BIOLOGICAL AND ECONOMIC STUDIES TO SUPPORT THE DEVELOPMENT OF EXTRACTIVE RESERVES IN AMAZONIAN ECUADOR

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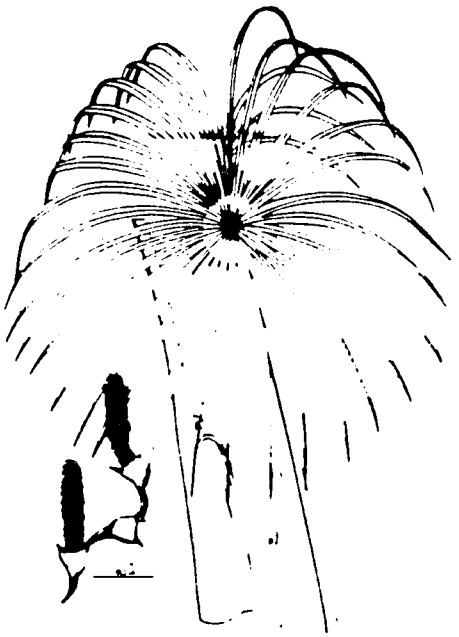

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Carlos David Grefa, a Quijos Quichua from the upper Napo, identifying plants in the Jatun Sacha plot.

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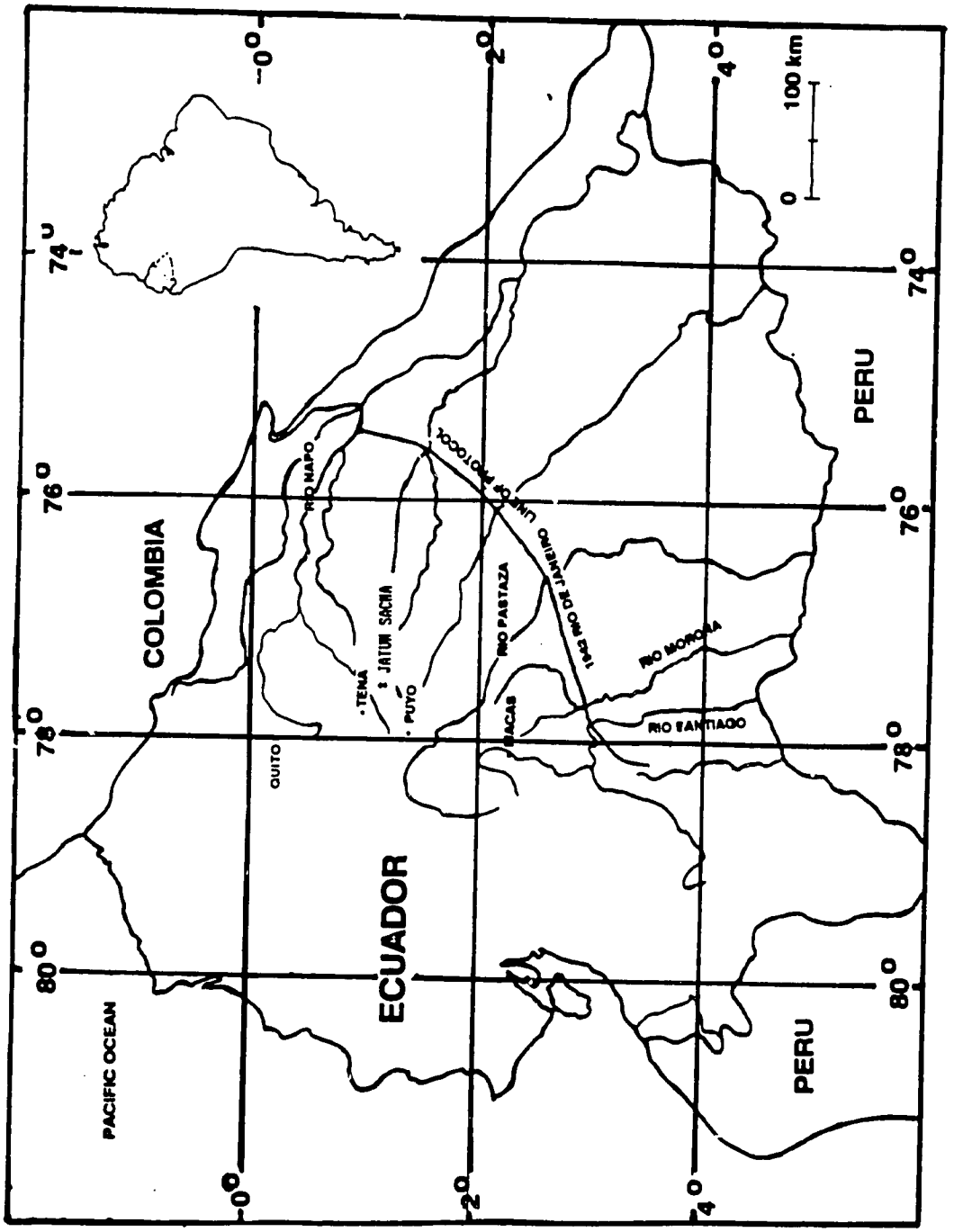

INTRODUCTION

In this report, we discuss the first six month's progress of New York Botanical Garden's "Extractive Reserves in Amazonian Ecuador" project. This project is supported by U.S. Agency for International Development Grant No. 518-0780-G-00-0247-00.

Extraction of renewable forest products offers sustainable, ecological and economic alternatives to timber harvesting, single-species agriculture, and cattle-ranching in the lowland tropics. Like agroforestry and resource management, sustainable extraction is not a new idea. The Amazon's indigenous people have extracted non-timber forest products for hundreds of years (Alcorn 1984; Anderson and Posey 1989; Balée and Gély 1989; Boom 1987; Denevan and Treacy 1988; Irvine 1989; Posey 1984).

NYBG researcher Charles Peters and colleagues showed that the economic return from sustainably harvested forest products could exceed that of destructive forest uses (Peters et al. 1989). One of those colleagues, Robert Mendelsohn of Yale School of Forestry, is collaborating on this project.

Several questions must be answered to determine the potential of extraction. Our goals are to examine the following four questions as they relate to sites in Amazonian Ecuador.

1. What useful plant species occur in each plot and what proportion of the flora do they comprise?

2. What is the market value of extractable products from these plots?

3. What is the value of subsistence products that do not enter the cash economy?

4. What are the effects of extraction on the reproduction and establishment of economic species?

LOGISTICS

We began by focusing on the first question. Working in collaboration with Dr. David Neill of the Missouri Botanical Garden, we examined the number of useful tree species in a one hectare plot at the Jatun Sacha Biological Station. The station, located along the upper Napo River near Misahualli, has several permanent plots. Neill, Walter Palacios and other Ecuadorians established these plots and conducted the botanical inventory. By working in an already established plot we saved considerable time. Analysis of a single plot may require 6-12 months of work from two workers.

Bennett, hired Rocío Alarcón formerly of Fundación Natura as the Ecuadorian counterpart in this project. Ms. Alarcón speaks Quichua and has extensive experience in the Napo Province. Alarcón began work on the project in January. Ecuadorian students will begin work on the project

in July. Another Ecuadorian ethnobotanist also may begin work on the project in July.

Bennett spoke to Yale School of Forestry Students in February. Several students expressed interest in the project. Robert Mendelsohn selected the two most-qualified students. They will begin working in June by focusing on the economic evaluation of natural resources.

RESULTS

Bennett and Alarcón worked with three sets of Quijos Quichua informants. They recorded the Quichua name and use for each tree in the one hectare parcel. Variability exists among the informants in both names and usages of many species. Nonetheless, the problem is not as significant as it appears. First, by working with several informants, we find the most common names and usages. More important, for the economically important species, there is greater constancy in the data.

A research team also has begun to work in the same plot with Waorani informants. The Waorani once lived in the region occupied by the field station. They have begun to migrate back to the region recently.

We found uses for 132 species in the first hectare plot. A complete list of useful species from this plot appears in Appendix A. As a heuristic exercise, we estimated the yield of and economic value of products from

the Jatun Sacha plot. We emphasize that these are only approximations. We will obtain better estimates as we generate more data.

Our preliminary calculations indicate that fruits are the most important product from the Jatun Sacha forest. Thatch, fuel and medicines also are potential products for extraction. We based production estimate on literature data or estimates from informants. Likewise, the unit values for each product are based on known market values or dollar equivalent from published data.

Given these preliminary estimates, the potential for fruit extraction is considerable. The Jatun Sacha plot produces $996.70 worth of fruit from 15 species. Iriartea deltoidea contributes almost half the value. Though not used in many parts of its range, indigenous inhabitants along the upper Napo consume fruits of this species. I. deltoidea also has potential as a natural starch source. Another palm, Jessenia bataua produces a high gross yield as well.

We also estimated the value of thatch. Using conservative estimates of production and value, palm fronds could yield $158.75 per year (Table 2). Usually not considered important, palm thatch is a valuable commodity in the upper Napo. Colonists often lack access to palms. Therefore, they purchase thatch from Quijos Quichua. Thatch

is the preferred roof material for some applications, especially kitchen roofs.

Another commodity often ignored is fuel. Forest inhabitants collect substantial quantities of wood to use for cooking. The effects of this activity in lowland Ecuador have not been examined. The value of firewood from a one hectare parcel is $132.00 per year (Table 3).

We also estimated the yield from plant medicines. Indigenous people often prefer natural medicines to western pharmaceuticals. Many traditional medicines have equal or greater therapeutic properties. As traditional medicines become scarce, native populations must purchase medicines. Besides the costs of these products, transportation costs must be considered. The value of medicines in the one hectare plot is $116.75 per year.

Our estimate for the value of all extractable products is $1,404.20 per year (Table 5). This value is only an approximation. We will revise it as better data becomes available.

To compare alternative uses of the forest we calculated the net present value (NPV) of forest products from the Jatun Sacha plot. We based this calculation on three assumptions. First, the total harvest is 75% of the gross yield. One quarter of gross production remains in place for regeneration and animal consumption. Second, value of the

net yield is 60% of the gross. Forty percent of the gross is lost to production and transportation costs. Third we used a discount rate of 5%. Peters et al. used the same values for these variables in their calculations. Speaking with collectors in the region indicated that transportation costs range from 20-50% of the value of cultivated crops like cacao and coffee. Forty percent is a reasonable average estimate.

Using the figures cited above, the Jatun Sacha plot produces a net revenue of $631.89. The NPV based on this net revenue is $12637.80 (Table 6). This figure is much higher than the few other reported values from Amazonia. We therefore recalculated NPV using a more conservative value for the production of Iriartea deltoidea, the most common species. Net revenue using the revised calculation is $511.52 yielding a NPV of $10,230.40.

This value is also high so we recalculated NPV based only on the value of fruits (Table 8). The net revenue stream of fruits is $328.14 yielding a NPV of $6,562.80. Peters et al. found a similar in their analysis of a one hectare plot in Peru.

How do the NPV of these studies compare to the NPV of other forest uses? The value of forest products exceeds that of alternative uses for which data is available (Table

9). Moreover, extraction offers a sustainable use of the forest, unlike agriculture, logging or cattle ranching.

FUTURE STUDIES

We lack reliable data on value and production of non-wood products from the tropical rainforest. We will collect some of these data during the next 18 months of the project. Like other studies we are not investigating the value of non-tree species. The values of these products may be considerable.

Even if the tropical rainforests offer potential for sustainable extraction, such activities will not work without additional changes. First, markets for rainforest products must develop. This should be done at local, regional, national and international levels. Second, economist must determine the level of market saturation. What is the likely demand for each product? How much of each product can markets process? Third, biologist must determine the long term effects of extraction. What are the effects on plant regeneration? What are the effects on animal populations?

Our calculations are still largely speculative but the initial indication is that extraction is feasible in Ecuador as it is elsewhere in Amazonia. In the next 18 months we will generate better estimates of the NPV at the Jatun Sacha plot and other plots in Amazonian Ecuador.

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Table 1. Potential yield of native fruits from a one hectare Jatun Sacha plot in Ecuador's Napo Province.

FAM	SPECIES	NUM	FRUIT PROD.	x $/UNIT =	VALUE
ARE	*Iriartea deltoidea*	107	15	$0.30	$481.50
ARE	*Jessenia bataua*	10	36.8	$0.40	$147.20
BOM	*Matisia obliquifolia*	1	200	$0.05	$10.00
CEC	*Pourouma guianensis*	3	10	$1.00	$30.00
CEC	*Pourouma tomentosa*	5	10	$1.00	$50.00
FAB	*Abarema jupunba*	2	100	$0.05	$10.00
FAB	*Inga aliena*	2	100	$0.05	$10.00
FAB	*Inga coriacea*	2	100	$0.05	$10.00
FAB	*Inga* sp. 7	1	100	$0.05	$5.00
FAB	*Inga spectabilis*	2	200	$0.15	$60.00
LEC	*Grias neuberthii*	6	36	$0.50	$108.00
MOR	*Batocarpus costaricensis*	5	75	$0.10	$37.50
MOR	*Brosimum utile*	1	50	$0.25	$12.50
SAP	*Chyrsophyllum venezuelanense*	3	50	$0.10	$15.00
STE	*Theobroma subincanum* Martius	2	500	$0.01	$10.00
		202			$996.70

Table 2. Potential yield of palm thatch from a one hectare Jatun Sacha plot in Ecuador's Napo Province.

			THATCH		
FAM	SPECIES	NUM	PROD.	x $/UNIT	= VALUE
ARE	Astrocaryum chambira	2	5	0.5	$5.00
ARE	Iriartea deltoidea	107	5	0.25	$133.75
ARE	Jessenia bataua	10	4	0.5	$20.00
		202			$158.75

Table 3. Potential yield of fuel (firewood) from a one hectare Jatun Sacha plot in Ecuador's Napo Province.

			FUEL		
FAM	SPECIES	NUM	PROD.	x $/UNIT =	VALUE
BOM	Matisia aff. bracteolosa	3	4	$1.00	$12.00
CEC	Pourouma guianensis	3	4	$1.00	$12.00
CEC	Pourouma tomentosa	5	4	$1.00	$20.00
CLU	Tovomitopsis membranacea	7	4	$1.00	$28.00
FAB	Inga sp. 6	1	4	$1.00	$4.00
FAB	Inga tenuistipula	3	4	$1.00	$12.00
FAB	Pterocarpus rohrii	7	4	$1.00	$28.00
MLI	Guarea gomma	1	4	$1.00	$4.00
RUB	Alseis sp.	1	4	$1.00	$4.00
RUB	Capirona sp. nov.	1	4	$1.00	$4.00
SAB	Melisoma sp. nov.	1	4	$1.00	$4.00
		202			$132.00

Table 4. Potential yield of plant medicines from a one hectare Jatun Sacha plot in Ecuador's Napo Province.

		MEDICINE			
FAM	SPECIES	NUM	PROD.	x $/UNIT =	VALUE
ANN	Guatteria sp. 3	2	1	2.5	$5.00
ARE	Iriartea deltoidea	107	1	0.25	$26.75
CEC	Cecropia cf. ficifolia	4	1	2.5	$10.00
CEC	Cecropia sciadophylla	6	1	2.5	$15.00
FAB	Myroxylon balsamum	1	1	2.5	$2.50
FAB	Pterocarpus rohrii	7	1	2.5	$17.50
LEC	Grias neuberthii	6	1	2.5	$15.00
MOR	Naucleopsis amara	4	1	2.5	$10.00
MRI	Virola multinervia	2	1	2.5	$5.00
OLA	Minquartia guianensis	4	1	2.5	$10.00
		202			$116.75

Table 5. Potential yield of fruits, thatch, fuel and medicines from a one hectare Jatun Sacha plot in Ecuador's Napo Province.

SPECIES	FRUIT	THATCH	FUEL	MEDICINE	TOTAL
Guatteria sp. 3				$5.00	$5.00
Astrocaryum chambira		$5.00			$5.00
Iriartea deltoidea	$481.50	$133.75		$26.75	$642.00
Jessenia bataua	$147.20	$20.00			$167.20
Matisia aff.			$12.00		$12.00
Matisia obliquifolia	$10.00				$10.00
Cecropia cf. ficifolia				$10.00	$10.00
Cecropia sciadophylla				$15.00	$15.00
Pourouma guianensis	$30.00		$12.00		$42.00
Pourouma tomentosa	$50.00		$20.00		$70.00
Tovomitopsis membranacea			$28.00		$28.00
Abarema jupunba	$10.00				$10.00
Inga aliena	$10.00				$10.00
Inga coriacea	$10.00				$10.00
Inga sp. 6			$4.00		$4.00
Inga sp. 7	$5.00				$5.00
Inga spectabilis	$60.00				$60.00
Inga tenuistipula			$12.00		$12.00
Myroxylon balsamum				$2.50	$2.50
Pterocarpus rohrii			$28.00	$17.50	$45.50
Grias neuberthii	$108.00			$15.00	$123.00
Guarea gomma			$4.00		$4.00
Batocarpus costaricensis	$37.50				$37.50
Brosimum utile	$12.50				$12.50
Naucleopsis amara				$10.00	$10.00
Virola multinervia				$5.00	$5.00
Minquartia guianensis				$10.00	$10.00
Alseis sp.			$4.00		$4.00
Capirona sp. nov.			$4.00		$4.00
Melisoma sp. nov.			$4.00		$4.00
Chyrsophyllum venezuelanense	$15.00				$15.00
Theobroma subincanum Martius	$10.00				$10.00
	$996.70	$158.75	$132.00	$116.75	$1,404.20

Table 6. Net present value (NPV) of extractable products (fruit, thatch, fuel and medicines) from a one hectare plot in Ecuador's Napo Province.

PRODUCT	YIELD	75% YIELD	NET
FRUIT	$996.70	$747.53	$448.52
THATCH	$158.75	$119.06	$71.44
FUEL	$132.00	$99.00	$59.40
MEDICINE	$116.75	$87.56	$52.54
TOTAL	$1,404.20	$1,053.15	$631.89

NPV = V / r

= $631.89 / 5%

= $631.89 / 0.05

= $12637.80

NPV = NET PRESENT VALUE

V = NET REVENUE

r = DISCOUNT RATE

= 5%

Table 7. Net present value (NPV) of extractable products (fruit, thatch, fuel and medicines) from a one hectare plot in Ecuador's Napo Province using a conservative estimate of fruit production.

PRODUCT	YIELD	75% YIELD	NET
FRUIT	$729.20	$546.90	$328.14
THATCH	$158.75	$119.06	$71.44
FUEL	$132.00	$99.00	$59.40
MEDICINE	$116.75	$87.56	$52.54
TOTAL	$1,136.70	$852.53	$511.52

NPV = V / r

= $511.52 / 5%

= $511.52 / 0.05

= $10,230.40

NPV = NET PRESENT VALUE

V = NET REVENUE

r = DISCOUNT RATE

= 5%

Table 8. Net present value (NPV) of extractable products (fruits) from a one hectare plot in Ecuador's Napo Province using a conservative estimate of fruit production.

PRODUCT	YIELD	75% YIELD	NET
FRUIT	$729.20	$546.90	$328.14
THATCH	$0.00	$0.00	$0.00
FUEL	$0.00	$0.00	$0.00
MEDICINE	$0.00	$0.00	$0.00
TOTAL	$729.20	$546.90	$328.14

NPV = V / r

= $328.14 / 5%

= $328.14 / 0.05

= $6,562.80

NPV = NET PRESENT VALUE

V = NET REVENUE

r = DISCOUNT RATE

= 5%

Table 9. A comparison of the net present value of alternative uses of the rain forest.

LOCATION	ACTIVITY	NPV
BRAZIL	Gmelina arborea (for pulp)	$3,184.00
BRAZIL	Cattle (fully stocked pasture)	$2,960.00
PERU	EXTRACTION (Peters et al.)	$6,820.00
ECUADOR	EXTRACTION (this study)	$6,562.80

APPENDIX A

FAM	SPECIES	num	COMMON NAME	CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
ANA	Tapiria guianensis	3	CACHIG, HUAPA GRANDE	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
ANN	Annona duckei	2	HUASI CASPI, SICO CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
ANN	Guatteria sp. 2	1	AJUA	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
ANN	Guatteria sp. 3	2	CARA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
ANN	Trigynae ecuadorensis	2	CHONTA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
APO	Lacmella oblongata	1	YANA CAUCHO	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
ARA	Dendropanax sp.	5	SARA MUYU YURA,TAMIA,PILCHE M. PEQ.	N	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N
ARE	Astrocaryum chambira	2	RAMOS	N	Y	N	Y	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N
ARE	Iriartea deltoidea	107	POTANGA,CARAPUTO,BAMBIL,PUSHIHUA	N	Y	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N
ARE	Jessenia bataua	10	SHIHUA MUYU, UNGURAHUA	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
BOM	Matisia aff. bracteolosa	3	SACHA SHALLIPU	Y	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N
BOM	Matisia obliquifolia	1	MUNILO CASPI	N	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
BOM	Phragmotheca ecuadoriensis	1	ICHILLA PUSCALA	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
BOM	Quararibea sp. 1	2	SAPOTE	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
BOR	Cordia alliodora	2	CHIRI CASPI, HUALLCA MUYU	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
BOR	Cordia cf. ucayaliensis	1	RAYU CASPI	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
BUR	Protium fimbriatum	14	ICHILA COPAL CASPI, C.C., C. BLANCO	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
BUR	Protium polybotrium	2	QUIJINA CACHIG, COPAL CASPI	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y
BUR	Protium puncticulatum	1	COPAL BLANCO	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y
BUR	Tetragastris panamensis	1	SACHA SHALLIPU	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
CEC	Cecropia cf. ficifolia	4	DONDO	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
CEC	Cecropia herthae vs	6	DONDO	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
CEC	Cecropia sciadophylla	6	DONDO	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
CEC	Coussapoa bicolor	1	PUCANGA	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
CEC	Pourouma bicolor ssp. bicolor	1	PICUANCO	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CEC	Pourouma guianensis ssp. gui	3	IANDRA UYILLA, SACHA SHALLIPU, S.U.	Y	Y	N	N	N	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N
CEC	Pourouma tomentosa	5	PICUANCA, SACHA UYILLA	N	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N
CHY	Hirtella racemosa var. rac	2	CACHIG	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CHY	Licania sp.	1	CHONTA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CLU	Marila grandiflora	1	ARDILLA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CLU	Tovomitopsis membranacea	7	SHULLA CASPI, S.MUYU YURA,S.M.	N	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N
CLU	Vismia sp.	1	SACHA ACHITILLO	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
EUP	Drypetes amazonica	4	URCU CACHIG	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
EUP	Mabea cf. caudata	7	HUALCA MUYU, H.M. YURA, MONTA CACHIG	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
FAB m	Abarema jupunba	2	CULQUI CASPI, MANGUCHIG	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga aliena	2	MONTA CACHIG	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N
FAB m	Inga coriacea	2	CACHA PILLINGAS	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga ruiziana	4	ICHILLA COPAL CASPI	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga sp. 1	2	MONTA CACHIG	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga sp. 10	1	URCU CACHIG	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga sp. 12	1	RAYU PACAI	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga sp. 6	1	MONTA CACHIG	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N
FAB m	Inga sp. 7	1	MONTE CACHIG	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga sp. 8	1	SARA MUYU CASPI	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga spectabilis	2	-	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Inga tenuistipula	3	VERDE CARI CACHIG	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N
FAB m	Inga vismiifolia	2	PUCA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB m	Parkia velutina	4	TAMBURO	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FAB p	Myroxylon balsamum	1	BALSAMO	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
FAB p	Pterocarpus rohrii	7	YAHUAR MUYU,CACHIG,C.GRANDE,TARAGUA CA.	Y	Y	N	N	N	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N
FABm	Inga aff. microcana	1	MONTA CACHIG	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
FLA	Hasseltia floribunda	7	SARA MUYU YURA, ATUN S.M.Y.	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

APPENDIX A

FAM	SPECIES	num	COMMON NAME	CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
FLA	Laetia procera	3	LLAUTA CASPI, AURU MUYU	Y	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N
FLA	Tetrathylacium macrophyllum	35	HUAMBI CASPI,HUALCA MY,ICHILLA SM, SMY	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
ICA	Discophora guianensis	1	ILA YURA	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
LAC	Lacistema nena	2	AGUA UCHAN, UCHAN YURA, CHIRI CASPI	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LAU	Aniba cf. puchury-minor	1	AJUA PUNDUCHIG	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LAU	Lauraceae genus indet.	1	QUILLU AHUA	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LAU	Nectandra coeloclada	7	QUILLU AJUA, AJUA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LAU	Ocotea bufo	4	CALUN-CALUN, ICHILLA AJUA, QUILLU CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LEC	Eschweilera sp.	1	CARA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
LEC	Grias neuberthii	6	PITON	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N
MAL	Bunchosia argentea	2	PISHCU TOCOTA, URCO CHUTO	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MEL	Miconia sp. 1	5	PAYATZI, PAYANTZE PEQUEÑO	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
MEL	Tessmannianthus heterostemon	2	PAYATZI	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
MLI	Guarea gomma	1	PAUSHI TOCOTA	Y	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N
MLI	Guarea kunthiana	1	TOCOTO	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MLI	Guarea pterorhachis	7	PISHCO TOCOTA, T., SACHA AVIO	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
MOR	Batocarpus costaricensis	5	ATUN ORITO ILA, SACHA PAPARAGA	Y	Y	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
MOR	Brosimum lactescens	2	YURAC CHONTA CASPI, CHONTA CASPI BLANCO	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Brosimum utile	1	CHONTA RUCU MUYU	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Clarisia racemosa	1	CHINCHI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Ficus yoponensis	2	CIPI, ILA	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Mabea cf. caudata	7	SARA MUYU	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Maquira calophylla	4	PUNGARA MUYU, PAPARAGUA	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Naucleopsis amara	4	CHONTA CASPI, ATUN ARDILLA PAPARAGUA G,	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N
MOR	Perebea guianensis ssp. gui	4	ARDILLA PAPARO, HUALCA CASPI	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
MOR	Perebea xanthochyma	4	MANGAL PACACHIG	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
MOR	Pseudolmedia laevis	7	HAULLIS CASPI, CHONTA CASPI	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
MOR	Pseudolmedia rigida	5	CHONTA CASPI	Y	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N
MRI	Iryanthera juruensis	5	CEDRO AJUA	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
MRI	Iryanthera laevis	2	CEDRO AJUA	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MRI	Iryanthera sp.	1	HUAPA	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MRI	Osteophloem platyspermum	4	HUACHIG CASPI, HUAPA	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N
MRI	Otoba glycycarpa	55	ICHILLA PANGA HUAPA, HUAPA, PUCUNO H.	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
MRI	Otoba novogranadensis	2	HUAPA 2	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MRI	Otoba parvifolia	5	HUAPA 4	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MRI	Virola calophylla	12	ARDILLA PAPARAGUA, SACHA CERQUILLO	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y
MRI	Virola duckei	8	ANGUS CASPI, HUAPA	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
MRI	Virola flexuosa	3	SANGE DE GALLINA, P. HUAPA	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MRI	Virola multinervia	2	ILA YURA	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
MRI	Virola peruviana	1	SACHA AVIO, SACHA ANNONA	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
MRI	Virola sp. 2	1	PUCUNA HUAPA	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MYR	Parathesis amazonica	1	SARA MUYU YURA	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
MYT	Myrciaria sp.	1	HAULLIS CASPI	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
OLA	Minquartia guianensis	4	HUAMBULA	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
POL	Coccoloba mollis	1	PUCA CASPI	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
RHA	Rhamnidium elaeocarpum	1	SACHA PONCE	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
RUB	Alseis sp.	1	CHILLA AMARUN CASPI	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
RUB	Capirona sp. nov.	1	CALUN-CALUN, CAPIRONA	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N
RUB	Chimarrhis glabriflora	2	INTACHIG	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
RUB	Coussarea paniculata	1	PILANTZU	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
RUB	Pentagonia spathicalyx	4	AJUA, PAUSHI TOCOTA	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
RUB	Rubiaceae genus indet. 1	1	ICHILLA ILA	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

APPENDIX A

FAM	SPECIES	num	COMMON NAME	CM	CN	CR	DP	FI	FS	FO	FP	FR	FU	HU	ME	OR	PE	PO	RM	TO	VE	MI
SAB	Meliosma herberlii	2	CHULLU MUYU YURA	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAB	Melisoma sp. nov.	1	SHULLAQUI YURA	Y	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N
SAP	Chyrsophyllum amazonicum	1	ICHILLA SACHA AVIO	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Chyrsophyllum pomiferum	1	SACHA AVIO	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Chyrsophyllum venezuelanense	3	SACHA CALMITO, ICHILLA JAMBI MANGA	Y	Y	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N
SAP	Diploon cuspidata	1	HUASI CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SAP	Ecclinusa guianensis	1	CARA CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SAP	Micropholis egensis	1	TUTA PISHCU ILA	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Pouteria cuspidata	3	PITON, ANGU CASPI, SACHA AVIO	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Pouteria sp. 1	1	YURA CAUCHO	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y
SAP	Pouteria sp. 2	1	CACHIG	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Pouteria sp. 3	1	YANA ILA	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Pouteria trilocularis	1	URA TOCOTA	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Pouteria unilocularis	1	MULCHI MUYU	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SAP	Sapotaceae genus indet. 3	1	ANGU CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SIM	Simaba plataphylla aff.	1	COPAL CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
STE	Sterculia colombiana	5	PUSCALA	Y	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
STE	Sterculia rugusa	3	SAPOTE	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
STE	Sterculia tessmannii	2	PUNSE YURA, SAPOTE	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
STE	Theobroma subincanum	2	PUSHIHUA CAMBIA	Y	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N
TIL	Apeiba aspera	5	PUCALA, NACCHAG CASPI, SAPOTE DE MONTE	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
TIL	Apeiba tibourbou	2	ÑACCHE CASPI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
ULM	Ampelocera longissima	2	SARA MUYU YURA, YAHUAR M, SHALLIPU GRAND	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
VIO	Gloeospermum equatoriense	3	SACHA SHALLIPU	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
VIO	Leonia crassa	2	TAMIA MUYU YURA, JAMBI CASPI	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
VOC	Erisma uncinatum	2	HUAPA	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
VOC	Vochysia biloba	7	TAMBURO CASPI, AGUA PAYATZI	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
ZZZ	liana 1912	1	TASA HUASCA	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N