PRELIMINARY RESULTS OF A LARGE-SCALE TREE INVENTORY OF UPLAND RAIN FOREST IN THE CENTRAL AMAZON.

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ABSTRACT

A large-scale inventory of trees ≥ 10cm DBH was conducted in the upland "terra firme" rain forest of the Distrito Agropecuário da SUFRAMA (Manaus Free Zone Authority Agricultural District) approximately 65Km north of the city of Manaus (AM), Brasil. The general appearance and structure of the forest is described together with local topography and soil texture. The preliminary results of the inventory provide a minimum estimate of 698 tree species in 53 families in the 40Km radius sampled, including 17 undescribed species. The most numerically abundant families, Lecythidaceae, Leguminosae, Sapotaceae and Burseraceae as also among the most species rich families. One aspect of this diverse assemblage is the proliferation of species within certain genera, including 26 genera in 17 families with 6 or more species or morphospecies. Most species have very low abundances of less than 1 tree per hectare. While more abundant species do exist at densities ranging up to a mean of 12 trees per ha, many have clumped distributions leading to great variation in local species abundance. The degree of similarity between hectare samples based int the Coefficient of Community similarity index varies widely over different sample hectares for five ecologically different families. Soil texture apparently plays a significant role in determining species composition in the different one hectare plots examined while results for other variable were less consistent. Greater differences in similarity indices are found for comparisons with a one hectare sample within the same formation approximately 40Km to the south. It is concluded that homogeneity of tree community composition within this single large and diverse yet continuous upland forest formation can not be assumed.

Key words - Forest inventory; Upland rain forest; Amazon floristic composition; Species diversity; Plot similarity.

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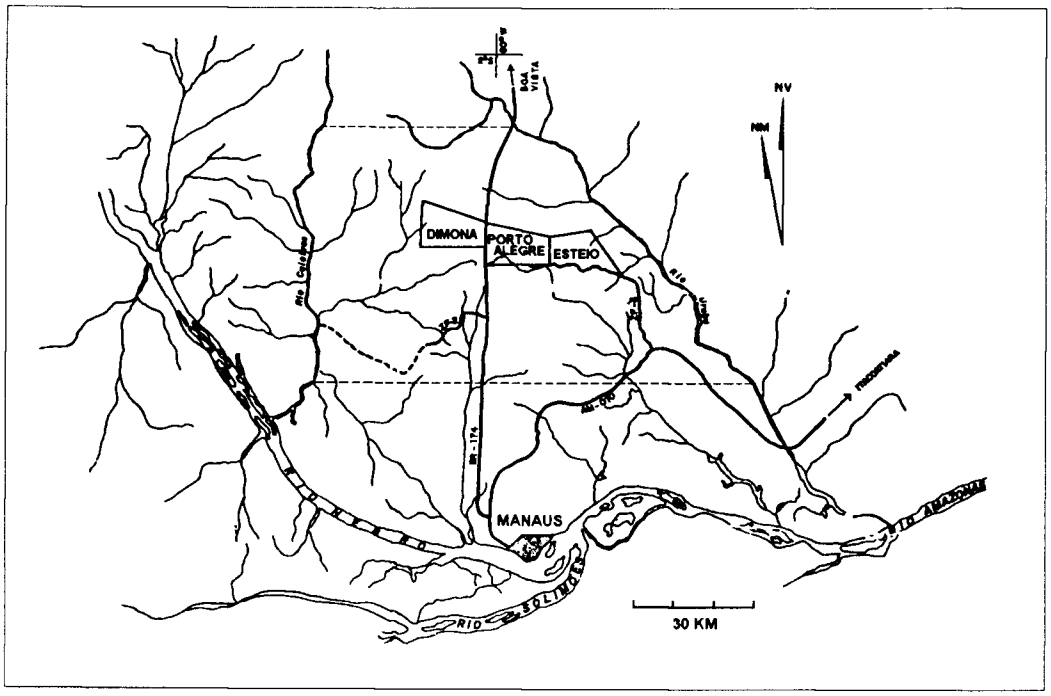
INTRODUCTION

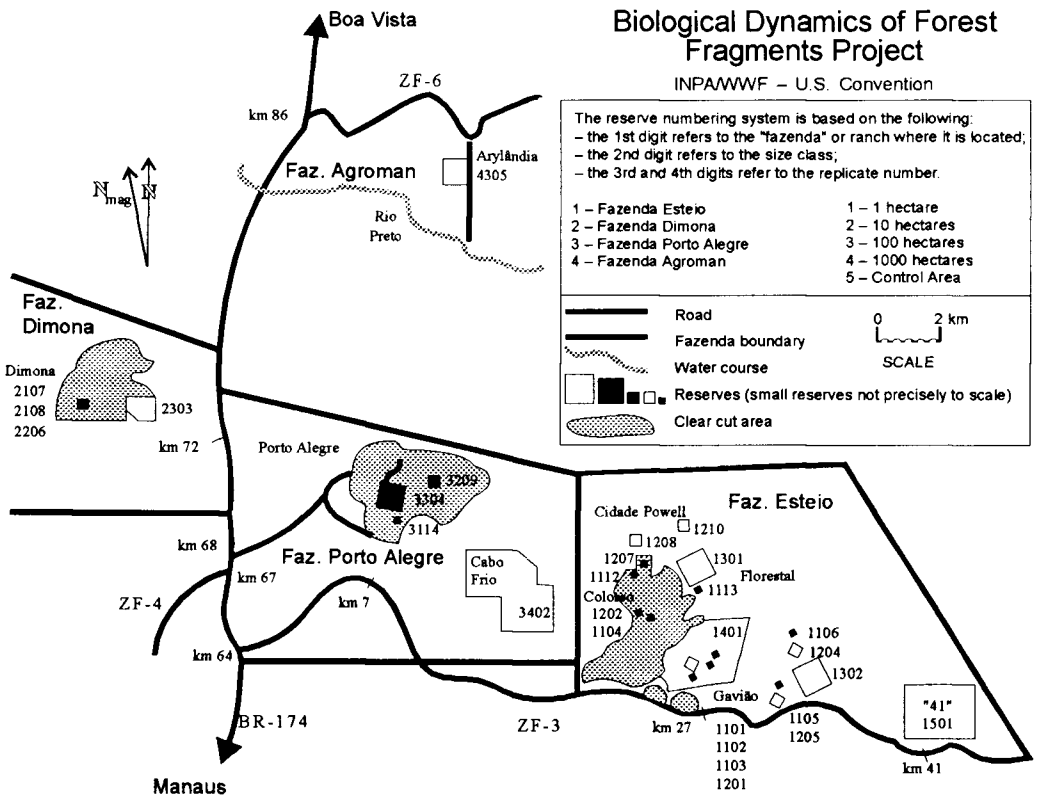
The high species richness and low population densities of many species have remained a challenge to biologists studying tropical communities, both in the cataloging of the species present and in the comparison of community composition at different sites within a single formation. The present investigation presents the preliminary results of an on-going study of the tree populations of the upland ''terra firme'' rain forest of the central Amazon just north of the city of Manaus (Amazonas) Brazil. The immediate objectives of the inventory are to provide base-line data on tree species presence, abundance and distribution to determine the similarity of patches of forest in a broad but superficially homogeneous locality, and to serve as controls for the same patches after experimental manipulation. This paper presents the preliminary floristic results of the inventory and describes the tree element of the forest community before disturbance. This study is a contribution of the ''Botanical Ecology'' subproject of the multidisciplinary project ''The Biological Dynamics of Forest Fragments'' (BDFF) being conducted under the bilateral agreement between Instituto Nacional de Pesquisas da Amazônia, the Smithsonian Institute and originally the World Wildlife Fund. The project's main goal is to investigate the effects of forest fragmentation on the remaining isolated forest patches. Working with SUFRAMA, the Manaus Free Zone Authority, the project has been able to select forest patches in areas destined for conversion to pasture to be set a side at the time of felling, thus creating a series forest island replicates in what was once a continuous forest landscape. The project is unique in it's dimensions, the opportunity to gather ample base-line data before forest isolation takes place and int he large number of different taxa being studied under the same global objectives on the same sites.

STUDY LOCATION

The study is being conducted in the upland ''terra firme'' rain forest of the Distrito Agropecuário da SUFRAMA (Manaus Free Zone Authority Agricultural District) approximately 65Km north of the city of Manaus, AM (Figure 1 inset). Patches of forest denominated ''reserves'' are marked out in agreement with the land owner before deforestation. The series of reserve replicates includes patches of 1, 10, 1000 and a single 10,000ha area. Initiated in late 1979, the project now covers a total of 23 different patches in the replicate series spread across a 40Km east-west swath of originally unbroken forest (Figure 1).

Figure 1 – Location of the Biological Dynamics of Forest Fragments project within 3 cattle ranches of the SUFRAMA (Manaus Free Zone Superintendency).





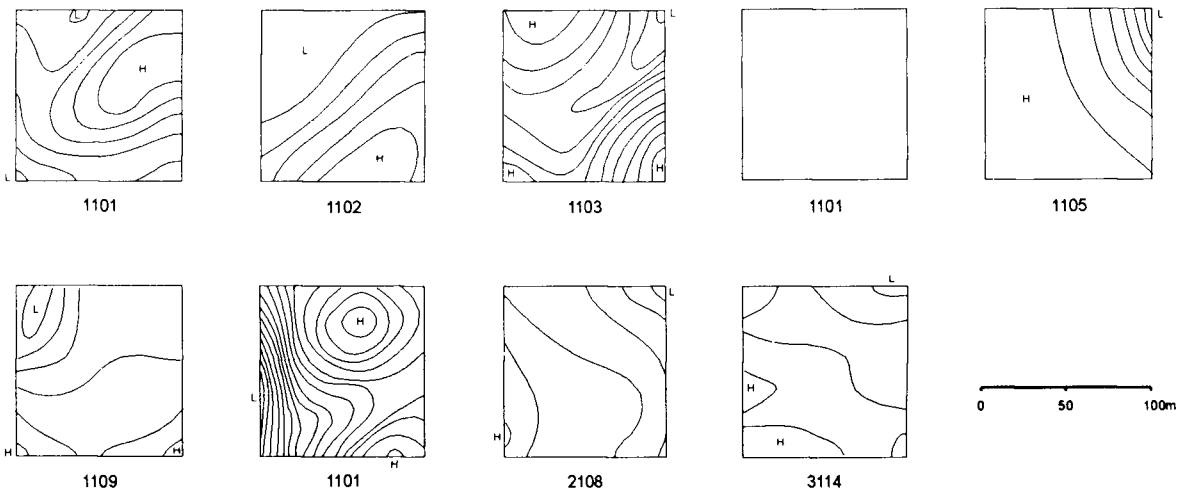
METHODS

The forest tree inventory includes all trees greater or equal to 10cm diameter at breast height (DBH) in the study plots. In each reserve, study areas of 1 hectare, generally 100m×100m, are laid out and divided into 20m×20m quadrats. Quadrat corners are marked with PVC pipe and identified within a coordinate grid. Each tree is measured for DBH and it's position in the quadrat mapped. A sample of leaves, flowers or fruits is collected from every tree for later identification in the INPA Herbarium and by family specialists. Reference vouchers (Appendix I) are maintained in the project reference collection at INPA and in the INPA Herbarium, where an additional representative stand collection for several hectares will also be kept and reference collection duplicates are int he process of being incorporated in the Laboratoire de Phanérogamie, Museum National d'Histoire Naturelle in Paris. Each tree receives a uniquely numbered tag for that reserve attached to a galvanized nail. At the present the inventory has been conducted for over 50,000 trees in 78 hectares of forest, including 2 plots of 9 contiguous hectares each, one of which was isolated in 1980 and the other which is located in the center of a 1000ha reserve. Results for 70 contiguous and noncontiguous hectares are presented in this publication.

General site description

The landscape in the Distrito Agropecuário is hilly, composed of steep slopes alternating with flat plateaus. Small and occasionally large streams cross the area but there are no rivers of navigable size. All 100ha reserves contain permanent streams or waterlogged low areas while 1ha reserves contain neither of these features. Topographic maps of inventory hectares show a variation in elevation of from 0 to 16m with a mean difference of 6.85 ± 4.00m (Fig. 2). The total topographic variation for the region is approximately 80m (Ranzani, 1980).

Figure 2 – Topography of 9 scattered one hectare rederves as indicated by 1m elevation countour lines (relationship of contour lines to absolute elevation not established). H = highest ground, L = lowest ground within each reserve.



The soils of the region are clayey and are classified as ''podzólico vermelho amarelo álico'' (aluminum-rich red yellow podzol) and ''latosolo amarelo álico'' (aluminum-rich yellow latosol) (Ranzani, 1980). Preliminary soil texture data indicate differences between low wet areas, characterized by a high percentage of sand, and the rest of the terrain dominated by clay (P. Fearnside, unpublished data). In the inventory hectares for which data is available, low wet areas represent 4.2% of the 20m by 20m quadrats of the 382 quadrats sampled. Sand is invariably associated with water and a low relative position on the slope while a rolling topography but without water is generally clayey with a few occurrences of clayey loam, sand clay loam and sandy clay (Table 1). In only 2 of 159 samples from the sites without water, both in Reserve 1103, does sand account for more than 50% of the soil. Texture may vary within a single hectare: Reserves 1104 and 1105 have only a single very clayey texture while Reserve 1103 has as many as four textures present ranging from clay to sandy clay.

Table 1 – Soil textures in selected inventory hectares of the Biological Dynamics of Forest Fragments study area (unbublished data, P. M. Fearnside).

Area (ha)	Reserve Number	No. of 20×20m quadrats per texture category:			Total No. of quadrats sampled
		Sandy, loamy sand & sandy loam (<20% clay + >50% sand)	Clayey loam, sandy clay loam & sandy clay	Clay & very clayey (>40% clay + <50% sand)	
No water present:					
1	1101, 1102, 1103, 1104, 1105, 1109, 2107, 2108, 3114	0 (0%)	14 (12%)	105 (88%)	119 (100%)
10	1202, 3209	0 (0%)	0 (0%)	159 (100%)	159 (100%)
Subtotal		0 (0%)	14 (5%)	264 (95%)	278 (100%)
Water present:					
10	1201, 2206	16 (15%)	54 (52%)	34 (33%)	104 (100%)
Total		16 (4%)	68 (18%)	298 (78%)	382 (100%)

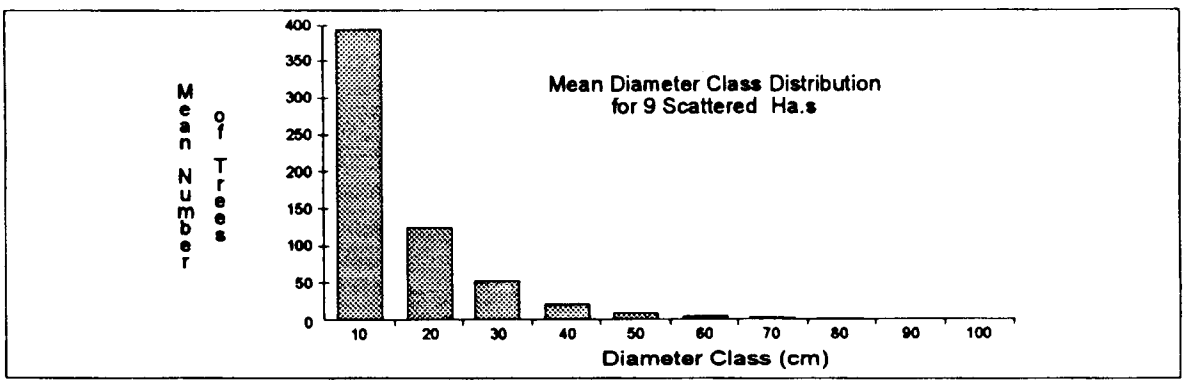
The general appearance of the undisturbed forest is that of a very closed vegetation with a high density of trees of low stem diameter and an abundance of stemless or juvenile pinnate leaf palms (Figure 3). Arborescent palms are also present in abundance in the canopy and mid-story (see Results). Few examples of massive individuals can be found and in general trees are much smaller both in height and diameter than in upland forests in other sites in the Brazilian Amazon such as Carajás or Jarí.

Figure 3 – General aspect of the forest understory of the study

INVENTORY RESULTS

The greatest number of trees in the portion of the stand included in the present study (≥ 10cm DBH) is found in the 10 to 20cm classes (Figure 4). Few trees attain diameters greater than 60cm, with the notable exceptions of emergents such as **Caroycar villosum** (Caryocaraceae), **Dinizia excelsa** (Leguminosae) and certain Lecythidaceae. The mean tree density of 636.8 ± 40.8 trees per ha (based on a sample of 9 noncontiguous single hectares). Basal area is 30.55 ± 3.5m² per ha, slightly below values around 35m² from other forests in the Brazilian Amazon (Pires, 1978).

Figure 4 – Distribuition of trunk diameters for trees ≥ 10cm in the study area.

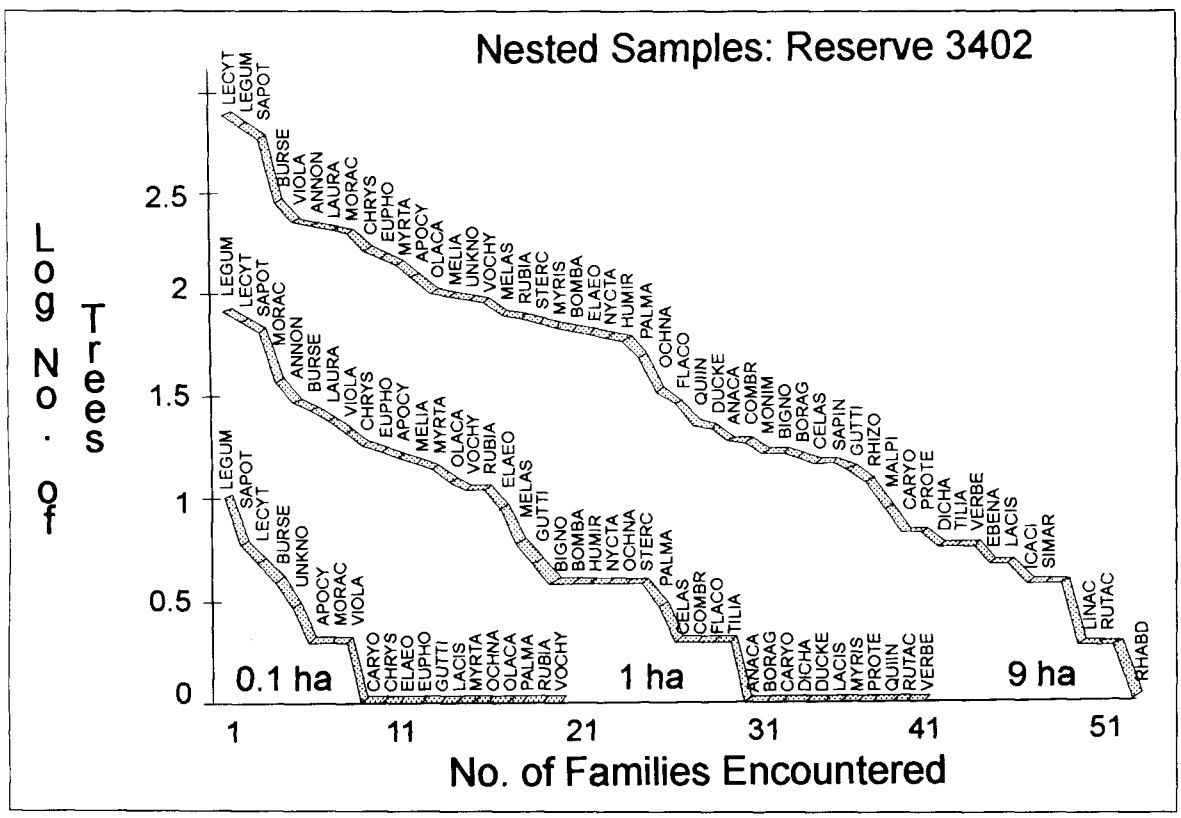


The canopy height is between 35 and 40m, with emergent trees reaching up to 45m. The average bole length (height to the first branch) for trees ≥ 10cm DBH is 11.6m, varying between 3 and 32m. This branch distribution plus a high density of saplings and stemless or juvenile tree palms reduces visibility to around 20m in the understory and not more than 30m in the mid-story. The tree crown zone of the forest, the mid-story and the understory vary widely due to trees fall gaps, standing dead trees, architectural differences in tree species and total tree heights. No distinct strata can be perceived on a forest-wide basis.

A preliminary analysis of the families and species of trees present in the 70 inventory hectares provides a minimum estimate of 698 species in 53 families analyzed to date for the region (Appendix I). The eventual confirmation of an additional 156 existing morphospecies and the inclusion of numerically important families currently not available or still under study, such as Leguminosae and Lauraceae, will bring this number to around 1000 species (estimates for missing families based on species counts from the Reserva Ducke in the same region, Prance, 1990).

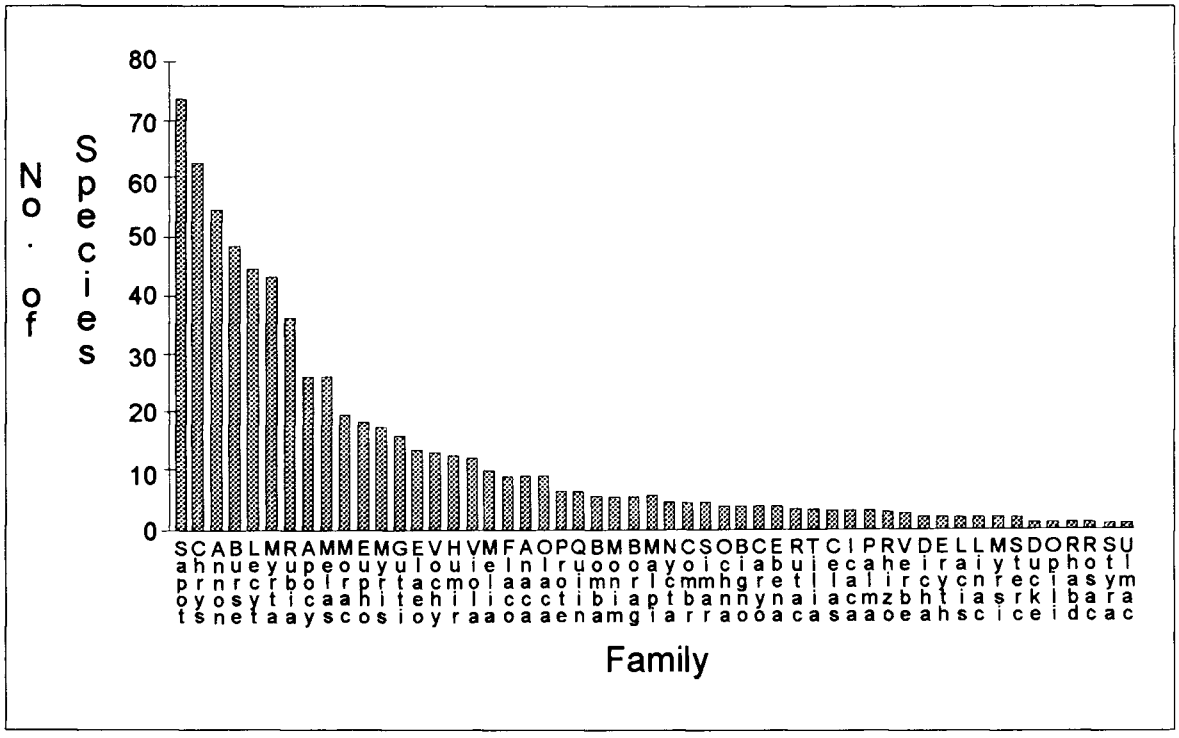
Examining the inventory results at the family level, the Lecythidaceae, Leguminosae and Sapotaceae are consistently the three most abundant families in sample sizes ranging from 0.1 to 9 hectares (Figure 5). The trees of these three families alone make up a remarkable 41% of the stand in the 9 contiguous hectares sample. The fourth most abundant is the Burseraceae, 5.5% in 9ha, a family well represented at all sample levels but with densities significantly lower than any of the first three and similar to those of the Annonaceae, Chrysobalanaceae, Lauraceae, Moraceae and Violaceae.

Figure 5 – Number of collections per family of trees ≥ 10cm diameter at breast height (DBH) in three nested plots within Reserve 3402.



The most numerically abundant families are also among the most species-rich, with 74, 49 and 45 species respectively in the Sapotaceae, Burseraceae and Lecythidaceae (Figure 6). The study area appears to be a major center of diversity for the Sapotaceae where up to 50 species have been encountered in a hectare containing only 98 individuals of this family (L. D. A. Teixeira, pers. com.). A similar result is found for the Burseraceae where half of the species in the 70 inventory hectares are present among 98 trees in the one hectare reserve 2107. The mean number of species per hectare for the family is 17.9 ± 3.69 (based on 9 noncontiguous hectares). In general however, most families have been found to have fewer than twenty species and 6 (10.9%) are represented by a single species (Figure 6).

Figure 6 – Preliminary number of tree species by family of 70ha inventoried for the present study in the central Amazon (data not available for Leguminosae and Lauraceae).



Much of the species richness of this forest is due to the proliferation of species within certain genera of a family. The greatest number of species within a single genus to date is in **Licania** (Chrysobalanaceae), and **Protium** (Burseraceae), both with 35 species followed by **Eschweilera** (Lecuthidaceae) with 20 species. There are 26 genera in 16 families which qualify as species-rich when a minimum of 6 species per genus is used as the arbitrary cutoff for ''species-rich'' genera (Table 2, also see Appendix I). The presence of more than one such genus in a family is not uncommon. Again, the numerically most abundant families distinguish themselves in possessing species-rich genera.

Table 2 – Families with genera comprised of six or more species and morphospecies[1].

Annonaceae	Guatteria 18, Duguetia 11, Xylopia 8
Apocynaceae	Aspidospermum 11
Boraginaceae	Cordia 6
Burseraceae	Protium 35, Dacroydes 7
Chysobalanaceae	Licania 35, Couepia 18, Hirtella 7
Combretaceae	Buchenavia 6
Elaeocarpaceae	Sloanea 14
Lecythidaceae[3]	Eschweilera 20, Couratari 14, Lecythis 7
Leguminose[3]	Inga ≥ 10
Melastomataceae	Miconia 19
Monimiaceae	Siparuna 6
Myristicaceae	Virola 10, Iryanthera 7
Myrtaceae	Eugenia 17, Myrcia 13, Calypetranthes 6
Proteaceae	Roupala 6
Sapotaceae	Micropholis 10 Pouteria 6
Violaceae	Rinorea 7

[1] Not examined: Lauraceae, Sterculiaceae
[2] + Indicates other morphospecies yet to be confirmed
[3] Partial data

A small portion of the species diversity of the BDFF study area is due to the encounter of previously unknown species. The number of new taxa detected in families where all inventory collections have been completely identified by specialists has reached 17 to date (indicated in Appendix I), including species such as **Protium occultum** Daly which is unknown from other collection sites (D. Daly, pers. com.). The absence or extreme low density of these new species at other well collected area nearby, such as Reserva Ducke, 40Km to the south, attests to the variability in species distributions in the region. The final number of new species discovered will undoubtedly be greater given the many morphospecies which can not be matched to identified material in the INPA Herbarium.

The numerically most abundant species in the inventory to date does not from one of the families of greatest overall abundance but from the 10th ranking Euphorbiceae. **Micrandropsis scleroloxyon** is represented by 875 individuals in 70ha, with an average density of 12.5 trees/ha. A significant amount of variation exists in local population density which ranges from 0 to 42 trees in any given hectare plot. Almost equally abundant is **Protium** cf. **llewelynii** of the Burseraceae, with 839 trees or 12 trees/ha. The high density of **Oenocarpus bacaba** Mart., with over 500 trees is not surprising in view of the striking first impression this forest makes of a community rich in palms (see previous section). The most abundant species in each family for which such data are currently available are listed in Table 3. Only 12 families have their most abundant species present at densities of greater than 1 tree per hectare although future results from the still incomplete Sapotaceae, Leguminosae and Lauraceae may raise this to 15. Several families, such as the Annonaceae, Burseraceae, Chrysobalanaceae, Euphorbiaceae, Lecythidaceae, Myristicaceae and Violaceae, have two of more species with densities greater than 1 tree per hectare. At least five of these 12 families are also among those relatively rich in species and 7 of these species belong to genera rich in species.

Table 3 – Preliminary list of the most abundant tree species for each family present in the 70 noncontiguous inventory hectares.

Family	nº of trees	Species
Enphorbiaceae	875	**Micrandropsis scleroxylon** W. Rodr.
Burseraceae	839	**Protium** cf. **llewelynii** Macbr.
Palmae	500	**Oenocarpus bacaba** Mart.
Bombacaceae	426	**Scleronema micranthum** Ducke
Chrysobaianaceae	249	**Licania heteromorpha** Benth. var. **heteromorpha**
Apocynaceae	210	**Geissospermum argenteum** R.E. Woodson
Annonaceae	199	**Unonopsis stipitata** Diels
Myristacaceae	196	**Virola calophylla** Warb.
Lecythidaceae[1]	168	**Eschweilera** cf. **wachenheimii** (R.Ben.) Sandw.
Melastomataceae	156	**Mouriri angulicosta**/duckeana/duckeanoides complex
Violaceae	147	**Rinorea flavescens** (Aubl.) O. Kuntze
Myrtaceae[1]	93	**Myrcia grandis** McVaugh.
Celastraceae	67	**Goupia glabra** Aubl.
Humiriaceae	58	**Vantanea parviflora** Lam.
Rubiaceae	57	**Coussaria racemosa** A. Rich ex DC.
Sapotaceae[1]	55	**Ecclinusa bacuri** Aubr. et Pellegr.
Duckeodendraceae[2]	55	**Duckeodendron cestroides** Kuhlm.
Dichapetalaceae	54	**Tapura amazonica** Poepp. & Endl.
Vochysiaceae	53	**Qualea labouriauna** Stafl.
Ochnaceae	52	**Ouratea** cf. **decagyna** Maguire
Monimiaceae	51	**Siparuna decipiens** (Tul.) A. DC.
Bignoniaceae	51	**Bignoniaceae** sp. 01
Olacaceae	43	**Heisteria laxiflora** Engler
Lacistemataceae	43	**Lacistema aggregatum** (Berg) Rusby
Meliaceae[1]	41	**Carapa guianensis** Aubl.
Rhizophoraceae	40	**Anisophyllea manausensis** Pires & W. Rodr.
Flacortiaceae	40	**Casearia javitensis** H.B.K.
Elaeocarpaceae	40	**Sloanea floribunda** Spruce ex Benth.
Caryocaraceae	35	**Caryocar pallidum** A.C. Smith
Malpighiaceae	32	**Bysonima** aff. **stipulacea** Juss.
Boraginaceae	32	**Cordia sagoti** Johnston
Quiinaceae	27	**Quiina obovata** (Tul.) A.C. Smith
Icacinaceae	27	**Dendrobangia boliviana** Rusby
Simaroubaceae	21	**Simaba polyphylla** (Cavalcante) Thomas
Linaceae	20	**Roucheria punctata** Ducke
Ebenaceae	20	**Diospyros pseudoxylopia** Mildbr.
Guttiferae[1]	18	**Vismia duckei** Maguire
Tiliaceae	17	**Apeiba echinata** Gaertn.
Nyctaginaceae	14	**Nyctaginaceae** sp. 2
Anacardiaceae	13	**Anacardium** cf. **parvifolium** Ducke
Combretaceae	11	**Buchenavia parviflora** Ducke
Verbenaceae	9	**Vitex triflora** Vahl
Proteaceae	8	**Roupala** sp. 3
Ulmacaceae[1]	6	**Ampelocera edentula** Kuhlm.
Rutaceae	6	**Spathelia excelsa** (Krause) Cowan & Brizieky
Rhabdodendraceae[2]	4	**Rhabdodendron amazonicum** (Spr. ex Benth.) Huber
Rosaceae[2]	2	**Prunus myrtifolia** (L.) Urban
Opiliaceae[2]	2	**Agonandra** sp. 1
Erythroxalaceae	2	**Erythroxylum citrifolium** St. Hil.
Styracaceae	1	**Styraz guianensis** A.DC.
Myrsinaceae	1	**Stylogine longifolia** (Mart. ex Miq.) Mez.

(not available: Lauraceae, Leguminosae, Moraceae, Sterculiaceae

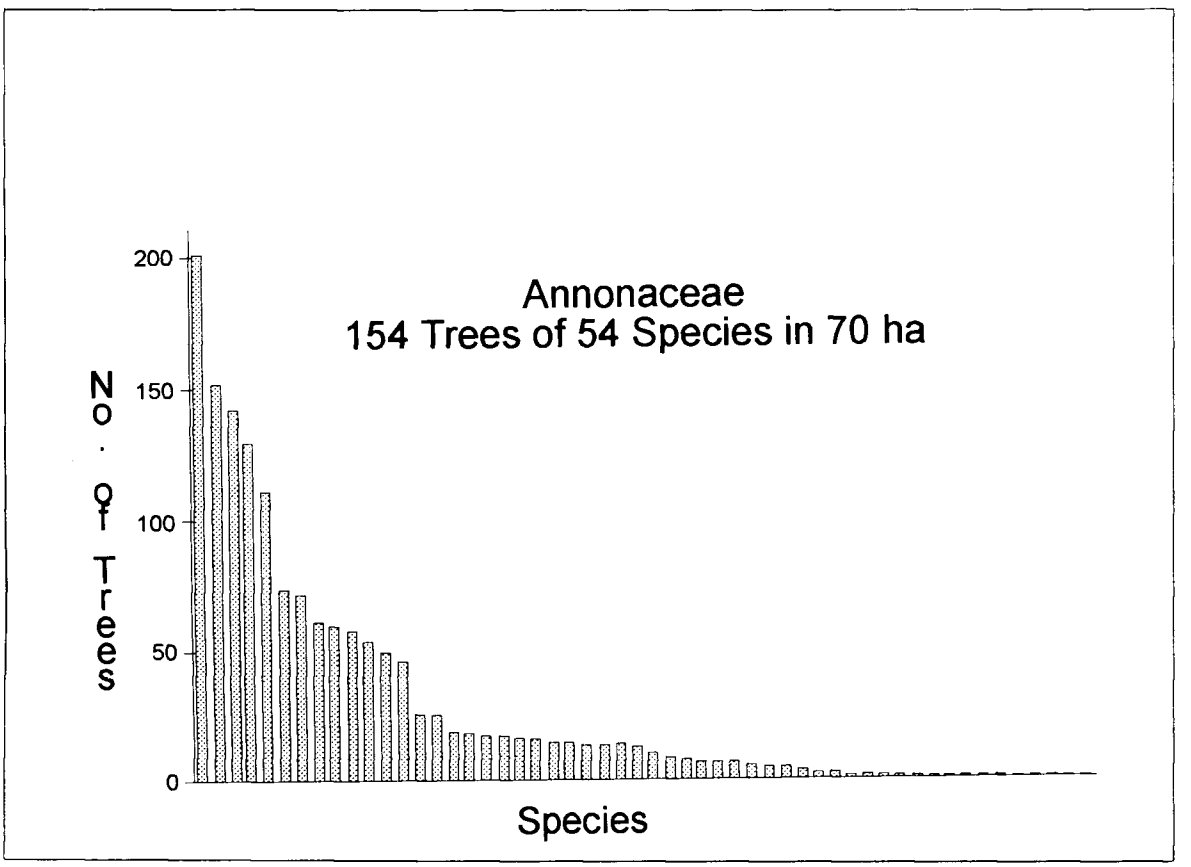
[1] partial data

[2] only 1 species in the region or family

The concentration of tree species in a single hectare of the upland forest is enormous. A previous inventory in the same region (Prance et al., 1976) observed 191 species ≥ 10cm DBH in 36 families. A preliminary estimate for the present study is more than 124 species per hectare based on data from only 29 of the 37 families occurring in the one hectare Reserve 1105 and not including, among others, three of the richest families (Lecythidaceae, Sapotaceae, Leguminosae) for which data by hectare are not yet available.

The Annonaceae, the sixth ranking family in numerical abundance in a 9 contiguous hectare sample and to date 3rd in species richness for the entire 70ha, provides a good example of species abundance and distribution patterns within a major family. As in other abundant families, it is represented by many individual trees in every hectare sampled, ranging in this case from 12 to 46 trees with a mean of 24 ± 8.77 trees per ha (based on 9 separate hectares). Fifty five species were encountered in the 70 inventory hectares, making this the third most diverse of the families studied to date. A majority of the species, 48 out of 55 or 87% of the family, are relatively rare, occurring at densities equal to or less than 1 tree per hectare (Figure 7), thus only a subset of the species known to be present in the project area will necessarily be found in any given hectare. Many of the less abundant species have individuals of 25cm DBH or greater, for example the generally large **Onychopetalum amazonicum**, suggesting that the observed low densities are not an artifact of the 10cm lower DBH limit used in the study.

Figure 7 – Abundance by species for trees of the Annonaceae.



The spatial distributions of abundant species are not regular. Of those 7 Annonaceae species occurring at densities of 1 tree per hectare or more over all 70 inventory hectares, only 2 occurred in all the 9 scatter 1 ha reserves: the most abundant **Unonopsis stipitata**, with 199 (13%) of 1530 trees in the family and the third most abundant **Bocageopsis multiflora** with 140 trees (9.2%), while the fourth most abundant, **Duquetia** sp. 25 with 133 trees (8.7%), occurred in only 5 of the 9 hectares (Table 4). Mean densities also differed. Five of the seven species occurred at greater mean densities over 9 hectares than for all 70 hectares despite the absence of 3 of these species from one or more of the 9 hectares. Data from the closely adjacent or contiguous inventory hectares in the larger reserves may give slightly lower density estimates for clumped species. Applying the general rule that clumped distributions are indicated by sample variance larger than the mean (Pielou, 1974: 141-143), four of these species have definitely clumped distributions and one more is probably clumped at the 1 hectare sampling unit level for the 9 hectares examined (Table 4) the remaining two appear to have regular and random distribution patterns respectively. It is remarkable to note that among the most abundant species for this family are three species of **Duguetia** which have not yet been identified and are probably undescribed (P. Maas, pers. com.). According to specimens registered in the INPA herbarium, two of these species have been collected only a few times previously in the Manaus region and never from any other Amazon locations represented in this herbarium.

Table 4 – Distribuition over 9 scattered hectares of Annonaceae having overall densities of ≥ 1 tree/ha for 70 hectares.

Reserve Number			1101	1102	1103	1104	1105	1109	2107	2108	3114				
Species	Tot 70	Mean dens 70ha	Number of Trees Present									Tot 9ha	# Res	Mean dens 9ha	s.d.	var.
Unonopsis stipitata	199	2.84	6	2	3	4	11	2	6	1	1	36	9	4.00	± 3.240	10.498
Fysea Longifolia	141	2.01	4	1	2	5	5	0	1	2	0	20	7	2.22	± 1.986	3.944
Bocageopsis multiflora	140	2.00	3	2	2	3	2	4	1	1	2	20	9	2.22	± 0.972	0.944
Duguetia sp. 25	133	1.90	0	0	0	3	4	1	0	4	3	15	5	1.60	± 1.803	3.250
Duguetia sp. 59	105	1.50	1	7	2	2	2	1	2	1	0	18	8	2.00	± 2.000	4.000
Duguetia sp. 37	72	1.02	1	0	0	2	4	2	0	2	1	12	6	1.33	± 1.323	1.750
Ephedrantbus amazonicus	70	1.00	1	0	2	0	1	0	2	2	1	9	6	1.00	± 0.866	0.749

Sampling unit similarity

If the spatial distributions for a majority of the most abundant species in a large family are irregular and with abundant species showing a tendency toward clumped distributions, will this have a significant impact on the degree of similarity in species composition for the family over the nine scattered 1 hectare reserves? It might be assumed that such patterns would result in low similarity of species composition between sample hectares as long as the factor(s) responsible for them does (do) not act in the same way on certain species, causing them to be distributed as a block. The Coefficient of Community (referred to henceforth as C.C.), a measure of similarity in species composition (Pielou, 1974: 311-312), was calculated for a subset of the possible pair-wise comparisons of the 9 scattered 1ha reserves, selected on the basis of hectar proximity, topography, soil texture and the number of species present. The values obtained range form 31.6 to 77.4 with 5 of the 13 clustered around 50 (Table 5). The highest value obtained was for hectares 1105 and 1101, rich in species and with a high number of species in common, although species richness alone is not a guarantee of a high C.C. as seen in the case of 1105 and 1102 having the same numbers of species as the first comparison but few in common. Reserves 1101 and 1102 have similar soil texture and topography which differ from 1105, however the next highest C.C. was found for a comparison where soil texture and topographic similarity were also high. The lowest C.C. was found for the hectares poorest in species. Other low values were found for sites with differing topography regardless of proximity and soil texture. Thus great differences in hectare species similarity exist, a result not incompatible with irregular spatial distributions and clumping due in part to the factors examined here. While similar soil texture and topography combined with species richness and to a lesser extent plot proximity are associated with high C.C. values, the relationship between these factors is not entirely consistant over the comparasion examined. Other yet unidentified factors and stochastic effects are also probably at work.

Families of different ecological characteristics, abundances and distribution patterns may lead to different conclusions about the similarity of the different sample hectares. Coefficient of Community indices for four additional families were calculated for the same comparisons (although not always the same hectares depending on the nature of the comparison) to see to what extent the results from the Annonaceae may be generalized. While each family is distinct in the range and degree of similarity detected, soil texture emerges as a significant factor in all four (Table 5). The Burseraceae, an abundant species-rich family with many small or medium sized trees, has relatively high C.C.s over a small range, between 50 and 70. This is apparently due to the presence of a group of 8 ubiquitous species which occur consistently in 8 or all of the 9 hectares. This is seen in the second highest C.C. value for the 2 least diverse hectares 1101 and 1102. The presence of another 10 species which occur in only one of the 9 hectare causes similarity to drop as the overall number of species per hectare increases beyond the ubiquitous group. Beyond this, similarity of soil texture and hectare proximity are associated with all high highest C.C. values while the role of topography is inconsistent.

Table 6 – Coefficients of Community of five families for selected pairs of 9 scattered single hectares.

	Annon				Burse				Melas				Apocy				Myris				Overall			
Total Species 70ha	55				49				27				27				18				171			
Total Species 9ha	36				40				19				14				17				125			
Range Species/ha	9-16				14-25				3-9				1-6				4-9							
Reserve Characteristics	Res.	N	Ns	C.C.	Res.	N	Ns	C.C.	Res.	N	Ns	C.C.	Res.	N	Ns	C.C.	Res.	N	Ns	C.C.	Res.	N	Ns	C.C.
Rich in species: most species in common[1]	1105 1101	16 15	12	77.4	2107 1103	25 21	14	61.0	1103 1109	9 7	4	50.0	1102 1104	6 6	4	66.7	1102 1103	8 9	5	58.8				
Similar soils[2]: very clayey	1104 1105	13 16	10	70.0	1104 1105	19 18	11	59.5	1104 1105	7 6	5	76.9	1104 1105	6 5	5	90.9	1104 1105	4 5	3	66.7	1104 1105	49 50	33	66.7
Similar topography + neighboring + rich in species[1]	1101 1102	15 15	10	66.6	1102 1103	15 21	12	66.7	1105 1109	6 7	2	30.8	1105 1109	5 5	2	40.0	1102 1103	8 9	5	58.8				
																	1101 1103	9 9	4	44.4				
Similar topography + soils[2] (clay + cllayey loam) + neighboring	1101 1102	15 15	10	66.6	1101 1102	14 15	10	69.0	1101 1102	3 4	1	28.6	1101 1102	3 6	4	44.4	1101 1102	9 8	4	47.1	1101 1102	44 48	29	63.0
Neighboring	1102 1103	15 10	8	64.0	1102 1103	15 21	12 12	66.7	1102 1103	4 9	3	46.2	1102 1103	6 1	0	0	1102 1103	8 9	5	58.8	1102 1103	48 50	28	57.1
Similar topography + widely separated	3114 2108	9 12	6	57.1	3114 2108	18 18	12	66.6	3114 2108	4 3	1	23.6	3114 2108	5 3	1	25.0	3114 2108	4 7	3	54.5	3114 2108	40 43	23	55.4[3]
Different topography + soils[2]: partially claysand vs. very clayey	1103 1104	10 13	6	52.2	1103 1104	21 19	10	50.0	1103 1104	9 7	3	37.5	1103 1104	1 6	0	0	1103 1104	9 4	2	30.8	1103 1104	50 49	21	42.4
Rich in species[1]	1105 1102	16 15	8	51.6	2107 1103	25 21	14	61.0	1103 1104	9 7	3	37.5	1109 3114	5 5	3	60.0	1101 1103	9 9	4	44.4	2107 1105	56 50	27	50.9
Most widely separated	1109 2108	12 12	6	50.0	1109 2108	13 18	8	51.6	1109 2108	7 3	1	20.0	1109 2108	5 3	2	50.0	1109 2108	8 7	3	40.0	1109 2108	45 43	20	45.5
Richest vs. poorest in species[1]	1105 3114	16 9	6	48.0	1101 2107	14 25	11	56.4	1103 1101	9 3	2	33.3	1102 1104	6 3	2	44.4	1101 1104	9 4	3	46.2				
									1103 2108	9 3	1	16.7	1104 1101	6 3	1	22.2	1101 3114	9 4	2	30.8				
Different topography + widely separated	1104 2107	13 13	6	46.2	1104 2107	19 25	14	63.6	1104 2107	7 6	4	61.5	1104 2107	6 5	3	54.5	1104 2107	4 7	2	36.4	2107 1104	56 49	29	55.2
Different topography + neighboring	2107 2108	13 12	5	40.0	2107 2108	25 18	15	70.0	2107 2108	6 3	1	22.2	2107 2108	5 3	0	0	2107 2108	7 7	4	57.1	2107 2108	56 43	25	50.5
Poorest in species[1]	1103 3114	10 9	3	31.6	1101 1102	14 15	10	69.0	1101 2108	3 3	1	33.3	1101 2108	3 3	0	0	1104 3114	4 4	1	25.0	2108 3114	43 40	23	55.4[3]

N = number of species in the ha
Ns = number of species shared between the ha

[1] Different hectare pairs user for each family where necessary due to differences in the number of species present.
[2] Only soil texture considered.
[3] Reserve pair also used in another comparison same column.

The remaining three families have similar and much lower numbers of species. The Melastomataceae is composed of small sight-loving trees while the Apocynaceae and the Myristicaceae are both closed forest families with a mix of large and small stature species. All show wider ranges in C.C. for the various comparisons than for the previous two families, with Apocynaceae having the greatest range as well as both the highest and lowest C.C. values in any family, including four different comparisons with zero values. The absence of ubiquitous species in these families does not preclude C.C. values as high or higher than those observed for the Annonaceae and Burseraceae but certainly contributes to the lower values obtained. In all three families the highest C.C. value was obtained for the reserves with similar very clayey soils, while lowest, values were obtained for reserves having the greatest differences in soil texture. The other comparisons were inconsistent and at times directly contradictory for the remaining factors examined.

Normally such an examination of sample similarity would include all species encountered in the two samples. This is not possible in the present case due to the number of families still not completely identified. When based on the five families considered above, a moderate but not great similarity between hectares was found with a narrower range of C.C. values than for four of the individual families. The C.C. values range from 42.5 and 45.5, for the greatest contrast in soil texture and the most widely separated hectares, to 66.7 and 63.0, for the greatest similarity in soil texture and the closest hectares of similar soil texture and topography (Table 5).

Comparisons with other regional inventories

The present study demonstrates the great diversity, low population densities and variability in taxonomic similarity of sampled hectares in the upland forest of the BDFF study area in the central Amazon. It is interesting to consider how these results apply to the region in general which in its pristine state is under almost total continuous forest cover.

To date, there have been 8 upland rain forest inventories conducted in the central Amazon in the region of Manaus, north of the Amazon River and east of the Rio Negro, including the present study (Table 6). These studies have varied greatly in their area (0,185ha to 92ha), botanical precision and the minimum DBH limit. Only two of these inventories were conducted with the collection of botanical vouchers for all trees, thus guaranteeing the accuracy and verifiability of the species cited as well as permitting quantification of species abundances (Prance et al., 1976 and this study). Information on the regional flora is also available from a study of the collections from the Reserva Ducke registered in the herbarium of the Instituto Nacional de Pesquisas da Amazônia (Prance, 1990). While based on pooled material collected under differing criteria, it provides a botanically accurate reference point against which regional inventories can be checked.

The number of species encountered in these inventories varies widely (Table 6) and interpretation of these data is complicated by differences in inventory method mentioned above. An inventory of commêrcial size trees in 92ha spread over many scattered plots of the upland forest in the Distrito Agropecuário da Suframa cites 352 tree species (Alencar, 1972). Other estimates given vary between 169, 326, 43. A preliminary estimate for the Reserva Ducke collections reaches 825 species for all vascular plants (Prance, 1990). The BDFF inventory is thus the richest assembly of tree species encountered in the region, probably due in a large part to the breadth and intensity of the inventory, identification based on vouches collected for all trees rather than common name-based identifications and the possibility to recollect additional material from the tagged tree to resolve eventual problems of identification.

Table 6 – Inventories of upland "terra firme" forest in the central Amazon near Manaus (Amazonas) Brasil.

DBH Limit (cm)	Author(s)	Local	Total Area Sampled (ha)	Sampling Layout	Botanical Identification	Trees /ha	No. of Families	No. of Spp.	Most Abundant Families (descending order)
8 8	Lechthaler, 1956	Reserva Ducke, Km 20 NE of Manaus on Manaus-Itacoatiara Highway AM-010	1	1 parcel	common name no botanical vouchers	745	30	61	Burseraceae Lecythidaceae Leguminosae Sapotaceae Sapindaceae
8 10	Takeuchi, 1960	42 Km NE of Manaus	0.185	?	?	676	18	52[1]	Leguminosae Lecythidaceae Sapotaceae Burseraceae Moraceae
8 10	Rankin-de-Mérona, (this paper)	Biological Dynamics of Forest Fragments study area centered on Ramal ZF-3 of Manaus-Caracaraí Highway BR-174 75 Km N of Manaus	70	52 noncontiguous 1ha parcels + 2 separate parcels of 9 contiguous ha each	botanical vouchers from all trees	637	55	698	Lecythidaceae Leguminosae Sapotaceae Burseraceae Violaceae
8 15	Prance et al., 1976	EMBRAPA Experimental Station, Km 30 of Manaus-Itacoatiara Highway AM-010	1	1 parcel	common name + some botanical vouchers	350	36	191	Lecythidaceae Leguminosae Sapotaceae Moraceae Burseraceae
8 20	Rodrigues, 1967a	Araras, left bank of the Rio Negro, 50 Km NW of Manaus	5	noncontiguous parcels	common name + some botanical vouchers	167	35	164	Sapotaceae Rosaceae[2] Lecythidaceae Leguminosae Lauraceae
8 20	Jardim, 1985	INPA Estação Experimental de Silvicultura Tropical, Ramal ZF-2 of BR-174, 55 Km N of Manaus	8	noncontiguous parcels	common name + some botanical vouchers	247	47	326	Lecythidaceae Sapotaceae Euphorbiaceae Leguminosae Moraceae
8 25	Rodrigues, 1967b	Km 64 to Km 200 along the Manaus-Itacoatiara Highway AM-010, NE of Manaus	27	noncontiguous parcels	common name + some botanical vouchers	?	46	43	Leguminosae Rosaceae[1] Lauraceae Sapotaceae Lecythidaceae
8 25	Alencar et al., 1972	Distrito Agropecuário da Suframa, Km 30 to Km 100 of BR-174, N of Manaus	92	noncontiguous parcels	common name + some botanical vouchers	?	41	352	Leguminosae Sapotaceae Lauraceae Lecythidaceae Annonaceae

[1] Rosaceae = Chrysobalanaceae

If comparisons are limited to the family level, which corresponds roughly to the regional common name level of distinction, all 8 inventories show the consistent numerical domination of individuals of the Sapotaceae, Lecythidaceae and Leguminosae regardless of the lower DBH limit employed. When lower DBH limits of 8 to 15 cm are used, the Burseraceae also appears on the list of the 5 most abundant families along with Sapindaceae, Moraceae and Violaceae. The Chrysobalanaceae, Lauraceae, Euphorbiaceae and Annonaceae appear at and above 20cm DBH.

Of all these studies, the only two which can be compared at the species level are Prance et al (1976) and the present study. The former was conducted on a one ha plot at the Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC) field station on the Manaus-Itacoatiara Highway AM-010, some 40km to the south of the BDFF study area. The outward appearances of the forest stands at the two sites are typical for the region as described in the previous section. The one ha Reserve 1105, on similar topography and clay soil, was chosen for comparison with the CEPLAC hectare. Even though both studies are based on complete voucher collections, not all species can be compared directly due to partial or incomplete identifications of sterile material in both studies and the lack of identifications for some families in the BDFF study. Nonetheless a majority of the species are available for comparisons between the two sites. While the CEPLAC data were summarized for publication based on a 15cm minimum DBH limit, calculations for the present comparison were made from the raw data available in the appendices so as to include trees ≥ 10cm DBH compatible with the BDFF study.

Thirty six families with trees ≥ 10cm DBH were encountered in the CEPLAC hectare and 38 at reserve 1105, of which 14 were not held in common between the sites, with 8 occurring only in reserve 1105 and 6 in the CEPLAC hectare (Table 7). Another 11 families of trees are known to occur in the region based on the rest of the BDFF inventory but were not present in either of these two hectares. None of the missing families are abundant nor species rich according to the results of the BDFF inventory (Figures 5 and 6). The large total number of species in each of the two hectares has already been cited in the previous section. Data form selected families for which comparisons can be made at present suggest nonetheless that Reserve 1105 hectare is somewhat richer in species, with 124 versus 91 in 28 families. Of these 124 a maximum of 32 species are present at the two sites.

Table 7 – Families encountered in 1 hectare of forest at two central Amazon sites north of Manaus (AM) Brasil.

	Families Unique to:		
Families Shared	Reserve 1105	CEPLAC Hectare	Families in 70ha BDFF Inventory not found in either hectare[4]
Annonaceae[1]	Anacardiaceae	Caryocaraceae[3]	Bignoniaceae
Apocynaceae[1]	Celastraceae	Dichapetalaceae[2, 3]	Boraginaceae
Palmae[1]	Icacinaceae	Duckeodendraceae[2, 3]	Ebenaceae
Bombacaceae[1]	Lacistemataceae	Guttiferae[3]	Erythroxylaceae
Burseraceae	Linaceae	Monimiaceae[2, 3]	Proteaceae
Chrysobalanaceae[1]	Malpighiaceae	Opiliaceae[3]	Rhabdodendraceae
Combretaceae	Rhizophoraceae		Rosaceae
Elaeocarpaceae[1]	Rutaceae		Styracaeae
Euphorbiaceae			Tiliaceae
Flacortiaceae			Ulmaceae
Humiriaceae			Verbenaceae
Lauraceae			
Lecythidaceae			
Leguminosae			
Melastomataceae			
Meliaceae			
Moraceae			
Myristicaceae[1]			
Myrtaceae			
Nyctaginaceae			
Ochnaceae			
Olacaceae			
Quiinaceae			
Rubiaceae			
Sapindaceae			
Sapotaceae[2]			
Simaroubaceae			
Sterculiaceae			
Violaceae[2]			
Vochysiaceae			

[1] The most abundant species in the family in the entire BDFF inventory is shared between Reserve 1105 and the CEPLAC hectare.
[2] The most abundant species in the family in the entire BDFF inventory is present in the CEPLAC hectare but not in Reserve 1105.
[3] Family present elsewhere in the BDFF 70 ha inventory.
[4] All have fewer than 10 species and individual species densities less than 1 tree/ha.

The same five families used for Coefficient of Community index comparisons across the BDFF single hectare reserves were again used to compare Reserve 1105 with the CEPLAC hectare. Values range from 0 to 36.4 (Table 8), and are inferior the minimum values obtained for 3 families within the BDFF study area and in the lower half of the range for the other two families. The overall C.C. for the five families between the two sites is 25.0, thus indicating much lower similarity in species composition than for any comparison within the BDFF site (Tables 5 and 8). While a single comparison based on sample as small as hectare may work against detecting similarity, an examination of the entire species list for the BDFF 70 ha inventory shows that 20% of the species at the CEPLAC hectare are not encountered even at such an intensive sampling level and are thus probably not present at all within the BDFF study site. This suggests that the low C.C. obtained for the five family Reserve 1105/CEPLAC comparison is probably a true reflection of compositional differences and not a function of small sample size.

Table 8 – Coefficient of Community for five families in two 1 hectare plots of upland rain forest north of Manaus (AM) Brazil.

Family	No. of Species Present: Reserve 1105	CEPLAC Ha	No. Spp Shared	C.C.
Annonaceae	14	7	3	28.6
Apocynaceae	6	4	1	20.0
Burseraceae	18	11	4[1]	27.5
Melastomataceae	5	6	2[1]	36.4
Myristicaceae	5	4	0	0
Total	48	32	10	25.0

[1] Maximum possible number of shared species used in case of determinations only to genus.

The most abundant tree species at the CEPLAC hectare are **Eschweilera adora** (= **Eschweilera coriacea**, Lecythidaceae) and **Scleronema micranthum** (Bombacaceae) and **Oenocarpus bacaba** (Palmae). All are also abundant in Reserve 1105 but surpassed by 2 or 3 trees by **Protium** cf. **llewelynii** (Burseraceae) and **Rinorea guianensis** var **subintegrifolia**, neither of which can be confirmed as present in former site. The most abundant species in the whole 70 ha BDFF inventory, **Micrandropsis scleroloxyon** (Euphorbiaceae), is not present in either the CEPLAC nor the 1105 hectares. Nonetheless, the most abundant species in a family in the 70 BDFF inventory is often among the species present at the CEPLAC site, if not among the species shared with Reserve 1105 (12 out of 18 cases where a direct comparison can be made, see note Table 7).

DISCUSSION AND CONCLUSIONS

The upland rain forest at the BDFF study site is rich in families and species, with outstanding examples of species proliferation within certain genera. A number of new tree species have been identified in several families and the large number of fortile morphospecies not identifiable to species on the basis of collections in the INPA Herbarium suggest that more will be discovered in that material. That the area appears somewhat more diverse than would be concluded from collections at Reserva Ducke and other forest inventories in the region is probably due in part to the intensity of the inventory and the collection of vouchers from all trees regardless of reproductive state. It is recommended for forest inventories in the region that voucher specimens from all trees be collected to avoid the otherwise inevitable confusion of closely related species with similar morphology in species-rich genera. The preliminary results of the present inventory indicate that the study of the upland forest in this region is far from complete and that intensive botanical investigation will continue to yield new taxa and insights to the patterns of forest tree species distributions.

A majority of the tree species encountered are present at densities inferior to one tree per hectare. While the more abundant species may held in common at different local sites, as in the case of the ubiquitous Burseraceae species, this is by no means true of all abundant species. Mean density may be a poor indication of true local density due to a tendency toward clumping, such as demonstrated for some species of Annonaceae where even the most abundant species may be absence from some sample hectares. This is reflected in the wide variation and low lower values of the Coefficient of Community especies similarity index for the Annonaceae as compared to the Burseraceae. In general, the similarity of the observed hectare samples for the 5 families studied was only moderate (42.4 to 66.7) and would have been lower still had individual species abundances been taken into account.

Soil texture appears to play an important role in determining how similar species composition will be for the families studied, suggesting that it is important to expand consideration to other soil parameters which may eventually contribute to a better understanding of what controls the distributions of individual species and the composition of the forest community on any given site within the same formation. It is known that drainage and suraface hydromorphology may influence species distributions in the Guianan forests (Lescure & Boulet, 1985). The sometimes contradictory results of soil texture and topography may be due to the need to consider the relative positions of sample hectares on the slope gradient and with respect to the headwaters of nearby streams and seasonal channels (Lucas **et al.**, 1984).

These preliminary results suggest that overall forest tree species composition varies widely over intermediate distances within the same region and that the homogeneity of this single large yet continuous formation can not be assumed. This conclusion is supported by results for comparisons with the CEPLAC site to the south of the BDFF study site where the overall similarity index based on five families was much lower than any observed within the BDFF area. Studies of the composition of this upland forest must thus be based on multiple sample units whose extrapolation validity must be recognized as being limited to the immediate sampling neighborhood. The implication for conservation is that more than one regional conservation unit of a dimension adequate to conserve viable populations will be necessary to guarantee complete species presence and persistence. A minimum estimate of the area necessary for even the most common species of the Myristicaceae examined here is greater than 200 hectares and will be much greater for rarer species (Ackerly **et al.**, 1990).

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RESUMO

Um inventário florestal das árvores ≥ 10 cm DAP foi realizado na floresta tropical da terra firme do Distrito Agropecuário da SUFRAMA, 65 km ao norte da cidade de Manaus (AM), Brasil. A fisionomia geral e a estrutura da floresta são descritas junto com a topografia e textura do solo. Os resultados preliminares do inventário acusam um mínimo de 698 espécies de árvores em 53 famílias, no raio de 40 km amostrado, incluindo 17 espécies novas para a ciência. As famílias numericamente mais abundantes são as Lecythidaceae, Leguminosae, Sapotaceae e Burseraceae, que são também as mais ricas em espécies. Um aspecto interessante desta floresta é a proliferação de espécies dentro de certos gêneros, chegando a ser 26 em 17 famílias com 6 ou mais espécies ou morfoespécies. A maioria das espécies tem densidade inferior a 1 árvore por hectare. Enquanto que existe espécies com densidade que chega até 12 árvores por hectare em média, muitas têm distribuições agrupadas dando como resultado uma grande variação na densidade local. O grau de similaridade entre hectares amostrados usando como índice a Coeficiência de Comunidade varia muito para 5 famílias ecologicamente diferentes. A textura do solo tem um papel importante na similaridade de composição de espécies, mas, outras variáveis não tem um resposta tão coerente. As diferenças são ainda mais pronunciadas para comparações com um inventário realizado na mesma comunidade 40 km ao sul. Concluindo-se que, apesar de ela ser contínua, não pode presupor que existe nesta comunidade diversa e de grande dimensão uma homogeneidade na distribuição de espécies de árvores.

APPENDIX I

Preliminary Partial List of Tree Species from the ''Biological Dynamics of Forest Fragments'' Study Area, Central Amazon.

ANACARDIACEAE

Anacardium cf. **parviflora** Ducke 2206.370
Anacardium spruceanum Benth. ex Engl. 2107.233
Anacardium sp. 1 3209.870
Astronium cf. **ulei** Mattick 3209.2352
Astronium sp. 1 1202.3209
Tapirira guianensis Aubl. 1201.721
Tapirira sp. 3 1201.1864
Thyrsodium paraense Huber 1103.384
Thyrsodium schomburgkianum Benth. 1105.282
Thyrsodium sp. 1 1103.88

Anaxagorea brevipes Benth. 2206.1352
Anaxagorea phaeocarpa Mark 1104.555
Annona ambotay Aubl. 2303.2795
Annona foetida Mart. 2303.1318
Annona sp. 20 1202.5094
Annona sp. 49 2303.3677
cf. **Annona** sp. 50 1303.2863
Bocageopsis multiflora (Mart.) R.E.Fries 2206.2246
Diclinanona calycina (Diels) R.E.Fries 1301.1275
Duguetia caudata R. E. Fries 2303.639
Duguetia cauliflora R.E.Fries 1202.3278
Duguetia flagelaris Huber. 3402.3785
Duguetia pycnastera Sandw. 2206.2180
Duguetia stelechantha (Diels) R.E.Fries 2206.2940
Duguetia surinamensis R.E.Fries 2303.1893
Duguetia sp. 16 3402.4169
Duguetia sp. 25 spec. nov P. Maas 2206.3523
Duguetia sp. 28 spec. nov. P. Maas 1105.105
Duguetia sp. 37 2303.702
Duguetia sp. 59 1201.2043
Ephedranthus amazonicus R.E.Fries 3304.209
Fusaea longifolia (Aubl.) Safford 3304.5980
Guatteria discolor R.E.Fries 3402.830
Guatteria foliosa Benth. 3304.4889
Guatteria cf. **guianensis** (Aubl.) R.E.Fries 2206.1868
Guatteria megalophylla Diels 2303.1133
Guatteria olivacea R.E.Fries 2206.3496
Guatteria punctata (Aubl.) Howard 1201.246
Guatteria schomburgkiana Mart. 3304.1413
Guatteria scytophylla Diels 2303.3050.1186
Guatteria sect. **Mecocarpus** 1301.3970
Guatteria sect. **Trichoclonia** 2303.3509
Guatteria sp. 17 3402.4259
Guatteria sp. 26 1102.438
Guatteria sp. 27 3114.65
Guatteria sp. 29 2206.2299
Guatteria sp. 42 2107.393
Guatteria sp. 50 2303.5776
Guatteria sp. 55 3304.562
Guatteria sp. 56 3402.264

Onychopetalum amazonicum R.E.Fries 3402.1048
Pseudoxandra coriacea R.E.Fries 1102.87
Rollinia insignis R.E.Fries 3304.5621
Tetrameranthus duckei R.E.Fries 1113.140
Unonopsis guatterioides (A.DC.) R.E.Fries 2206.2636
Unonopsis rufescens (Baill.) R.E.Fries 3209.591
Unonopsis stipitata Diels 3304.3246
Xylopia amazonica R.E.Fries 2303.4777
Xylopia benthamii R.E.Fries 2303.907
Xylopia cf. **calophylla** R.E.Fries 2303.1263
Xylopia nitida Dunal 3304.4601
Xylopia cf. **nitida** Dunal 1202.892
Xylopia sp 12 2303.1668
Xylopia sp. 13 2303.5050
Xylopia sp. 54 3402.338

APOCYNACEAE

Ambelania acida Aubl. 1201.1826
Ambelania duckei Markgraf. 2206.917
Aspidosperma album (Vahl) R.Ben. 3209.118
Aspidosperma carapanauba Pichon. 3402.1034
Aspidosperma cruentum Woodson 2107.490
Aspidosperma cuspa (H.B.K.) S.F. Blake 2107.761
Aspidosperma marcgravianum Woodson 1109.202
Aspidosperma oblongum A.DC. 2206.2128
Aspidosperma sandwithianum Markgraf. 1202.3717
Aspidosperma vargasii A.DC. 1105.247
Aspidosperma sp. 19 2303.2265
Aspidosperma sp. 21 3209.2859
Aspidosperma sp. 22 3304.4630
Couma macrocarpa Barb. Rodr. 2206.1513
Geissospermum argenteum R.E. Woodson 2206.839
Geissospermum laeve (Vellozo) Miq. 1201.1926
Himatanthus stenophyllus Plumel (sp. nov. ined.) 1109.88
Himatanthus sucuuba (Spruce) Woodson 2206.2937
Lacmellea aculeata Ducke 2303.4793
Lacmellea arborescens (Muell. Arg.) Markgraf 2206.2563
Lacmellea gracilis (Muell. Arg.) Markgraf 1202.2879
Macoubea guianensis Aubl. 1302.2743
Malouetia duckei Markgraf 2206.2547
Mucoa duckei (Markgraf) Zarucchi 1102.279
Parahancornia amapa (Hub.) Ducke 2303.4685
Rauvolfia sprucei Muell. Arg. 3209.1717
Rauvolfia pentaphylla Ducke 2303.2444

BIGNONIACEAE

Jacaranda copaia D.Don 3402.312
Tabebuia incana A. Gentry 3402.548
Tabebuia sp. 1 3209.2184
Tabebuia sp. 2 3402.585

BOMBACACEAE

Bombacopsis macrocalyx (Ducke) A. Robyns 1103.438
Bombacopsis nervosa (Vitt.) A.Robyns 1104.480
Catostemma albuquerquei Paula 3209.940
Eriotheca globosa (Aubl.) A.Robyns 3209.580
Quararibea ochrocalyx (K.Schum.) Vischer 2206.432
Scleronema micranthum Ducke 2108.163

BORAGINACEAE

Cordia sagoti Johnston 3209.531
Cordia sellowiana Chamb. 1202.4248
Cordia trachyphylla Mart. 2206.1351
Cordia ulei Johnston 3402.926
Cordia sp. 6 3114.59
Cordia sp. 9 1104.450

BURSERACEAE

Crepidospermum rhoifolium (Benth.) Tr. & Pl. 1301.3440
Dacryodes chimantensis Cuatr. 3209.2153
Dacryodes cuspidata (Cuatr.) Daly (comb. nov. ined.) 2206.1055
Dacryodes kukachkana L.O. Wms. 2303.4371
Dacryodes nitens Cuatr. 2303.5784
Dacryodes cf. **peruviana** (Loes) Lam. 2303.5768
Dacryodes roraimensis Cuatr. 2206.1103
Dacryodes sp. 1 2303.3858 (sp. nov. ined. Daly)
Protium altsonii Sandw. 2206.464
Protium apiculatum Swart 2206.1859
Protium aracouchini (Aubl.) March. 3209.465
Protium aff. **carnosum** A.C. Smith 2206.1438
Protium crassipetalum Cuatr. 1202.44

Protium decandrum (Aubl.) March. 2206.1228
Protium ferrugineum (Engl.) Engl. 1201.1885
Protium fimbriatum Swart. 1201.534
Protium gallosum Daly 2206.1875
Protium giganteum Engl. 2206.2478
Protium grandifolium Engl. 2206.1874
Protium guianense (Aubl.) March. ssp. **guianense** 2206.2054
Protium guianense (Aubl.) March. ssp. **pilosissimum** (Engl.) Daly. 2303.86
Protium hebetatum Daly 2206.2735
Protium heptaphyllum (Aubl.) March. 2206.1968
Protium insigne (Tr. & Pl.) Engl. 2206.522
Protium krukoffii Swart. 1301.5134
Protium cf. **llewelynii** Macbr. 1201.77
Protium nitidifolium Cuatr. 3209.1747
Protium occultum Daly 2206.2344 (sp. nov. in press)
Protium opacum Swart 2206.1106
Protium pallidum Cuatr. 2206.1215
Protium paniculatum Engl. & Swart var. **riedelianum** (Engl.) Daly 1301.1874
Protium paniculatum Engl. & Swart var. nov. Daly (ined.) 1301.5590
Protium peruvianum Swart. 1202.683
Protium polybotryum (Turcz.) Engl. 2303.5609
Protium robustum (Swart) Porter 3402.1097
Protium rubrum Cuatr. 2206.1343
Protium sagotianum March. 1301.2859
Protium spruceanum (Benth.) Engl. 1201.1910
Protium strumosum Daly 2107.709
Protium subserratum (Engl.) Engl. 1201.1750
Protium tennifolium (Engl.) Engl. var. **tennifolium** 3304.5773
Protium tennifolium (Engl.) Engl. var. 1 6402.570
Protium trifoliolatum Engl. 2206.2590
Tetragastris panamensis (Engl.) 2206.2494
Trattinnickia burserifolia Mart. 3209.1899
Trattinnickia glaziovi Swart 1301.2734
Trattinnickia cf. **lawrencei** var. **boliviana** Swart. 2206.451
Trattinnickia peruviana 1201.2215
Trattinnickia rhoifolia Willd. 2206.27.92.0985

CARYOCARACEAE

Caryocar glabrum (Aubl.) Pers. 3304.4190
Caryocar glabrum ssp. **parviflorum** 3304.6422
Caryocar pallidum A.C.Smith 3304.4249
Caryocar villsum (Aubl.) Pers. 2206.2085

CELASTRACEAE

Goupia glabra Aubl. 3402.25
Maytenus guianensis Klotsch 1201.1257
Maytenus sp. 1 3402.3018

CHRYSOBALANACEAE

Couepia bracteosa Benth. 2206.2913
Couepia canomensis (Mart.) Benth. ex Hook. f. 1202.3032
Couepia caryophylloides R.Ben. 1202.1328
Couepia elata Ducke 3209.2379
Couepia excelsa Ducke 2206.2747
Couepia glabra Prance 1202.998
Couepia guianensis Aubl. ssp. **glandulosa** (Miq.) Prance 1201.1322.1185
Couepia guianensis Aubl. ssp. **guianensis** Aubl. 3114.200
Couepia habrantha Standl. 2303.363
Couepia longipendula Pilger 2206.1533
Couepia magnoliifolia Benth ex Hook. f. 1202.1937
Couepia obovata Ducke 1101.304
Couepia robusta Huber 1103.74
Couepia sandwithii Prance 1301.435
Couepia spicata 2206.1862
Couepia sp. 8 sp. nov. ined. Prance 3304.1149.1085
Couepia sp. 12 2303.2435.0588
Couepia so. 14 1202.2124
Hirtella bicornis Mart. & Zucc. var. **pubescens** Ducke 2107.694
Hirtella conduplicata 1301.598
Hirtella hispidula Miq. 1202.1994
Hirtella obidensis Ducke 1104.307
Hirtella piresii 1301.583
Hirtella rodriguesii Prance 2107.663
Hirtella cf. **suffulta** 2303.2970
Licania apetala (E. Mey.) Fritsch 1102.569
Licania blackii Prance 2108.559
Licania bracteata Prance 2206.2271
Licania canescens R. Ben. 1201.2139
Licania caudata Prance 1301.3046
Licania davilliifolia 2206.1222
Licania divaricata 3304.1168
Licania agleri Prance 1202.5581

Licania elliptica Standl. 3304.846

Licania fanshawii 1101.527

Licania heteromorpha Benth. var. **heteromorpha** Benth. 2107.255

Licania heteromorpha Benth. var. **prismatocarpa** 1202.119

Licania hirsuta Prance 1104.577

Licania hypoleuca Benth. 2108.64

Licania impressa Prance 2108.322

Licania kunthiana Hook.f. 1201.1715

Licania laevigata sp. nov. ined. Prance 3304.2500

Licania latifolia Benth. 2206.1571

Licania laxiflora Fritsch 2206.2389

Licania longistyla (Hook.f.) Fristsch 2206.2721

Licania micrantha Miq. 2206.2285

Licania minutiflora (Sagot.) Fritsch 1202.829

Licania oblongiflora Standl. 2206.1341

Licania occultans 1202.1443

Licania octandra (Hoffm. ex R. & S.) **Kuntze** ssp. **pallida** (Hook.f.) Prance 1202.6121

Licania pallida Spr. ex Sagot. 1301.398

Licania reticulata 1302.531

Licania robusta 3304.297

Licania rodriguesii Prance 1201.2234

Licania sp. 22 sp. nov. ined. Prance 2206.2712

Licania sandwithii Prance 3402.757

Licania sprucei Hook. F. 2206.2048

Licania unguiculata 1104.605

Licania sp. 13 sp. nov. ined. Prance 1302.2622

Licania sp. 18 sp. nov. ined. Prance 2206.1200

Parinari excelsa Sabine 2108.60

Parinari montana Aubl. 1109.283

Parinari parviflora 1301.4588

COMBRETACEAE

Buchenavia guianensis (Aubl.) Alwan 1202.5431

Buchenavia parviflora Ducke 2206.2666

Buchenavia grandis Ducke 2107.583

Buchenavia sp. 2 2206.1194

Buchenavia sp. 3 1109.373

Buchenavia sp. 4 3209.1565

DICHAPETALACEAE

Tapura amazonica Poepp. & Endl. 1104.426
Tapura guianensis Aubl. 2303.5849

DUCKEODENDRACEAE

Duckeodendron cestroides Kuhlm. 1202.584

EBENACEAE

Diospyros duckei Sandw. 3204.264
Diospyros melinonii (Hiern.) A.C. Smith 1201.193
Diospyros pseudoxylopia Mildbr. 1201.1292
Diospyros sp. 1 2206.2167

ELAEOCARPACEAE

Sloanea aff. **caribaea** Krug. 1105.97
Sloanea eichleri K. Schum. 1201.831
Sloanea floribunda Spruce ex Benth. 2108.633
Sloanea guianensis (Aubl.) Benth. 1201.1437
Sloanea laxiflora Spruce ex Benth. 1105.379
Sloanea pubescens (Poepp. & Engl.) Benth. 1201.1524
Sloanea synandra Spruce ex Benth. 2206.910
Sloanea sp. 2 3209.1276
Sloanea sp. 3 3402.35
Sloanea sp. 18 1103.302
Sloanea sp. 26 3209.1293
Sloanea sp. 33 2206.2420
Sloanea sp. 35 3209.1842
Sloanea sp. 36 1105.102

ERYTHROXYLACEAE

Erythroxylum citrifolium St. Hil. 1102.419
Erythroxylum macrophyllum Cav. 1201.224

EUPHORBIACEAE

Alchornea sp. 1 3304.655
Alchorniopsis floribunda (Benth.) Muell. Arg. 3304.112
Conceveiba guianensis Aubl. 3209.1453
Conceveiba hostmanii Benth. 3304.922
Conceveiba martiana 1201.1605
Conceveiba cf. **nitida** W.Rodr. 1202.3984
Croton lanjouwensis Jablonski 3304.5252
Croton sp. 1 3304.1092
Drypetes variabilis Vittien 3304.5826
Glycidendron amazonicum Ducke 2206.2378
Hevea guianensis Aubl. 1109.484.0585
Mabea caudata Paz & Hoffm. 3402.153Mabea sp. 1 3304.5778
Micrandra elata (Didr.) Muell. Arg. 1109.115
Micrandropsis scleroxylon W. Rodr. 2108.134
Pausandra macropetala Ducke 1105.40
Pera schomburgkiana (Benth.) Muell. Arg. 2107.463
Pogonophora schomburgkiana Miers 2206.2242
Sagotia sp. 1 3114.372

FLACOURTIACEAE

Carpothoche crispdentata Ducke 2206.200
Casearia arborea (Rich.) Urb. 1202.4789
Casearia combaymensis Tul. 1109.330
Casearia javitensis H.B.K. 1201.944
Casearia negrensis Eich. 2206.2065
Casearia ulmifolia Vahl. ex Ventena 1202.4571
Casearia sp. 1 2206.2930.0485
Laetia procera (Poepp.) Eich. 1202.2065
msp. 7 1201.1391
msp. 1 1202.3794

GUTTIFERAE

Calophyllum angulare A. C. Smith 3209.229
Caraipa sp. 2 1104.482
Clusia sp. 1 1202.1961
Lorostemon coelhoi Paula 1103.29

Moronobea coccinea Aubl. 1202.5981
Moronobea cf. **coccinea** Aubl. 2108.297
Moronobea sp. 4 2206.2303
Rheedia acuminata Pl. & Triana 2206.829
Rheedia sp. 2 1201.1851
Symphonia globulifera L. 2206.2543
Tomovita cf. **choisyana** Pl. & Triana 1101.231
Tomovita sp. 1 3209.1290
Tomovita sp. 2 1201.759
Tomovita sp. 3 1202.4890
Tomovita sp. 6 3209.1606
Vismia duckei Maguire 1202.4662
Vismia juruensis Reich. 2206.1889

HUMIRIACEAE

Duckesia verrucosa (Ducke) Cuatr. 1109.318
Endopleura uchi (Huber) Cuatr. 1202.1957
Endopleura sp. 1 1202.2644
Sacoglottis matogrossensis Malme 1202.520.1085
Sacoglottis matogrossensis Malme var. subintegra (Ducke) Wart. 1202.235
Sacoglottis sp. 1 1202.3173
Sacoglottis sp. 2 1104.114
Sacoglottis sp. 4 1302.2980
Sacoglottis sp. 5 3209.1539
Vantanea deniseae W. Rodr. 1202.1071 (sp. nov.)
Vantanea macrocarpa Ducke 1202.888
Vantanea cf. **obovata** (Ducke) Cuar. 1301.421
Vantanea parviflora Lam. 1202.380

ICACINACEAE

Dendrobangia boliviana Rusby 1202.484
Emmotum acuminatum (Benth.) Miers. 1201.1367
Poraqueiba guianensis Aubl. 2206.474

LACISTEMATACEAE (21.05.90)

Lacistema aggregatum (Berg) Rusby 3209.156
Lacistema grandifolium Schnizl 2206.182

(LAURACEAE not available)

LECYTHIDACEAE

Cariniana decandra Ducke 3402.71
Cariniana domestica (Mart.) Miers 3402.4888
Cariniana micrantha Miq. 1202.3288
Cariniana sp. 1 1301.2965
Corythophora alta R. Knuth 3402.4783
Corythophora rimosa W. Rodr. 1101.535
Corythophora sp. 1 1202.6229
Couratari cf. **duckei** R. Knuth. 3402.3230
Couratari guianensis Aubl. 1301.1572
Couratari cf. **macrosperma** A.C. Smith 3402.673.0387
Couratari multiflora (J.E. Smith) Eyma 1104.292
Couratari stellata A.C. Smith 1301.5155
Couratari sp. 1 3402.1044.0487
Couratari sp. 2 1202.5197
Couratari sp. 3 1103.252
Couratari sp. 5 1103.129
Couratari sp. 6 1202.4902
Eschweilera amazonicaformis Mori. 3402.786.0387
Eschweilera apiculata (Miers) A.C. Smith 1104.582
Eschweilera atropetiolata Mori 1103.158
Eschweilera bracteosa (Poepp. ex Berg.) Miers 1301.5274
Eschweilera collina Eyma. 1301.3196
Eschweilera coriaceae (A.P.D.C) Mart. ex Berg. 2206.1679
Eschweilera cyathiformis Aubl. 4302.1387
Eschweilera decolorans Sandw. 1301.3710
Eschweilera grandiflora (Aubl.) Sandw. 1301.5618
Eschweilera micrantha (Berg.) Miers 1301.5625
Eschweilera parviflora (Aubl.) Miers 1301.3566
Eschweilera rankinae sp. nov. ined. Mori 2206.2288
Eschweilera rodriguesiana Mori 2206.2370
Eschweilera tessmannii R. Knuth 1301.3485
Eschweilera cf. **wachenheimii** (R.Ben.) Sandw. 1202.2688.1085
Eschweilera sp. 3 1301.1813
Eschweilera sp. 4 1301.2390
Eschweilera sp. 5 3209.1914.1085
Eschweilera sp. 6 1301.4296
Eschweilera sp. 7 sp. nov. ined. Mori 1301.3336

Gustavia elliptica Mori 1102.374
Lecythis barnebyi Mori 1301.1858
Lecythis cf. **chartacea** Berg. 3402.1116
Lecythis poiteaui Berg. 1301.3531
Lecythis prancei Mori 1301.1746
Lecythis retusa Spruce ex Berg. 3402.771.0387
Lecythis zabucaja Aubl. 1301.2107
Lecythis sp. 1 3402.1396

(LEGUMINOSAE not available)

LINACEAE

Hebepetalum humirifolium (Planch.) Benth. 2303.4578
Roucheria punctata Ducke 1301.2094

MALPIGHIACEAE

Byrsonima crispa Juss. 3402.4053
Byrsonima rodriguesii W. Anderson 1202.2137
Byrsonima aff. **stipulacea** Juss. 1202.1560
Byrsonima sp. 1 1201.1895
Byrsonima sp. 2 2206.1502
Pterandra arborea Ducke 1102.200

MELASTOMATACEAE

Bellucia grossularioides (L.) Triana 1202.2946
Bellucia imperialis Sald. & Cogn. 1105.394
Loreya spruceana Benth. & Triana 1103.424
Miconia cf. **crassinervia** Cogn. 2206.601
Miconia dispar Benth. 2206.882
Miconia eleagnoides Cogn. 1103.605
Miconia gratissima Benth. 2206. 1631
Miconia holoserica (L.) DC. 2107.354
Miconia minutiflora (Bonpl.) DC. 2206.898
Miconia cf. **navioensis** Wurdack 1202.6008
Miconia punctata (Desv.) D. Don 1109.190
Miconia pyrifolia Naud. 3114.464

Miconia regelii Cogn. 2206.2859
Miconia splendens (Sw.) Griseb. 2206.596
Miconia cf. **tetragona** Cogn. 1302.3052
Miconia cf. **tetrasperma** Gleason 1202.511
Miconia tetraspermoides Wurdack 3114.24
Miconia tomentosa (Rich.) D. Don 1109.517
Miconia ''c'' (sp. nov. ined. Renner) 1201.1100
Miconia aff. **lepidota/puncata** (sp. nov. ined. Renner) 1201.1077
Miconia ''p'' (sp. nov. ined. Renner) 2206.3193
Miconia ''**rubi**'' (sp. nov. ined. Renner) 1102.310
Mouriri angulicosta/duckeana/duckeanoides Marley 1109.55.0187
Mouriri collocarpa Ducke 1104.204
Mouriri huberii Cogn. 2206.383
Mouriri nigra (DC) Morley 1201.1916
Mouriri vernicosa Naudin 1103.231

MELIACEAE

Carapa guianensis Aubl. 2206.1619
Guarea carinata Ducke 3209.3018
Guarea duckei C.DC. 3304.4269.0789
Guarea kunthiana A. Juss. 3304.2789
Guarea subsessiflora C. DC. 3209.2888
Guarea sp. 2 3304.2827
Guarea sp. 3 2107.726
Trichilia excelsa Benth. 3209.3033
Trichilia sp. 1 2108.611
Trichilia sp. 2 1102.62.0787
Trichilia sp. 3 2303.1728

MONIMIACEAE

Siparuna argyrochysea Pert. 2108.77
Siparuna cuspidata (Tul.) A. DC. 1201.450
Siparuna decipiens (Tul.) A. DC. 2206.3197
Siparuna emarginata Corvan 2206.51
Siparuna guianensis Aubl. 1201.2021
Siparuna sp. 7 3304.5746

MORACEAE

Brosimum guianensis (Aubl.) Huber 1202.3524
Brosimum paranarioides Ducke 1202.4470
Brosimum potabile Ducke 1202.816
Brosimum rubescens Taubert 1202.130
Cecropia purpurescens C.C. Berg. 3209.179
Cecropia sciadophylla Mart. 2206.3014
Cecropia ulei Snethlage 2206.1339
Clarisia illicifolia (Spreng.) Lanj. & Rossb. 1202.4206
Clarisia racemosa Ruiz & Pavon 1202.4725
Helianthostylis sprucei Baill. 1202.4941
Helicostylis lancifolia Ducke 1202.1027
Helicostylis tomentosa (P. & E.) Rusby 1202.2029
Maquira guianensis Aubl. 1202.4666
Maquira sclerophylla (Ducke) C.C. Berg 1202.5049
Naucleopsis caloneura (Huber) Ducke 1202.6117
Naucleopsis ternstroemiiflora (Mildb.) C.C. Berg 1202.704
Pseudolmedia laevis (R. & P.) Macbr. 1202.5191
Perebea sp. 1 1202.5220
Sorocea guilleminiana Gaud. 1202.68
Trymatococcus amazonicus P.& E. 1202.1535

MYRISTICACEAE

Iryanthera coriacea Ducke 1109.449
Iryanthera elliptica Ducke 1202.149
Iryanthera juruensis Warb. 2303.4805
Iryanthera laevis Markgraf. 3304.2350
Iryanthera polyneura Ducke 1202.201
Iryanthera cf. **tessmani** Mgf. 3304.699
Iryanthera ulei Warb. 2206.1695
Osteophloeum platyspermum (A.DC.) Warb. 2206.1169
Virola caducifolia E. Rodr. 2107.257
Virola calophylla Warb. 1202.579
Virola divergens Ducke 1201.1139
Virola elongata (Benth.) Warb. 1201.1166
Virola guggenheimii W. Rodr. 1201.07
Virola michelii Heckel 1202.5106
Virola multicostata Ducke 2206.886
Virola multinervia Ducke 1201.2037
Virola pavonis (A.DC.) A. C. Smith 2206.2988
Virola venosa (Benth.) Warb. 1201.19

Stylogine longifolia (Mart. ex Miq.) Mez 3304.455
Cybianthus sp. 1 2303.4400
Calyptranthes macrophylla Berg. 1301.2380
Calyptranthes panicultura R. & P. 2206.2911
Calyptranthes sp. 4 3304.3210.0586
Calyptranthes sp. 5 3402.687
Eugenia citrifolia Poir 1104.332.0187
Eugenia cupulata Amsh 2303.858.0286
Eugenia feijoi Berg. 1202.2312
Eugenia heterochroma Diels 2206.2620
Eugenia patrisii Vahl 3209.173
Eugenia pseudopsidium Jacq. 2107.692
Eugenia sp. 1 1202.745.0286
Eugenia sp. 4 1202.2451.0286
Eugenia sp. 5 2206.2793.0886
Eugenia sp. 6 3209.24
Eugenia sp. 8 1109.54
Eugenia sp. 9 2206.1941
Eugenia sp. 10 1202.745.0286
Eugenia sp. 11 2206.418
Eugenia sp. 12 1202.2447.1186
Eugenia sp. 13.1113.284
Eugenia sp. 14 1101.343.0386
Marlierea spruceana Berg. 1102.408.0786
Marlierea umbraticola (H.B.K.) Berg. 3114.349.0486
Marlierea sp. 1 3304.1051
Myrcia amazonica DC. 1201.1241
Myrcia bracteata (Reich.) DC. 1113.572
Myrcia grandis MacVaugh. 2206.3213.0286
Myrcia guianensis (Aubl.) D.C. 2303.4972
Myrcia sylvatica (Mey) DC.
Myrcia sp. 1 3209.158
Myrcia sp. 2 3209.2343
Myrcia sp. 5 3402.2326.0187
Myrcia sp. 7 3209.1942. rec
Myrcia sp. 10 2303.664
Myrcia sp. 11 2206.3529
Myrcia sp. 12 3209.760
Myrcia sp. 14 1103.320
Myrcia sp. 15 3114.344
Myrciaria floribunda (West ex Willd) Berg. 1104.521.0187
msp. 1 2206.3210
msp. 5 3209.315
msp. 16 3209.711

NYCTAGINACEAE

Neea stellulata (Hub.) Himerl. 3402.3467
Neea sp. 3 3402.4979
Neea sp. 6 1301.5744
Neea sp. 7 1113.123
msp. 2 1301.1096

OCHNACEAE

Elvasia cf. **calophylla** DC. 3402.3669
Elvasia sp. 1 1202.583
Ouratea candollei (Phanchon) Van Tieghem 2108.610
Ouratea decagyna Maguire 3304.3154

OLACACEAE

Cathedra sp. 1 1104.150
Chaunochiton kappleri (Sagot.) Ducke 2206.1360
Chaunochiton sp. 2 1202.5755
Dulaine guianensis (Engler) O. Kuntze 3209.2006 check spell
Heisteria barbata Cuatr. 1202.1139
Heisteria laxiflora Engler 1201.1150
Heisteria densifrous Engler 1201.1018
Heisteria sp. 1 3402.513
Minquartia guianensis Aubl. 1105.223
Ptychopetalum olacoides Benth. 2206.2000

OPILIACEAE

Agonandra sp. 1 1202.63

PALMAE

Euterpe oleracea Mart. 1202.85
Jessenia bataua (Mart.) Burret 3304.2270
Oenocarpus bacaba Mart. 1202.112

PROTEACEAE

Euplassa sp. 1 3209.1211
Roupala montana Aubl. 2206.1413
Roupala sp. 1 1202.370
Roupala sp. 2 1202.4384
Roupala sp. 3 1101.532
Roupala sp. 4 3304.3785
Roupala sp. 5 3304.5235

QUIINACEAE

Lacunaria crenata (Tul.) A.C.Smith 2108.421
Lacunaria jenmani (Oliv.) Ducke 1104.324
Lacunaria sp. 1 1202.2428
Quiina amazonica A.C.Smith 1105.632
Quiina negrensis A.C.Smith 1103.294
Quiina obovata (Tul.) A.C.Smith 1109.243
Touroulia guianensis Aubl. 2206.2424

RHABDODENDRACEAE

Rhabdodendron amazonicum (Spr. ex Benth.) Huber 3114.210

RHIZOPHORACEAE

Anisophyllea manausensis Pires & W. Rodr. 1202.164
Cassipourea ulei Briq. 3209/109
Sterigmapetalum obovatum Kuhlm. 1201.603

ROSACEAE

Prunus myrtifolia (L.) Urban 1103.584

RUBIACEAE

Alibertia cf. **curviflora** K. Schum. 1101.483
Alibertia hadrantha Standl. 3209.1896
Alibertia latifolia (Benth.) K. Schum. 1202.3993

Amaioua guianensis Aubl. 1101.474
Amaioua sp. 1 2108.165
Bathysa obovata (Ruiz) K. Schum. ex Standl. 1202. 1800
Borojoa sorbilis (Ducke) Cuatr. 2107.67
Calycophyllum sp. 1 3209.76
Capirona decorticans Spruce 3304.362
Chimarrhis barbata (Ducke) Brem. 1102.14
Chimarrhis turbinata DC. 1109.393
Chomelia tenuiflora Benth. 2303.2511
Coussarea grandis Muell. Arg. 1101.77
Coussarea hirticalyx Standl. 1102.424
Coussarea racemosa A. Rich. 1102.229
Coussarea tenuiflora Standl. 3402.836
Coussarea sp. 1 2303.2501
Duroia longiflora Ducke 1202.184
Duroia macrophylla Huber 1104.185
Duroia saccifera (Mart.) Hook. f. ex K. Schum 1201.923
Duroia sp. 1 1202.5387
Faramea corymbosa Aubl. 1202.2658
Faramea juruana Krause 1101.41
Ferdinandusa elliptica Pohl 1104.342
Ferdinandusa rudgeoides (Benth.) Wedd.
Isertia hypoleuca Benth. 2303.940
Ixora ulei Krause 3209.862
Kotchubaea insignis Fisher ex DC. 1103.173
Ktochubaea semisericea Ducke 3114.272
Pagamea guianensis aubl. 2303.2482
Palicourea grandifolia (Willd. ex R. & S.) Standl. 3304.855
Posoqueria latifolia (Rudge) R. & S. 2303.4086
Posoqueria longiflora Aubl. 3209.1964
Pyschotria mapourioides DC. 1201.814
Rudgea laurifolia (H.B.k.) Steyerm. 1202.826
Stachyarrhena acuminata Standl. 1202.5901
Stachyoccoccus adinanthus (Standl.) Standl. 3402.4347

RUTACEAE

Hortia superba Ducke 3304.5243
Spathelia excelsa (Krause) Cowan & Brizieky 1201.53
Zanthoxylum djalma-batistae (Albuq.) Waterm. 2107.662

(SAPINDACEAE not available)

Achrouteria pomifera Eyma 1104.98
Achrouteria sp. 1 1201.1178
cf. **Achrouteria** sp. 1103.590
Barylucuma decussata Ducke 1202.5677
Caramuri opposita (Ducke) Aubr. & Pellegr. 1103.199
cf. **Chromolucuma rubiflora** Ducke 1104.251
Cherysophyllum anomalum Pires 1102.196
cf. **Chrysophyllum** sp. 1202.5893
Diploon venezuelana Aubr. 1104.28
Ecclinusa bacuri Aubr. et Pellegr. 1102.586
Ecclinusa guianensis Eyma 1104.319
Ecclinusa sp. 1 2206.2283
Elaeoluma glabrescens (Mart. & Eirchl. ex Miq.) Ubr. & Pellegr. 1201.966
Elaeoluma sp. 1 1102.325
cf. **elaeoluma** sp. 1201.713
Eremoluma williamii Aubr. et Pellegr. 1103.459
Eremoluma sp. 1 2108.660
Franchetella cf. **gongrijpii** (Eyma) Aubl. 1201.751
Franchetella platyphylla (A.C. Smith) Aubl. 1102.181
Franchetella sp. 1 1104.267
cf. **Franchetella** sp. 1103.454
Labatia sp. 1 1109.197
Manilkara amazonica (Huber) Standley 1201.820
Manilkara huberi (Ducke) Standley 1104.20
Manilkara sp. 1 1102.218
Micropholis cyrtobotria (Mart et Miq.) Baill. 1103.576
Micropholis guianensis (A.DC.) Pierre 1201.357 (flores)
Micropholis mensalis (Baehni) Aubl. 1101.519
Micropholis rosadinha-brava Aubr. & Pellegr. 1202.5713
Micropholis spruceana (Mart. & Miq.) Pierre 1202.3974
Micropholis cf. **trunciflora** Ducke 1104.320
Micropholis venulosa (MART. & Eichl.) Pierre 1202.1192
Micropholis williamii Aubr. & Pellegr. 1103.524
Micropholis sp. 1 1102.47
Micropholis sp. 2 1201.1649
Myrtiluma eugenifolia (Pierre) Baill. 1101.491
Myrtiluma sp. 1 1103.247
cf. **Myrtiluma** sp. 1201.1115
Nemaluma anamala (Pires) Pires 1201.746
Nemaluma engleri (Eyma) Aubr. et Pellegr. 1102.90

Neoxythece clandantha (Sandw.) Aubr. 1104.31
Neoxythece elegans (A.DC. Aubr. 1101.326
Neoxythece sp. 1201.70
cf. **Neoxythece** sp. 1201.40
Podoluma sp. 2108.40
Pouteria caimito (Ruiz et Pavon) Radlk. 1103.618
Pouteria echnocarpa W. Rodr. 1102.460
Pouteria guianensis Aubl. 1201.24
Pouteria gutta (Ducke) Baehni 1202.4692
Pouteria hispida Eyma 1101.276
Pouteria sp. 1 1102.435
Pradosia verticillata Ducke 1102.426
Pradosia cf. **verticillata** Ducke 1104.216
Pradosia sp. 1 2108.308
Prieurella amazonensis Aubr. 1104.17
Prieurella manaosensis Aubr. & Pellegr. 1202.4005
Prieurella sp. 1 1103.293
cf. **Prieurella** sp. 1202.1116
Pseudolabatia cf. **pennicillata** Pires 1201.1543
Pseudolabatia sp. 1 1202.3008
Radlkoferella sp. 1 1109.84
cf. **Radlkoferella** sp. 1104.321
Ragala sanguinolenta Pierre 1201.1424
Ragala spuria (Ducke) 1202.4578
Ragala ucuquirana-branca (Aubr. et Pellegr.) W. Rodr. 1201.736
Ragala sp. 1 1201.542
Richardella macrophylla (Lam.) Aubr. 1104.380
Richardella manaosensis Aubr. & Pellegr. 1201.238
Richardella sp. 1 1202.4096
cf. **Richardella** sp. 1202.769
Sandwithiodoxa sp. 1 1202.534
Sarcaulus brasiliensis Eyma 1201.749
Syzygiopsis oblanceolata (Pires) Pires 1201.731
cf. **Syzygiopsis oppositifolia** Ducke 1201.1074

SIMAROUBACEAE

Simaba cedron Planch. 1202.3280
Simaba guianensis ssp. **ecaudata** (Cronquist) Cavalcante 2303.4328
Simaba guianensis ssp. **guianensis** (Cronquist) Cavalcante 1101.349
Simaba polyphylla (Cavalcante) Thomas 3402.1186
Simaruba amara Aubl. 1105.56

STERCULIACEAE

Sterculia pruriens (Aubl.) K.Schum. 1202.329
Theobroma sulvestre Aubl. ex Mart. 1202.612

STRYACACEAE

Stryax guianensis A.DC. 1202.6508

TILIACEAE

Apeiba echinata Gaertn. 3402.1026
Lucheopsis rosea (Ducke) Burrex. 1104.296
Lucheopsis sp. 2 1104.125

ULMACEAE

Ampelocera edentula Kuhlm. 2206.27640

VERBENACEAE

Vitex triflora Vahl 2108.65
Vitex sp. 2 3209.2739
Vitex sp. 3 3209.750

VIOLACEAE

Amphirrhox surinamensis Eichl. 3402.156
Amphirrhox sp. 1 1202.2449 lots
Leonia cymosa Mart. 2206.3127
Leonia glyxycarpa Ruiz & Pav. 2206.1400
Paypayrola grandiflora Tul. 2206.1153.0485
Paypayrola cf. **guianensis** Aubl. 1105.186
Rinorea flavescens (Aubl.) O. Kuntze 1202.3163
Rinorea guianensis var. **subintegrifolia** Aubl. 1105.396
Rinorea macrocarpa (Eichler) Kuntze 1202.4271
Rinorea cf. **martini** (Turcz.) Blanck 1102.131
Rinorea racemosa (Mart. ex Zucc.) O. Kuntze 1202.1568
Rinorea sp. 1 1105.438
Rinorea sp. 2 3209.611

VOCHYSIACEAE

Erisma bicolor Ducke 3209.1564
Erisma bracteosum Ducke 3209.1409
Erisma floribundum Rudge. 1103.254
Erisma fuscum Ducke 1105.214
Erisma uncinatum Warm. 1109.534
Qualea albiflora Warm. 3209.1808
Qualea homosepala Ducke 3209.2088
Qualea labouriauna Stafl. 3209.2357
Qualea paraensis Ducke 1102.26
Qualea cf. **retusa** Spr. ex Warm. 1102.457
Vochysia guianensis Aubl. 2108.44
Vochysia cf. **leguiana** Marcbr. 1109.259
Vochysia sp. 1 1101.549
Vochysia sp. 3 1102.94

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