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# Vascular plant species counts in the rain forests of the middle Caquetá area, Colombian Amazonia

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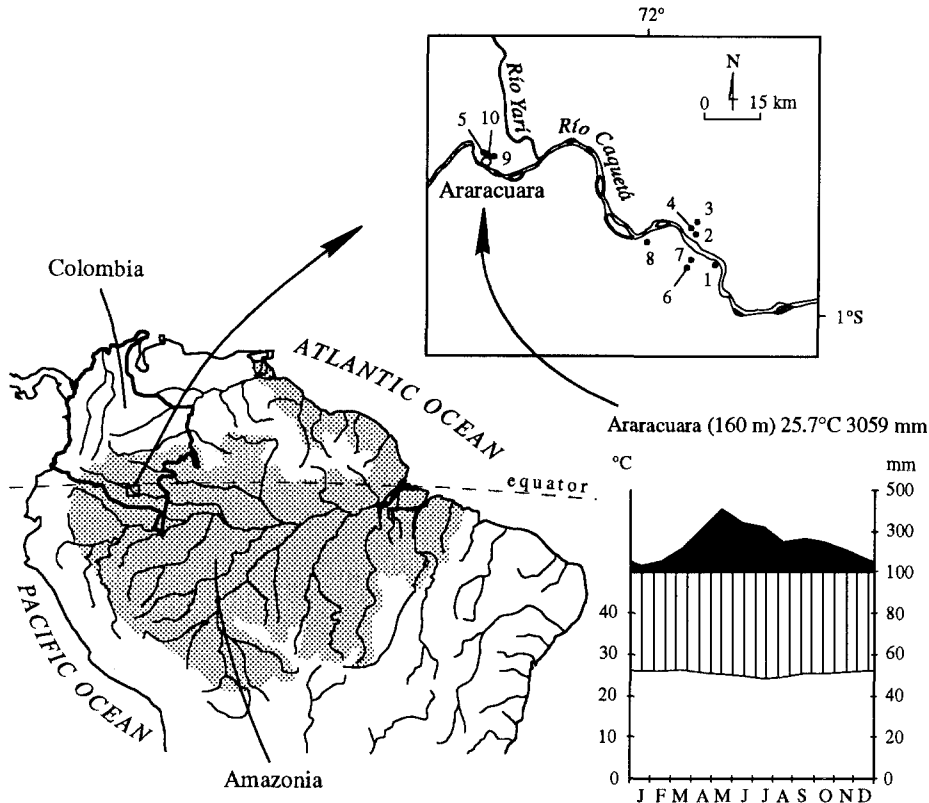
More than 1200 vascular plant species, distributed over 369 genera and 112 families were encountered in ten plots of 0.1 ha in the humid evergreen rain forests of the middle Caquetá area in eastern Colombia. The total number of vascular plant species in the two most diverse plots ranged from 310 to 313 species  $0.1 \text{ ha}^{-1}$ . These values indicate that high levels of vascular plant species densities may be encountered all over NW Amazonia, including the Colombian Amazon. The floodplain plots contained fewer vascular plant species and families than the well-drained upland plots. The high species density in the well-drained upland plots was mostly due to comparatively large numbers of species found among the very slender trees of diameter at breast (DBH)  $\leq 2.5$  cm. Small and slender treelets (DBH < 10 cm) are by far the most species rich habit group. About 50% of the total number of vascular plant species in the plots was exclusively collected with a diameter of less than 2.5 cm. Shrubs, (hemi)epiphytes, and climbers were present with relatively few species. Many of the most species-rich families were tree families. The highest species richness was principally found among tree genera, as well. In this respect the floristic sample from the ten species count plots combined shows much affinity to the local florula around Manaus.

*Keywords:* humid tropical forest; biodiversity; species richness; trees; understory; conservation; Araracuara.

## Introduction

The high tree species richness of the rain forests of the north-western Amazon basin has become increasingly better documented in the past few years due to studies in Peruvian Amazonia (Gentry 1988a,b) and the lowlands of eastern Ecuador (Balslev *et al.*, 1987; Korning *et al.*, 1991; Neill *et al.*, 1993; Valencia *et al.*, 1994). However, up till now, the plant diversity of the rain forests from Colombian Amazonia has never been recorded in a systematic way. During the radar survey of the Colombian Amazon area (Proradam, 1979) many tree species were sampled, but, by depending on local tree spotters (Gentry, 1988b), a considerable number of species was lumped under few vernacular names. Recently, a number of forest inventories have started in Colombian Amazonia within the framework of the Tropenbos research programme. Principal activities are the mapping and regional characterization of the forests in the middle Caquetá area (Duijvenvoorden and Lips, 1993; Urrego, 1994), combined with quantitative inventories and ecological studies in selected physiographic units as well as the preparation of a local flora (Sipman, 1990; Galeano, 1992; Alvarez, 1993; Londoño, 1993).

This paper reports the results of a reconnaissance study of the (near-)total vascular plant species richness of mature forests in the middle Caquetá area. The data are



**Figure 1.** Location of the middle Caquetá area in Colombia and NW Amazonia, including a climate diagram from Araracuara. The detailed map shows the western part of the middle Caquetá area with the approximate position of the ten vascular plant species count plots.

derived from species counts in ten 0.1 ha plots in various physiographic units in the wide surroundings of Araracuara (Fig. 1). Species counts per unit area yield basic information of alpha diversity, and are therefore a tool in the evaluation of land suitability (desirabilities) for conservation. In ecological inventories of lowland rain forests it is still common practice to use diameter cut-offs. Often used limits are 10 cm (see recent overviews for the neotropics in Campbell *et al.*, 1986, 1992; Gentry, 1988a,b), and 2.5 cm (overviews in Gentry, 1988a). Limits of 1 cm are rarely used, and only in special studies where the local flora is well described (e.g. in Barro Colorado Island; Foster and Hubbell, 1990).

Due to these artificial sampling restrictions it is still virtually unknown how many vascular plant species may be expected in a tract of lowland rain forest in the neotropics, and in Amazonia in particular. Limited information of total numbers of vascular plant species in lowland Amazonian forests (excluding Amazonian savannas and allied species-poor vegetation types) is provided by only three studies (a 0.02 ha sample from a species-poor campina forest by Takeuchi, 1960; an incomplete sample of a 465 m<sup>2</sup> plot at 400 m altitude on the lower Amazonian slope of the Andes in Ecuador

by Grubb *et al.*, 1963; and semi-quantitative data of six 25 m-line transects from Peru and Brazil by Gentry and Emmons, 1987). Outside of Amazonia, records of total species counts in neotropical lowland rain forests are only known from western Ecuador (three 0.1 ha inventories, Gentry and Dodson, 1987a), Costa Rica (one 0.01 ha plot, Whitmore *et al.*, 1985), and in Puerto Rico (various plot sizes, Smith, 1970).

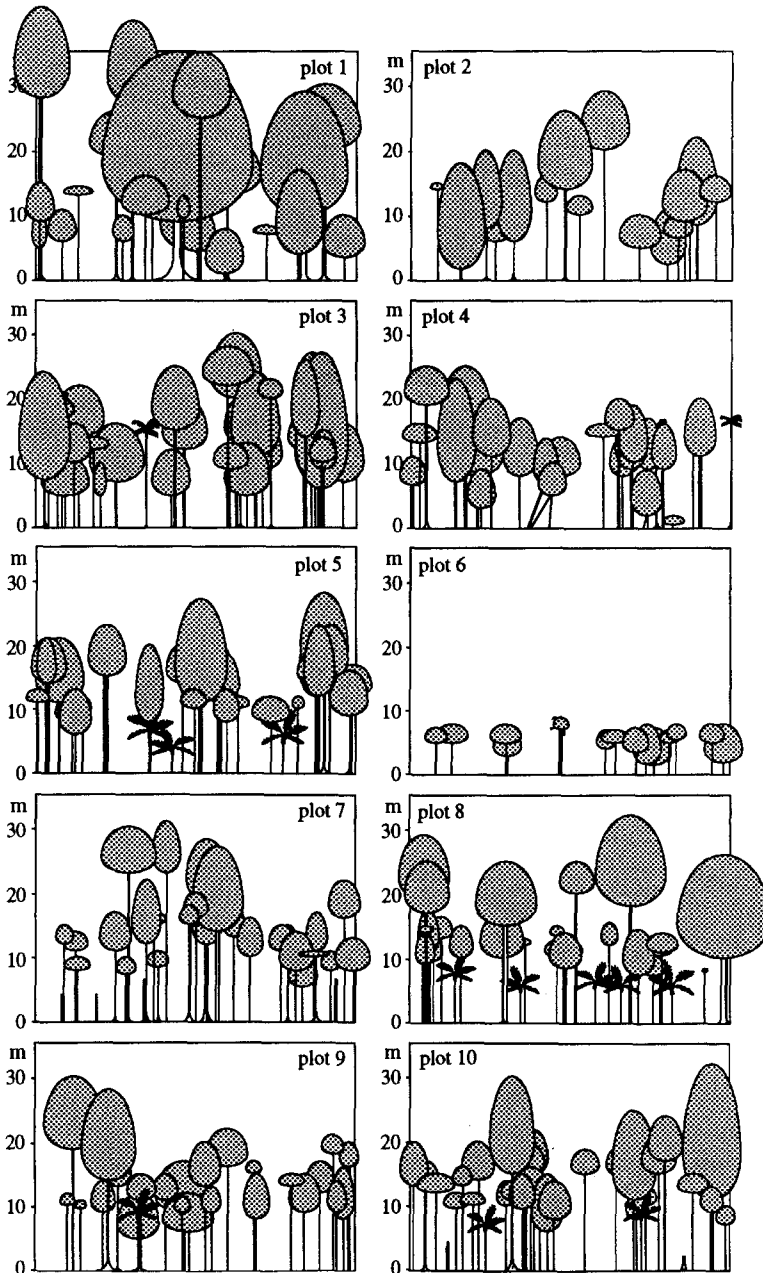
Records of vascular plant alpha diversities can only be properly evaluated when the influence of physiography upon the number of species per unit area is understood. For example, swamp forests tend to have lower alpha diversities (e.g. Lieberman *et al.*, 1985; Hart, 1990; Duivenvoorden and Lips, 1993), and several studies also point to lower tree species densities (DBH  $\geq$  10 cm) in (well drained) floodplains than in upland situations (e.g. Campbell *et al.*, 1986; Balslev *et al.*, 1987; Duivenvoorden and Lips, 1993). The present study, therefore, also aims at providing more insight into the effect of physiography upon patterns of (near-)total vascular plant species densities in the forests near Araracuara.

The middle Caquetá area (0°25'-1°30'S, 72°30'-70°40'L) receives an average annual precipitation of about 3060 mm (Duivenvoorden and Lips, 1993; Fig. 1), and belongs to the humid parts of NW Amazonia. Its current climate can be classified as Af (Köppen, 1936). In terms of Holdridge *et al.* (1971), the middle Caquetá area is part of the humid tropical forest zone (BhT). At Araracuara, the average rainfall in the least wet months is well above 100 mm. The annual rainfall departures from the average yearly rainfall (between-year rainfall variability; see Ashton, 1992) are small (between 1–11% in the period of 1985–1990).

### Materials and methods

Tree species with DBH  $\geq$  10 cm (DBH = diameter at 1.30 cm or directly above high stilt or tabular roots) were sampled between March 1988 and December 1989, as part of a landscape ecological survey of the middle Caquetá area (Duivenvoorden and Lips, 1993). Sampling took place in ten rectangular plots of 0.1 ha each (mostly 20  $\times$  50 m and, in two cases, 16  $\times$  66.6 m), which were situated in physiognomically homogeneous forest stands. Open gaps, with exceptionally low aerial covers of tree crowns, due to recent falls in upper canopy trees or land slides, were excluded from the plots. The sampling included DBH measurements of all trees (DBH  $\geq$  10 cm). Furthermore, total height, height of first branch of ramification, and maximum and minimum crown diameters were estimated for all trees (DBH  $\geq$  10 cm) using a 6 m calibrated stake. In order to construct schematic forest profiles (Fig. 2), the exact position of the trees (DBH  $\geq$  10 cm) was recorded within an area of 7.5  $\times$  50 m at one side of the plot.

Vascular plant species of all other habit groups were sampled in October–November of 1991. This time, maximum diameter at 1.30 cm (in the case of trees and climbers > 1.30 cm tall), or at zero stem height (in case of all other habit groups) was recorded of all species in two classes of < 2.5 cm and 2.5  $\leq$  DBH < 10 cm. Few trees (0–2 per plot) had passed the 10 cm diameter limit in the time lapse after the tree species (DBH  $\geq$  10 cm) sampling. These tree species were recorded in the 2.5  $\leq$  DBH < 10 cm diameter class. Herbs were defined as all non-woody plants not classifying as climbers, hemi-epiphytes, or epiphytes. Acaulescent palms (including those with subterranean stems or juveniles of arborescent palms) were classified as herbs, but arborescent palms



**Figure 2.** Schematic forest profiles of the ten species count plots in the middle Caquetá area. The horizontal and vertical scale are similar. The depth of the profiles is 7.5 m. Only trees with DBH  $\geq 10$  cm are shown. Plot 6 represents a closed canopy forest, in which the upper canopy consisted mostly of crowns belonging to treelets with DBH  $< 10$  cm of about 7–8 m high (not depicted in the profile).

**Table 1.** Selected soil and forest data of the ten vascular plant species count plots

Plot	Soil classification	Volume weighted averages at 50–100 cm depth of mineral profile										Necromass	Density	Basal area	Height <sup>d</sup>
		Sand clay texture (%)	pH water (1:1)	CEC <sup>a</sup> pH = 7 (cmol(+) kg <sup>-1</sup> )	Available P	BrayII (mg.kg <sup>-1</sup> )	Ca	Mg	K	P	N				
1	Tropofluent	21	5.6	11	3	12 440	10 200	18 600	431	277	600 ± 196	5	78	8.9	37
2	Typic Dystropept	12	5.1	13	2	—	—	—	—	—	450 ± 75	5	41	2.4	24
3	Tropofluent	27	4.9	8	2	—	—	—	—	—	590 ± 140	5	70	3.1	25
4	Tropofluent <sup>b</sup>	—	—	—	—	—	—	—	—	—	1090 ± 452	5	68	3.6	25
5	Tropaquodic	82	5.1	2	1	45	18	92	16	30	6200 ± 1490	5	82	3.4	22
6	Tropaquodic	76	4.6	3	1	32	17	44	10	22	3700 ± 1160	3	44	0.6	8
7	Typic Palendult	54	5.1	6	1	111	662	735	109	313	5240 ± 542	5	58	2.4	23
8	Typic Kandiidult	44	4.9	6	2	—	—	—	—	—	1630 ± 425	5	70	3.8	27
9	Typic Palendult	18	4.5	10	1	—	—	—	—	—	700 ± 258	15	72	2.4	21
10	Typic Palendult	21	4.8	16	2	82	2400	9180	276	824	1400 ± 880	5	103	4.5	30

<sup>a</sup> CEC with NH<sub>4</sub>OAc; total content of Ca, Mg, K, and P after dry combustion at 500°C and destruction with 48% HF and 4N H<sub>2</sub>SO<sub>4</sub>; N according to Kjeldahl.

<sup>b</sup> soil analytical properties in plot 4 are probably close to those from plot 3 (on basis of field observation).

<sup>c</sup> average ± SD of *n* samples from L, F, and H horizons (if present) in each plot (see Duivenvoorden and Lips, 1993).

<sup>d</sup> calculated as average height of tallest trees with cumulative crown cover > 750 m<sup>2</sup> (compare Fig. 2).

(with aerial erect stems) were considered trees (see Kahn and Granville, 1992). Woody plants with a basitonic branching pattern (all trunks coming from the stem base; Oldeman, 1990) were recorded as shrubs. Tree, shrub, or woody vine saplings smaller than 50 cm were neglected. Hemi-epiphytic or epiphytic species growing at inaccessible positions were counted without sampling. Sampling in tree crowns was mostly carried out by local indigenous assistants.

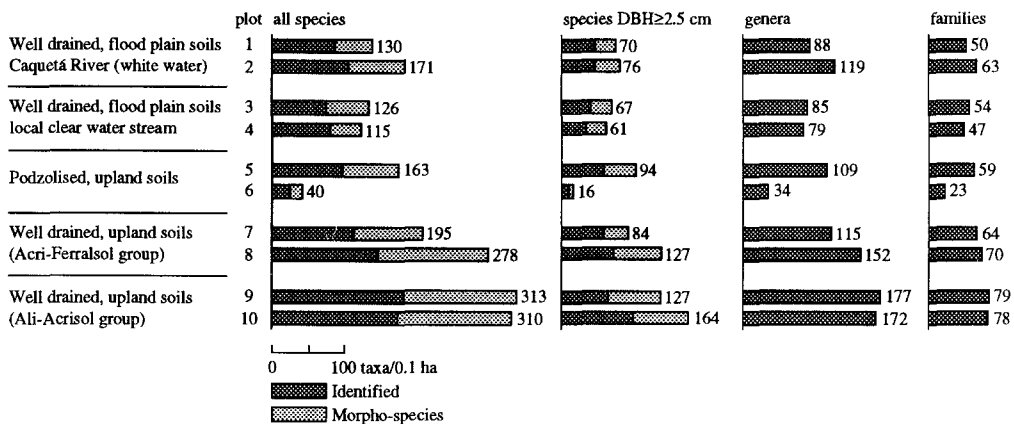
Botanic vouchers were deposited in the Herbario Amazónico of the Corporación Colombiana para la Amazonia, Araracuara. Most samples were sent to specialists for identification (see Acknowledgements). Unidentified species were assigned to morphospecies. The number of taxa per plot area of 0.1 ha is referred to as taxon density (Magurran, 1988). The term 'richness' is simply used as equivalent to number or amount.

Four plots were laid out on moderately-well to well-drained soils at flat topographic positions in flood plains. Of these, plots 1 and 2 were located in the flood plain of the Caquetá River, a white water river of Andean origin. Plot 1 was located on a frequently inundated (i.e. every year) natural levee, and plot 2 in a somewhat higher and less frequently (probably once in every 3–20 years) flooded part. Plots 3 and 4 were situated at more or less similar physiographic positions within the floodplain of a local clear water river. Four plots were located in flat, upland areas, where soils were well drained and classified as Ultisols (SSS, 1990). Soils in plots 7 and 8 pertained to the so-called Acriferralsol group, and those in plots 9 and 10 to the so-called Ali-Acrisol group (Duivenvoorden and Lips, 1993). Finally, plots 5 and 6 were situated at flat upland sites with podzolized ('white sand') soils. These soils are water-saturated during a large part of the year but may dry out during persistent dry spells (Duivenvoorden and Lips, 1993). Apart from plot 1, where the soil is moderately nutrient rich (base saturation above 50%), all other plots have poor to extremely poor soils which are highly desaturated in bases (base saturation far below 50%). Selected soil and forest data of the plots are given in Table 1. The minimum distance between two plots was at least 1 km (Fig. 1).

## Results

Of the cumulative number of 1223 species encountered in the ten species count plots, 620 species (51%) could be identified to species. Total numbers of 369 genera and 112 families were identified, including 12 pteridophyte families, three families of gymnosperms (Zamiaceae, Podocarpaceae, and Gnetaceae), and 97 of angiosperms (81 dicotyledons, Hippocrateaceae and Celastraceae combined, Cecropiaceae separated from Moraceae, Leguminosae as one family, and 16 monocotyledons). Eighty-four percent of the species were identified to genus and 99% to family. A complete list of identified species, morphospecies, genera, and families (Mabberley, 1989) is presented in the Appendix.

Between 40–313 vascular plant species were recorded in the plots of 0.1 ha (Fig. 3). The flood plain plots contained less species and families than the well-drained upland plots. Average (near-)total species density in flood plainplots was more than twice as low as that in the upland plots. The high species density in the well-drained upland plots was mostly due to comparatively large numbers of species found among the slender trees of  $DBH < 2.5$  and  $2.5 \leq DBH < 10$  cm (Figs 4 and 5). The densities of



**Figure 3.** Vascular plant species, genus, and family density in the ten species count plots in the middle Caquetá area. All graphs have similar horizontal scales.

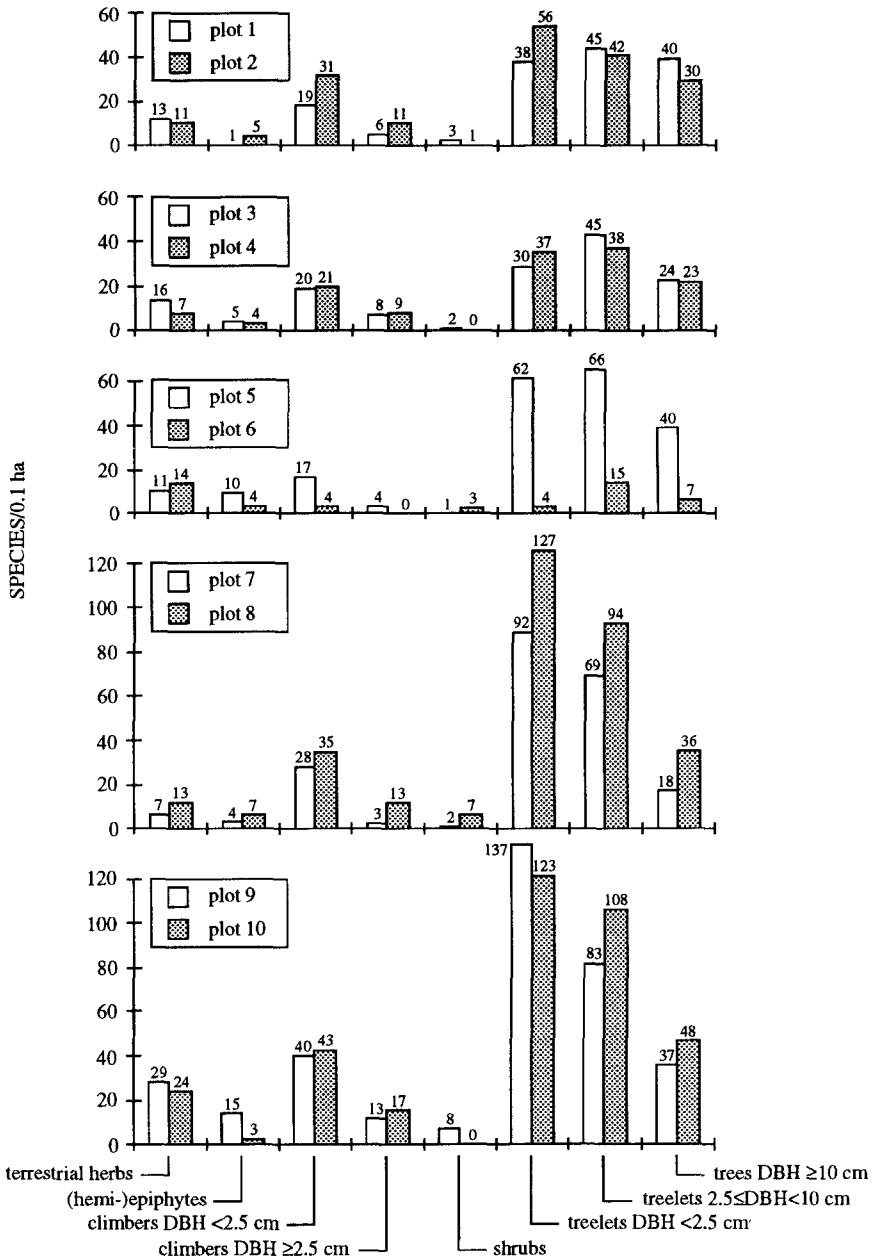
vascular plant taxa in plot 6 (in low forest on a podzolized soil; Fig. 2 and Table 1) were very low compared with all other plots.

Tree species ( $DBH \geq 10$  cm) comprized approximately 10–30% of the total vascular plant species density in the ten species plots (Fig. 6). It is striking that so many species were present within the smaller diameter classes. About 50% of the total number of species in the plots were exclusively collected with a diameter of less than 2.5 cm. Similar patterns were observed for genus and family densities (data not shown). Shrubs and (hemi)epiphytes were present with few species. Climbers contributed more to the species density than herbs, but on the whole the species density of climbers was relatively low.

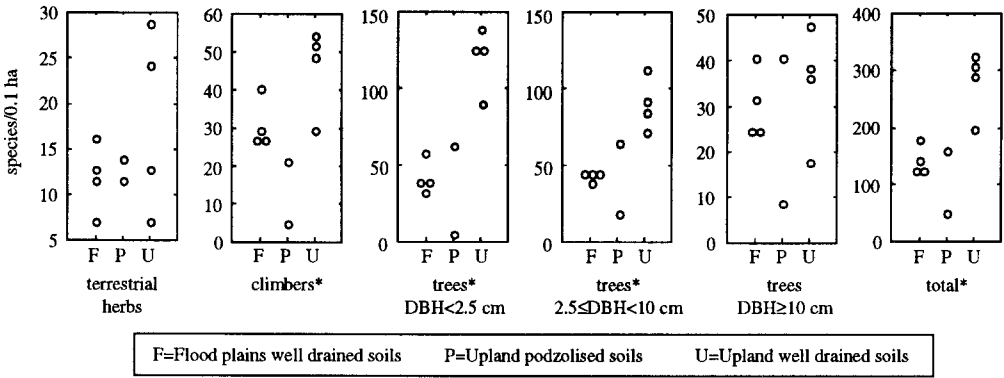
Slightly less than 50% of the genera were present with two or more species, which means that 186 genera were represented by only one species. When the taxon lists from the ten species count plots are combined, Leguminosae is by far the most species rich family, followed by Rubiaceae and Sapotaceae (Fig. 7). It is noteworthy that many of the very species-rich families represent tree families. The first non-woody family is Araceae, and is only ranked in seventh position. The high species richness among tree genera also is striking.

A species-area curve on the basis of the cumulative species numbers in the ten 0.1 ha plots (Fig. 8A) rises steadily, suggesting that additional plot sampling would yield many more species. Likewise, a higher number of genera can be expected after more intensive sampling (Fig. 8B). The slope of the family-area curve (Fig. 8C), however, declines quickly and substantially suggesting that the number of extra plant families to be found in additional plots in comparable physiographic units and forest types would be relatively small.

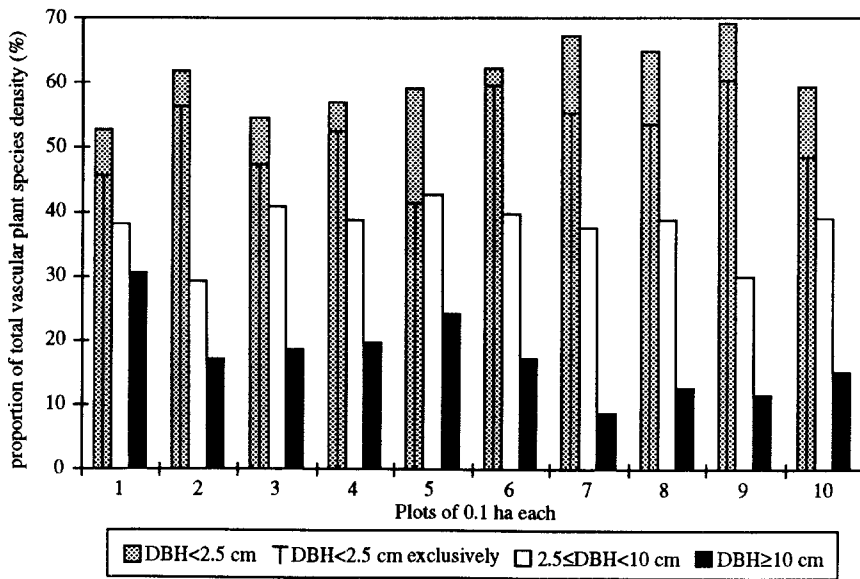




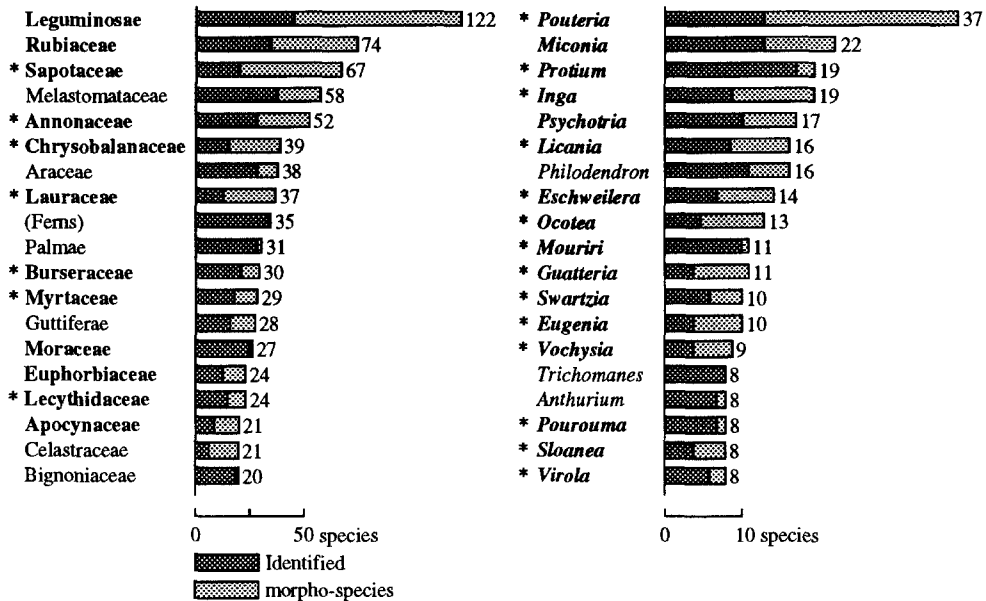
**Figure 4.** Species density of various growth forms in ten species count plots in the middle Caquetá area. Note that species may overlap between growth forms.



**Figure 5.** Species density of various growth form subsets in 0.1 ha plots in the middle Caquetá area arranged according to broad physiographic category. Asterisks denote significant ( $p < 0.05$ ) Kruskal–Wallis tests (SYSTAT, 1992).



**Figure 6.** Vascular plant species density within various DBH (or diameter at zero height) size classes in proportion to the total vascular plant species density in the ten species count plots in the middle Caquetá area. Note that species may overlap between size classes. See the absolute values of species density corresponding to 100% in Fig. 3.

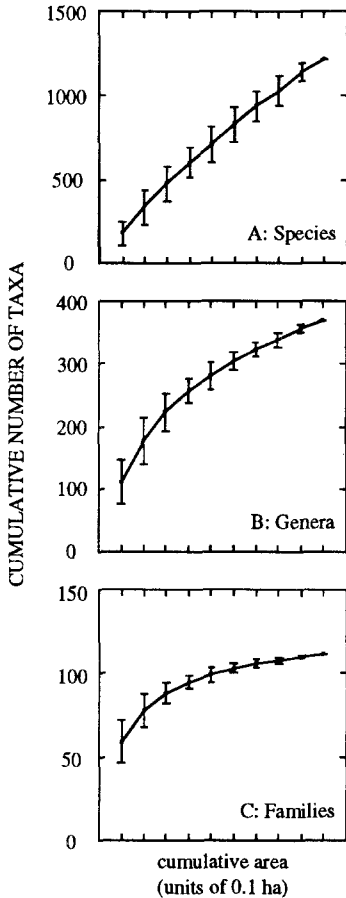


**Figure 7.** Cumulative species richness of the most species-rich families and genera in the ten species count plots in the middle Caquetá area. Tree taxa are in bold and marked with an asterisk. Predominant tree taxa (i.e. with more than 75% of the species showing tree habits in the species count plots) are in bold but lack the asterisk.

## Discussion

### *Flooding and canopy height as factors influencing vascular plant taxon density*

Vascular plant species and family densities were lower in the floodplain plots than in the well-drained upland plots. These results correspond to trends of lower tree (DBH  $\geq 10$  cm) species densities in flood plain plots compared to upland plots in various parts of Amazonia (e.g. Campbell *et al.*, 1986; Balslev *et al.*, 1987; Duivenvoorden and Lips, 1993). Flooding may impose a temporary oxygen stress to roots, and is likely to hamper photosynthesis, particularly of tiny plants (Junk, 1989; Kubitzki, 1989). The observations that the lower species densities in the flood plain plots were largely due to much lower number of species within the habit groups of slender trees of DBH  $< 10$  cm, suggests that the stress of flooding may reduce vascular plant alpha diversity by at least two mechanisms. Saplings, seedlings, and small thin treelets may show high mortalities during flooding events (Mori and Becker, 1991). This may reduce the density of plant individuals, which, in turn, would limit species densities. Secondly, the number of species adapted to flooding may be relatively low in comparison to the number of species adapted to upland conditions. This would lead to relatively small species pool sizes (Eriksson, 1993) in floodplains, which would yield reduced diversities of the propagule bank. The forests in the four flood plain plots are likely to be in old successional stages close to a 'climax' phase (Worbes *et al.*, 1992). This can be deduced from the canopy heights, basal areas and tree densities (DBH  $\geq 10$  cm), which are more or less



**Figure 8.** Species-, genus-, and family-area curves on the basis of the ten 0.1 ha species count plots combined. Ferns and allies are included in the family-area curve. Vertical bars represent standard deviations of average cumulative taxon numbers derived from 20 random plot sequences.

at the same level of the forest at the well-drained upland sites (Fig. 2, and Table 1), and from the absence of typical successional species found elsewhere in the floodplains from the middle Caquetá area (e.g. *Pseudobombax munguba*, *Cecropia membranacea*, *Annona hypoglauca*; Duivenvoorden and Lips, 1993). Phillips *et al.* (1994) report a general tendency of higher tree species richness ( $\text{DBH} \geq 10$  cm) in physiognomically mature aseasonal tropical forests subject to higher stem and basal area turnover rates. As yet, it is unknown whether this forest dynamics model explains vascular plant species diversity when more than just big trees ( $\text{DBH} \geq 10$  cm) are included. In general terms, it seems probable that flooding affects forest productivity, and associated patterns and frequencies of small-scale canopy disturbances (or impacts; Oldeman, 1983, 1989), and that this might lead to lower (near-)total taxon densities in flood plains compared to well drained upland sites.

The very low taxon densities encountered in plot 6 (on a podzolized upland soil) seems principally due to the less complex three dimensional spatial structure and

associated low number of available (regeneration) niches (Grubb, 1977) of the low forest in this plot (see Fig. 2). In the two plots (5 and 6) on podzolised soils, stress induced by very low nutrient content in the mineral soil profile and the poor drainage combined with short intermittent periods of desiccation (Duivenvoorden and Lips, 1993), might explain the relatively low taxon densities compared with those encountered in the well-drained upland sites.

*Species densities in the middle Caquetá area compared to other humid neotropical lowland areas*

The total vascular plant species density of 300–313 species  $0.1 \text{ ha}^{-1}$  in the two most diverse upland plots (plots 9 and 10; Fig. 3) is at the higher part of the range of 120–365 species  $0.1 \text{ ha}^{-1}$  from various neotropical tropical forest and woodlands (Table 2). Considering only individuals with  $\text{DBH} \geq 2.5 \text{ cm}$ , the most diverse upland plots (plot 10) yielded 159 vascular species  $0.1 \text{ ha}^{-1}$  (Fig. 3), which is again near the upper part of the range of 83–167 species  $0.1 \text{ ha}^{-1}$  obtained in tropical forests from six lowland areas with about 3000 mm rainfall (Gentry, 1988a). The species density ( $\text{DBH} \geq 2.5 \text{ cm}$ ) of lowland tropical forests from areas with higher rainfall (Peruvian Amazonia with about 3500 mm and the Chocó area of Colombia with over 5000 mm rainfall) rises above 200 species  $0.1 \text{ ha}^{-1}$  (Table 2), but most of these high values are obtained by the so-called exploded quadrat method (Gentry, 1982, 1988a). According to this method, results of species counts in series of spatially widely distributed  $50 \times 2 \text{ m}$  rectangular transects are combined, which leads to higher species numbers than those obtained in  $0.1 \text{ ha}$  plots. This point is illustrated by Faber-Langendoen and Gentry (1991), who encountered averages of 108 and 166 species ( $\text{DBH} \geq 2.5 \text{ cm}$ )  $0.1 \text{ ha}^{-1}$  in closely spaced sample plots in Bajo Calima, Chocó, where Gentry (1986) had found the very high number of 264 species ( $\text{DBH} \geq 2.5 \text{ cm}$ )  $0.1 \text{ ha}^{-1}$  in a previous exploded quadrat inventory.

With respect to bigger trees ( $\text{DBH} \geq 10 \text{ cm}$ ) the middle Caquetá area is very species

**Table 2.** Ranges of vascular plant species density in  $0.1 \text{ ha}$  samples from mature lowland rain forests in various moist and wet neotropical regions (annual rain fall above 1750 mm), compared with those of the well-drained uplands in the middle Caquetá area. NW Amazonia is here defined as Peruvian, Colombian, and Ecuadorean Amazonia together with the upper Purus and Jurúa basins in Brazil. Total species densities from central America and rest Amazonia are based on samples smaller than  $0.1 \text{ ha}$ . Data derived from Gentry (1982, 1986, 1988a,b); Whitmore *et al.* (1985); Campbell *et al.* (1986); Gentry and Dodson (1987a); Faber-Langendoen and Gentry (1991), and Duivenvoorden and Lips (1993)

Mature lowland rain forests	Vascular plant species $0.1 \text{ ha}^{-1}$		
	Total	$\text{DBH} \geq 2.5 \text{ cm}$	Trees $\text{DBH} \geq 10 \text{ cm}$
NW Amazonia	no data	147 <sup>a</sup> –249 <sup>a</sup>	33–68 <sup>a</sup>
Rest Amazonia	> 57 <sup>b</sup>	83–131	19–40
Chocó and western Ecuador	169 <sup>a</sup> –365 <sup>a</sup>	96–265 <sup>a</sup>	25–55
Central America and Caribbean	( $\pm 120$ )–>233	90–167 <sup>a</sup>	21–44
Well-drained uplands Middle Caquetá area	195–313	86–159	18–57

<sup>a</sup> obtained by exploded quadrat method.

<sup>b</sup> in  $0.02 \text{ ha}$  of campina forest (Takeuchi, 1960; total number given by Gentry and Dodson, 1987a).

**Table 3.** Total number of vascular plant species and families recorded in the ten species count plots near Araracuara, compared with the species and family richness in a selection of local neotropical lowland florulas

	Species	Families	References
ten 0.1 ha plots middle Caquetá area	1223 (620) <sup>a</sup>	100	this study
<i>local florulas</i>			
Ducke reserve near Manaus, Brazil	825 <sup>b</sup>	88	Prance (1990); Gentry (1990)
Iquitos area, Peru	2255	125	Gentry and Ortiz (1993)
Amazonian Ecuador	3100	149	Renner <i>et al.</i> (1990)
Cocha Cashu, Peru	1856	130	Foster (1990); Gentry (1990)
Barro Colorado, Panama	1320	118	Foster and Hubbell (1990); Gentry (1990)
La Selva, Costa Rica	1668	121	Hammel (1990); Gentry (1990)

<sup>a</sup> the number of identified species in parentheses.

<sup>b</sup> according to Prance (1990) the final number of species probably increases beyond 1030.

rich as well. The tree (DBH  $\geq$  10 cm) species richness of several upland plots of 0.1 ha (Duivenvoorden and Lips, 1993) reaches the same high level of about 55–60 species found by Gentry (1988b) in the first 0.1 ha samples of the very tree species rich Mishana and Yanamono plots near Iquitos. One inventory in Peruvian Amazonia (Gentry, 1986) yielded 68 tree species 0.1 ha<sup>-1</sup> (Table 2), but again this value may be (slightly) biased because of the exploded quadrat method used.

The high species richness of the forests of the middle Caquetá area also becomes apparent when it is realized that the cumulative numbers of species and families in the small sample of ten 0.1 ha plots near Araracuara are of the same order of magnitude as those found within local florulas from other neotropical lowland areas (Table 3), which are based on extensive collection efforts by experienced field botanists (see e.g. Hammel, 1990). The high cumulative taxon richness in the present study is undoubtedly related to the distribution of the species count plots over various physiographic units with different soil and forest types. Obviously, many vegetation types with additional vascular plant taxa have not been included in the sampling. For example, the savanna-like vegetation from the top of the sandstone plateau near Araracuara contains at least 13 higher plant families which were not encountered in the ten species count plots: Burmanniaceae, Droseraceae, Eriocaulaceae, Lentibulariaceae, Loranthaceae, Lythraceae, Malvaceae, Rapateaceae, Rutaceae, Styracaceae, Tepuianthaceae, Xyridaceae (at least 11 species of *Xyris*), and Velloziaceae (Kral and Duivenvoorden, 1993; Duivenvoorden and Cleef, 1994; Sanchez *et al.*, in press). At least 16 other vascular plant families were not found in the present inventory but were previously recorded in the middle Caquetá area: Amaranthaceae, Balanophoraceae, Begoniaceae, Bixaceae, Campanulaceae, Cannaceae, Caricaceae, Labiatae, Liliaceae, Onagraceae, Phytolaccaceae, Podostemaceae, Portulacaceae, Scrophulariaceae, Turneraceae, Ulmaceae, Urticaceae, and Vitaceae (Sastre and Reichel, 1978; Palacios, 1986; Duivenvoorden and Lips, 1993). Including the recently encountered species of the Dipterocarpaceae family (mentioned in Sanchez *et al.*, in press; a new genus according to Gentry, 1993), the total number of flowering vascular plant families in the surroundings of Araracuara increases to (at least) 127, which is more than the total number of 125 families found in the very species rich forests near

Iquitos (Gentry and Ortiz, 1993; Hippocrateaceae and Celastraceae combined, Cecropiaceae separated from Moraceae, Leguminosae as one family).

#### *Species richness by habit*

Small and slender treelets ( $DBH < 2.5$  and  $2.5 \leq DBH < 10$  cm) are by far the most species rich growth form in the ten plots of the species counts (Fig. 4). Excluding the very low forest in plot 6, between 37–137 species were found among treelets with  $DBH < 2.5$  cm representing 24–47% of the (near-)total species densities. Gentry and Dodson (1987a) found between 38–87 treelets in this diameter size class corresponding to 22–28% of the total species densities in the three plots in western Ecuador. Whitmore *et al.* (1985) recorded 64 seedlings smaller than 1 m comprising 27% of the total number of vascular plant species in the 0.01 ha plot inventory in Costa Rica.

Species densities among terrestrial herbs and climbers are relatively low. Poulsen and Balslev (1991) found 25–41 obligate herb species (excluding palms) in 0.1 ha subplots of an upland forest plot in the moist lowlands of Amazonian Ecuador, which is slightly above the range of 21 and 25 herb species (excluding palms) encountered in the two most species rich upland plots (9 and 10) in the present study. The range of 0–7% climbing species in the 0.1 ha plots is below the average percentage of 20% of such species in neotropical forests reported by Gentry (1982).

The strikingly low number of shrub species in the present study is partly due to the strict application of the basitonic shrub concept (Oldeman, 1990). If shrub species are defined on the basis of a height limit (e.g. Hammel, 1990) or on the basis of the original taxonomic description (e.g. Becker and Castillo, 1990), higher estimates of shrub species richness may be obtained.

The number of (hemi-)epiphyte species comprises less than 5% of the total vascular species counts (Fig. 4). This low number may be partly due to the inaccuracy of the applied counting and sampling procedure. Small, tiny vascular plant (hemi-)epiphytes growing on branches in the upper canopies may have remained unnoticed (apart from those in the low forest of plot 6 where all branches were well accessible). The low (hemi-)epiphyte diversity in the present study, nevertheless, contrasts strongly with results from species counts in the Río Palenque area in western Ecuador (Gentry and Dodson, 1987a) and near La Selva in Costa Rica (Whitmore *et al.*, 1985; Gentry and Dodson, 1987b; see also Hammel, 1990), where 35% (127 species) and 25% (61 species in a 100 m<sup>2</sup> plot) of vascular (hemi-)epiphyte species were recorded, respectively. Data of epiphyte abundance and diversity from the Amazon basin itself are scarce. Gentry and Dodson (1987b) mention minimum numbers of 31 and 38 vascular (hemi-)epiphyte species from areas near Iquitos, Peruvian Amazonia, but do not specify sample area size. In the same paper these authors report observations of much less epiphytes in poor soil parts of central Amazonian Brazil, southern Venezuela, and elsewhere in the Guiana shield area than in parts of the neotropics with richer soils as encountered near the Andes and in Central America. This might be in accordance with the low epiphyte diversity in the species count plots, which are situated in physiographic units with mostly poor to extremely poor soils. Gentry (1990) ascribed the poor representation of epiphyte taxa in the florula of the Ducke reserve near Manaus also to the high seasonality and relative low precipitation (of around 1700–2000 mm) in that area (apart from a possible sampling bias). He suggested that higher precipitation would result in higher plant diversities because of increasing epiphytism. The higher rainfall in the middle

Caquetá area indeed seems to result in a higher plant diversity than at the Manaus site, but this increasing diversity is not found among epiphytes but among the habit group of tiny, slender trees. It might imply that rich epiphytism in lowland forests is perhaps a function of proximity to the Andes where conditions of fog might be more prevailing than in Amazonian lowlands.

#### *Species richness within tree families and genera*

Comparing the floristic composition of the cumulative sample from the ten species count plots with local florulas from other areas is hazardous because the sample is incomplete (as shown by the species area-curve; Fig. 8A), and because certain gap specialists and epiphytes may have been under represented. Furthermore, the total species sums for the different plots may be influenced by the subjective element in the morphocategorization. The high proportion of almost 50% morphospecies in the present study is caused by the mostly sterile condition of the botanical samples, in combination with the poor state of knowledge of the flora of the Colombian Amazon. Comparatively, Gentry (1982) published species lists that contain 76–93% of identified species in samples from tropical forests with limited and well-known floras, and 44% identified species in a species rich sample from the floristically poorly known Chocó region of Colombia. Due to these constraints, only one short comment is to be made about the high species richness (by ranking and in absolute terms) of tree genera and families in the sample from the present study, which corresponds remarkably well to a similar trend within the florula of the Ducke reserve near Manaus (Gentry, 1990; Prance, 1990). Among the 16 most species-rich families at Manaus and Araracuara, 13 families are shared between both areas. Seven of these are predominant tree families (Leguminosae, Sapotaceae, Chrysobalanaceae, Annonaceae, Lauraceae, Lecythidaceae, and Burseraceae), and four others (Rubiaceae, Melastomataceae, Moraceae, and Euphorbiaceae) consist of many tree species as well. Likewise, all genera shared among the 19 most species rich genera at both sites consist predominantly of tree species (*Protium*, *Licania*, *Eschweilera*, *Ocotea*, *Pouteria*, *Miconia*, *Inga*, *Sloanea*, *Swartzia*, *Guatteria*, and *Virola*). The existence of (largely) similar sets of species-rich families and genera in Manaus and Araracuara would correspond to observations by Prance (1990) that Manaus plant species share strong relationships with western and north-western Amazonia. According to Gentry and Ortiz (1993), the occurrence of species-rich Sapotaceae, Chrysobalanaceae, Lauraceae, and (marginally) Apocynaceae in Amazonia is restricted to sandy, nutrient poor soils. This statement is partly confirmed by the high species richness of these families in the present study, considering the poor to extremely poor nutrient status (not always accompanied by sandy textures) of the soils in most plots (Table 1), and in the middle Caquetá area in general (Duijvenvoorden and Lips, 1993).

#### *Implications for conservation and diversity assessments*

Together with the record of Gentry (1988b) from Iquitos, and the new information from Valencia *et al.* (1994) and Neill *et al.* (1993) from Amazonian Ecuador, the data presented here from the Colombian Amazon show that high vascular plant diversities may be found throughout NW Amazonia. High rain forest diversity is perhaps most of all important because it reflects the large size of the reservoir of potential useful species (Plotkin, 1988; Nepstad and Schwartzman, 1992). The use, conservation, and protection



of the biodiversity should therefore be an essential component of management plans for these NW Amazonian rain forest areas. Data on local and regional levels of vascular plant diversities are indispensable for these plans. The present study may provide a first insight in the kind of information on vascular plant alpha diversity obtained from simple, physiography orientated plant species counts in small plots.

Despite the low number of plots studied, it is shown that (near-)total vascular plant alpha diversities in small plots of 0.1 ha may be predictable by physiography (flooding) and forest structure (canopy height). As such, these results correspond to general correlations between abiotic environment and tree species diversity (DBH  $\geq$  10 cm) in the middle Caquetá area (Duivenvoorden and Lips, 1993; Duivenvoorden, 1994), and other areas in Amazonia (e.g. Campbell *et al.*, 1986; Balslev *et al.*, 1987). Both physiography and canopy height are easily detectable on most types of remote sensing material from the Amazon basin, and may offer a ground for systematic regional surveys of vascular plant alpha diversities. Quick diversity assessments in small plots preceded by general physiographic surveys on the basis of remote sensing means would be a efficient tool to estimate the overall level of the vascular plant alpha diversity and its variability in large regions as a whole, or in separate physiographic subdivisions (i.e. flood plains, swamps, well-drained uplands, Amazonian caatingas, etc.). Such information would offer basic reference material to evaluate desirabilities for conservation and protection of rain forest areas, and to interpret the effects of human intervention and fragmentation of forests upon local and regional levels of vascular plant diversity.

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## Appendix

List of vascular plant taxa encountered in the ten 0.1 ha species count plots. Unidentified species are codified with the code (three letters of first collector followed by the number) of one arbitrarily selected voucher. The three letter code of the first collector is as follows: pap = P.A. Palacios; mss = M. Sanchez; jbr = J. Brand; ncg = N.C. Garzón; dui = J.F. Duivenvoorden. Vouchers are deposited in the Herbario Amazónico of the Corporación Colombiana para la Amazonia, Araracuara, Calle 20 No. 5–44, SantaFé de Bogotá. When morphocategorization was impossible (mostly in case of seedlings/saplings) sp. is added. The explanation of the symbols in parentheses is as follows: t = tree (DBH  $\geq$  10 cm); tl = treelet (DBH < 10 cm), sapling or seedling > 50 cm; s = shrub; hhe = hemi-epiphyte; h = terrestrial herb; he = epiphyte; b = liana or vine; pa = acaulescent (or juvenile) palm; the numbers refer to the plots where the species were recorded (original plot numbers are: 1 = 59, 2 = 69, 3 = 68, 4 = 70, 5 = 113, 6 = 67, 7 = 66, 8 = 50, 9 = 54, 10 = 112).

Ferns and allies (Pteridophytes)

**Adiantaceae:** *Adiantum terminatum* Miq. (h; 3); *A. tomentosum* Kl. (h; 8, 9, 3, 10); *A. sp.* (h; 2)

**Aspleniaceae:** *Arachniodes macrostegia* (Hook.) Tryon and Conant (h; 5); *Asplenium*

*auritum* Sw. (h; 2); *Cyclodium meniscioides* (Willd.) Presl (h; 3); *Elaphoglossum discolor* (Kuhn) C. Chr. (h; 6); *E. mss408* (h; 7); *Lomariopsis japurensis* (Mart.) J. Smith (hhe; 1, 2); *Polybotrya caudata* Kunze (h, b; 1, 2); *P. osmundacea* Willd. (h; 8, 9); *Tectaria incisa* Cav. (h; 1)

**Blechnaceae:** *Salpichlaena volubilis* (Kaulf.) Hook. (h; 4)

**Cyatheaceae:** *Cyathea* sp. (tl; 8, 9, 7)

**Dennstaedtiaceae:** *Lindsaea lancea* (L.) Bedd. (h; 8); *L. lancea* (L.) Bedd. var. *falcata* (Dryand.) Ros. (h; 9, 7, 5); *L. rigidiuscula* Lind. (h; 6); *L. ulei* Hieron. (h; 9)

**Hymenophyllaceae:** *Trichomanes ankersii* Parker ex Hook. and Grev. (hhe; 8, 9, 7); *T. bicornis* Hook. (h; 5); *T. elegans* Rich. (h; 8, 9); *T. heterophyllum* L. (h; 6); *T. hostmannianum* (Kl.) Kunze (h; 3, 4); *T. martiusii* C. Presl (h; 5); *T. (aff.) pinnatum* Hedw. (h; 8, 9, 10); *T. spruceanum* Hook. (h; 6)

**Lycopodiaceae:** *Lycopodiella contexta* (Mart.) Holub (h; 6)

**Marattiaceae:** *Danaea elliptica* J. Smith (b; 8, 7)

**Metaxyaceae:** *Metaxya rostrata* (H.B.K.) Presl (h; 9)

**Polypodiaceae:** *Campyloneurum angustifolium* (Sw.) Fée (h; 5); *Dicranoglossum desvauxii* (Kl.) Proctor (he; 3); *Microgramma baldwinii* Brade (h; 10); *M. lycopodioides* (L.) Copel. (h; 4); *M. reptans* (Cav.) Smith (b; 2, 4); *Polypodium triseriale* Sw. (hhe; 5)

**Schizaeaceae:** *Schizaea elegans* (Vahl) Sw. (h; 9, 10, 5); *S. fluminensis* Miers ex Sturm (h; 9)

**Selaginellaceae:** *Selaginella conduplicata* Spring (h; 3); *S. haematodes* (Kunze) Spring (h; 1)

#### Gymnosperms and Angiosperms

**Acanthaceae:** *Aphelandra aurantiaca* (Scheidw.) Lindl. var. *aurantiaca* (h; 2); *A. pilosa* Leonard (tl?; 5); *Justicia dui1834* (b, tl?; 3, 2); *J. sp.* (h; 3); *Mendoncia trilobata* Leon. (b; 2); *M. dui789* (b; 7, 5); *M. sp.* (b; 9, 2, 10); *Mendoncia?* dui1983 (b; 10); genus unknown dui1428 (tl; 1)

**Alismataceae:** *Echinodurus dui1432* (h; 1)

**Anacardiaceae:** *Spondias venosa* Mart. ex Colla (tl; 2); *Tapirira (aff.) guianensis* Aubl. (tl, t; 8, 7, 4, 10, 5)

**Anisophyllaceae:** *Anisophyllea (aff.) guianensis* Sandwith (tl; 8, 10)

**Annonaceae:** *Anaxagorea angustifolia* Timmerman (tl, t; 3) *A. dolichocarpa* Sprague and Sandwith (tl; 4); *A. dui1593* (tl; 3); *Annona aff. dolichophylla* R.E. Fries (t; 2); *A. excellens* R.E. Fries (tl; 8, 9, 7, 10); *A. scandens* Diels (b; 9); *Diclinanona tessmannii* Diels (t; 4); *Duguetia asterotricha* (Diels) Fries (tl, t; 1); *D. dui1669a* (tl; 3); *D. dui2654* (tl; 9); *D. dui786a* (tl; 5); *D. flagellaris* Huber (tl; 8, 7, 10); *D. (cf.) macrophylla* Fries (tl; 2, 4); *D. (cf.) stelechantha* (Diels) Fries (tl; 10); *Ephedranthus amazonicus* R.E. Fries (t; 10); *Guatteria decurrens* R.E. Fries (tl, t; 5); *G. dui1159* (tl; 7); *G. dui1872* (tl; 3, 4); *G. dui2427* (tl; 9); *G. dui746* (tl; 5); *G. (cf.) ferruginea* St. Hil. (tl; 5); *G. guianensis* (Aubl.) Fries (tl; 8); *G. megalophylla* Diels (tl, t; 9, 7); *G. mss1636* (tl; 10); *G. tomentosa* Fries (tl; 8); *Guatteria?* jbr1519 (t; 8); *Malmea aff. lucida* Diels (tl; 1); *Oxandra acuminata* Diels (tl; 3, 2, 4); *O. dui1085* (tl; 10); *O. euneura* Diels (tl; 9, 2, 10); *O. macrophylla* Fries (tl; 1); *O. mediocris* Diels (tl, t; 1, 2); *O. polyantha* Fries (tl, t; 3, 4); *O. (aff.) xylopioides* Diels (tl, t; 10); *Porcelia?* mss166 (t; 8); *Pseudoxandra dui966* (tl; 10); *Rollinia cuspidata* Mart. (tl; 1);

*Stenanona?* dui1098 (tl; 10); *Unonopsis* dui1904 (tl; 4); *U. aff. guatterioides* (A. DC.) Fries (tl; 2); *U. stipitata* Diels (tl; 8, 7, 10); *Xylopi* aff. *benthami* Fries (tl; 8); *X. cuspidata* Diels (tl; 8, 9, 10); *X. dui999* (tl; 10); *X. spruceana* Benth. ex Spr. (tl, t; 5); genus unknown dui1210 (tl; 7); genus unknown dui1258 (tl; 8, 7); genus unknown dui2014 (tl; 10); genus unknown dui2434 (b; 9); genus unknown dui2567 (tl; 9); genus unknown dui931 (tl; 10)

**Apocynaceae:** *Aspidosperma* dui2040 (tl; 8); *A. dui2177b* (tl; 8, 7); *A. dui2671* (tl; 9); *A. mss1399* (t; 5); *A. mss1640* (tl, t; 8, 5); *A. sp.* (tl, t; 4); *Couma catingae* Ducke (tl, t; 6, 5); *Laemellea* dui1965 (tl; 10); *L. (aff.) foxii* (Stapf) Markgr. (tl, t; 7, 5); *L. cf. gracilis* (Muell. Arg.) Markgr. (tl; 1); *L. cf. lactescens* (Kuhlm.) Markgr. (tl; 7); *Macoubea* (aff.) *guianensis* Aubl. (t; 1, 5); *Malouetia* dui2624 (tl; 9, 10); *Mandevilla* sp. (b; 8, 7); *Mucoa* cf. *duckei* (Markg.) Zar. (tl; 9, 10); *Neocouma ternstroemiacea* (Muell. Arg.) Pierre (tl, t; 5); *Odontadenia cognata* (Stadelm.) Woodson (b; 10); *O. dui1870* (b; 3, 4); *O. dui2518* (b; 9); *O. sp.* (b; 5); *Tabernaemontana* dui1073 (tl; 10); *T. dui1573* (tl; 3); *T. aff. siphilitica* (L.f.) Leeuwenberg (tl; 8); genus unknown sp. (tl; 10); genus unknown sp. (tl; 7); genus unknown sp. (tl; 2)

**Aquifoliaceae:** *Ilex* (cf.) *laureola* Tr. and Pl. (tl; t; 8); *I. mss433* (tl; 6, 5); *Ilex?* dui2325 (tl; 8, 7)

**Araceae:** *Anthurium bonplandii* Bunting ssp. *bonplandii* (hhe; 5); *A. clavigerum* Poepp. and Endl. (hhe; 4); *A. dui942* (hhe, b; 10, 3); *A. eminens* Schott (b; 1, 2); *A. gracile* (Rudge) Lindl (hhe; 10); *A. kunthii* Poepp. and Endl. (b; 1); *A. sinuatum* Benth. ex Schott (hhe; 9); *A. sp.* (hhe; 3); *A. vittariifolium* Engl. (hhe; 4); *Dieffenbachia* cf. *parvifolia* Engl. (h; 4); *Heteropsis flexuosa* (H.B.K.) Bunting (b; 8, 3, 2, 4, 10); *H. oblongifolia* Kunth (hhe, b; 9, 4, 10, 5); *H. sp.* (b; 9, 10); *H. sp. nov.?* (b; 10); *H. spruceana* Schott (b; 9, 3, 4); *H. steyermarkii* Bunting (hhe, b; 9, 3, 2, 4, 10, 5); *Monstera adansonii* Schott (b; 1); *M. obliqua* Miq. (b; 1, 3); *M. sp.* (sect. *Monstera*) (hhe, b; 9, 4); *M. cf. spuceana* (Schott) Engl. (b; 8); *Philodendron chinchamayense* Engl. (hhe, b; 3, 2, 4); *P. dui1849* (b; 4); *P. dui673* (h; 5); *P. fragrantissimum* (Hook.) Kunth (hhe, b; 9, 10); *P. guttiferum* Kunth (b; 4); *P. heteropleurum* K. Krause (b; 2); *P. holtonianum* Schott (b; 8); *P. hylaeae* Bunting (hhe; 8, 3); *P. linnaei* Kunth (h; 10); *P. megalophyllum* Schott (hhe; 2, 4, 5); *P. pteropus* Mart. ex Engl. (b; 1, 2); *P. scandens* Koch and Sello (b; 1); *P. sect. oligospermum* series *Belo-cardium* (sp. nov.?) (hhe; 8, 7); *P. sp.* (b; 8, 9, 7); *P. sp. nov.* ('lynette') (hhe; 5); *P. sp. nov.?* (hhe; 9); *P. cf. venustum* Bunting (hhe; 9); *Rhodospatha latifolia* (Poepp. and Endl. (hhe; 9); *R. venosa* Gleason (hhe, b; 7, 5); genus unknown dui1615 (he; 3); genus unknown dui1718 (b; 2); genus unknown dui2475 (hhe; 9); genus unknown sp. (h, he, hhe; 8, 9, 7, 4, 5)

**Araliaceae:** *Dendropanax* aff. *palustris* (Ducke) Harms (tl; 5); *Schefflera* dui1331 (tl; 7) *Schefflera?* pap2166 (tl, t; 9)

**Aristolochiaceae:** *Aristolochia* dui1967 (b; 10)

**Asclepiadaceae:** *Cynanchum?* dui737 (b; 5); *Matelea* dui1931 (b; 4); *Tassadia* cf. *aristata* (Benth. ex Fourn.) Fontella Pereira (b; 8)

**Bignoniaceae:** *Arrabidaea chica* (Humb. and Bonpl.) Verl. (b; 10); *A. corallina* (Jacq.) Sandwith (b, tl/b?; 8, 7); *A. mollis* (Vahl) Bur. ex K. Schum. (tl; 9); *A. aff. prancei* Gentry (b; 10); *A. sp.* (b; 7); *Callichlamys latifolia* (L. Rich) K. Schum. (b, tl; 9, 5); *Clytostoma sciuripabulum* Bureau and K. Schum. (b; 10); *Cydista aequinoctialis* (L.) Miers (b; 9); *Distictella magnoliifolia* (H.B.K.) Sandwith (b; 9); *D. parkeri* (DC.)

- Sprague and Sandwith (b; 8); *Jacaranda copaia* ssp. *spectabilis* (Mart. ex DC.) Gentry (tl; 8, 10); *J. glabra* (DC.) Bur. and K. Schum. (tl; 9); *J. macrocarpa* Bur. and K. Schum. (tl, t; 8, 7, 5); *Macfadyena uncata* (Andr.) Spr. and Sw. (b; 1); *Memora cladotricha* Sw. (tl, tl/b?; 9, 10); *M. pseudopatula* Gentry (b; 3, 2, 4); *Paragonia pyramidata* (L. Rich.) Bur. (b; 4); *Pleonotoma jasminifolia* (H.B.K.) Miers (b; 9, 10); *P. variabilis* (Jacq.) Miers (b; 10, 5); *Spathicalyx xanthophylla* (DC.) Gentry (b; 1); genus unknown dui1742 (tl/b?; 2)
- Bombacaceae:** *Catostemma commune* Sandwith (tl, t; 9); *Pachira?* mss1583 (t; 10); *Quararibea* dui1467 (tl; 1); *Q.* dui2282 (tl; 8); *Q.* dui2309 (tl; 8); *Q.* aff. *jbr1350* (tl; 10); *Q.* aff. *oblongifolia* (P. and E.) Vischer (tl, t; 2, 4); *Q.* sp. (tl; 10); *Rhodognaphalopsis brevipes* Robijns (tl, t; 6, 5); *Scleronema micranthum* (Ducke) Ducke (tl, t; 9, 5); *S. praecox* (Ducke) Ducke (t; 10)
- Boraginaceae:** *Cordia* dui2520 (b, tl; 9, 10); *C.* dui2669 (tl; 9); *C.* dui793 (tl; 5); *C. erios-tigma* Pittier (tl; 9); *C.* ncg441 (tl; 7); *C. nodosa* Lam. (tl; 8, 9, 7, 3, 10)
- Bromeliaceae:** *Vriesea?* mss429 (he; 6); genus unknown dui1795 (hhe; 2); genus unknown dui2696 (h; 9); genus unknown sp. (he; 3, 5)
- Burseraceae:** *Crepidospermum* dui730 (tl; 5); *C. prancei* D.C. Daly (tl; 9, 10); *Dacryodes* dui2026 (tl; 8); *D.* dui822 (tl; 8, 10); *D. nitens* Cuatrec. (tl; 8); *D.* cf. *roraimensis* Cuatrec. (t; 9); *D. sclerophylla* Cuatrec. (t; 8); *D.* sp. nov. (t; 10); *Protium alstonii* Sandw. (t; 8); *P. aracouchili* (Aubl.) March. (tl; 10); *P.* cf. *crassipetalum* Cuatrec. (tl; 10); *P.* dui1481 (tl; 1, 2); *P.* dui1751 (tl; 2); *P. elegans* Engl. (tl; 10, 5); *P.* cf. *gallosum* Daly (tl; 9, 7, 10); *P. grandifolium* Engl. (t; 8); *P. guianense* (Aubl.) March. var. *guianense* (tl; 10); *P. hebetatum* Daly (tl; 8); *P.* cf. *laxiflorum* Engl. (tl; 10); *P.* cf. *nitidifolium* (Cuatrec.) Daly (tl; 8); *P.* (cf.) *nodulosum* Swart (tl, t; 1, 2, 4); *P. paniculatum* Engl. var. *paniculatum* (tl, t; 8, 7, 10, 5); *P.* sp. nov. (tl; 5); *P.* aff. *spruceanum* (Benth.) Engl. (tl; 4); *P. strumosum* Daly (tl; 10); *P. subserratum* (Engl.) Engl. (tl, t; 8, 9, 5); *P. trifoliolatum* Engl. (tl; 9, 10); *Tetragastris* cf. *altissima* (Aubl.) Sw. (tl; 2); *Trattinnickia burseraefolia* Mart. (tl; 5); genus unknown mss481 (tl; 3); genus unknown sp. (tl; 8)
- Cactaceae:** *Epiphyllum?* dui1727 (he; 2)
- Capparidaceae:** *Capparis* dui1485 (tl; 1); *C.* dui1492 (tl; 1); *C.* dui2156 (tl; 8)
- Caryocaraceae:** *Anthodiscus?* dui990 (tl; 10); *Caryocar* dui1684 (tl; 1, 2); *C.* (aff.) *glabrum* (Aubl.) Pers. (tl; 9, 7); *C.* cf. *nuciferum* L. (tl, t; 7); *C. pallidum* A.C. Smith (tl; 8, 9); *C.* sp. (tl; 8)
- Cecropiaceae:** *Coussapoa viridifolia* Cuatrec. (b; 8); *Pourouma* aff. *acuminata* Mart. ex Miq. (tl; 4); *P. cecropiaefolia* Mart. (tl; 10); *P.* cf. *cucura* Standl. and Cuatrec. (tl; 1, 2, 10); *P.* dui2146 (tl; 8); *P. formicarum* Ducke (tl; 8, 7); *P. myrmecophila* Ducke (tl, t; 8, 7, 5); *P. ovata* Tréc. (tl; 9, 10); *P. tomentosa* Mart. ex Miq. (tl; 9, 7, 10)
- Celastraceae:** *Cheiloclinium cognatum* (Miers) A.C. Smith (tl; 8); *C.* dui1468 (b; 1, 2); *C.* dui825 (b, b?; 10, 5); *C.* sp. (b; 8, 9); *Hippocratea* (cf.) *volubilis* L. (b; 3, 2, 10); *Hylенаea?* dui1818 (b; 2); *Maytenus* dui2450 (tl; 9); *M.* dui812 (tl; 10); *M.* sp. (tl; 5); *Maytenus?* dui993 (tl; 10); *Peritassa* dui1647 (b; 3); *Salacia bullata* Mennega (b; 8, 7); *S.* aff. *cordata* (Miers) Mennega (b; 1); *S.* dui2636 (b; 9); *S. gigantea* Loes. (tl, t; 9, 1, 2, 10); *Salacia?* dui1651 (tl; 3); *Tontelea attenuata* (Peyr.) Miers (tl/b?; 8); *T. fluminensis?* (Peyr.) A.C. Smith (b; 10); genus unknown dui2012 (tl, tl/b?; 10); genus unknown dui2034 (tl; 8); genus unknown dui2276 (tl/b?; 8); genus unknown dui2532 (b; 9); genus unknown dui796 (tl; 5)

- Chrysobalanaceae:** *Couepia dolichopoda* Prance (t; 10); *C. jbr1448* (tl; 8); *C. mss470* (tl, t; 8, 3, 2); *C. obovata* Ducke (tl; 9, 10); *C. parillo* DC. (tl; 3, 2, 10, 5); *Hirtella bicornis* Mart. and Zucc. var. *pubescens* Ducke (tl; 8); *H. dui1263* (tl; 7); *H. (aff.) guainiae* Spr. ex Hook. f. (tl, t; 9, 2, 4, 10); *H. physophora* Mart and Zucc. (tl; 9, 10); *H. pilosissima* Mart. and Zucc. (tl; 10); *H. schultesii* Prance (tl; 10); *Licania apetala* (E. Meyer) Fritsch (tl, t; 8, 7); *L. arachnoidea* Fanshawe and Maguire (tl, t; 1, 10); *L. dui1630* (tl; 3); *L. dui1766* (tl; 2, 10); *L. dui1937* (tl; 4); *L. dui655* (tl; 5); *L. dui839* (tl; 10); *L. harlingii* Prance (tl, t; 9, 7, 5); *L. longistyla* (Hook. f.) Fritsch (t; 3, 4); *L. micrantha* Miq. (tl, t; 9, 10); *L. mss1676* (t; 5); *L. mss445* (t; 3); *L. octandra* (Hoffm. ex R. and S.) Kuntze (tl; 10); *L. pap2169* (tl; 9, 10); *L. triandra* Mart. ex Hook. f. (tl, t; 1, 4); *L. (cf.) urceolaris* Hook. f. (tl, t; 10); genus unknown (?) dui1193 (tl; 7); genus unknown (?) dui1256 (tl; 7); genus unknown dui1287 (tl; 7); genus unknown (?) dui1600 (tl; 3); genus unknown (?) dui1636 (tl; 3); genus unknown (?) dui1970 (tl; 10); genus unknown (?) dui2039 (tl; 8); genus unknown (?) dui2530 (tl; 9); genus unknown dui916 (tl; 9, 10); genus unknown (?) mss1612 (t; 10); genus unknown mss504 (?) (t; 4); genus unknown (?) mss515 (t; 4)
- Combretaceae:** *Buchenavia dui2339* (tl; 8); *B. parvifolia* Ducke (s, tl; 9, 7); *Buchenavia?* sp. (t; 9); *Combretum?* dui1994 (b; 10); *Terminalia amazonica* (J. Gmel.) Exell (tl; 10); *T. mss450* (t; 3); *Terminalia?* sp. (tl; 8); genus unknown dui1223 (tl; 7); genus unknown dui1249 (tl; 7); genus unknown dui2553 (tl; 9)
- Commelinaceae:** *Dichorisandra ulei* Macbride (h; 1)
- Compositae:** *Mikania dui1817* (b; 2); *M. cf. parviflora* (Aubl.) Karst. (b; 3, 4); *Piptocarpha dui1040* (b; 10)
- Connaraceae:** *Conarus fasciculatus* (DC.) Planch. (tl; 8, 10); *C. mss944* (tl; 1); *C. ruber* (P. and E.) Planch. (b; 2); *C. sp.* (b; 3); *Pseudoconarus aff. macrophyllus* (P. and E.) Radlk. (b; 7); *P. rhynchosoides* (Standl.) Prance (b; 8, 9, 7); *Rourea dui1942* (b; 3, 2, 4); *R. dui988* (b, tl; 9, 10); genus unknown dui2615 (b; 9, 10)
- Convolvulaceae:** *Dicranostylis dui2266* (b; 8, 7); *D. aff. sericea* Gleason (b, tl; 8, 9, 7); *Dicranostylis?* sp. (b; 8, 3, 2, 10); *Maripa dui2382* (b; 9, 10); *M. dui2472* (b; 8, 9); genus unknown dui2174 (b; 8)
- Cucurbitaceae:** *Cayaponia (aff.) macrocalyx* Harms (b; 8, 9); *Cayaponia?* dui2188 (b; 8, 7); *Selysia prunifera* (P. and E.) Cogn. (b; 10)
- Cyclanthaceae:** *Asplundia* sp. (hhe; 5); *A. xiphophylla* Harling (hhe; 8, 9); *Cyclanthus bipartitus* Poit. (h; 1); *C. indivisus* Schultes (h; 10); *Dicranopygium?* sp. (hhe; 9); *Ludovia?* dui1858 (b; 4); *L. dui2016* (hhe, b; 8, 9, 5); genus unknown dui2235 (hhe; 8); genus unknown dui2312 (h; 8); genus unknown sp. (b; 2)
- Cyperaceae:** *Calyptracarya mss419* (h; 6); *Cyperus?* sp. (h; 6); *Diplasia karataefolia* Rich. (h; 10); *Rhynchospora aff. cephalotoides* Griseb. (h; 3); *Scleria dui2356* (h; 9); *S. dui954* (h; 10); *S. secans* (L.) Urban (h; 3, 4); genus unknown dui1618 (h; 3); genus unknown mss418 (h; 6)
- Dichapetalaceae:** *Dichapetalum* sp. (tl; 7); *Stephanopodium peruvianum* P. and E. (tl; 2); *Tapura amazonica* P. and E. (tl, t; 9, 10)
- Dilleniaceae:** genus unknown dui1581 (b; 3); genus unknown dui2756 (b; 10); genus unknown sp. (b; 8, 9, 1, 6, 2, 10)
- Dioscoreaceae:** *Dioscorea dui1950* (b; 4); *D. dui2363* (b; 9); genus unknown sp. (h; 8)
- Ebenaceae:** *Diospyros dui912* (tl; 10); *D. aff. glomerata* Spruce (tl; 10); *D. melinoni*



- (Hiern) A.C. Smith (tl; 10); *D. aff. pseudoxylophia* Mild. (t; 2); *D. cf. tetrandia* Hiern (tl, t; 10)
- Elaeocarpaceae:** *Sloanea* dui1985 (tl; 10); *S. dui2689* (tl; 10); *S. jbr1534* (t; 8); *S. laxiflora* Spr. ex Benth. (tl; 10); *S. aff. macroana* Steyerl. (t; 9, 10); *S. pap2180* (t; 9); *S. rufa* Pl. ex Benth. (tl; 9, 10); *S. sp.* (tl; 8, 9, 7, 3, 2, 4, 10); *S. aff. spathulata* C.E. Smith (tl; 6)
- Ericaceae:** *Satyria panurensis* (Benth.) Benth. and Hook. (b; 8, 6)
- Erythroxylaceae:** *Erythroxylum* dui1680 (tl; 2); *E. dui2456* (tl; 9); *E. aff. macrophyllum* Cav. (tl; 9, 10); *E. mss1678* (tl, t; 5); *E. mucronatum* Benth. (tl; 10)
- Euphorbiaceae:** *Alchornea schomburgkii* Kl. (t; 5); *Alchornea?* dui1667 (tl; 3); *Croton* dui882 (tl; 10); *Didymocistus chrysadenius* Kuhl. (tl, t; 3, 2, 4); *Drypetes aff. amazonica* Steyerl. (tl, t; 1); *D. sp.* (tl; 3); *Hevea guianensis* Aubl. (tl, t; 3); *H. nitida* Muell. Arg. (tl, t; 5); *H. cf. pauciflora* (Spr. ex Benth.) Muell. Arg. (tl; 9); *H. cf. spruceana* (Benth.) Muell. Arg. (t; 10); *Hyeronima alchorneoides* Allem. var. *alchorneoides* (tl, t; 1, 2); *Mabea* dui1635 (tl; 3); *M. dui773* (tl; 3, 2, 5); *Mabea?* dui1268 (tl; 7); *Micranda cf. rossiana* Schultes (tl; 6); *M. spruceana* (Baill.) Schultes (tl, t; 10, 5); *Nealchornea yapurensis* Huber (tl; 8, 9); *Phyllanthus?* dui1324 (b; 7); *P. dui1575* (b; 3, 4); *Richeria tomentosa* Huft. (tl; 9); *Senefeldra* dui981 (tl; 10); *S. sp.* (tl; 9); *Senefeldra?* dui2338 (tl; 8); *Vaupesia cataractarum* Schultes (t; 10); genus unknown mss484 (t; 2); genus unknown sp. (b; 4)
- Flacourtiaceae:** *Carpotroche amazonica* Mart. (tl; 8); *C. grandiflora* Spr. ex Eichl. (tl; 9, 10); *Casearia fasciculata* (R. and P.) Sleumer (s; 1); *C. mss1641* (t; 5); *Casearia?* dui2546 (tl; 9); *Mayna cf. grandifolia* (Karst. and Triana) Warb. (tl; 1); *Neoptychocarpus killipii* (Mon.) Buchheim (tl; 7); *N. sp.* (tl; 10); *Ryania angustifolia* (Turcz.) Monachino (tl; 3); genus unknown mss443 (t; 3); genus unknown pap2184 (t; 9)
- Gentianaceae:** *Tachia aff. occidentalis* Mag. and Weav. (tl; 7, 5); *Voyria flavescens* Griseb. (h; 9, 10)
- Gesneriaceae:** *Codonanthe crassifolia* (Focke) Morton (b; 6); *C. sp.* (he, b; 9, 2, 5); genus unknown dui1351 (h, he, b; 6); genus unknown dui2522 (b; 9)
- Gnetaceae:** *Gnetum leyboldi* Tul. (b; 10); *G. sp.* (b; 8, 1, 7, 3, 10, 5)
- Gramineae:** genus unknown dui1405 (h; 1, 3, 2); genus unknown dui1614 (h; 3, 2); genus unknown dui2323 (h; 8, 9, 10)
- Guttiferae:** *Calophyllum brasiliense* Camb. (tl; 8, 3, 2, 5); *C. mss591* (t; 2); *Caraipa* pap1872 (tl, t; 6); *C. sp.* (tl; 7, 4, 10); *Chrysochlamys* mss1598 (t; 10); *C. mss934* (tl; 2); *C. sp. nov.* (tl; 9); *Clusia amazonica* Pl. and Tr. (b; 7); *C. liesneri* B. Maguire (b; 3); *C. aff. lineata* Pl. and Tr. (t; 1); *C. sp. nov.* (b; 9); *C. spathulaefolia* Engl. (tl, t; 6); *Garcinia cf. acuminata* (Ruiz and Pavon) Pl. and Tr. (tl; 1); *G. (cf.) macrophylla* Mart. (tl, tl/b?; 8, 7, 3, 2, 4); *G. mss1715* (tl; 9); *Havetiopsis flexilis* Pl. and Tr. (b; 8); *Lorostemon bombaciflorum* Ducke (tl; 10); *L. colombianum* Maguire (tl; 9); *Moronobea coccinea* Aubl. (tl; 10); *Oedematopus* sp. nov. (b; 10); *Quapoya peruviana* (P. and E.) Kuntze (b; 8, 5); *Tovomita (cf.) brasiliensis* Mart. (tl, t; 3, 4); *T. (cf.) clarkii* Pipoly (tl; 7, 5); *T. dui1316* (tl; 7); *T. dui2413* (tl; 9, 10); *T. sp.* (tl; 8); *T. (cf.) spruceana* Pl. and Tr. (s, tl; 8, 9, 5); *T. cf. weddeliana* Pl. and Tr. (tl; 9); *Tovomita?* dui2195 (tl/b?; 8); *Tovomitopsis* sp. (tl; 4); genus unknown sp. (t; 8)
- Heliconiaceae:** *Heliconia julianii* Barreiros (h; 9)
- Humiriaceae:** *Duckesia?* dui1991 (tl; 10); *Humiriastrum aff. piriparaense* Cuatrec. (t; 5); genus unknown dui2306 (tl; 8); genus unknown sp. (tl; 9, 10)

- Icacinaceae:** *Calatola* dui2189 (tl; 8); *Dendrobangia* aff. *boliviana* Rusby (t; 5); *Discophora guianensis* Miers (tl; 9, 7, 5); *Emmotum* aff. *fagifolium* Desv. (t; 5); *Leretia cordata* (Engl.) Vell. (b; 2, 4); *Pleurisanthes flava* (hhe, b; 9, 10)
- Lacistemataceae:** *Lacistema aggregatum* (Berg) Rusby (tl; 7); *L. nena* Macbride (tl; 3, 2)
- Lauraceae:** *Aniba* dui1395 (tl; 1, 2); *A.* dui2342 (tl; 8, 7); *A.* dui2707 (tl; 9); *A.* (aff.) *megaphylla* Mez (tl; 2, 4); *A.* cf. *panurensis* (Meissn.) Mez (tl; 3, 4); *A.* cf. *puchury-minor* (Mart.) Mez (t; 1); *Endlicheria anomala* Nees ex Meissn. (tl, t; 3, 4); *E. bracteata* Mez (tl; 9); *E.* dui1190 (tl; 7); *E.* dui2257 (tl; 8, 7); *E.* cf. *tessmannii* O. Schmidt (tl; 3); *Endlicheria?* dui2350 (tl; 8); *E.* dui2517 (tl; 9); *Licaria cannella* (Meissn.) Kosterm. (tl, t; 8, 10, 5); *Licaria?* dui2551a (tl; 9); *Mezilaurus itauba* (Meissn.) Taub. ex Mez (t; 8); *Nectandra* mss496 (t; 2); *Ocotea* (cf.) *aciphylla* (Nees) Mez (tl, t; 8, 5); *O. argyrophylla* Ducke (tl, t; 8, 5); *O.* dui1459 (tl; 1); *O.* dui2299 (tl; 8); *O.* dui2545 (tl; 9); *O.* dui749 (tl; 8, 5); *O.* dui836 (tl; 10); *O. javitensis* (H.B.K.) Pitt. (tl; 8, 9, 1, 7, 5); *O.* mss1586 (t; 10); *O.* mss806 (tl, t; 8, 9); *O.* aff. *neblinae* Allen (t; 7); *O. olivacea* A.C. Smith (tl, t; 5); *Ocotea?* mss1674 (t; 5); *Rhodostemonodaphne* jbr1532 (t; 8); genus unknown dui2107 (tl; 8)
- Lecythidaceae:** *Cariniana decandra* Ducke (tl, t; 8, 9, 7); *C. multiflora?* Ducke (t; 10); *Couratari oligantha* Mori (tl; 3); *C. stellata* A.C. Smith (tl; 9); *Couratari?* dui1069 (tl; 10); *Eschweilera* aff. *alata* A.C. Smith (tl, t; 7, 10); *E. andina* (Rusby) Macbride (tl; 2); *E.* aff. *chartaceifolia* Mori (tl; 3, 4); *E. coriacea* (A.P. DC.) Mart. ex Berg (tl, t; 7, 3, 4); *E.* dui1955 (tl; 2, 4); *E.* dui2708 (tl; 9); *E.* dui818 (tl; 8, 7, 10); *E.* mss1100 (t; 9); *E.* pap2156 (tl; 10); *E.* pap2159 (t; 9); *E.* pap2176 (tl, t; 9, 7); *E.* (cf.) *punctata* Mori (tl, t; 8, 9, 7); *E. rufifolia* Mori (tl; 9); *E.* sp. (t; 10); *E. tessmannii* R. Knuth (tl, t; 8, 9, 10); *Gustavia hexapetala* (Aubl.) Smith (tl; 4); *G. poeppigiana* Berg (tl; 2); *Lecythis chartacea* Berg (t; 10); *L. pisonis* Cambess. (t; 9, 3); genus unknown dui1261 (tl; 7); genus unknown sp. (t; 8)
- Leguminosae:** *Abarema* cf. *auriculata* (Benth.) Barneby and Grimes (tl; 8); *A. barbouriana* (Standl.) Barneby and Grimes var. *barbouriana* (tl, t; 6); *A.* dui2340 (tl/b?; 8); *Acosmium* aff. *praeclarum* (Sandwith) Yakovlev (tl, t; 6, 5); *Bauhinia* dui1729 (b; 1); *B.* dui2639 (b; 9); *B.* sp. (b; 2); *Brownea* cf. *grandiceps* Jacq. (tl; 2); *B.* aff. *longipedicellata* Huber (tl; 4); *Clathrotropis macrocarpa* Ducke (tl, t; 9, 7, 10, 5); *C.* (aff.) *nitida* (Benth.) Harms (tl, t; 9); *Clitoris* dui1244 (b, tl, tl/b?; 8, 9, 7); *Cynometra* mss578 (tl; 9, 10); *Dalbergia* dui775 (b, tl; 9, 5); *Dialium guianense* (Aubl.) Sandwith (t; 1); *Dimorphandra pennigera* Tulasne (t; 5); *Diploptropis* cf. *duckei* Yakovlev (t; 7); *D.* cf. *martiusii* Benth. (tl; 6); *Dipteryx* mss489 (t; 2); *D.* cf. *odorata* Willd. (tl; 9); *D.* sp. (t; 1); *Hymenaea* sp. (tl; 1); *Inga brachystachya* DC. (tl, t; 5); *I. capitata* Desv. (tl; 9, 10); *I.* aff. *chartacea* Poepp. and Endl. (tl; 9); *I.* dui1048 (tl; 10); *I.* dui1049 (tl; 10); *I.* dui1493 (tl; 1); *I.* dui1545 (tl; 3, 4); *I.* dui2053 (tl; 8); *I.* dui2178 (tl; 8); *I.* dui2233 (s, tl; 8, 5); *I.* dui767 (tl; 5); *I.* dui835 (tl; 10); *I.* aff. *gracilifolia* Ducke (tl; 9); *I.* jbr1434 (tl; 8); *I.* mss596 (tl; 2); *I.* (cf.) *pezizifera* Benth. (tl, t; 8, 7); *I.* cf. *pruriens* Poepp. and Endl. (tl; 8, 7, 2); *I.* sp. (tl; 2, 10); *I.* (aff.) *spectabilis* Willd. (tl, t; 2, 4); *I. stipulacea* G. Don (tl; 1, 2); *Machaerium* cf. *leiophyllum* Benth. (tl; 9); *M. multifoliolatum* Ducke (b, tl/b?; 8, 7); *Machaerium?* sp. (t; 8); *Macrolobium discolor* Benth. (t; 5); *M.* dui638 (tl; 5); *M. gracile* Spr. ex Benth. (tl; 5); *Macrolobium?* dui982 (tl; 10); *M.* sp. (tl; 2); *Monopteryx uauca* Spr. ex Benth. (tl, t; 8, 7); *Ormosia discolor* Spr. ex Benth. (tl, t; 5); *Parkia nitida* Miq. (tl, t; 8, 7); *P. panurensis* Benth. ex Hopkins (tl; 9, 10, 5); *P. pendula* (Willd.) Benth. ex Walp. (tl; 8); *Piptadenia*

uaupensis Spr. ex Benth. (b; 10); *Pithecellobium claviflorum* Spr. ex Benth. (tl, t; 1); *P. gonggrijpii* Kleinh. (t; 10); *Pithecellobium?* mss176 (t; 1); *Pterocarpus amazonum* (Benth.) Amsh. (t; 2); *P. pap1717* (t; 9); *Pterocarpus?* mss505 (t; 4); *Sclerolobium?* dui372 (tl; 2); *S. jbr1522* (t; 8, 9); *Swartzia benthamiana* Miq. (tl; 9, 3); *S. (aff.) cardiosperma* Spr. ex Benth. (tl, t; 9, 1, 3, 2, 4); *S. dui1197* (tl; 7); *S. dui1672* (tl; 9); *S. dui1749* (tl; 2); *S. aff. leptopetala* Benth. (t; 1); *S. polyphylla* DC. (tl, t; 9, 10); *S. racemosa* Benth. (tl, t; 9, 3, 2, 4, 10); *S. schomburgkii* Benth. (tl, t; 8, 9, 10); *Swartzia?* dui1197 (tl; 9); *Tachigali (cf.) multijuga* Benth. (tl; 8, 9); *T. pap1546* (t; 10); *T. sp.* (tl; 8, 7); *Tachigali?* pap1666 (t; 9); *T. pap1785* (t; 7); *Zygia basijuga* (Ducke) Barneby and Grimes (tl; 9, 7, 10); *Z. latifolia* (Boiv.) Fawc. and Rendl. (tl; 2); *Z. aff. pilosula* (Pittier) Britton and Rose (t; 2); *Z. racemosa* (Ducke) Barneby and Grimes (tl; 8, 7); genus unknown dui1017 (b; 3, 10); genus unknown dui1088 (b; 10); genus unknown dui1135 (b, tl, tl/b?; 8, 7); genus unknown dui1194 (tl; 7); genus unknown dui1218 (tl; 8, 7); genus unknown dui1283 (tl, tl/b?; 8, 7, 10); genus unknown dui1378 (tl; 6); genus unknown dui1402 (b, tl/b?; 1); genus unknown dui1412 (b; 1); genus unknown dui1672 (b; 3); genus unknown dui1813 (b; 2); genus unknown dui1821 (tl; 2); genus unknown dui1914 (b; 3, 4); genus unknown dui1924 (b; 4); genus unknown dui1949 (tl; 4); genus unknown dui1989 (tl; 9, 10); genus unknown dui2006 (b, s, tl; 8, 9, 7, 10); genus unknown dui2075 (tl; 8); genus unknown dui2079 (tl; 8); genus unknown dui2090 (tl; 8); genus unknown dui2176 (b; 8); genus unknown dui2246 (tl; 8); genus unknown dui2263 (tl; 7); genus unknown dui2263 (b; 8, 9); genus unknown dui2372 (tl; 9); genus unknown dui2386 (tl; 9); genus unknown dui2458 (tl; 9, 5); genus unknown dui2471 (b; 9); genus unknown dui2515 (tl; 9); genus unknown dui2642 (tl; 9); genus unknown dui2672 (b; 9); genus unknown dui652 (tl; 8, 5); genus unknown dui707 (tl; 5); genus unknown dui769 (tl; 5); genus unknown dui808 (b, tl, tl/b?; 8, 9, 10); genus unknown dui814 (tl; 10); genus unknown dui928 (tl; 10); genus unknown dui964 (tl; 10); genus unknown dui979 (b; 10); genus unknown mss499 (t; 3); genus unknown mss1723 (tl; 8, 9, 7); genus unknown mss413 (tl, t; 6); genus unknown mss583 (tl; 1); genus unknown mss726 (tl; 3, 2, 4); genus unknown sp. (t; 4)

**Linaceae:** *Roucheria* dui2457 (tl; 8, 9); *R. dui794* (tl; 5); *R. aff. punctata* (Ducke) Ducke (tl, t; 7, 5)

**Loganiaceae:** *Potalia amara* Aubl. (h, tl; 3, 2, 10); *Strychnos* dui2019 (b, tl/b?; 8, 7); *S. guianensis* (Aubl.) Mart. (b; 10); *S. cf. mitscherlichii* Schomb. (b; 1, 3, 2, 4); *S. cf. panurensis* Sprag. and Sandw. (b; 9); *S. peckii* Robinson (b, tl; 10); *S. poeppigii* Prog. (b; 1); *S. sp.* (tl; 10); *S. (aff.) subcordata* Spr. ex Benth. (b, tl; 8, 7, 3, 2, 4)

**Malpighiaceae:** *Byrsonima* dui1374 (tl; 6); *B. mss1626* (t; 10); genus unknown dui1102 (b; 10); genus unknown dui1314 (b; 7); genus unknown dui1461 (b/tl?; 1); genus unknown dui1763 (b; 2); genus unknown dui1763 (b; 1); genus unknown dui1848 (b; 4); genus unknown dui2085 (b; 8); genus unknown dui2556 (tl; 9); genus unknown dui969 (b; 10)

**Marantaceae:** *Calathea capitata* (R. and P.) Lindley (h; 8, 7); *C. dui1789* (h; 2); *C. dui2503* (h; 9); *C. dui715* (h; 5); *C. lanata* Petersen (h; 1); *C. sp.* (h; 7); *C. micans* (Mathieu) Koernicke (h; 9, 10); *Ischnosiphon arouma* (Aubl.) Koern. (b; 10); *I. dui2377* (b; 9); *I. longiflorus* K. Schum. ssp. *longiflorus* (b; 5); *I. longiflorus* K. Schum. ssp. *angustifolius* (b; 8, 7); *I. puberulus* Loes. (h; 2, 4); ?*I. killipii* Macbr. (b;

8); *Monotagma juruanum* Loes. (h; 9); *M. laxum* (Poepp. and Endl.) K. Schum. (h, b?; 3, 7, 10, 5); genus unknown dui1175 (h; 7)

**Marcgraviaceae:** *Marcgravia* dui1117 (b; 10); *M.* dui2419 (hhe, b; 9); *M.* aff. *macrophylla* (Wittm.) Gilg. (b; 8)

**Melastomataceae:** *Adelobotrys linearifolia* Uribe (b; 9); *Clidemia* cf. *bernardii* Wurdack (s, tl; 8, 7); *C.*? dui1126 (tl; 7); *C.*? dui2330 (tl; 8); *C. epibaterium* DC. (b; 5); *C. juruensis* (Pilger) Gleason (s, tl; 9, 10); *Graffenrieda patens* Triana (b; 8, 7, 5); *L.* cf. *glandulifera* (Triana) Cogn. (tl; 9); *Maieta guianensis* Aubl. var. *leticiana* Whiffin (s, tl; 9); *Miconia amazonica* Triana (tl; 8); *M. carassana* Cogn. (tl; 9); *M.* cf. *cazaletii* Wurdack (s, tl; 3, 4); *M.*? dui1090 (tl; 10); *M.*? dui1472 (tl; 1); *M.* dui1801 (s; 2); *M.*? dui2059 (tl; 8); *M.*? dui2103 (tl; 8); *M.* dui2237 (tl; 8); *M.* dui2679 (tl; 9); *M.*? dui691 (tl; 5); *M.*? dui933 (h; 10); *M.* cf. *elaeagnoides* Cogn. (tl; 9, 3); *M.* cf. *eugenioides* Triana (tl; 7); *M.* cf. *minutiflora* (Bonpl.) DC. (tl; 8); *M. nervosa* (Smith) Triana (tl; 8); *M. phanerostila* Pilger (tl; 7, 10); *M. pterocaulon* Triana (tl; 9); *M.* (cf.) *punctata* D. Don (tl, t; 9, 3); *M. spichigeri* Wurdack (s, tl; 8, 7); *M.* (cf.) *splendens* (Sw.) Griseb. (s/tl; 8, 9); *M. trinervia* (Sw.) Don ex Loud. (tl; 2); *Mouriri acutiflora* Naudin (tl; 3); *M. cauliflora* DC. (tl; 8, 7, 10); *M.* dui1034 (tl; 10); *M.* aff. *grandiflora* DC. (tl; 1, 2); *M.* aff. *myrtifolia* Spr. ex Triana (t; 3, 4, 10); *M.* aff. *nigra* (DC.) Morley (tl; 8, 9, 3, 10); *M.* aff. *oligantha* Pilger (tl; 4); *M.* aff. *pauciflora* Spr. ex Cogn. (tl; 8, 7, 10); *M.* pap2179 (t; 9); *M. retentipetala* Morley (tl; 8); *M.* sp. (tl; 9, 2, 4, 10); *M. vernicosa* Naudin (tl; 9, 3, 10); *Myrmidone macrosperma* (Mart.) Mart. (s, tl; 9, 7, 6, 5); *Ossaea araneifera* Markgraf (b; 8, 7); *Tococa discolor* Pilg. (tl; 10); *T.*? dui1235 (tl; 7); *T.* dui1572 (tl; 4); *T.* dui1940 (tl; 3, 4); *T.* dui2292 (tl; 8, 7); *T. macrophysca* Spr. ex Triana (s, tl; 6, 5); *Votomita* aff. *pubescens* Morley (tl; 7); genus unknown dui1564 (h, tl; 3, 2, 4); genus unknown dui2486 (h; 9); genus unknown dui2687 (tl; 9); genus unknown dui937 (tl; 10); genus unknown sp. (b, t; 8)

**Meliaceae:** *Guarea* dui856 (tl; 10); *G. kunthiana* A. Juss. (tl, t; 1); *G. macrophylla* Vahl (tl, t; 3, 4); *G. purusana* C. DC. (tl, t; 8, 9, 1, 7, 2); *G. trunciflora* C. DC. (tl, t; 7, 10); *Trichilia* mss487 (t; 2); *T.* aff. *poeppii* C. DC. (t; 7); *T.* cf. *solitudinis* Harms (tl; 8, 5); genus unknown dui1071 (tl; 10); genus unknown dui1095 (tl; 10); genus unknown dui1095 (tl; 7); genus unknown dui1416 (tl; 1); genus unknown dui1554 (tl; 3, 2, 4); genus unknown dui1689 (tl; 2); genus unknown dui2041 (tl; 8); genus unknown dui891 (tl; 9, 10); genus unknown pap1622 (tl; 7, 5)

**Menispermaceae:** *Abuta grandifolia* (Mart.) Sandwith (b, tl; 9, 7, 10); *A.* cf. *pahni* (Mart.) Krukoff and Barneby (b; 8, 2); *Abuta?* dui1252 (b; 7); *Curarea* dui2588 (b; 9); *Odontocarya* dui1806 (b; 2); *Sciadotenia* dui1517 (b; 1); *Telitoxicum* dui2381 (b; 8, 9, 10); *T. krukovii* Mold. (b, tl; 9, 5); genus unknown dui1027 (tribe Tinosporeae) (b; 10); genus unknown dui1120 (tl; 7); genus unknown dui1702 (b; 2); genus unknown dui1953 (b; 4); genus unknown sp. (b, tl; 8, 10)

**Monimiaceae:** *Mollidenia* dui1980 (tl; 9, 10); *M.* dui2647 (b?, tl?; 9); *M.* dui2713 (tl; 9); *M.* dui2757 (tl; 10); *Mollidenia?* dui1804 (tl; 2); *M.* dui2757 (tl/b?; 10); *Siparuna* dui1014 (tl; 10); *S.* dui2602 (tl; 9); *S.* pap1825 (tl; 5)

**Moraceae:** *Brosimum guianense* (Aubl.) Huber (tl, t; 1, 10); *B.* (aff.) *lactescens* (S. Moore) C.C. Berg (tl, t; 2, 10); *B. rubescens* Taub. (tl, t; 8, 9, 7, 10, 5); *B.* (aff.) *utile* (H. B. K. ) Pittier ssp. *ovatifolium* (Ducke) C. C. Berg (tl, t; 8, 7, 5); *Clarisia racemosa* R. and P. (tl; 10); *Ficus guianensis* Desv. (b; 4); *F. insipida* Willd. ssp.

*scabra* C.C. Berg (t; 1); *F. vs. paraensis* (Miq.) Miq. (b?; 3); *F. sp.* (t; 1); *Helicostylis* cf. *elegans* (Macbr.) C.C. Berg (tl; 9); *H. heterotricha* Ducke (tl; 10); *H. scabra* (Macbr.) C.C. Berg (tl, t; 8, 5); *H. vs. tomentosa* (P. and E.) Rusby (tl; 7); *Maquira* mss1711 (t; 8); *Naucleopsis concinna* (Standl.) C.C. Berg (tl; 10); *N. glabra* Spr. ex Pitt. (tl, t; 9, 1); *N. dui1207* (probably identical to a species that will be published by C.C. Berg as *Naucleopsis humilis*) (tl; 8, 9, 7); *N. (aff.) imitans* (Ducke) C.C. Berg (tl; 9, 1); *N. aff. mello-barretoii* (Standl.) C.C. Berg (tl; 10); *Perebea vs. guianensis* Aubl. (tl; 9); *P. mennegae* C.C. Berg (tl; 8, 10); *P. (vs.) xanthochyma* Karst. (t, tl; 9, 1); *Pseudolmedia laevigata* Tréc. (tl; 8, 7, 5); *P. laevis* (R. and P.) Macbr. (tl; 9); *Sorocea hirtella* Mildbr. ssp. *hirtella* (tl, t; 1, 2); *S. muriculata* Miq. (tl; 3, 2, 4, 10); *S. steinbachii* C.C. Berg (tl; 2, 4); *Trymatococcus amazonicus* P. and E. (tl; 8, 9, 10); genus unknown sp. (t; 10)

**Myristicaceae:** *Compsonaura* aff. *sprucei* (A. DC.) Warb. (tl; 8); *C. ulei* Warb. ex Pilg. (tl; 7); *Iryanthera juruensis* Warb. (tl; 8, 9, 5); *I. paraensis* Huber (tl; 2); *I. polyneura* Ducke (tl; 8); *I. tricornis* Ducke (tl, t; 8, 9); *I. ulei* Warb. (tl, t; 9, 7, 10); *Osteophloeum platyspermum* (Spr. ex A. DC.) Warb. (tl; 8); *Virola calophylla* (Spr.) Warb. (tl, t; 8, 7, 2); *V. dui1248* (tl; 7); *V. dui762* (tl; 5); *V. (aff.) elongata* (Benth.) Warb. (tl, t; 1, 3, 2, 4, 10); *V. lorentensis* A.C. Smith (tl; 3, 4); *V. marlenei* W.A. Rodrigues (tl; 8, 7); *V. obovata* Ducke (tl; 7); *V. pavonis* (A. DC.) A.C. Smith (tl; 9, 7, 10, 5); *V. sp.* (t; 8); genus unknown dui650 (tl; 5)

**Myrsinaceae:** *Ardisia* sp. nov. (tl; 10); *Cybianthus amaralae* Pipoly (tl; 9); *C. amplus* (Mez) G. Agostini (tl; 8, 7); *C. guianensis* Miq. (tl; 10); *C. holstii* Pipoly (tl; 7); *C. sp. nov.* (tl; 9); *C. spicatus* (H.B.K.) G. Agostini (tl; 5); *C. vasquezii* Pipoly (tl; 9, 10); *Stylogyne* dui1434 (sp. nov.?) (tl; 1); *S. (cf.) laxiflora* Mez (tl, t; 2, 4); *S. cf. longifolia* (Mart. ex Miq.) Mez (tl; 1, 2)

**Myrtaceae:** *Calyptranthes cuspidata* Mart. ex DC. (tl; 5); *C. dui1958* (tl; 4); *C. mss488* (t; 2); *C. mss710* (tl; 10); *C. cf. paniculata* R. and P. (tl; 5); *C. pulchella* DC. (tl, t; 3, 5); *Eugenia anastomosans* DC. (tl; 8, 10); *E. coffeaefolia* DC. (tl/b?; 9); *E. cf. cupulata* Amsh. (tl; 10); *E. dui1396* (tl; 1); *E. dui1444* (tl; 1); *E. dui1473* (tl; 1, 2); *E. dui1524* (tl, t; 1); *E. florida* DC. (tl; 1, 10); *E. pap2173* (t; 9); *E. pseudopsidium* Jacq. (tl; 10); *Marlierea caudata* McVaugh (tl; 9, 7, 5); *M. (cf.) spruceana* Berg (tl, t; 2, 10); *Myrcia dui1754* (tl; 2); *M. dui2626* (tl; 9, 10); *M. fallax* (Rich.) DC. (tl; 4); *M. cf. guianensis* (Aubl.) DC. (tl; 3, 4); *M. magnoliaefolia* DC. (tl; 7); *M. splendens* (Sw.) DC. (tl; 8); *M. sylvatica* (Meyer) DC. (tl; 7); *Myrciaria (aff.) floribunda* (West ex Willd.) Berg (tl; 1, 2); *Plinia* aff. *duplipilosa* McVaugh (tl; 9, 7); *P. cf. pennata* L. (tl; 2); *Plinia?* dui2407 (tl; 9); genus unknown sp. (tl; 7)

**Nyctaginaceae:** *Guapira* mss692 (tl, t; 8, 9); *Neea* jbr1523 (tl; 8); *N. aff. robusta* Steyermark (tl; 7); *N. verticillata* R. and P. (tl; 9, 7, 10); genus unknown dui1298 (tl; 8, 7); genus unknown dui1329 (tl; 8, 7); genus unknown dui2430 (tl; 9); genus unknown jbr1453 (tl; 10); genus unknown mss490 (t; 2); genus unknown sp. (s; 8)

**Ochnaceae:** *Ouratea* cf. *polyantha* (Tr. and Pl.) Engl. (tl; 9); *O. dui1221* (tl; 7, 5); *O. dui1664* (tl; 3, 4); genus unknown dui1128 (b; 7)

**Olacaceae:** *Aptandra caudata* Gentry and Ortiz (b, tl; 10, 5); *Dulacia* dui1094 (tl; 9, 10); *Heisteria* dui2294 (b; 8); *H. insculpta* Sleumer (tl; 9, 10); *H. pap1405* (tl; 1, 4); *H. cf. scandens?* Ducke (b; 2); *Minquartia guianensis* Aubl. (tl, t; 8, 1, 2, 10); genus unknown dui1074 (b; 10); genus unknown dui1577 (b; 3); genus unknown dui1731 (b; 2); genus unknown dui2005 (b; 10); genus unknown dui2105 (b; 8); genus

unknown dui2120 (tl/b?; 8); genus unknown dui2759 (b; 10); genus unknown mss1599 (t; 10); genus unknown pap1903 (tl; 8); genus unknown pap2174 (t; 9)

**Oleaceae:** *Chionanthus* dui1089 (tl; 10); *C.* dui1160 (tl; 7)

**Orchidaceae:** *Bifrenaria longicornis* Lindl. (h; 6); *Bulbophyllum setigerum* Lindl. (h; 6); *Epidendrum orchidiflorum* Salzm. ex Lindl. (h; 6); *Epistephium parviflorum* Lindl. (h; 6); *Octomeria erosilabia* C. Schweinf. (hhe; 6); *Otostylis brachystalix* (Reichb. f.) Schlechter (h; 6); *Palmorchis* dui949 (h; 10); *P.* sp. (h; 7, 3); *Vanilla* dui719 (he, hhe; 6, 5)

**Oxalidaceae:** *Biophytum* dui1612 (h; 3)

**Palmae:** *Astrocaryum sciophilum* (Miq.) Pulle (pa; 9, 10); *Attalea racemosa* (Drude) Spruce (pa; 7); *Bactris balanophora* Spruce (tl; 10); *B. fissifrons* Mart. (tl; 9, 4); *B. hirta* Mart. (h, tl; 8, 9, 7, 5); *B. humilis* (Wallace) Burret (tl; 10); *B. killipii* Burret (tl; 10); *B. monticola* Barb. -Rodr. (tl; 1); *B. simplicifrons* Mart. (h, tl; 8, 9, 3, 4, 10); *Desmoncus pumilus* Trail (h, b; 8); *D. setosus* Mart. (b; 9); *Euterpe catinga* Wallace (tl; 6); *E. precatorea* Mart. (pa, tl, t; 9, 1, 3, 2, 4); *Geonoma* (aff.) *arundinacea* Mart. (h, tl; 2, 10); *G. deversa* (Poit.) Kunth (tl; 8); *G. leptospadix* Trail (tl; 10); *G. maxima* (Poit.) Kunth (tl; 10); *G.* (aff.) *piscicauda* Dammer (tl; 8, 9, 7, 2, 10); *G.* (aff.) *pycnostachys* Mart. (h, tl; 9, 10); *Hyospathe?* sp. (tl; 8); *Iriartea deltoidea* Ruiz and Pavón (tl; 1, 2); *Iriartella setigera* (Mart.) Wendl. (tl; 8, 9, 7, 10, 5); *Lepidocaryum tenue* Mart. (tl; 7); *Mauritiella aculeata* (H.B.K.) Burret (tl, t; 6, 5); *Oenocarpus bacaba* Mart. (tl; 8, 7, 5); *O. bataua* (Mart.) Burret (pa, t; 8, 9, 10, 5); *O. mapora* Karsten (tl; 1); *Scheelea insignis* (Mart.) Karsten (pa; 9, 1, 2, 10); *Socratea exorrhiza* (Mart.) Wendl. (tl; 8); *Wettinia augusta* P. and E. (tl; 8); genus unknown sp. (pa, tl; 9, 10)

**Passifloraceae:** *Dilkea* aff. *acuminata* Mast. (tl; 8); *D.* dui2717 (b, tl; 9, 2); *D.* (aff.) *parviflora* Killip (b, tl; 8, 7, 10); *Dilkea?* sp. (tl; 9); *Passiflora* dui2063 (b; 8); *P. spinosa* Mast. (b; 9)

**Piperaceae:** *Peperomia* cf. *angularis* C. DC. (b; 1); *P. angustata* H.B.K. (hhe, b; 3, 2, 4); *Piper* dui1165 (h; 9, 7); *P.* dui2018 (h, b, tl, tl?; 8, 1, 7, 2); *P.* dui2516 (tl?; 9); *P. reticulatum* L. (tl, tl/b?; 1); genus unknown dui1031 (h; 10); genus unknown dui1055 (b; 10)

**Podocarpaceae:** *Podocarpus* aff. *magnifolius* Buchholz and N. Gray (tl; 5) (this species is referred to as *Podocarpus* sp. nov. in Gentry and Ortiz, 1993)

**Polygalaceae:** *Diclidanthera* dui2334 (b; 8); *Moutabea* aff. *aculeata* (R. and P.) P. and E. (b, tl/b?; 8, 9, 7, 2, 4, 10); *M.* dui2008 (b; 10); *M.* dui729 (tl; 5); *M.* cf. *longifolia* P. and E. (b; 8, 9, 10)

**Polygonaceae:** *Coccoloba acuminata* H.B.K. (b, tl; 5); *C.* dui1138 (tl; 7); *C.* dui1663 (b; 3); *C.* dui2442 (tl; 9); *C.* aff. *parimensis* Benth. (b; 9, 2)

**Proteaceae:** *Panopsis?* dui2584 (tl; 8, 9); *Roupala* pap2181 (t; 9); genus unknown dui1083 (tl; 10)

**Quinaceae:** *Froesia?* dui2310 (tl; 8); *Quiina* aff. *cruegeriana* Griseb. (tl; 9, 1); *Q.* dui1162 (tl; 7); *Q.* dui976 (tl; 10); *Q.* aff. *macrophylla* Tul. (tl; 3, 4); *Touroulia guianensis* (Aubl.) Aubl. (tl; 10); genus unknown dui2234 (s, tl; 8, 7); genus unknown sp. (h; 9)

**Rhamnaceae:** *Ampelozizyphus amazonicus* Ducke (b, tl/b?; 9, 7)

**Rhizophoraceae:** *Cassipourea* dui1087 (tl; 10); *C.* dui658 (tl; 5); *C.* sp. (tl; 10); *Sterigma petalum colombianum* Mon. (t; 10); *S.* dui2349 (tl; 8)

**Rubiaceae:** *Alibertia* dui1649 (tl; 3); *A. hispida* Ducke (tl; 8, 9, 10, 5); *A.* aff. *stenantha*

*Standl.* (tl; 2); *A. aff. triloba* Steyerl. (tl; 10); *Amaioua* mss1136 (tl; 9); *Chimarrhis* mss648 (tl; 2); *Coussarea* dui2337 (tl/b?; 8); *C. dui774* (tl; 5); *C. dui879* (tl; 10); *C. dui895* (tl; 9, 10); *C. aff. durifolia* J.D. Dwyer (tl; 4); *C. aff. macrophylla* Muell. Arg. (tl; 2); *Duroia* dui801 (tl, t; 4, 5); *D. hirsuta* Hook. f. (tl; 1, 2); *D. aff. petiolaris* (Spr. ex Schum.) Hook. f. (tl; 3); *D. saccifera* (Mart.) Hook. f. ex Schum. (tl; 8, 7, 5); *Elaeagia* dui894 (tl; 10); *Faramea brevipes* Steyerl. (tl; 9); *F. capillipes* Muell. Arg. (s, tl; 3, 2, 4); *F. dui2273* (tl; 8); *F. aff. eurycarpa* Donn. Smith (tl; 2); *F. (aff.) sessilifolia* DC. (tl, t; 1); *Ferdinandusa* dui1227 (tl; 7, 5); *F. mss1631* (t; 10); *Ferdinandusa?* mss1352 (tl, t; 6); *Ixora* dui1714 (tl; 2); *I. ulei* Krause (t; 9, 10); *Ladenbergia* dui2336 (tl; 8); *Pagamea aff. guianensis* Aubl. (t; 7); *P. cf. macrophylla* Spruce (tl; 8, 7); *P. (cf.) plicata* Spruce (tl; 9, 5); *Pagamea?* dui2575 (tl; 9); *Paliourea corymbifera* (Muell. Arg.) Standl. (tl; 8); *P. dui1523* (tl; 1); *Pentagonia?* mss1238 (t; 9); *Posoqueria aff. latifolia* (Rudge) Roem. and Schult. (tl; 1, 2); *Psychotria aff. acuminata* Benth. (tl; 3, 4); *P. aff. bahiensis* DC. (tl; 9); *P. cincta* Standl. (tl; 9, 7); *P. dui1452* (s, tl; 1); *P. dui1471* (tl; 1); *P. dui1735* (tl; 2); *P. dui2274* (tl; 8); *P. dui2367* (tl; 9); *P. dui884* (tl; 10); *P. egensis* Muell. Arg. (tl; 7); *P. haematocarpa* Standl. (tl; 9); *P. aff. lorentensis* Standl. (tl; 9); *P. podocephala* (Muell. Arg.) Standl. (tl; 8, 9); *P. aff. tapajozensis* Standl. (tl; 9); *P. aff. tricephala* Muell. Arg. (?) (s, tl; 9, 7); *Psychotria?* dui1111 (s, tl; 9, 10); *P. dui1737* (tl; 2); *P. sp.* (h; 9); *Remijia* dui1315 (tl; 7); *R. dui712* (tl; 5); *R. peruviana* Standl. (tl; 7); *R. aff. vaupesiana* Steyerl. (tl; 7, 5); *Rudgea aff. cryptantha* Standl. (tl; 3, 2, 4); *R. dui2158* (tl; 8); *R. duidae* (Standl.) Steyerl. (tl; 8, 10); *R. fissistipula* Muell. Arg. (tl; 10); *R. lorentensis* Standl. (s; 1); *Rudgea?* sp. (t; 10); *Simira* mss307 (tl, t; 1, 3, 4); *Stachyarrhena* mss1795 (tl; 8); *S. aff. penduliflora* Schum. (tl; 9, 10); genus unknown dui1143 (tl; 7); genus unknown dui1238 (tl; 7); genus unknown dui1418 (tl; 1); genus unknown dui1507 (tl; 1); genus unknown dui2074 (tl; 8); genus unknown dui2451 (tl; 9); genus unknown jbr1520 (t; 8); genus unknown mss507 (t; 4); genus unknown pap2165 (t; 9)

**Sabiaceae:** *Ophiocaryon heterophyllum* (Benth.) Urb. (tl; 2)

**Sapindaceae:** *Paullinia alsmithii* Macbr. (b; 1); *P. dui1682* (tl; 2); *P. dui698* (b, tl; 5); *P. fimbriata* Radlk. (b, tl; 8, 9, 3); *P. cf. ingaefolia* Rich. ex Juss. (b, s, tl; 8, 9, 1, 7); *P. nobilis* Radlk. (b, tl; 2, 10); *P. cf. serjaniaefolia* Tr. and Pl. (tl; 1); *Sapindus* dui2244 (tl; 8); *S. pap1553* (tl; 10); *Sapindus?* dui782 (tl; 5); *Talisia* dui1923 (tl; 4); *T. sp.* (tl; 8); genus unknown dui1116 (tl; 7, 10); genus unknown dui1443 (tl; 1); genus unknown sp. (tl; 10)

**Sapotaceae:** *Chrysophyllum* dui2677 (tl; 9); *C. aff. manaosense* (Aubr.) Penn. (tl; 1); *C. (aff.) sanguinolentum* (Pierre) Baehni (tl, t; 8, 7, 5); *Chrysophyllum?* dui2622 (tl; 9); *Ecclinusa bullata* Penn. (tl; 9); *E. aff. guianensis* Eyma (tl; 8); *E. lanceolata* (Mart. and Eichl.) Pierre (tl, t; 3, 4); *Ecclinusa?* sp. (tl; 5); *Manilkara?* mss214 (tl, t; 1); *Micropholis guyanensis* (A. DC.) Pierre (tl, t; 8, 9, 7, 10, 5); *M. mss1646* (t; 5); *M. venulosa* (Mart. and Eichl.) Pierre (tl; 1); *Micropholis?* dui2681 (tl; 9); *M. dui705* (tl; 5); *M. dui758* (tl; 5); *Pouteria aff. arcuata* Pennington (tl, t; 5); *P. aff. caimito* (R. and P.) Radlk. (tl; 7); *P. cuspidata* (A. DC.) Baehni (tl; 5); *P. dui1064* (tl; 10); *P. dui1131* (tl; 7); *P. dui1285* (tl; 7); *P. dui1868* (tl; 4); *P. dui2110* (tl; 8, 9); *P. dui2118* (tl; 8); *P. dui2160* (tl; 8); *P. dui2162* (tl; 8); *P. dui2191* (tl; 8); *P. dui2198* (tl; 8); *P. dui2240* (tl; 8); *P. dui2385* (tl; 9); *P. dui2568* (tl; 9); *P. dui2604* (tl; 9); *P. dui2712* (tl; 9); *P. dui887* (tl; 10); *P. glauca* Pennington (tl, t; 10); *P. aff. glomerata* (Miq.)

- Radlk. (t; 10); *P. guianensis* Aublet (t; 10); *P. laevigata* (Mart.) Radlk. (tl; 3, 4); *P. mssl12* (tl; 5); *P. mssl613* (t; 10); *P. aff. reticulata* (Engler) Eyma (t; 9); *P. aff. retinervis* Pennington (tl; 10); *P. aff. rostrata* (Huber) Baehni (t; 3); *P. sp.* (tl, t; 9, 10); *P. torta* (A. DC.) Radlk. (tl, t; 1, 3, 2, 4); *P. ucuqui* Pires and Schult. (t; 10); *P. vernicosa* Pennington (tl; 9, 10); *Pouteria?* dui1002 (tl; 10); *P. dui1453* (tl; 1); *P. dui2587* (tl; 9, 3); *P. dui2643* (tl; 9); *P. dui786* (tl; 5); *P. mssl649* (t; 5); *Sarcaulus? brasiliensis* (A. DC.) Eyma (tl, t; 1); genus unknown dui1030 (tl; 8, 10); genus unknown dui1231 (tl; 7); genus unknown dui1240 (tl; 7); genus unknown dui1375 (tl; 6); genus unknown dui2193 (tl; 8, 1); genus unknown dui2240 (tl; 8); genus unknown dui2283 (tl; 8); genus unknown dui2429 (tl; 8, 9); genus unknown dui2509 (tl; 8, 9, 10); genus unknown dui2682 (tl; 9); genus unknown dui2698 (tl; 9); genus unknown dui833 (tl; 10); genus unknown dui834 (tl; 10); genus unknown dui910 (tl; 10); genus unknown dui986 (tl; 10); genus unknown dui996 (tl; 10)
- Simaroubaceae:** *Simaba* aff. *cavalcantei* Thomas (tl; 4); *S. polyphylla* (Cavalc.) Thomas (tl; 4, 10, 5); *Simarouba amara* Aubl. (tl, t; 9, 1, 7)
- Smilacaceae:** *Smilax* (aff.) *aequatorialis* A. DC. (b; 8, 7, 3, 2, 10)
- Solanaceae:** *Solanum oppositifolium* R. and P. (tl; 9)
- Sterculiaceae:** *Herrania nitida* (Poepp.) Schult. (tl; 1, 2); *Sterculia* dui2623 (tl; 9); *Theobroma cacao* L. (tl, t; 1, 2); *T. grandiflorum* (G. Don) Schum. (t; 9); *T. obovatum* Kl. ex Bern. (tl, t; 1, 2); *T. subincana* Mart. (tl; 8, 10); genus unknown dui654 (tl; 5)
- Strelitziaceae:** *Phenakospermum guyanensis* (Steud.) Endl. (h; 9, 10)
- Theaceae:** *Ternstroemia* sp. (tl; 5)
- Theophrastaceae:** *Clavija weberbaueri* Mez (tl; 1, 2)
- Thymelaeaceae:** *Schoenobiblus?* sp. (tl; 1)
- Tiliaceae:** *Luehopsis* dui936 (tl; 10); *Mollia* (aff.) *lepidota* Spr. ex Benth (tl, t; 3, 4)
- Trigonaceae:** *Trigonía* dui827 (b; 10)
- Triuridaceae:** *Sciaphila purpurea* Benth. (h; 9); *S. sp.* (h; 10)
- Verbenaceae:** *Aegiphila* dui1045 (b; 10); *A. mssl635* (tl; 10)
- Violaceae:** *Amphirrhox* (aff.) *latifolia* Mart. ex Eichl. (tl; 3, 4); *Leonia cymosa* Mart. (tl; 8, 9, 7, 10); *L.* (aff.) *glycyarpa* R. and P. (tl, t; 9, 2, 4); *Rinocarpus ulei* (Melch.) Ducke (tl; 8); *Rinorea guianensis* Aubl. (tl; 9); *R. macrocarpa* Mart. ex Eichl. (tl; 9, 10); *R. sp.* (b?, tl; 2, 10); *Rinorea?* dui2621 (tl; 9); genus unknown dui2524 (tl; 9)
- Vochysiaceae:** *Erisma bicolor* Ducke (tl; 8, 9, 10); *Qualea acuminata* Spr. ex Warm. (tl; 7); *Q. ingens* Warm. (t; 2); *Q. paraensis* Ducke (tl; 8); *Q. psidiifolia* Spr. ex Warm. (tl; 10); *Q. sp.* (tl; 5); *Vochysia* dui1001 (tl; 9, 10); *V. dui1208* (tl; 7); *V. dui1637* (tl; 3); *V. lomatophylla* Standl. (t; 1); *V. mssl632* (t; 10); *V. mssl455* (t; 3); *V. paraensis* Huber ex Ducke (tl; 7); *V. sp.* (t; 9); *V. aff. venulosa* Warm. (tl; 8, 7); *V. vismiaefolia* Spr. ex Warm. (tl; 9); genus unknown dui1334 (tl; 7)
- Zamiaceae:** *Zamia ulei* Dammer (h, tl; 8, 9, 10)
- Zingiberaceae:** *Costus* dui1798 (subgenus *Cadalvena*) (h; 2); *C. scaber* R. and P. (h; 1)
- Family unknown:** genus unknown dui1595 (tl; 3); genus unknown dui1658 (tl; 3); genus unknown dui1770 (b; 2); genus unknown dui2003 (b; 10); genus unknown dui2050 (tl; 8); genus unknown dui2083 (tl; 8); genus unknown dui2113 (tl; 8); genus unknown dui2192 (tl; 8); genus unknown dui2469 (tl; 9); genus unknown dui2521 (b; 9); genus unknown dui2557 (b; 9); genus unknown dui643 (tl; 5); genus unknown dui697 (tl; 5); genus unknown dui867 (tl; 10); genus unknown mssl461 (t; 3); genus unknown sp. (b, tl, t; 8, 1, 7, 6, 2, 5)