prepared by Salvador Carpi, Jr.).

vegetal fibers, especially *piassava* (*Leopoldina piassaba*) in the Rio Negro (Leonardi 1999; Lescure et al. 1992), coupled with the increase in commercial fishing activities (Silva 2003). Additional factors, such as the availability of schools, jobs and hospitals, also motivate people to migrate to urban centers (Oliveira 1995). Along the migratory process, the rural-urban transit is reinforced by the continuity of the economic activities and by the kinship relations in the origin communities (Emperaire 2000a; Emperaire and Pinton 1996).

Ribeirinhos have a diversified economy based on fishing, seasonal hunting, small-scale agriculture, extraction and commercialization of forest products, and more recently tourism-related activities (Emperaire 2000b; Ribeiro 1995). At the Barcelos town, fishing is the main economic activity, including targeting small fish species for aquarium trade (ornamental fisheries), as well as fishes to be sold in the city's market and other Amazon cities as food (Begossi et al. 2002; Chao et al. 2001; Silva and Begossi 2004). At Carvoeiro, Piloto, and Cumaru, agricultural activities take a central economic role, where 90 percent of households cultivate swidden plots (*roças*). Wage-based activities, which have been increasingly incorporated into the household economy, include mostly teachers, governmental employees, and retirees (Silva 2003).

METHODS

Fieldwork was carried out between 1999 and 2000. Structured interviews based on questionnaires were conducted among adults (over 18 years old) concerning edible fruits and plants used for medicine, handicrafts, and construction of houses and canoes. Eighty-one adults of both sexes were interviewed (35 men and 46 women), including 48 residents in urban Barcelos and 33 in the rural areas of Carvoeiro, Piloto, and Cumaru. Although the interviews were fundamental in gaining an overview of useful species composition, direct observations over the course of two years revealed the most significant information on plant knowledge and use.

Plant specimens were collected in the flooded and non-flooded forests, homegardens and swiddens, with the help of local residents and key informants. They were identified by one of the authors (Tamashiro) and are deposited at the Herbarium of the Universidade Estadual de Campinas, Brazil.

Quantitative methodology is used in several ethnobiological studies and is useful to compare folk knowledge from different communities or between different use categories among and between communities (Jonhs et al. 1990; Peters 1996; Phillips and Gentry 1993, 1994; Prance et al. 1987). In our study, data analysis included the calculation of the Shannon-Wiener indices in order to compare plant use diversity among and between the urban and rural communities, taking into consideration sex, age (18 to 40; over 40 years old), and types of uses (e.g., medicine, food, construction, handicrafts, magic use, etc.), following Begossi (1996).

Diversity indices (Shannon-Wiener index), evenness and species richness curves were assessed for the number of citations per plant (local name) in interviews, and according to their use categories, with p_i as the proportional abundance of the *i*th species and n_i is the number of individuals for the *i*th species (Magurran 1988). Statistical comparisons of Shannon-Wiener indices were made through *t*-test, where N = number of quotations and S = number of species (richness). Comparisons of Shannon diversity indices were based on Zar (1984).

The rarefaction curves allow us to compare the diversity of items used by different populations with different sample sizes (Begossi 1996). For the rarefaction method, rarefied sub-samples of individuals are taken at random from the total. The formula given by Magurran (1988) is $E(S) = \Sigma \{1 - [N_n - pi/(N)]\}$, where:

$E(S)$ = expected number of species,

n = standardized sample size

N = total number of individuals recorded in the sample to be rarefied

Pi = the number of individuals in the *i*th species in the sample to be rarefied

RESULTS

Informants cited 274 species of plants in 81 interviews. We identified 124 species, belonging to 92 botanical families (Table 1). Plant families cited most frequently were Arecaceae, Asteraceae, Fabaceae, Myrtaceae, Mimosaceae, and Euphorbiaceae. Among the native plants, the most cited taxonomic group referred to was palms (Arecaceae), which are used for food, medicine, and construction.

Most plants cited as medicine and as edible fruits occur in the non-flooded forest (*terra-firme*) than in the flooded forests (*igapó*) (Figure 2). Diversity of non-flooded forests (*terra-firme*) plant species cited by informants ($H' = 4.47$) was significantly higher than those from the flooded forest (*igapó*) ($H' = 3.76$; $t = 1.28$, $p < 0.01$, df = 240). These results show that the diversity of uses may be related to the diversity of plants available in different ecosystems, since the *terra-firme* forests, including disturbed habitats and forest edges, present higher diversity of plants than flooded forests (Ferreira 1997; Oliveira 1997).

About 193 of the cited plant species are used for medicinal purposes (60%), 75 species are edible fruits (23%), 41 species are used for construction and handicrafts (13%), and 14 species are used for fishing (4%). Fourteen fruit species from *igapó* were cited for fish capture. Favorites are *careca* (*Margaritaria* sp.), *louro* (*Ocotea* spp., *Aniba* sp.), *jenipapo* (*Genipa* sp.), *seringa* (*Hevea brasiliensis* Müll. Arg.), and *buxuxu* (*Miconia* sp.). Palm heart from *jauari* (*Astrocaryum jauari* Mart.), *inajá* (*Attalea maripa* (Aubl.) Mart.), and *pupunha* (*Bactris gasipaes* Kunth) are used to capture giant turtles.

Several species served dual purposes. Thirteen plant species were mentioned as being used both for food and medicine, eight are used for construction and medicine, seven are used for food and construction, and three are used in all three categories. Food and medicine are closely related for several available treatments in the Rio Negro watershed. Examples include *uichi* (*Endopleura uichi* (Huber) Cuatrec), *castanheira* (*Bertolletia excelsa* H.B.K.), *umari* (*Poraqueiba sericea* Tul.), *jatobá* (*Hymenaea* sp.), and *sorva* (*Couma* spp.). Moerman (1996) also observed that that the food-medicine dichotomy is largely absent in rural and indigenous populations among native Indians from North America.

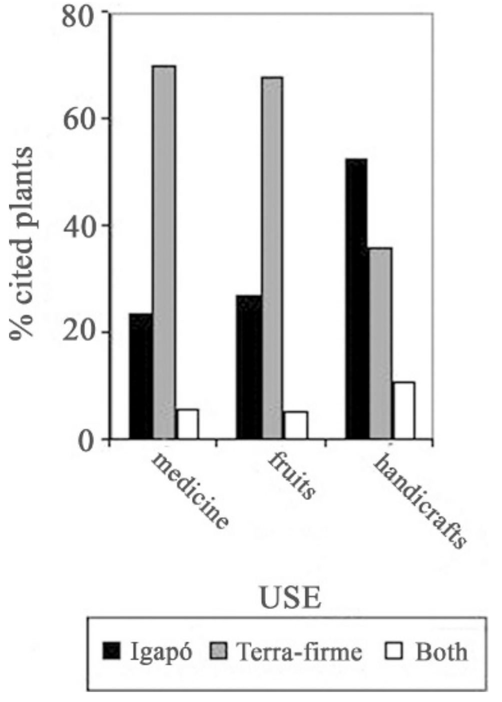

FIGURE 2.—Local of occurrence of cited plants (n = 81 interviews).

Medicinal Plants.—Medicinal plants are cultivated in swidden plots (*roças*) and homegardens nearby households (*quintais*), or collected in flooded and non-flooded forests. In the studied communities, men collect native plants in forest during extractive activities, whereas women possess refined perception about cultivated plants, since they are responsible for cultivating homegardens and swidden plots, organizing home pharmacies and processing of medicinal plants. It is common for elderly individuals to be responsible for preparing medicinal beverages with several plant species (*garrafadas*), or practice curing rituals through shamanism and other religious beliefs (*benzimentos* and *simpatias*).

About 76% of the medicinal plants cited by interviewees are native to the Amazonian forest. The five most cited native medicinal plants were *copaíba*, *andiroba, jatobá, açaí* and *carapanaúba*. *Copaíba* oil (*Copaifera* sp.) is one of the most commonly used Amazonian medicinals. As a cicatrizant, it also serves as a natural antibiotic for deep wounds, a common ailment among people who use knives, axes and maxetes on a daily basis (Balée 1994). In small doses, *copaíba* oil is also taken internally to alleviate sore throats (Shanley and Rosa 2004).

Another highly esteemed medicinal oil used historically in the Rio Negro region and popular throughout Amazonia is *Carapa guianensis* Aubl. (*andiroba*). Applied topically, *C. guianensis* is used for rheumatism, bruises, and as an insect repellent, and in veterinary treatment of animals. In Rio Negro, the oil of *andiroba* is extracted from fruits, which are cooked and dried in the sun. Bark of *Hymenaea* spp. (*jatobá*) is known elsewhere to combat cough and flu and as a general bodystrengthening tonic. *Carapanaúba* (*Aspidosperma* sp.) and *açaí* (*Euterpe* spp.) are highly valued for their medicinal properties, including as treatments for malaria.

About 72 exotic (non-native) species used for medicinal purposes are cultivated at homegardens (*quintais*). The five most commonly cultivated medicinal herbs are citron grass (*Cymbopogon citratus* (DC.) Stapf), *pirarucu-caá* (*Kalanchoe* sp.), *amor-crescido* (*Portulacca* sp.), peppermint (*Mentha* spp.), and ginger (*Zingiber officinale* Roscoe). Cultivated herbs used both for food and medicinal purposes include basil (*Ocimum* spp.), kale (*Brassica oleracea* L.), *jambú* (*Spilanthes acmella* (L.) Murray), *chicória* (*Eryngium foetidum* L.), and *urucum* (*Bixa orellana* L.).

In Brazil, people living in other tropical areas have often included introduced plant species in folk medicine, most of them native to Europe, the Mediterranean and Asia (Bennet and Prance 2000). In the Jaú National Park, Rio Negro, Rodrigues (1998) documented 151 plants used for medicinal purposes, 34% of them exotic. Amorozo and Gély (1988) found that 32% of the 178 medicinal plants cited by Caboclos from Barcarena (Belém) are introduced species. A mixture of native and introduced plants has also been found among inhabitants of Atlantic Forest in Southeastern Brazil, descendents from Indian and Portuguese (Caiçaras), where about 44% of medicinal plants used are exotic (Begossi et al. 2002; Hanazaki et al. 1996, 2000; Rossato et al. 1999). The use of native and introduced species show the maintenance of many therapeutic traditions of indigenous groups, along with a progressive incorporation of introduced species from other continents, demonstrating the complex, combined indigenous and colonial heritage (Amorozo and Gély 1988). Some authors have observed that cultivated and spontaneous species, present in homegardens and successional environments, have high importance to local popular medicine in the Neotropics (Ankli et al. 1999; Voeks 1996). The use of introduced plants from disturbed habitats and forest edges in Caiçaras medicine probably diminished negative impacts on the forest, since about half of the pharmacopia represent introduced plants from disturbed habitats, which has little or no impact in the forest (Begossi et al. 2001). As in other peasant pharmacopoeias, the importance of introduced plants in this region may help to prevent overuse of native species and habitats.

Ribeirinhos from the Rio Negro use a large number of medicinal plants to treat illnesses associated with gastrointestinal diseases (e.g., diarrhea, worms, stomach pain), followed by dermatological diseases, fever and pain, women-associated treatments (e.g., menstrual cramps, abortive, contraceptive, uterus problems), animal bites (e.g., snakes, rays, ants), liver associated problems (e.g., malaria, hepatitis) and respiratory diseases (Table 2). These results are compatible with other studies, which show that the majority of cited plants are employed to treat the most common pathologies in tropical areas (Schultes and Raffauf 1990). Plants used to treat respiratory and gastrointestinal disorders are frequently employed of Yucatec-Maya of Mexico and Yanomami of Venezuela (Ankli et al. 1999; Milliken and Albert 1997). Dermatological uses of medicinal plants are largely observed in indigenous pharmacopoeias (Balick and Cox 1996). Caiçaras from the Atlantic forest of Brazil know several plant species for illness associated with fever, pain, respiratory diseases, and gastrointestinal disorders (Begossi et al. 2001, 2002).

TABLE 1.—Plants collected in the Rio Negro (including cited interviews and observations). Plant collection site: Ho = Homegarden, Ig = *Igapó* (flooded forest), Tf = *Terra-firme* forest, Sw = Swidden-plot, Sf = Secondary forest, Ca = *campina.*

Local name	Latin binomial	Family	Plant collection site	Voucher #
Abacate	*Persea americana* L.	Lauraceae	Ho	1
Abacatirana	indet.	Lauraceae	Ig	
Abacaxi	*Anannas* sp.	Bromeliaceae	Ho, Sw	
Abiu	*Pouteria caimito* (R. & Pav.) Radkl.	Sapotaceae	Ho	2
Abiuarana	indet.	Sapotaceae	Ig	3
Abolda	*Vernonia polyanthes* Less.	Asteraceae	Ho	4
Açaí	*Euterpe precatoria* Mart.	Arecaceae	Ho, Tf	5
Acapú	*Couepia* sp.	Chrysobalanaceae	Tf	6
Acariquara	*Minquartia guianensis* Aubl.	Olacaceae	Ig	7
Acerola	*Malpighia glabra* L.	Malpighiaceae	Ho	8
Alfavaca	*Ocimum* sp.	Lamiaceae	Ho	9
Amor-crescido	*Portulaca* sp.	Portulacaceae	Ho	10
Anador	*Eupatorium* sp.	Asteraceae	Ho	11
Ananá-de-curupira	*Bromelia* sp.	Bromeliaceae	Tf	12
Anani	*Symphonia globulifera* L. f.	Clusiaceae	Tf	
Andiroba	*Carapa guianensis* Aubl.	Meliaceae	Tf	13
Angelim-branco	*Hymenolobium* sp.	Fabaceae	Tf	14
Apuí	*Clusia* sp.	Clusiaceae	Tf	15
Arabá	*Swartzia* sp.	Fabaceae	Ig	
Arabi	indet.	Myrtaceae	Ig	16
Araçá	*Psidium acutangulum* DC.	Myrtaceae	Tf	17
Araçá	*Psidium guineense* Sw.	Myrtaceae	Tf	18
Araçá-boi	*Eugenia stipitata* McVaugh	Myrtaceae	Ho	19
Araticum	*Rollinia* sp.	Annonaceae	Tf	20
Ariã	indet.	indet.	Ho	21
Aritu	*Licaria chrysophylla* (Meisn.) Kosterm.	Lauraceae	Ig	22
Arruda	*Ruta graveolens* L.	Rutaceae	Ho	23
Arumã	*Ichnosiphon* sp.	Marantaceae	Tf	24
Ata	*Annona* sp.	Annonaceae	Ho	25
Azeitona	*Syzygium cummini* (L.) Skeel	Myrtaceae	Ho	26
Babosa	*Aloe vera* L.	Liliaceae	Ho	27
Bacaba	*Oenocarpus bacaba* Mart.	Arecaceae	Tf	28
Bacuri	*Symphonia globulifera* L. f.	Clusiaceae	Ig	29
Banana	*Musa* x *paradisiaca*	Musaceae	Sw, Ho	
Baraturi	*Theobroma* sp.	Sterculiaceae	Ho	30
Batata	*Ipomoea batatas* (L.) Lam.	Convolvulaceae	Sw	31
Beribá	*Rollinia* sp.	Annonaceae	Tf, Ho	32
Bico-de-pato	indet.	Sapotaceae	Ig	33
Bochecha-de-velha	indet.	Hippocrateaceae	Ig	34
Boldo	*Plectranthus barbatus* Andr.	Lamiaceae	Ho	35
Breu, cicantá	*Protium* sp.	Burseraceae	Tf	36
Breu-branco	*Tetragastrys* sp.	Burseraceae	Tf	37
Buxoxo, buiuiu	*Miconia* sp.	Melastomataceae	Sf	38
Caapí	*Banisteriopsis caapi* (Spruce ex Griseb.) C.V. Morton	Malpighiaceae	Ho	39
Cabeçuda	*Virola* sp.	Myristicaceae		40
Cabibi	*Parkia* sp.	Mimosaceae	Ig	

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Caçari, camu-camu	*Myrciaria dubia* (Kunth) McVaugh	Myrtaceae	Ig	41
Cacau-do-mato	*Theobroma* sp.	Sterculiaceae	Tf	
Cacauí	*Theobroma sylvestris* (Aubl.) G. Don	Sterculiaceae	Tf	42
Café	*Coffea arabica* L.	Rubiaceae	Sw, Ho	43
Caferana	*Picrolemma sprucei* Hook. f.	Simaroubaceae	Tf	
Cajamanga	*Spondias dulcis* Forst.	Anacardiaceae	Ho	44
Caju	*Anacardium occidentale* L.	Anacardiaceae	Sw, Ho	45
Camacamali	*Senna* sp.	Caesalpiniaceae	Ho	
Camapu	*Physalis angulata* L.	Solanaceae	Sw	46
Camomila	*Lippia* sp.	Verbenaceae	Ho	47
Cana	*Saccharum officinarum* L.	Poaceae	Sw, Ho	48
Canela-de-jacamim	*Ichnosiphon* sp.	Marantaceae		49
Canela-de-jacamim	*Rinorea racemosa* (Mart.) Kuntze	Violaceae	Tf	50
Capeba	*Potomorphe umbelatta* L.	Piperaceae	Ho	
Capim-santo	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Ho	51
Capitari	*Tabebuia* sp.	Bignoniaceae		52
Capitiú	*Siparuna* sp.	Monimiaceae	Tf	53
Capitiú-do-mato	*Siparuna guianensis* Aubl.	Monimiaceae	Tf	
Caporana	indet.	Mimosaceae	Sw	54
Cará	*Dioscorea* sp.	Dioscoreaceae	Sw, Ho	
Cará-do-ar	*Dioscorea* sp.	Dioscoreaceae	Ho	55
Cará-do-mato	*Dioscorea* sp.	Dioscoreaceae		56
Caraipé	*Licania* sp.	Chrysobalanaceae	Ig	57
Cará-jacuruaru	indet.	Dioscoreaceae	roça	58
Carajiru-da-campina	indet.	Bignoniaceae	Ca	59
Carajiru-do-mato	*Arrabidaea chica* (H.B.K.) Verlot	Bignoniaceae	Ho	60
Carambola	*Averrhoa carambola* L.	Oxalidaceae	Ho	61
Caramuri	*Pouteria* sp.	Sapotaceae	Ig	62
Carapanaúba	*Aspidosperma* sp.	Apocynaceae	Tf	
Careca	*Margaritaria* sp.	Euphorbiaceae	Ig	63
Cariru	indet.	Portulacaceae	Sw, Ho	64
Castanha-da-india	*Ludwigia* sp.	Onagraceae	Ho	65
Castanha-da-india	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Ho	66
Castanheira	*Bertolletia excelsa* H.B.K.	Lecythidaceae	Tf	67
Castanheirinha	*Croton* sp.	Euphorbiaceae	Ho	68
Catinga-de-mulata	*Tanacetum vulgare* L.	Asteraceae	Ho	69
Cauchurana	*Pouteria* sp.	Sapotaceae	Ig	70
Cebola-do-mato	indet.	Liliaceae	Ho	
Cebolinha	*Allium sativum* L.	Liliaceae	Ho	71
Cedrinho	*Protium* sp.	Burseraceae	Tf	72
Chicória	*Eryngium foetidum* L.	Apiaceae	Ho	73
Cibalena	*Chrysanthemum* sp.	Asteraceae	Ho	74
Cidreira	*Lippia* sp.	Verbenaceae	Ho	75

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Cipó-alho	*Adenocalymma alliaceum* Mart.	Bignoniaceae	Ho	76
Cipó-cravo	*Tynanthus panurensis* (Bureau) Sandwith	Bignoniaceae	Tf	77
Cipó-cururu	*Distictella parkeri* (DC.) Sprague & Sandwith	Euphorbiaceae	Tf	78
Cipo-de-lontra	indet.	Fabaceae	Ig	79
Cipó-tuiri	*Mendoncia hoffmannsegiana* Nees	Acanthaceae	Sw	80
Coainho	*Duroia longifolia* (Poepp.) K. Schum.	Rubiaceae	Ig	81
Coainho	indet.	Hippocrateaceae	Ig	82
Côco	*Cocos nucifera* L.	Arecaceae	Ho	83
Cominho	*Cuminum cyminum* L.	Apiaceae	Ho	
Contraveneno	*Abuta* sp.	Menispermaceae	Ho	84
Contraveneno	*Gomphrena* sp.	Amaranthaceae		85
Contraveneno	*Piper* sp.	Piperaceae		86
Contraveneno	indet.	Bignoniaceae		87
Contraveneno	*Mikania* sp.	Asteraceae		88
Copaíba	*Copaifera* sp.	Caesalpiniaceae	Tf	
Copaibarana	indet.	Caesalpiniaceae	Ig	89
Crajiru	*Arrabidaea chica* (H.B.K.) Verlot	Bignoniaceae		90
Crista-de-galo	*Securidaca* sp.	Polygalaceae	Ig	91
Cubio	*Alibertia* sp.	Rubiaceae		92
Cubio	*Capsicum frutescens* L.	Solanaceae	Ho, Sw	93
Cubiu	*Solanum sessiliflorum* Dun.	Solanaceae	Sw, Ho	94
Cuia, cuité	*Crescentia cujete* L.	Bignoniaceae	Ho	95
Cuia-mansa	*Acanthospermum* sp.	Asteraceae	Ho	96
Cumandá	*Senna* sp.	Caesalpiniaceae	Ig	
Cumaru	*Dipteryx* sp	Menispermaceae	Tf	97
Cumati	*Eugenia* sp.	Myrtaceae	Tf	98
Cupiúba	*Casearia* sp.	Flacourtiaceae	Sf	99
Cupuaçu	*Theobroma grandiflorum* (Willd. ex Sprague) K. Schum	Sterculiaceae	Tf, Sw, Ho	100
Cupuí	*Theobroma subincanum* Mart.	Sterculiaceae	Tf	101
Dauicu	*Mouriri* sp.	Mimecylaceae	Ig	102
Edimã	*Duguetia* sp.	Annonaceae	Tf	103
Embaúba	*Cecropia concolor* Willd.	Cecropiaceae	Tf	104
Envira-branca	*Guatteria* sp.	Annonaceae		105
Envira-ferro	indet.	Annonaceae	Ig	106
Epadu	*Erythroxylum coca* Lam.	Erythroxylaceae	Ho	
Escada-de-jabuti	*Bauhinia* sp.	Caesalpiniaceae	Sw	
Esmério-de-surucucu	indet.	Rubiaceae	Ho	107
Fedegoso	*Senna* sp.	Caesalpiniaceae	Ho	
Frutos-dieta-de-cabeçudo	*Eugenia* sp.	Myrtaceae	Ig	108
Genipapo	*Genipa* sp.	Rubiaceae	Ig	109

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Gergelim-preto	*Sesamum indicum* L.	Pedaliaceae	Ho	110
Gogó-de-guariba	*Salacia* sp.	Hippocrateaceae	Ig	111
Goiaba	*Psidium guajava* L.	Myrtaceae	Ho, Sw	112
Goiaba-do-igapó	*Alibertia* sp.	Rubiaceae	Ig	113
Graviola	*Annona* sp.	Annonaceae	Ho, Sw, Tf	114
Hortelã, hortelã-grande	*Plectranthus* sp.	Lamiaceae	Ho	115
Hortelã-roxo	*Mentha* sp.	Lamiaceae	Ho	116
Hortelãzinha	*Mentha* sp.	Lamiaceae	Ho	117
Inajá	*Attalea maripa* (Aubl.) Mart.	Arecaceae	Tf	118
Ingá	*Inga* sp.	Mimosaceae	Sw,Tf,Ho	
Inga-açu	*Inga* sp.	Mimosaceae	Tf, Sw	
Ingá-biscoito	*Inga* sp.	Mimosaceae	Ho	
Ingá-cipó	*Inga* sp.	Mimosaceae	Tf	
Ingá-xixica	*Inga* sp.	Mimosaceae	Ig	119
Ingá-xixica	*Swartzia* sp.	Fabaceae		120
Itaúba	*Mezilaurus itauba* (Meissn.) Taubert ex Mez	Lauraceae	Tf	121
Itaubarana	indet.	Sapotaceae		122
Jaca	*Artocarpus heterophyllus* Lam.	Moraceae	Ho	123
Jacamim	*Justicia* sp.	Acanthaceae	Ho	124
Jacarandá	indet.	Fabaceae	Tf	
Jacaré-café	*Coccoloba ovata* Benth.	Polysonacaceae	Ig	125
Jacareúba	*Calophyllum brasiliense* Cambess.	Clusiaceae	Ig	126
Jacareúba	*Ternstroemia* sp.	Theaceae		127
Jacitara	*Desmoncus polyacanthos* Mart.	Arecaceae	Tf	128
Jambo	*Eugenia malaccensis* L.	Myrtaceae	Ho	129
Jambu	*Spilanthes acmella* var. *oleracea* (L.) C.B. Clarke ex Hook. f.	Asteraceae	Ho	130
Japana	*Eupatorium* sp.	Asteraceae	Ho	131
Japana-roxa	*Eupatorium* sp.	Asteraceae	Ho	132
Jaraqui-caá	indet.	Caryophyllaceae	Ho	133
Jasmim	indet.	Apocynaceae	Ig	134
Jatobá	*Hymenaea* sp.	Caesalpiniaceae	Tf	
Jenipapo	*Genipa* sp.	Rubiaceae	Ig	135
Jucá	*Caesalpinia* sp.	Caesalpiniaceae	Ho	
Jupati	*Raphia taedigera* (Mart.) Mart.	Arecaceae	Tf	
Jurubeba	*Solanum crinitum* Lam.	Solanaceae	Sw	136
Jutaí	*Hymenaea* sp.	Caesalpiniaceae	Tf	137
Lacre	*Vismia* sp.	Clusiaceae	Tf	138
Laranja-da-terra	*Citrus* sp.	Rutaceae	Ho	139
Limão-caiana	*Citrus* sp.	Rutaceae	Ho	140
Limão-galego	*Citrus* sp.	Rutaceae	Ho	141
Limão-tangerina	*Citrus* sp.	Rutaceae	Ho	142
Língua-de-vaca	*Elephantopus mollis* Kunth	Asteraceae	Ho	143
Louro-abacate	*Ocotea tabacifolia* (Meisn.) Rohwer	Lauraceae	Ig	144
Louro-aritu	*Virola* sp.	Myristicaceae		145

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Louro-aritu	*Licaria chrysophylla* (Meisn.) Kosterm.	Lauraceae	Ig	146
Louro-de-sapucaia	indet.	Anacardiaceae	Ig	
Louro-namoim	indet.	Lauraceae	Ig	147
Louro-preto	*Ocotea* sp.	Lauraceae	Ig	148
Macacaricuia	*Couroupita guianensis* Aubl.	Lecythidaceae	Ig	
Maçaranduba	indet.	Sapotaceae	Ig	149
Macucu	*Aldina heterophylla* Spruce ex Benth.	Fabaceae	Ig	
Macucuí	*Licania* sp.	Chrysobalanaceae	Ig	150
Mãe-da-roça	indet.	indet.	roça	
Malvarisco	*Plectranthus* sp.	Lamiaceae	Ho	151
Mamão-papaia	*Carica papaya* L.	Caricaceae	Ho	152
Mandioca, macaxeira	*Manihot esculenta* Crantz	Euphorbiaceae	Sw, Ho	153
Manga	*Mangifera indica* L.	Anacardiaceae	Ho	154
Mangarataia, assaflor	*Zingiber officinalis* Roscoe	Zingiberaceae	Ho	155
Mangericão, mangeroninha	*Ocimum* sp.	Lamiaceae	Ho	156
Manufa	*Staurogyne* sp.	Acanthaceae	Ho	157
Mão-aberta	*Dioscorea* sp.	Dioscoreaceae	Ho	158
Maracarana	*Coccoloba* sp.	Polygonaceae	Ig	
Maracujá	*Passiflora* sp.	Passifloraceae	Sw	159
Maracujá-da-capoeira	*Passiflora* sp.	Passifloraceae	Sw	160
Maracujá-do-mato	*Passiflora* sp.	Passifloraceae	Sw	161
Maracuja-peroba	*Passiflora edulis* Sims	Passifloraceae	Ho	162
Marajá	*Bactris* sp.	Arecaceae	Tf	163
Marcela	*Melampodium* sp.	Asteraceae	Ho	164
Mari	*Licania* sp.	Chrysobalanaceae		
Mari-mari	*Senna* sp.	Caesalpiniaceae	Ig	
Marmelada	*Alibertia* sp.	Rubiaceae	Ig	165
Marupá	*Simarouba amara* Aubl.	Simaroubaceae	Ho	
Mastruz	*Chenopodium ambrosioides* L.	Chenopodiaceae	Ho	166
Matamatá	indet.	Moraceae		167
Matamatá	*Escheweilera* sp.	Lecythidaceae	Tf	168
Matapasto	*Senna reticulata* (Willd.) H.S. Irwin & Barneby	Caesalpiniaceae	Tf	169
Matoguaia	indet.	Rutaceae	Sw	170
Melão-caetano	*Cardiospermum* sp.	Sapindaceae	Ho	171
Melhoral	indet.	Asteraceae	Ho	172
Mirapiranga	*Swartzia* sp.	Fabaceae	Ig	173
Mirapuama	*Ptychopetalum olacoides* Benth.	Olacaceae	Tf	
Miratinga	*Pogonophora schomburgkiana* Miers ex Benth.	Euphorbiaceae		174
Mirirana	*Qualea* sp.	Vochysiaceae		175
Moela-de-jacu	indet.	Euphorbiaceae	Tf	176
Molongô	*Malouetia* sp.	Apocynaceae	Ig	177
Mucura-caá	*Petiveria alliacea* L.	Phytolaccaceae	Ho	178

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Mucura-caá	*Phytolacca rivinoides* Kunth & C.D. Bouché	Phytolaccaceae	Ho	179
Murapiranga	*Vismia* sp.	Clusiaceae		180
Muré de cabeçudo	*Brosimum acutifolium* Huber	Moraceae	Ig	181
Murtinha	*Myrcia servata* McVaugh	Myrtaceae	Tf	
Muruxi	*Byrsonima* sp.	Malpighiaceae	Tf	182
Mutuquinha	indet.	Lamiaceae	Ho	183
Ocuqui	indet.	Lauraceae	Ho	184
Óleo-elétrico	*Piper* sp.	Piperaceae	Ho	185
Olho-de-peixe	*Ternstroemia* sp.	Theaceae	Ig	186
Olho-de-peixe	*Cybianthus* sp	Myrsinaceae	Ig	187
Olho-de-veado	indet.	Humiriaceae	Ig	188
Orelha de cachorro	*Psittacanthus* sp.	Loranthaceae	Ho	189
Oriza	indet.	Lamiaceae	Ho	190
Paca	*Cyclanthus* sp.	Cyclanthaceae	Sw	
Pacuacatinga	indet.	Liliaceae	Ho	191
Padurana	indet.	Apocynaceae	Ig	192
Padurana	*Neea* sp.	Nyctaginaceae		193
Palma-jauarí	*Astrocaryum jauari* Mart.	Arecaceae	Ig	
Palmeira-jara	indet.	Arecaceae	Ig	194
Palmeirinha	indet.	Liliaceae	Ho	195
Paracaxi	*Pentaclethra* sp.	Mimosaceae		
Parapará	*Jacaranda copaia* (Aubl.) D. Don	Bignoniaceae	Tf	
Parasita	indet.	Orchidaceae	Ho, Ig	
Patauá	*Oenocarpus bataua* Mart.	Arecaceae	Tf	196
Pau-d'arco	*Tabebuia serratifolia* (Vahl) G. Nicholson	Bignoniaceae	Sw	
Pau-de-surucucu	*Simaba cedron* Planch.	Simaroubiaceae	Tf	
Pau-mulato	*Capirona decorticans* Spruce	Myrtaceae	Ig	197
Pau-pra-tudo	indet.	Sapindaceae	Tf	198
Pau-tartaruguinha	*Mollia speciosa* Mart. & Zucc.	Tiliaceae	Ig	199
Pau-vidro	*Byrsonima* sp.	Malpighiaceae	Ig	200
Paxiúba	*Socratea exorrhiza* (Mart.) Wendl.	Arecaceae	Tf	201
Peão-branco	*Jatropha curcas* L.	Euphorbiaceae	Ho	202
Peão-roxo	*Jatropha gossypiifolia* L.	Euphorbiaceae	Ho	203
Pepino	indet.	Clusiaceae	Sw	204
Pepino do mato	*Ambelania acida* A. Rich.	Apocynaceae	Tf	205
Piarauara aruanã	*Connarus* sp.	Connaraceae	Ig	
Picão	*Bidens pilosa* L.	Asteraceae	Sw	206
Pimenta-do-reino	*Piper nigrum* L.	Piperaceae	Ho	
Pimenta-de-cheiro, esporão de galo, malagueta	*Capsicum frutescens* L.	Solanaceae	Ho	207
Pinhão	*Jatropha* sp.	Euphorbiaceae	Ho	208
Piquiá	*Caryocar villosum* (Aubl.) Pers.	Caryocaraceae	Tf	209
Piquiarana	*Caryocar* sp.	Caryocaraceae		210
Piradabi	*Parkia* sp.	Mimosaceae	Ig	

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Piranha-caá	indet.	indet.	Tf	
Piranha-cipó	*Dalbergia* sp.	Fabaceae	Tf	
Pirarucu-caá, corama	*Kalanchoe* sp.	Crassulaceae	Ho	v208
Piripirioca	indet.	Cyperaceae	Ho	209
Pitanga	*Eugenia uniflora* L.	Myrtaceae	Ho	210
Pitomba	*Talisia esculenta* A.St-Hil.	Sapindaceae	Ho	211
Pitomba-do-igapó	indet.	Loganiaceae	Ig	212
Pixuna	*Eugenia* sp.	Myrtaceae	Ig	213
Pobre-velho	*Costus* sp.	Costaraceae	Ho	214
Pombinha	indet.	Malpighiaceae	Ig	215
Preciosa	*Aniba* sp.	Lauraceae	Tf	
Pupunha	*Bactris gasipaes* Kunth	Arecaceae	Tf	216
Pupunharana	indet.	Arecaceae	Ig	217
Puruca-puçanga	*Dioscorea* sp.	Dioscoreaceae	Ho	
Quebra-pedra	*Phyllanthus* sp.	Euphorbiaceae	Ho	
Quiabo	*Abelmoschus esculentus* (L.) Moench	Malaceae	Ho	218
Quina-quina	*Geissospermum sericeum* (Sagot) Benth. & Hook.	Apocynaceae	Tf	219
Rabo-de-lontra	*Adenocalynma* sp.	Bignoniaceae	Ig	220
Ripeira	indet.	Lecythidaceae		221
Sabuarana	*Swartzia* sp.	Caesalpiniaceae	Ig	222
Sabugueiro	*Sambucus* sp.	Caprifoliaceae		223
Sacaca	indet.	Asteraceae		224
Sacaca	*Croton* sp.	Euphorbiaceae	Ho	225
Salva-de-marajó	*Lippia* sp.	Verbenaceae	Ho	226
Samambaia-do-mato	*Sellaginela* sp.	Sellaginelaceae	Ho	227
São-joão-caá	indet.	Asteraceae	Sw	228
Saracura-mirá, saracura-cipó	*Ampelozizyphus amazonicus* Ducke	Rhamnaceae	Tf	229
Sem-nome	*Canna* sp.	Cannaceae	Tf	
Sena	*Senna* sp.	Caesalpiniaceae	Ho	
Seringa	*Hevea brasiliensis* Müll. Arg.	Euphorbiaceae	Ig	230
Sororoca	*Phenakospermum guyannense* (Rich.) Endl.	Strelitziaceae	Tf	231
Sorva, sorvinha	*Couma utilis* Müll. Arg.	Apocynaceae	Tf	232
Sorvão	*Couma guianensis* Aubl.	Apocynaceae	Tf	233
Sucuúba	*Himatanthus sucuuba* (Spruce ex Müll. Arg.) Woodson	Apocynaceae	Tf	234
Sucuúba-da-vargem	*Himatanthus* sp.	Apocynaceae	Ig	235
Tabaco de veado	indet.	Asteraceae	Sf, Sw	236
Tajá	indet.	Araceae	Ho	237
Tangerina	*Citrus* sp.	Rutaceae	Ho	238
Tanibuca	indet.	Combretaceae	Tf	239
Taperebá	*Spondias mombin* L.	Anacardiaceae	Tf, Ho	240
Taquari	*Mabea subsessilis* Pax & K. Hoffm.	Euphorbiaceae	Ig	241
Tento	indet.	Fabaceae	Tf	242

TABLE 1.—Continued.

Local name	Latin binomial	Family	Plant collection site	Voucher #
Traíra-bóia	indet.	indet.	Ig	243
Trevo-roxo	indet.	Lamiaceae	Ho	244
Tucano-patauá	indet.	Icacinaceae	Ig	245
Tucano-patauá	indet.	Humiriaceae	Ig	246
Tucumã	*Astrocaryum acaule* Mart.	Arecaceae	Tf, Ho	
Tuiri	*Polypodium* sp.	Polypodiaceae	Tf	
Uambé-cima	indet.	Araceae	Tf	
Uambé-coroa	indet.	Araceae	Tf	
Ubim	indet.	Arecaceae	Ho	247
Ubim-juriti	indet.	Arecaceae	Tf	248
Uichi	*Endopleura uichi* (Huber) Cuatrec	Humiriaceae	Tf, Ho	
Uichirana	indet.	Humiriaceae	Ig	249
Umari	*Poraqueiba sericea* Tul.	Icacinaceae	Tf, Ho	250
Unha-de-gato	*Uncaria tomentosa* (Willd. ex Roem. & Schult.) DC.	Rubiaceae	Sw	
Unha-de-morcego	indet.	Bignoniaceae	Ho	251
Urubu-caá	*Aristolochia silvatica* Barb. Rodr.	Aristolochiaceae	Ho	252
Urucum	*Bixa orellana* L.	Bixaceae	Ho	253
Vassorinha	*Scoparia dulcis* L.	Scrophulariaceae	Ho	254
Vinagre	*Hibiscus sabdariffa* L.	Malvaceae	Ho	255
Vindicá	*Alpinia nutans* L.	Zingiberaceae	Ho	256
Virola	*Virola* sp.	Myristicaceae	Ig	257

Most medical treatments are indicated for internal uses, including methods such as cold and hot infusion, decoction, syrup, plant smoking, beverage made of several plant species (*garrafadas*), and extraction. Methods employed in external treatments include bath, plaster, friction, plant smoking, and ointment. Caboclos sometimes combine modern medicine with traditional herbal remedies to treat illness. For example, fever, headache and cold, are treated with topic on head of infused plants. The baths are done with aromatic herb such as *capitiú* (*Siparuna guianensis* Aubl.), *cipó-alho* (*Adenocalymma alliaceum* Mart.), and *vindicá* (*Alpinia nutans* L.). According to Amorozo and Gély (1988), the confidence in the topical medicine effectiveness is so much so that Caboclos are known to dissolve industrial remedies in water and mix them with the plants in the baths against influenza and headache. The treatments can still involve ingestion and topical use, such as several ''*contravenenos*'' species (Amaranthaceae) that are used for sting of snakes. The use of animal products, such as honey bee and medicinal animals, is also common, as are market products (e.g., sugar, onion, black pepper, eucalyptus, and garlic) in medicinal beverages. Bennett and Prance (2000) also note the addition of imported items, such as sugar to improve palatability and ginger and eucalyptus for their bioactive principles.

Plants kept at home pharmacies for medicinal purposes include exotic species well known in popular pharmacopeia, such as orange, rose, lavander, ginger, and eucalyptus. Native species include rare and endemic species, such as *preciosa* (*Aniba*

TABLE 2.—Medicinal uses of the plants mentioned by interviewed populations in the Rio Negro, Amazonas State, Brazil (n = 81 interviews; 189 plant species cited).

Treatment	Cited species	(%)
Gastrointestinal disorders	62	20
Animal bites	30	10
Fever and pain	29	9
Dermatological diseases	26	8
Liver-associated problems	25	8
Respiratory diseases	20	6
Women-associated treatments	16	5
Circulatory and cardiac disorders	15	5
Cicatrizing	25	8
Blood diseases	11	3
Urological disorders	10	3
Contraceptive, sterilizing and abortive	9	3
Ocular diseases	8	3
Spiritual diseases	6	2
Others	23	7

sp.), *cicantá* (*Protium* spp.), *tamaquaré* (*Caraipa* sp.), and *puxuri* (*Licaria puchury-major* (Mart.) Kosterm.), the last endemic of the Rio Negro (Emperaire 2000b).

Plants for Food.—A total of 75 food plants were identified. About 49 of these were cultivated and 46 were gathered from *igapó* and *terra-firme* forests. The cultivated food plants were grown either in homegardens near dwellings or in swidden plots. The most commonly cultivated trees were mango, cashew, guava, and banana. Papaya, lemon, orange, avocado, and coconut were also frequently encountered in homegardens.

Although the plants listed above add variety to the Caboclos diet, their staples are all grown in large fields known locally as *roças*. *Manihot esculenta* Crantz is the most important crop in terms of caloric contribution; around 100 varieties, both bitter and sweet, are cultivated in the Rio Negro (Chernela 1986). Another important food crop is banana (*Musa* × *paradisiaca*); at least eight varieties of bananas are cultivated in the studied area. Several plants are grown for edible tubers: four varieties of yam (*Dioscorea* spp.); and two varieties of sweet potato (*Ipomoea batatas* (L.) Lam.). Other crops include *Ananas* spp., *Citrullus vulgaris* Schrad. ex Eckl. & Zeyh. and *Sacharum officinarum* L.

The Caboclos practice slash-and-burn agriculture, clearing areas of between 0.5 and 2.0 ha, primarily along small levees near riverbanks and in small patches of *terra-firme* forest. *Roças* are utilized for one or two years, after which they are fallowed. Clearing a *roça* is done by men using frequently axes and machetes early in the dry season (July to August). After the cutting, the fallen trees are left to dry until the height of the dry season, when the plot is burned. Women and children help the men in planting tubers. It is the women's responsibility to harvest the tuber crops and to process manioc (*farinha*). Once *roças* are abandoned for intensive agricultural use, they continue to be valuable. A number of food plants are gathered from such old cultivated areas (*capoeiras velhas*).

Although cultivars form the bulk of their diet, Caboclos collect many edible species from the forest. About 87% of the cited edible fruits are considered native to the Amazonian forest (Figure 2). A number of the important wild fruits are found in the Arecaceae family. Significant species include: *açaí* (*Euterpe* spp.), *tucumã* (*Astrocaryum acaule* Mart.), *bacaba* (*Oenocarpus bacaba* Mart.), *patauá* (*Oenocarpus bataua* Mart.), and *pupunha* (*Bactris gasipaes* Kunth). Unlike the majority of wild fruits that are utilized on an opportunistic basis, most of the palms are specifically visited for the purpose of harvesting their fruits. The management of palms and other native edible fruit species in their cultivated plots or kitchen gardens increases the availability of these plant resources in areas with easy access.

Four native species in the Myrtaceae family provide edible fruit: *caçari* (*Myrciaria dubia* (Kunth) McVaugh) and *pixuna* (*Eugenia* sp.) from *igapó*; *araçá* (*Psidium* spp., *Eugenia stipitata* McVaugh) and *murtinha* (*Myrcia servata* McVaugh) from *terra-firme*. Among the Fabaceae, the fruits of *jatobá* (*Hymenaea* sp.) and several species of *Inga* (Mimosaceae) are eaten. Brazil nuts (*Bertholletia excelsa* H.B.K) are eaten raw or roasted, or alternatively, are a source of edible oil, as noted by some of our female informants. *Inga* species replace the mango as the most popular snack in the dry season when the latter has stopped bearing fruit. The oily, yellow flesh of *piquiá* (*Caryocar villosum* (Aubl.) Pers.) is prepared by boiling it in salt water, and it is eaten with *farinha* (cassava flour) and coffee. The sweet white pulp of *bacuri* (*Symphonia globulifera* L. f.) and *abiu* (*Pouteria caimito* (R. & Pav.) Radkl.) are highly valued during their harvest seasons. The oily, greenish yellow pulp of *uichi* (*Endopleura uichi* (Huber) Cuatrec) is also highly esteemed. The pulp of *cupuaçu* (*Theobroma grandiflorum* (Willd. ex Sprague) K. Schum.) is source of a sweet beverage and also prepared as puddding-like desserts.

Construction Materials.—Native trees provide sources of raw materials for handicrafts, house construction, and indigenous fishing techonlogies. Most homes near the river are constructed of wood. About 65 species are useful for construction of houses. *Acariquara* (*Minquartia guianensis* Aubl.), known as its termite-resistant properties, is regarded as material for house posts in Rio Negro as well as by the Waimiri Atroari (Milliken et al. 1992) and Tembé (Prance et al. 1987) of Brazil. *Maçarandura* (Sapotaceae), *castanheira* (*Bertholletia excelsa* H.B.K.), and *angelim* (*Hymenolobium* sp.) are used for roofing material as shingles and as posts, appreciated for their strength and durability. *Caferana* (*Picrolemma sprucei* Hook. f.), *louro* (*Ocotea* spp., *Licaria* sp., *Virola* sp., and *Aniba* sp.), and *açaí* (*Euterpe* spp.) are employed as rafters. The roof itself is thatched with a variety of leaves, the most important being palm leaves species collected from *ubim* (Arecaceae), which is also employed in making *casas de farinha* (open structures where cassava is processed into flour).

Living along the river, Caboclos mainly travel by canoes. Their canoes and paddles are often constructed of *louro* (*Ocotea* spp.), which grows relatively quickly and produces a medium density wood. More durable canoes are constructed from *itaúba* (*Mezilaurus itauba* (Meissn.) Taubert ex Mez). Several plants are used for fishing and hunting equipment. Fishing traps (*cacuris* and *matapis*) are made from palms, including *paxiúba* (*Socratea exorrhiza* (Mart.) Wendl.), *inajá* (*Attalea maripa* (Aubl.) Mart.), and *jupati* (*Raphia taedigera* (Mart.) Mart.) and lined with lianas.

About 31 species of trees are used specifically as a fuel for cooking. Interviewees recognize certain species as possessing burning qualities that make them superior for certain applications. Preferred species of trees specified as cooking fuels include *cumati* (*Eugenia* sp.), *cupiúba* (*Casearia* sp.), *cumandá* (*Senna* spp.), and *tucano-patauá* (Icacinaceae).

Caboclos weave baskets and containers with the roots of epiphytes and the stems of palms. Several plant species are used to make utensils for manioc processing (e.g., *tipiti, paneiro, peneira, abano*), artifacts for domestic use (e.g*., tupé, urutu, cestos*), and ceramics. A number of species are involved in the weaving of baskets and related items. Baskets are made from *cipó-titica* (*Heteropsis* spp.), *arumã* (*Ichnosiphon* sp.), and *uambé-coroa* (*Philodendron* sp.) roots, which are also collected for commerce. A type of cement used in the manufacture of ceramic vessels was formerly made from the hard, brittle barks of *Licania* sp. (*caraipé*), which is known for its durable, rot-resistant properties, and abundance of silica found in the rays of its wood (Prance 1972). Such materials are colored with *cubiu* (*Solanum grandiflorum* Jacq.), *urucum* (*Bixa orellana* L.), *ingá-xixica* (*Inga* sp.), *carajiru* (*Arrabidaea chica* (H.B.K.) Verlot), and *pacuacatinga* (Liliaceae). *Crescentia cujete* L. (*cuia*) is grown as a source of gourds; these are split and serve as containers for liquids, soap, and other items.

Magical or Spiritual Use.—A number of useful plants are employed for their perceived magical or spiritual properties. This includes the widely investigated hallucinogen *Banisteriopsis caapi* (Spruce ex Griseb.) C. V. Morton, known as *cipó-pajé*, *cipó-da-inteligência* or *caapí*. This species has been cultivated in a homegarden by a Tukano shaman, from Pari-Cachoeira (Upper Rio Negro) and living in Carvoeiro, for at least five years.

The most widespread and active spiritual and magic beliefs surrounding forest use in Rio Negro communities concern game. Several plants are believed to help hunters during hunting activities. A Baniwa man from Rio Içana living in Barcelos cultivates *paca* (*Cyclanthus* sp.) for luck and success in the hunt. *Pimenta* (hot pepper) is also used to treat bad luck during fishing and hunting activities (*panema*). As part of the religious and shamanistic rituals, plants used to treat the unlucky person are infused water or smoked with parts of medicinal animals. *Panema* is also treated with *peão-roxo* (*Jatropha gossypifolia* L.), *contra-malefício* (several species), *mucura-caá* (*Petiveria alliacea* L.), and *vindicá* (*Alpinia nutans* L.). The last two species are also utilized in Afro-Brazilian religions (Smith 1981). The spiritual diseases are treated through xamanic rituals along with different plant species, such as cashew (*Anacardium occidentale* L.), *pirarucu-caá* (*Kalanchoe* sp.), and *vassourinha* (*Scoparia dulcis* L.). A woman in Carvoeiro recalled the treatment for spiritual enchantment of dolphins with the bath of *peão-roxo* (*J. gossypifolia*), *sororoca* (*Heliconia* sp.), garlic, and lemon. Another non-identified species (*mãe-da-roça*), belonging to the Cyclanthaceae family, is cultivated by women in swidden plots to improve manioc productivity. An unidentified herb in the Rubiaceae family (*esmerio-de-surucucu*) is regarded as a love charm: when a woman refuses a man's advances, the man rubs the leaves of this plant on his hands in order to win her love.

Diversity, Knowledge and Conservation.—Comparisons between data obtained from urban and rural informants reveal no significant differences in knowledge of plants used for all the noted categories (Table 3). With respect to knowledge of

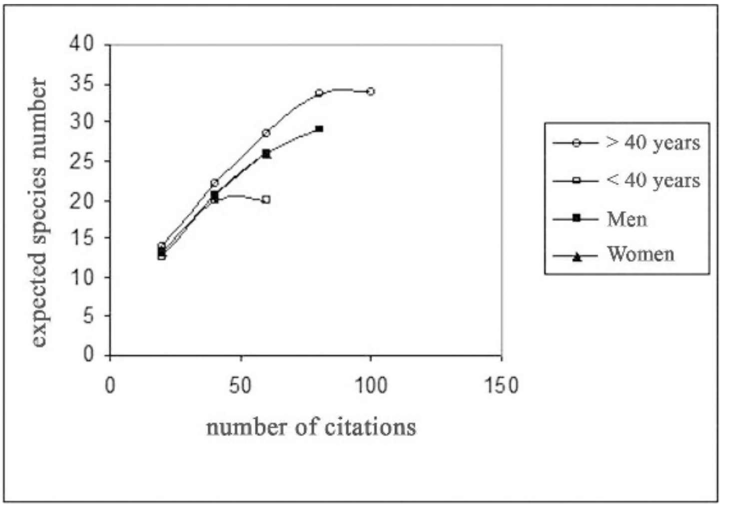

FIGURE 3.—Plants for handicrafts: Rarefaction curves based on the number of citations per plant in all communities for sex and age categories ($n = 81$ interviews).

edible fruit and plants used for construction and handicraft, there are no significant differences among studied communities relative to sex and age (Table 4). Women cited more plants than men (Figures 3 and 4), but this result seems to be related to different sample sizes. The rarefaction curves used to compare samples of different sizes show a higher diversity of medicinal plant citation among men compared to women (Figure 5). Men and older people in general also exhibited a higher variance of citations compared with women and younger people, indicating a more heterogeneous knowledge of plants in the former.

Of the 274 plant species cited in interviews, only 18 species were mentioned by more than 10% of the informants. The similarity of medicinal plant species

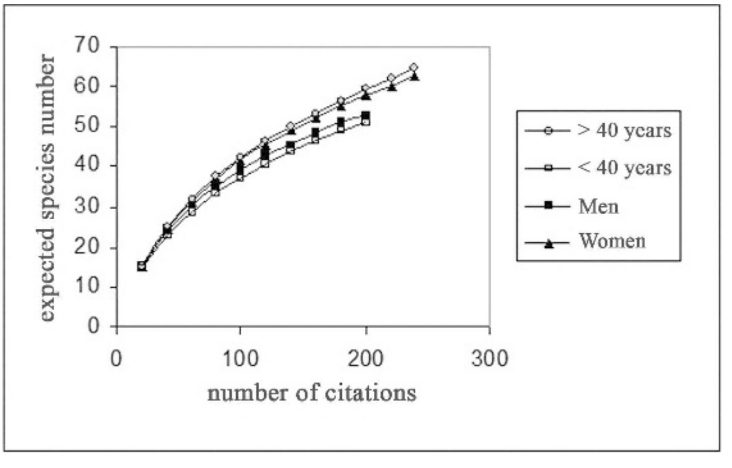

FIGURE 4.—Plants for food (edible fruits): Rarefaction curves based on the number of citations per plant in all communities for sex and age categories ($n = 81$ interviews).

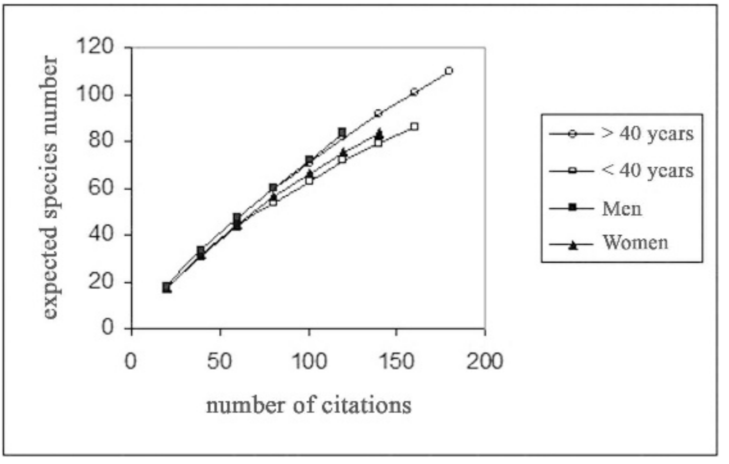

FIGURE 5.—Plants for medicine: Rarefaction curves based on the number of citations per plant in all communities for sex and age categories ($n = 81$ interviews).

mentioned as used in the four Amazonian communities is relatively low (6%). We suggest that this is probably due to the high diversity found in the area, and the resultant low density of an individual taxon may show different plant availability at different sites. As noted by Begossi et al. (2002), this likely leads to small numbers of individual species mentioned.

Among the informants, we found two men and three women who mentioned more than 20 medicinal plant species per interview. We found a few individuals with a very wide knowledge of medicinal plants who appear to be key elements in retaining medicinal knowledge in the communities. Ethnobotanical studies have shown that medicinal plant knowledge is largely confined to older people and/or women, for which the learning process involved is complex (Kainer and Duryea 1992; Phillips and Gentry 1993).

The importance of women and elders in the retention of knowledge of plant resources has been stressed in many communities. Such patterns have been observed in several ethnobotanical studies among Caboclos from Amazonia (Kainer and Duryea 1992), Caiçaras from the Atlantic Forest Coast (Begossi et al. 1993, 2002), and populations of the Guatemala (Girón et al. 1991). According to Milliken and Albert (1997), phytotherapeutic knowledge has been largely spread

TABLE 3.—Diversity indices based on citations of plant species in the interviews (H' = Shannon-Wiener index, (e) Evenness;).

Local (all plants)	Richness	H' (e[a])	Citation	Informants
Urban	194	4,75[c] (5,27)	632	48
Rural*	180	4,71[c] (5,21)	425	33
Total	274	4,95 (5,61)	1057	81

* communities of Carvoeiro, Cumaru and Piloto.
[a] H' = S pi log pi (base 2), where: pi = interviews' number in which an i plant was cited divided by the total number of citations.
[b] Evenness = H / lnS
[c] t tests: Differences of two diversity indices (Zar 1984), urban and rural ($t = 2.2$, $P >$ 0.,05, df = 348).

TABLE 4.—Comparisons of plants cited (per gender and age) in four Amazonian communities (Younger: 18 up to 40, Older: over 40 years old).

Uses	Gender		Age		
All plants	Men	Women	Younger	Older	Total
Richness	172	203	142	229	274
Mean of citations per species	13.43	13.78	12.74	14.63	
SD	10.65	8.65	8.75	10.17	
Shannon-Wiener index	4.73[a]	4.77[a]	4.47[b]	4.98[b]	4.95
Evenness	5.21	5.3	4.95	5.5	5.61
Citation	470	634	475	629	1104
<u>Medicinal</u>					
Richness	103	139	86	152	183
Mean of citations per species	4.91	6.16	4.67	6.82	
SD	6.02	5.32	4.39	6.55	
Shannon-Wiener index	4.47[c]	4.72[c]	4.2[d]	4.74[d]	4.75
Evenness	4.75	4.93	4.45	5.11	5.24
Citation	182	302	170	314	484
<u>Edible Fruits</u>					
Richness	53	63	51	65	74
Mean of citations per species	6.11	5.78	6.57	5.51	
SD	5.76	5.50	5.69	5.45	
Shannon-Wiener index	3.5[e]	3.5[e]	3.47[f]	3.68[f]	3.69
Evenness	3.97	4.1	3.93	4.17	4.32
Citation	214	266	243	237	480
<u>Handicraft</u>					
Richness	29	31	21	37	41
Mean of citations per species	2.11	1.43	1.60	1.81	
SD	2.48	2.02	2.12	2.31	
Shannon-Wiener index	2.99[g]	2.92[g]	2.79[h]	3.22[h]	3.22
Evenness	3.40	3.41	3.04	3.61	3.71
Citation	74	66	62	78	140
Informants	35	46	38	43	81

[a] t tests: all plants comparisons by sex ($t = 0.06$; $p > 0.5$, df = 315) and age ($t = 1.3$, $p < 0.0001$, df = 365); medicinal plants comparisons by sex ([c] $t = 2.17$, $p < 0.01$, df = 229) and age ([d] $t = 3.7$, $p < 0.\ 01$, df = 396); edible fruits comparisons by sex ([e] $t = 025$, $p > 0.1$ df = 118) and age ([f] $t = 0.15$, $p > 0.5$, df = 110); handicrafts comparisons by sex ([g] $t = 0.48$, $p > 0.5$, df = 61.4) and age ([h] $t = 0.32$, $p > 0.5$, df = 54.4).

among women while shamanism has been practiced by men in the indigenous populations of Amazonia. Kainer and Duryea (1992) empathize the pivotal role of women in Amazonian Extractive Reserves concerning the knowledge of medicinal plants, management of homegardens, and proficiency in medicinal plant processing. Murrieta and WinklerPrins (2003) also attempt to the gender roles among Caboclos from Ituqui Island, Lower Amazon river, where homegardens are typically the domain of women. Begossi et al. (2002) have shown that elders and a few women are key elements for the maintenance of local knowledge of folk medicine in Atlantic Forest coast.

There is a high diversity of plants (231 species), including native and introduced, used for the riverine populations from the Rio Negro, which can be compared to the other tropical sites, including the Atlantic Forest coast (Begossi et al. 2001; Figueiredo et al. 1993, 1997; Rossato et al. 1999) and Amazonia (Amorozo and Gély 1988; Bennett 1992; Boom 1989). Medicinal plants form the largest use category for populations from Rio Negro, being also an important category for other native people, as shown in other studies of the Amazonia (Amorozo and Gély 1988; Begossi et al. 2001, 2002; Kainer and Duryea 1992; Rodrigues 1998), Atlantic coastal forest (Begossi et al. 1993; Figueiredo et al. 1993, 1997; Hanazaki et al. 2000; Rossato et al. 1999), and northeastern Brazil (Voeks 1996).

This research was carried out in a region with extreme levels of biological richness, and one that is experiencing rapid rural to urban migration. Ethnobotanical studies show that indigenous knowledge is dynamic and that botanical knowledge is diminishing elsewhere (Boom 1989; Milliken et al. 1992; Posey 1983; Schultes and Raffauf 1990). Balée (1994) notes that especially in non-literate societies, which transmit knowledge orally, there is a limit of capacity for human memory to store relevant facts, including ethonoecological knowledge.

Economic alternatives are central aspects for managing inhabited tropical forests (Begossi et al. 2002). In our study area, the large varieties of non-timber products make a valuable contribution to the local economy of riverine populations. Phillips et al. (1994) stressed that collection of non-timber forest products is not free from destructive harvesting, although their collection has a less conspicuous impact on the forest. Moreover, the riverine economy based on a variety of non-timber products in Rio Negro may represent a strategy of risk aversion, since it allows economic survivorship during critical periods and minimizes economic dependence on a unique product (Anderson et al. 1995). Indeed, the extraction of non-timber forest products is believed to be compatible with conservation as long as there is a low environmental impact as well as incentives for users to conserve forest resources (Momberg et al. 2000).

CONCLUSIONS

Native plant species represent important resources for medicine, food and construction in the Rio Negro basin. The diversity of cited plants in our study can be compared to data from studies of other tropical high biodiversity areas, such as the Atlantic Forest and Amazonia. This knowledge should be considered on an *in situ* basis for biological conservation programs, which can then encourage traditional activities and also consider their knowledge of vegetation in conservation units. Given the extent of cultural transformations influenced by urbanization, particularly knowledgeable individuals should be included in all conservation processes.

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