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Floristic study of an igapó floodplain forest in Central Amazonia, Brazil (Tarumã-Mirim, Rio Negro)*

by

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Abstract

A floristic and structural analysis of a seasonal igapó forest at Rio Tarumã-Mirim, Central Amazonia, was performed. This floodplain vegetation is regularly inundated by nutrient-poor blackwater of the Rio Negro and its affluents, and it is distinct from nutrient-rich whitewater floodplains (várzea) and non-flooded uplands (terra firme). Trees with a circumference ≥10 cm were inventoried and measured in four 25 x 10 m plots, those with ≥100 cm in one 150 x 100 m plot. Family and species importance indices were calculated and compared with other forest stands in Amazonia. The four 25 x 10 m plots had a total of 162 trees, belonging to 44 species with 38 genera in 22 families (most common families: Mimosaceae, Rubiaceae, Lecythidaceae, Caesalpiniaceae, Clusiaceae). Four strata of height could be differentiated, each with typical representants. In the 150 x 100 m plot, there were 43 trees belonging to 10 species out of 10 genera and 5 families (most important family: Caesalpiniaceae). The species which dominated was the ochrospecies *Aldina latifolia* BENTH. var. *latifolia*. All plots were distinct as related to number of trees, species, families, mean tree dbh, height, and dominating species. The results obtained with the two inventory methods complete each other to gain an insight into the vegetation composition and structure of the igapó. Thirty percent of the inventoried species are typical representants of igapó vegetation and can be considered endemic to the Rio Negro, other species have a wide distribution and also occur in várzea or terra firme vegetation.
Keywords: **Blackwater floodplain, inundation forest, igapó, Rio Negro, Amazonia.**

Resumo

Foi realizada a análise florística e estrutural de uma floresta de igapó estacional localizada no Rio Tarumã-Mirim, Amazônia Central. Esta vegetação de planície de alagação é periodicamente alagada por água

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preta, ácida e pobre em nutrientes do Rio Negro e seus afluentes. Distingue-se das planícies de alagação de várzea inundadas por água branca e rica em nutrientes, e da vegetação de terra firme não inundável. Árvores com uma circunferência ≥10 cm foram inventariadas e mensuradas em quatro parcelas de 25 x 10 m e árvores com ≥100 cm em uma parcela de 150 x 100 m. Os índices de importância tanto das famílias como das espécies foram calculados e comparados com outros estudos semelhantes realizados na Amazônia. As quatro parcelas de 25 x 10 m apresentaram um total de 162 árvores, pertencentes a 44 espécies distribuídas por 38 gêneros e 22 famílias. As famílias mais encontradas foram Mimosaceae, Rubiaceae, Lecythidaceae, Caesalpiniaceae e Clusiaceae. A floresta diferenciou-se em quatro estratos de altura, cada um com representantes típicos. Na amostragem de 150x100 m, foram encontradas 43 árvores pertencentes a 10 espécies distribuídas por 10 gêneros e 5 famílias. Destas, a família mais importante foi Caesalpiniaceae. O táxon dominante foi a ocroespécie *Aldina latifolia* BENTH. var. *latifolia*. Todas as amostragens foram distintas quanto ao número de árvores, espécies, famílias, média do diâmetro das árvores (DAP), altura e espécies dominantes. Os resultados obtidos com os dois métodos de inventário complementam-se, obtendo-se assim um conhecimento da composição da vegetação e da estrutura da floresta de "igapó". Trinta porcento das espécies inventariadas são representantes da vegetação do igapó e podem ser consideradas endêmicas para o Rio Negro. Outras espécies têm uma ampla distribuição, podendo ocorrer, também, tanto na vegetação de várzea como de terra firme.

Introduction

The composition and physiognomy of the vegetation along the Rio Negro and its blackwater affluents are influenced by the periodical floodings with nutrient-poor, acid blackwater. This floodplain vegetation with xeromorphic adaptations growing mainly on sandy soils is called seasonal igapó forest (PRANCE 1979) or alluvial ombrophilous dense forest (IBGE 1992) and represents a specialized ecosystem, which is distinct from whitewater floodplains (várzea) and non-flooded upland (terra firme) vegetation (PRANCE 1979; ADIS 1984; KUBITZKI 1989; FERREIRA 1997a). Although some species occur in both black- and whitewater floodplain systems, and some occur in non-flooded upland forests as well (PIRES & PRANCE 1985; KUBITZKI 1989), most species are restricted to the blackwater inundation forests and represent a more or less uniform vegetation along the Rio Negro (HUBER 1910) with the exception of the Anavilhanas archipelago, below the confluence with the Rio Branco, where there is an influence of the sediment-rich whitewater (FILOSO & WILLIAMS 2000) and the vegetation may be conspicuous (RODRIGUES 1961). Despite the dimensions of the igapó floodplains and the high degree of endemism expected (PIRES 1974; PRANCE 1979), not many studies are available which deal with the forest composition and structure. Inventories of igapó forests along the Rio Negro were performed by TAKEUCHI (1962), RODRIGUES (1967), KEEL & PRANCE (1979), and in two unpublished theses (REVILLA 1981; FERREIRA 1991). In the Rio Jaú, an affluent of the Rio Negro, FERREIRA (1997b) and FERREIRA & STOHLGREN (1999) analysed the vegetation zonation caused by differential flooding tolerance of the trees. The flooding regime, with water columns of up to 15 m, leads to submersions of the roots, seedlings and stems, shrubs and small trees for up to seven months, every year causing influences on the vegetation cover and leading to a non-random distribution of species, with flooding tolerant species on the lower levels, and less flood-tolerant species on the upper levels.

The present study is a phytosociological analysis performed in a typical seasonal igapó forest in an experimental area of Rio Tarumã-Mirim where since the 1980's an ecological programme of floodplain forests is performed with the main focus on the

ecology of the terrestrial invertebrate fauna (e.g., ADIS 1981, 2002). A detailed description of the vegetation cover and of the forest structure shall contribute to gain knowledge about the unique floodplain ecosystem of the Rio Negro.

Methods

The study area is located on the lower course of the Rio Tarumã-Mirim, an affluent of the Rio Negro, approximately 20 km north from Manaus, Brazil (3°02'S, 60°17'W). The soils are mainly composed by clay (caulinite), silt, and sandy material with alternating fractions (ADIS 1981). The examination of mineralogic profiles indicates an origin of a former upland forest cover in the pleistocene and pliocene (IRION & ADIS 1979). Detailed information on topography, geomorphology, hydrochemistry and evolution of the floodplains along the Rio Tarumã-Mirim are given in IRMLER (1977), IRION & ADIS (1979) and KLINGE (1986).

Mean monthly temperature in Central Amazonia ranges from 26.3 to 27.2 °C. Rainfall ranges from 1700 to 2300 mm, being irregularly distributed throughout the year, with a dry season between June and November, and a rainy season from December to May. Therefore, variation of water level of the Amazon river and its affluents is markedly seasonal; the rising phase lies between December and June, and the receding period between July and November (NUNES & BARROS 2001). The flooded period can last up to 210 days (JUNK 1989). The whole study site had an area of 510 x 465 m, and was surrounded by the Igarapés Nova Inveja, São João, and Pupunha (Fig. 1). It extended from the non-inundated terra firme in the north with a constant declination to the bank of the Rio Tarumã-Mirim. The plots were situated at different heights in the inundation gradient and thus subjected to different periods of flooding (see Table 5).

Two methods were applied to characterize the vegetation: in four 25 x 10 m plots (E, F, G, H), all trees with a circumference ≥10 cm (corresponding to a diameter at 1.30 m from the ground (dbh) ≥3.2 cm), and in one 150 x 100 m plot (BP), all trees with circumference ≥100 cm (= dbh ≥32 cm) were inventoried. BP was selected in an area dominated by *Aldina latifolia* var. *latifolia*, a large, emergent tree (Fig. 2). The small plots E, G and H were close to the large plot BP, and plot F was inside the larger sampling plot (Fig. 1b). Tree heights were measured with a yardstick and with balloons filled with hydrogen attached to a rope with marked scale, and tree circumferences at 1.30 m from the ground were obtained with the use of a measuring tape. The family importance indices (FIV) were calculated as relative dominance (basal area at 1.30 m from the ground in %) + relative tree density + relative frequency of the family (percentage of plots in which the family occurs; this was excluded in the 150 x 100 m plot). The species importance value indices (IVI) was calculated as relative dominance (basal area at 1.30 m from the ground, in %) + relative tree density + relative frequency (percentage of plots in which the species occurs; this was excluded in the 150 x 100 m plot). The collected material was deposited in the INPA herbarium, Manaus.

Results

Floristic composition.

The four 25 x 10 m plots had a total of 162 trees with dbh ≥3.2 cm. They belonged to 44 species with 38 genera in 22 families (Table 1). The most common families were Mimosaceae, Rubiaceae, Lecythidaceae, Caesalpiniaceae and Clusiaceae with family importance values (FIV) above 20 (Table 1). The species with the highest number of individuals was *Parkia pectinata* (Mimosaceae), followed by *Eschweilera albiflora* (synonym *E. pachysepala*) (Lecythidaceae), but the species with highest importance value index (IVI) were *Sclerolobium* sp. (Caesalpiniaceae) and *Erisma calcaratum* (Vochysiaceae) (Table 3). This latter species was also the tallest, with a mean height of 20 m. The largest mean dbh was measured in individuals of *Parkia discolor* (Mimosaceae).

In the 150 x 100 m plot, there were 43 trees with dbh ≥32 cm, belonging to 10

species out of 10 genera and 5 families (Table 2). The most important family was Caesalpiniaceae with 6 genera, compared to only one genus in the other 4 families. The species which dominated was *Aldina latifolia* var. *latifolia*, with the highest number of individuals and an IVI of 67 (Table 4). *Swartzia polyphylla* (Fabaceae) had the largest mean dbh and mean basal area, and *Mora paraensis* (Caesalpiniaceae) the tallest trees with a mean height of 28 m (Table 4).

Forest structure.
In the four 25 x 10 m plots, most trees had diameters at breast height (dbh) below 10 cm (Fig. 3a), whereas in the 150 x 100 m plot most trees had a dbh between 40 and 99 cm (Fig. 3b). Mean dbh of all trees in the four 25 x 10 m plots was 23 cm, in the 150 x 100 m plot 76 cm. Mean tree height in the small plots was 8 m, with most trees between 5 and 9.9 m height (Fig. 4a), in the large plot average height was 21 m, and most trees were between 15 and 25 m tall (Figure 4b) which is also reflected in the main layer of the canopy structure (Fig. 5b), as follows: in the four 25 x 10 m plots there is one main layer at 8-11 m height (Fig. 5a), and few emergent trees at 25 m. A closer look at the forest structure may allow the distinction of four strata in the small forest plots, with characteristic species:

1. stratum, 1-3 m height: *Tabernaemontana rupicola*
2. stratum, 4-7 m height: *Ferdinandusa rudgeoides, Virola elongata, Microplumeria anomala, Faramea sessilifolia*
3. stratum, 8-11 m height: *Caraipa grandifolia, Parkia pectinata, Eschweilera albiflora, Zygia cataractae*
4. stratum, >12 m height: *Parkia discolor, Erisma calcaratum, Swartzia polyphylla, Aldina latifolia var. latifolia*

Comparison of the plots.
All five plots were different from each other as related to number of trees, species, families, mean tree dbh, height, and dominating species (Table 5).

Discussion

The results obtained with the two inventory methods, with different plot sizes and minimum dbh, are not comparable, but they complete each other to gain an insight into the vegetation composition and structure. However, the differences were as big between plot sizes as between plots of the same size (Table 5).

The species inventoried are typical representants of seasonal igapó vegetation if compared to other floristic inventories performed in Central Amazonia: *Aldina latifolia* var. *latifolia*, *Couepia paraensis* (Chrysobalanaceae), *Eugenia inundata* (Myrtaceae), *Licania apetala* and *L. heteromorpha*, *Macrolobium acaciifolium*, *Parkia pectinata*, *Macrosamanea discolor*, *Crudia amazonica* (Caesalpiniaceae), *Tabebuia barbata* (Bignoniaceae), *Swartzia argentea*, *Amphirrhox surinamensis* (Violaceae) to cite only a few (RODRIGUES 1967; KEEL & PRANCE 1979; PRANCE 1979; KUBITZKI 1989). Many species which are typical and which were found in adjacent inventories (WORBES 1983; FERREIRA 1991) did not appear in the study plots. Other species found in the study plots also occur in várzea, in terra firme or in mixedwater (PIRES & PRANCE 1985; KUBITZKI 1989; AMARAL et al. 1997).

Since the criterion for site selection was the dominance of *Aldina latifolia* var.

latifolia, the vegetation described here may represent a special vegetation type within the blackwater floodplain forest. Palms were not found in the study sites, although generally different species (e.g., *Leopoldinia pulchra*, *Mauritia aculeata*, *Astrocaryum jauari*) are part of a typical igapó forest with high numbers of individuals (PRANCE 1979; PIRES & PRANCE 1985; KUBITZKI 1989). According to MOREIRA (1970), the Arecaceae and Leguminosae "sensu lato" are most representative for the flora of igapó communities. The dominance of Leguminosae can be stated in part by the results of this study: in the big plot BP, Caesalpiniaceae and Fabaceae have the highest FIV (Table 2), and clearly dominate with a high number of species and individuals. In the four small plots, Mimosaceae have the highest FIV, followed by Caesalpiniaceae and to a less extent Fabaceae are represented by many species and individuals.

When considering the different elevation of the plots in the inundation gradient, different species dominate in different heights. Typical species in low-lying, long-flooded areas of an igapó of the Rio Jaú, an affluent of the Rio Negro, are *Buchenavia oxycarpa*, *Crudia amazonica*, *Eugenia cachoeirensis*, *Eschweilera* spp., *Macrolobium* spp. and *Sclerolobium* spp., to name a few (KUBITZKI & ZIBURSKI 1994; FERREIRA 1997b, FERREIRA & STOHLGREN 1999). Some of these species were present also in the sites of the study area, but not restricted to the lowest. The same is due for *Couepia paraensis* and *Tabernaemontana rupicola*, which are typical trees tolerant of long-lasting inundation, very poor soil conditions of the white sand as well as to poor light saturation at the forest floor of the high-level forest community (WORBES 1997). FERREIRA (1991) states that species which are restricted to the lowest elevations in the flooding gradient as adults were found regenerating on the highest levels as well. This indicates that there may be different conditions for establishment in differing years with different flooding durations which influences the composition of the regenerating tree community.

The correlation between the highest plot (H, close to the terra firme), and the amount of terra firme elements was very small. Typical elements of the upper levels, the less flooding tolerant *Swartzia polyphylla, Aldina latifolia*, *Mora paraensis* (KUBITZKI & ZIBURSKI 1994), were not necessarily found only in Plot H.

To gain an overview of the degree of the range in distribution and of species endemism, the occurrence of trees which were determined down to species level in this study was compared with other forest inventories (BRAGA 1979; ADIS 1981; PRANCE & SCHALLER 1982; WORBES 1983; RANKIN-DE-MÉRONA et al. 1992; SILVA et al. 1992; AYRES 1993; AMARAL et al. 1997; PAROLIN 1998; ROSALES et al. 1999; SCHESSL 1999; MIRANDA 2000; PAROLIN et al. 2003). The following distribution was found:

a) Species common in igapó, várzea and terra firme forests: 7 species out of 33 (21.2 %), *Caraipa grandifolia, Caryocar microcarpum*, *Licania heteromorpha, Macrolobium angustifolium*, *Pouteria elegans*, *Swartzia polyphylla*, *Virola elongata.*
b) Species common in igapó and várzea, but not in terra firme forests: 1 species (3 %), *Mora paraensis.*
c) Species common in igapó and terra firme forest, not in várzea forest: 6 species (18.2 %), *Peltogyne venosa*, *Swartzia argentea* var. *argentea, Swartzia laevicarpa, Ferdinandusa rudgeoides, Amphirrhox longifolia*, *Trymatococcus amazonicus.*
d) Species common only in igapó forest: 10 species (30.3 %), *Aldina latifolia* var. *latifolia, Tabernaemontana rupicola, Erisma calcaratum*, *Microplumeria anomala,*

Parkia discolor, Parkia pectinata, Macrosamanea amplissima, Zygia cataractae, Poecilanthe amazonica, Tovomita macrophylla.

e) Species common only in várzea and terra firme forests, but absent in igapó forest: 4 species (12.1 %), *Guatteria chrysopetala, Homalium racemosum, Zygia latifolia, Vismia cayennensis.*

f) Not common in igapó, várzea, terra firme forests in Central Amazonia, but in campina, savanna and the Pantanal: 5 species (15.2 %), *Eschweilera albiflora, Faramea sessilifolia, Talisia cerasina, Tococa guianensis, Toulicia acuminata.*

This shows that some species have a wide ecological amplitude and can grow under different distributional conditions (a, b, c), but 30 % of the occurring species are restricted to blackwater floodplain forests, maybe to the Rio Negro floodplains. More inventories are needed throughout Amazonia to be able to state whether the species are endemic of the Rio Negro, or to Central Amazonia, but the available inventories indicate a quite high degree of endemism among the inventoried species of this study.

Concluding, the present study gives an insight into a blackwater floodplain forest of the Rio Negro, with some typical representants, but also with some special features, as the dominance of *Aldina latifolia* var. *latifolia* and the lack of palms, a degree of 30 % of endemics and a number of species with a wide distribution.

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Table 1: Tree families in plots E, F, G, H (25 x 10 m) at Rio Tarumã-Mirim, in order by FIV = family importance value index = relative dominance (basal area in %) + relative tree density + relative frequency.

	Family	Number of genera	Number of species	Number of trees	Relative dominance (%)	Relative tree density (%)	Relative frequency (%)	FIV
1	Mimosaceae	2	5	33	10,26	20,37	1,00	31,63
2	Rubiaceae	3	4	19	13,16	11,73	0,50	25,39
3	Lecythidaceae	2	2	17	13,43	10,49	1,00	24,93
4	Caesalpiniaceae	5	6	12	16,54	7,41	0,75	24,69
5	Clusiaceae	4	3	22	8,08	13,58	1,00	22,66
6	Apocynaceae	2	2	15	4,02	9,26	0,75	14,03
7	Myristicaceae	1	1	9	5,90	5,56	1,00	12,46
8	Vochysiaceae	1	1	3	8,06	1,85	0,25	10,16
9	Fabaceae	2	4	7	0,47	4,32	0,50	5,29
10	Moraceae	1	1	5	0,07	3,09	0,25	3,41
11	Sapindaceae	2	2	4	0,03	2,47	0,50	3,00
12	Annonaceae	2	2	2	0,74	1,23	0,50	2,47
13	Violaceae	2	2	3	0,04	1,85	0,50	2,39
14	Chrysobalanaceae	1	1	2	0,13	1,23	0,25	1,62
15	Olacaceae	1	1	2	0,07	1,23	0,25	1,55
16	Sapotaceae	1	1	1	0,42	0,62	0,25	1,29
17	Meliaceae	1	1	1	0,21	0,62	0,25	1,07
18	Malpighiaceae	1	1	1	0,04	0,62	0,25	0,91
19	Melastomataceae	1	1	1	0,01	0,62	0,25	0,88
20	Caryocaraceae	1	1	1	0,01	0,62	0,25	0,87
21	Flacourtiaceae	1	1	1	0,01	0,62	0,25	0,87
22	Myrtaceae	1	1	1	0,00	0,62	0,25	0,87

Table 2: Tree families in plot BP (150 x 100 m) at Rio Tarumã-Mirim, in order by FIV = family importance value index = relative dominance (basal area in %) + relative tree density + relative frequency (= 1, only one plot).

	Family	Number of genera	Number of species	Number of trees	Relative dominance (%)	Relative tree density (%)	Relative frequency (%)	FIV
1	Caesalpiniaceae	6	6	30	64,49	69,77	1	135,26
2	Fabaceae	1	1	6	22,92	13,95	1	37,87
3	Vochysiaceae	1	1	4	5,45	9,30	1	15,75
4	Caryocaraceae	1	1	2	6,11	4,65	1	11,77
5	Moraceae	1	1	1	1,03	2,33	1	4,35

Table 3: Species in the plots E, F, G, H (25 x 10 m) at Rio Tarumã-Mirim, in order by IVI = importance value index of the species = relative dominance (basal area in %) + relative tree density + relative frequency.

Species	Family	Number of trees	Mean DBH (cm)	Mean basal area (m^2)	Mean height (m)	Relative basal area (%)	Relative tree density (%)	Relative frequence (%)	IVI
Sclerolobium sp.	Caesalpiniaceae	3	83,9	6632,2	11,3	13,0	1,85	0,25	15,1
Erisma calcaratum WARM.	Vochysiaceae	3	86,3	6151,5	20,1	12,1	1,85	0,25	14,2
Eschweilera albiflora MART.	Lecythidaceae	15	38,9	1960,4	10,1	3,8	9,26	1,00	14,1
Aldina latifolia BENTH. var. *latifolia*	Caesalpiniaceae	3	65,3	5828,0	19,3	11,4	1,85	0,50	13,8
Parkia pectinata BENTH.	Mimosaceae	16	7,5	131,2	8,9	0,3	9,88	0,50	10,6
Parkia discolor SPRUCE ex BENTH.	Mimosaceae	4	93,6	2998,5	10,9	7,6	2,47	0,50	10,6
Caraipa grandifolia MART.	Clusiaceae	11	32,4	1568,9	7,3	3,1	6,79	0,50	10,4
Ferdinandusa rudgeoides (BENTH.) WEDD.	Rubiaceae	10	41,5	1795,0	7,0	3,5	6,17	0,50	10,2
Virola elongata WARB.	Myristicaceae	9	24,3	1502,8	7,4	2,9	5,56	1,00	9,5
Microplumeria anomala (MÜLL. ARG.) MARKGR.	Apocynaceae	12	22,5	762,2	4,7	1,5	7,41	0,50	9,4
Faramea sp.	Rubiaceae	3	35,1	2402,1	6,5	4,7	1,85	0,50	7,1
Macrosamanea amplissima (DUCKE) BARNEBY & J.W. GRIMES	Mimosaceae	7	21,9	821,2	6,6	1,6	4,32	0,75	6,7
Faramea sessilifolia (KUNTH) DC.	Rubiaceae	5	32,8	992,7	5,8	1,9	3,09	0,50	5,5
Tovomita sp.	Clusiaceae	8	6,0	30,7	6,5	0,1	4,94	0,25	5,2
Pseudoxandra sp.	Annonaceae	1	46,2	1674,0	7,3	3,3	0,62	0,25	4,1
Pithecellobium sp.	Mimosaceae	6	9,0	77,7	8,7	0,2	3,70	0,25	4,1

Trymatococcus amazonicus POEPP. & ENDL.	Moraceae	5	6,3	33,1	7,4	0,1	3,09	0,25	3,4
Gustavia sp.	Lecythidaceae	2	23,2	682,3	5,5	1,3	1,23	0,50	3,1
Pouteria elegans (A.DC.) BAEHNI	Sapotaceae	1	35,0	963,4	7,2	1,9	0,62	0,25	2,8
Vismia cayennensis (JACQ.) PERS.	Clusiaceae	2	19,5	487,9	7,4	1,0	1,23	0,50	2,7
Swartzia polyphylla DC.	Fabaceae	2	21,7	478,4	16,0	0,9	1,23	0,25	2,4
Tabernaemontana rupicula BENTH.	Apocynaceae	3	5,0	22,3	3,9	0,0	1,85	0,50	2,4
Swartzia laevicarpa AMSTHOFF	Fabaceae	3	5,3	23,5	6,5	0,0	1,85	0,25	2,1
Macrolobium angustifolium (BENTH.) R.S. COWAN	Caesalpiniaceae	3	5,2	22,5	5,8	0,0	1,85	0,25	2,1
Guarea sp.	Meliaceae	1	24,5	472,1	15,0	0,9	0,62	0,25	1,8
Licania heteromorpha BENTH.	Chrysobalanaceae	2	13,2	150,6	15,0	0,3	1,23	0,25	1,8
Talisia cerasina (BENTH.) RADLK.	Sapindaceae	2	3,9	12,0	4,8	0,0	1,23	0,50	1,8
Heisteria sp.	Olacaceae	2	9,4	78,9	10,5	0,2	1,23	0,25	1,6
Tachigali sp. 1	Caesalpiniaceae	1	0,3	314,0	10,0	0,7	0,62	0,25	1,6
Amphirrhox longifolia (A.ST.-HIL.) SPRENG.	Violaceae	2	6,0	33,4	5,4	0,1	1,23	0,25	1,6
Toulicia acuminata RADLK.	Sapindaceae	2	5,4	23,0	7,3	0,0	1,23	0,25	1,5
Tachigali sp. 2	Caesalpiniaceae	1	0,3	63,6	5,0	0,3	0,62	0,25	1,2
Malpighiaceae sp.	Malpighiaceae	1	11,3	100,3	6,0	0,2	0,62	0,25	1,1
Swartzia argentea SPRUCE ex BENTH. var. *argentea*	Fabaceae	1	7,0	38,5	11,0	0,1	0,62	0,25	0,9
Psychotria sp.	Rubiaceae	1	6,4	31,8	5,0	0,1	0,62	0,25	0,9
Tococa guyanensis AUBL.	Melastomataceae	1	5,7	25,8	7,0	0,1	0,62	0,25	0,9
Undetermined vine	Violaceae	1	5,1	20,4	4,0	0,0	0,62	0,25	0,9
Tovomita macrophylla (POEPP.) WALP.	Clusiaceae	1	4,9	19,1	5,0	0,0	0,62	0,25	0,9
Elizabetha sp.	Caesalpiniaceae	1	4,6	16,7	6,5	0,0	0,62	0,25	0,9
Caryocar microcarpum DUCKE	Caryocaraceae	1	4,5	15,6	4,5	0,0	0,62	0,25	0,9

Table 3: Continuation.

Species	Family	Number of trees	Mean DBH (cm)	Mean basal area (m^2)	Mean height (m)	Relative basal area (%)	Relative tree density (%)	Relative frequence (%)	IVI
Guatteria chrysopetala (STEUDEL) MIQ.	Annonaceae	1	4,1	13,5	5,0	0,0	0,62	0,25	0,9
Homalium racemosum JACQ.	Flacourtiaceae	1	4,1	13,5	5,0	0,0	0,62	0,25	0,9
Undetermined	Myrtaceae	1	3,5	9,6	5,0	0,0	0,62	0,25	0,9
Poecilanthe amazonica (DUCKE) DUCKE	Fabaceae	1	3,3	8,8	6,0	0,0	0,62	0,25	0,9

Table 4: Species in plot BP (150 x 100 m) at Rio Tarumã-Mirim, in order by IVI = importance value index of the species = relative dominance (basal area in %) + relative tree density + relative frequency (= 1, only one plot).

Species	**Family**	**Number of trees**	**Mean DBH (cm)**	**Mean basal area (m^2)**	**Mean height (m)**	**Relative dominance (%)**	**Relative tree density (%)**	**Relative frequence (%)**	**IVI**
Aldina latifolia BENTH. var. *latifolia*	Caesalpiniaceae	24	76,9	5081,1	22,1	11,5	55,81	1	68,3
Swartzia polyphylla DC.	Fabaceae	6	93,7	8539,3	18,3	19,3	13,95	1	34,3
Caryocar microcarpum DUCKE	Caryocaraceae	2	84,4	6835,2	19,0	15,5	4,65	1	21,1
Erisma calcaratum WARM.	Vochysiaceae	4	62,1	3045,4	19,8	6,9	9,30	1	17,2
Sclerolobium sp.	Caesalpiniaceae	1	83,0	5402,9	16,5	12,2	2,33	1	15,6
Peltogyne venosa (VAHL.) BENTH.	Caesalpiniaceae	2	69,9	3910,1	24,0	8,9	4,65	1	14,5
Mora paraensis (DUCKE) DUCKE	Caesalpiniaceae	1	73,2	4211,8	28,0	9,5	2,33	1	12,9
Elizabetha sp.	Caesalpiniaceae	1	62,1	3027,5	14,0	6,9	2,33	1	10,2
Maquira sp.	Moraceae	1	54,1	2301,0	17,0	5,2	2,33	1	8,5
Cynometra sp.	Caesalpiniaceae	1	47,8	1791,4	17,0	4,1	2,33	1	7,4

Table 5: Comparison of four plots measuring 25 x 10 m (E, F, G, H) and one plot measuring 150 x 100 m plot (BP).

	E	F	G	H	BP
Approx. plot height m a.s.l.	24-25	25-26	26-27	27-28	25-26
Average flood duration per year (in months)	6-7	5-6	4-5	2-3	5-6
Number of individuals	49	42	33	38	43
Number of species	17	20	18	11	10
Number of genera	15	17	17	10	10
Number of families	11	10	13	9	5
Mean tree dbh (cm)	59±27	11±22	7±4	6±3	72±35
Mean tree height (m)	9±5	8±5	7±3	8±3	18±7
Dominating species (in order by IVI)	*Eschweilera albiflora*	*Swartzia polyphylla*	*Guarea* sp.	*Parkia pectinata*	*Aldina latifolia* var. *latifolia*
	Ferdinandusa rudgeoides	*Tachigali* sp. 2	*Tovomita* sp.	*Zygia cataractae*	*Swartzia polyphylla*
	Sclerolobium sp.	*Microplumeria anomala*	*Eschweilera albiflora*	*Eschweilera albiflora*	*Caryocar microcarpum*
	Erisma calcaratum	*Caraipa grandifolia*	*Heisteria* sp.	*Malpighiaceae* sp.	*Erisma calcaratum*
	Caraipa grandifolia	*Licania heteromorpha*	*Swartzia laevicarpa*	*Trymatococcus amazonicus*	*Sclerolobium* sp.

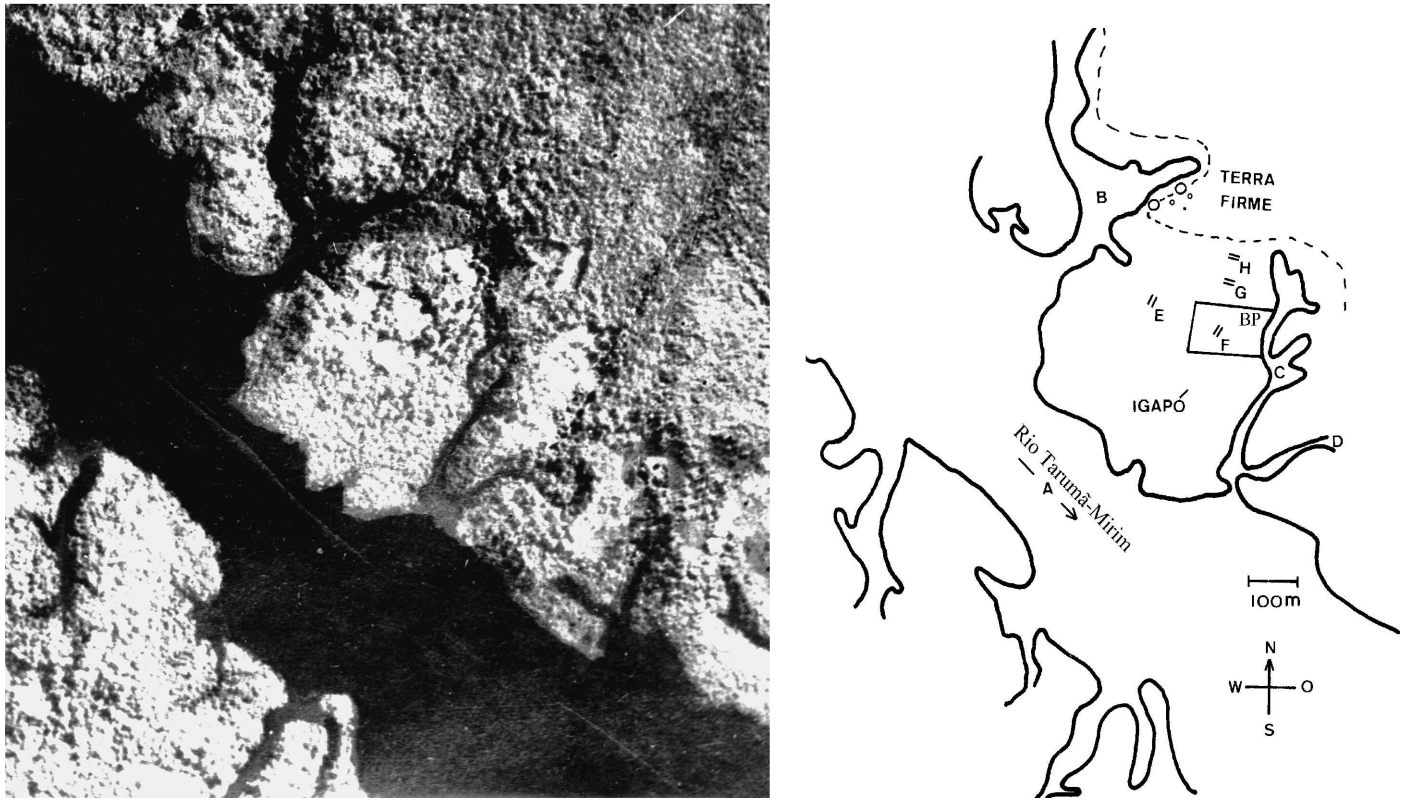

Fig. 1:
(**a: left**) Aerial view of the study site at Rio Tarumã-Mirim (SA-20-Z-D Projeto Radam; ampliation: J. Rômulo Silva J.) and (**b: right**) sites of floristic inventories. **A** = Rio Tarumã-Mirim, **B** = Igarapé São João, **C** = Igarapé Nova Inveja, **D** = Igarapé Pupunha; **E-H** = plots 25 x 10 m (**E** = 1, **F** = 2, **G** = 3, **H** = 4). Box: **BP** = plot 150 x 100 m. **O** = settlements, O = burnt area for charcoal production; terra firme = non-flooded secondary forest (capoeira); igapó = primary floodplain forest.

Fig. 2:
Study site at Rio Tarumã-Mirim (**A**) and *Aldina latifolia* (**B**; photo taken in Jaú National Park, October 1994).

Fig 3a

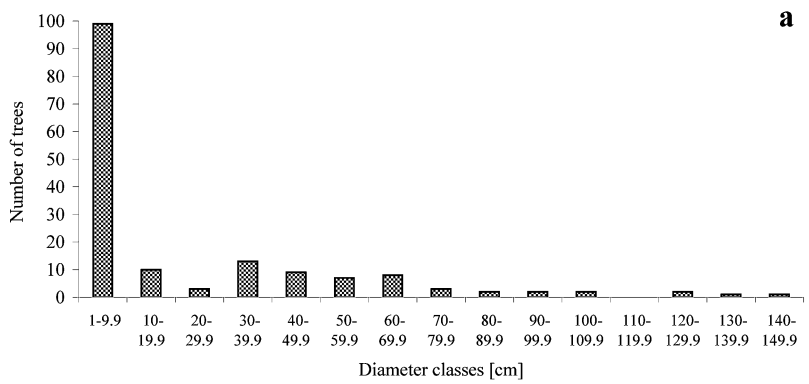

Fig 3b

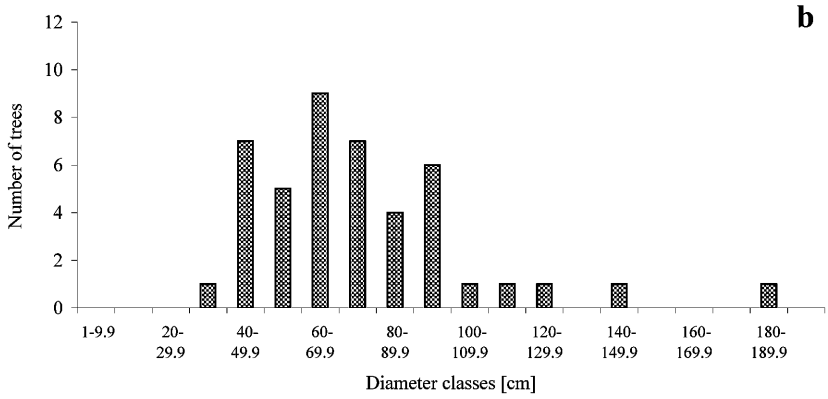

Fig. 3:
Diameter classes of 162 trees in (**a**) plots E, F, G, H (25 x 10 m) and 43 trees in (**b**) plot BP (150 x 100 m) inventoried in the floodplain study site at Rio Tarumã-Mirim.

Fig 4a

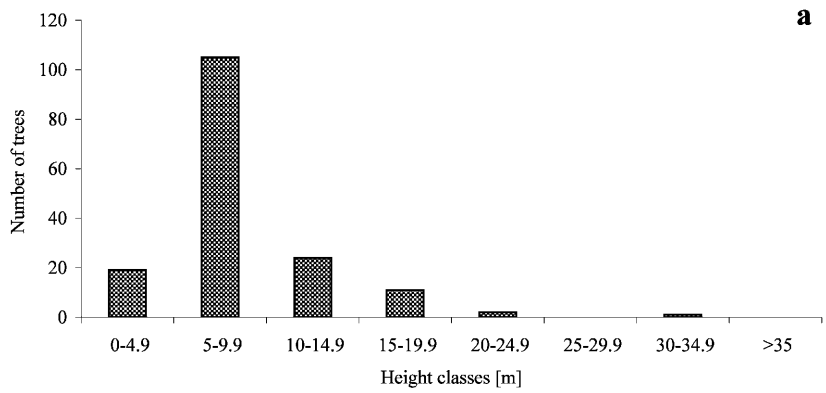

Fig 4b

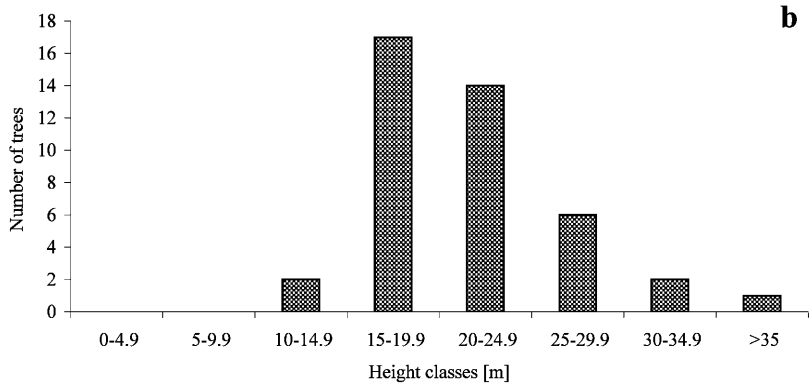

Fig. 4:
Height classes of 162 trees in (**a**) plots E, F, G, H (25 x 10 m) and 43 trees in (**b**) plot BP (150 x 100 m) inventoried in the floodplain study site at Rio Tarumã-Mirim.

Fig 5a

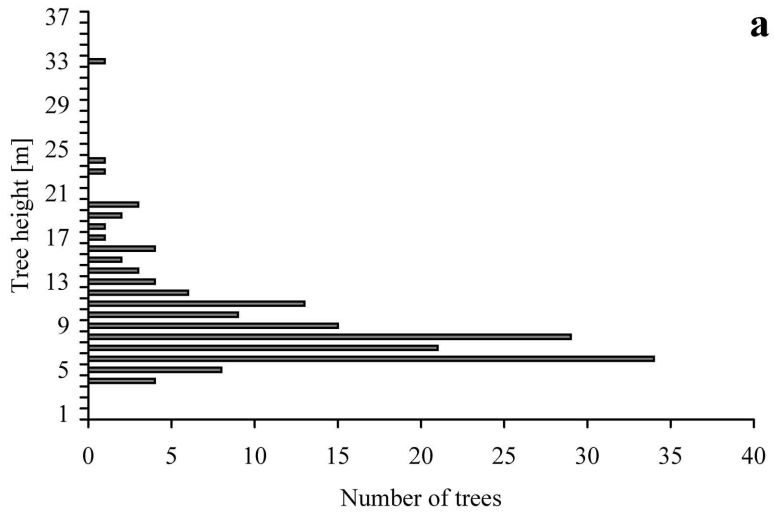

Fig 5b

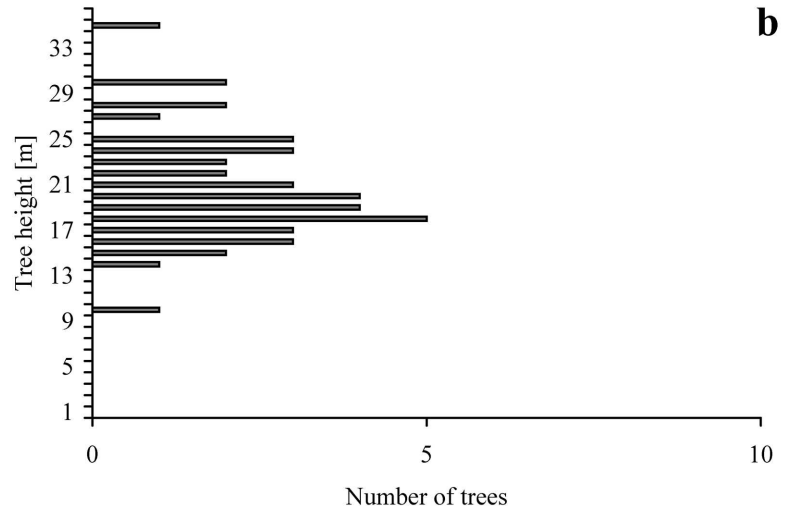

Fig. 5:
Frequency of tree height of 162 trees in (**a**) plots E, F G, H (25 x 10 m) and 43 trees in (**b**) plot BP (150 x 100 m) inventoried in the floodplain study site at Rio Tarumã-Mirim.