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# Floristic Composition and Structure of Floodplain Vegetation in the Northern Pantanal of Mato Grosso, Brazil

By

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With 18 Figures

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## Summary

SCHESSL M. 1999. Floristic composition and structure of floodplain vegetation in the northern Pantanal of Mato Grosso, Brazil. – Phyton (Horn, Austria) 39 (2): 303–336, 18 figures, English with German summary.

The Pantanal depression is located at the Brazil-Bolivia frontier in the upper Paraguay river basin. Its vegetation comprises various types of nonflooded terra firme forest and saisonally to permanently inundated herbaceous vegetation types. A collection of vascular plants in herbaceous vegetation types of the Poconé subunit includes 637 species, at least three of which are new to science. Eight major vegetation types are distinguished on seasonally inundated lowlands, these are hyperseasonal savannas, floating meadows ("batume"), swamps of rhizomatous geophytes, free floating macrophytes, vegetation of termite mounds ("murundus") as well as three communities of monodominant scrub, dominated by *Combretum* spp. ("pombeiro"), *Licania parvifolia* ("pimenteiral") or *Baillonia amabilis* ("sarã") respectively. Little vegetation remains undisturbed due to the influence of extensive cattle breeding.

## Zusammenfassung

SCHESSL M. 1999. Floristische Zusammensetzung und Struktur der Vegetation auf Überschwemmungsflächen im nördlichen Pantanal von Mato Grosso, Brasilien. –

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Phyton (Horn, Austria) 39 (2): 303–336, 18 Abbildungen, Englisch mit deutscher Zusammenfassung.

Die Vegetation der am Oberlauf des Rio Paraguay an der Grenze von Bolivien und Brasilien gelegenen Pantanal-Depression setzt sich aus verschiedenen überflutungsfreien Waldgesellschaften und einer Reihe von saisonal bis permanent überschwemmten, krautigen Pflanzengesellschaften zusammen. Durch eine floristische und pflanzensoziologische Bearbeitung der krautigen Vegetationstypen des im nördlichen Teil des Pantanal gelegenen sogenannten Pantanal von Poconé, wurden 637 Arten identifiziert, von denen zumindest drei bislang noch unbeschrieben sind. Die Vegetation der saisonal überfluteten Ebenen läßt sich acht Gruppen zuordnen: Gesellschaften der hypersaisonalen Savanne, Schwimmwiesengesellschaften („Batume"), Rhizomgeophyten-dominierte Sumpfpflanzengesellschaften, frei schwimmende Makrophytengesellschaften, die Gehölzvegetation auf „Murundú"-Hügeln („Murundus") und drei monodominante Gebüschgesellschaften, die jeweils von *Combretum* spp. („pombeiro"), *Licania parvifolia* („pimenteira") oder *Baillonia amabilis* („sarã") aufgebaut werden. Weite Gebiete sind durch die in der Region weit verbreitete extensive Rinderweidewirtschaft beeinflußt.

## 1. Introduction

The Pantanal of Mato Grosso covers an area of approximately 140.000 km$^2$ in the upper basin of the Rio Paraguay between 16° and 22° S and 55°–58° W. Situated near the geographical center of South America, the main area of the Pantanal is located in the Brazilian states of Mato Grosso and Mato Grosso do Sul (Fig. 1). It mainly consists of sedimentary deposits in a quarternary erosive depression of the western margin of the Brazilian shield. Various tributaries of the Paraguay river provided the material for alluvial cones (KLAMMER 1982), each forming a flat to slighltly undulating landscape, raising only to about 100–110 m above sea level. Due to differences in the parent alluvial material and different hydrological regimes, the sedimentary depression can be subdivided in various subregions (ADÁMOLI 1982). Runoff of summer precipitation is delayed because of the low inclination of 0,02‰ up to 0,5‰ (POTT 1988), and lowlands become flooded either by stagnant rainwater or by waters of transbording rivers. The monomodal floodpulse causes maximum annual waterlevel fluctuations between 2 and 5 m (JUNK & DA SILVA 1995). However, water level of the floodplains rarely exceeds 1.5 m. Extensive macrophyte stands cover these swamplands during rainy season while being substituted by xerophytic grassy campos during dry season. Nevertheless, nonflooded high ground ("terra firme") is interspersed throughout the region and covered by several forest types.

The tropical Aw climate of the region is strongly seasonal with a short dry season (June–September) and a long wet season (October–April). A mean annual temperature of 22,5° C and a mean annual rainfall of 1739 mm were calculated from data of the weather station set up at Fazenda Ipiranga (16°36'N/56°24'W, altitude: 110 m) in the study area in 1992

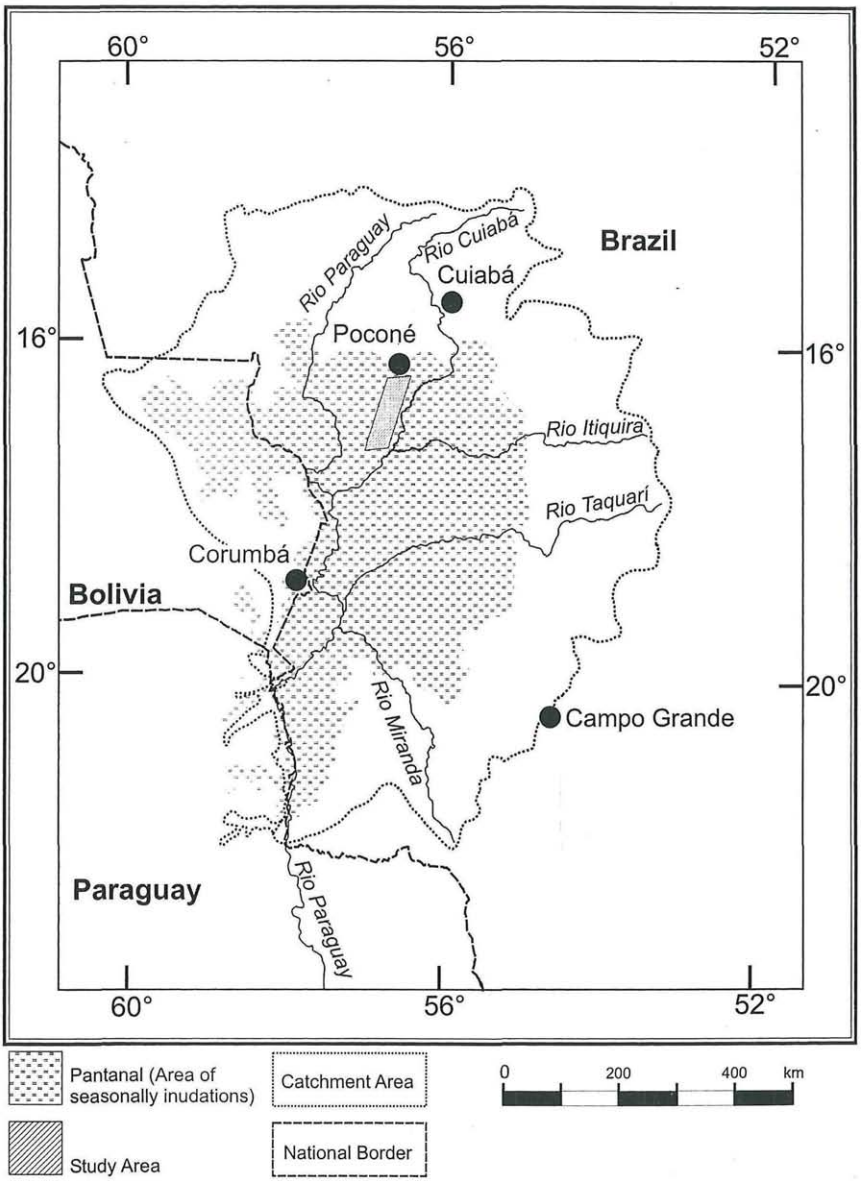



Fig. 1. Map showing the Pantanal of Mato Grosso and its catchment area.

(Fig. 2). The corresponding mean data (1961–1990) for the city of Cuiabá (15°33′S/56°07′W, alt.: 151 m), located about 100 air km northeast of the study area, are 25,8° C and 1315 mm respectively.

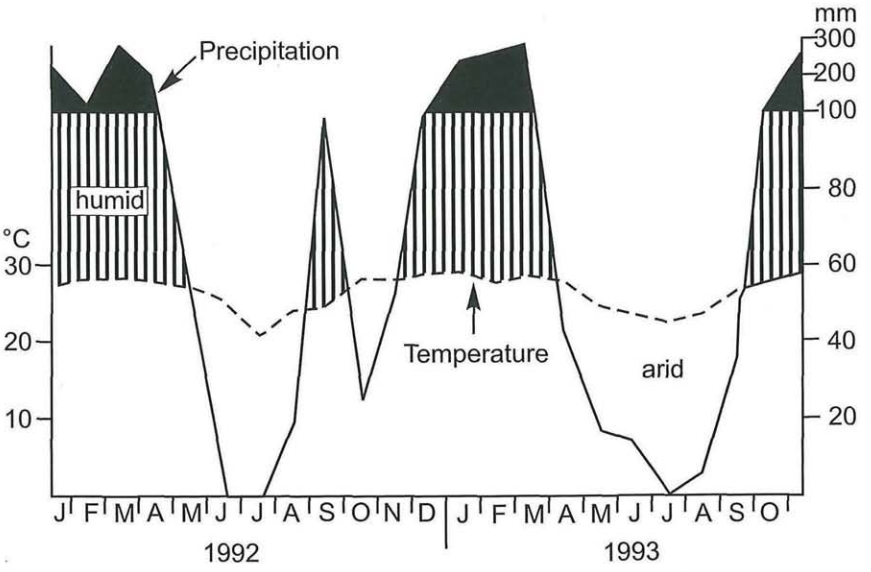



Fig. 2. Climatic diagram for Fazenda Ipiranga (16°36'N/56°24'W, 110 m. a.s.l.), municipality of Poconé, State of Mato Grosso, Brazil.

The soils of the study area are developed from alluvial parent material, and constitute hydromorphic soil types such as Hydromorphic Laterits, Planosols, Solonetz, Vertisols, Podzols, Gleys and recent alluvial soils (Orioli & al. 1982, Oliveira & al. 1982, Macedo 1982). The considerable variation of soil types ranging from pure alluvial sands to very fine textured clays is mainly correlated with the duration of flooding and with differences in the alluvial parent material. Most soil types in the study area have low pH-values of 4 to 5 and low contents of organic matter. Gleyic and stagnic properties (FAO-UNESCO 1988) are common characteristics of the floodplain soils of the region.

Few plant collections were carried out in the Pantanal during the last century (Sampaio 1916), and the Pantanal region still has been considered poorly collected only one decade ago (Prance & Schaller 1986). Since this time, considerable floristic research has been carried out resulting in floristic checklists (e.g. Guarim-Neto 1984, 1991, 1992, Pott & Pott 1986a, 1986b, Pott V.J. & al. 1986, Dubs 1998, Frey 1995), some major floristic surveys (Prance & Schaller 1986, Pott A. & al. 1986) and a first illustrated guide to Pantanal plants (Pott & Pott 1995).

Vegetation studies in the Pantanal are scanty, focussing on woody vegetation types (e.g. Prance & Schaller 1986, Ratter & al. 1988, Prado & al. 1992, Dubs 1992). Apart from a transect study of herbaceous macro-

phytes (POTT & al. 1992, PRADO & al. 1994, FREY 1995), no systematic phytosociological study of herbaceous lowland plant communities has been carried out.

This paper gives an overview of floristic composition of herbaceous lowland vegetation and describes structure and driving ecological factors of major vegetation types distinguished in the study area.

## 2. Study Area

The study was carried out in the Poconé subregion, an area in the northern part of the Pantanal wetland covering about 18.000 km$^2$ (ADÁMOLI 1982). Field work was done mainly along the Transpantaneira road and near two base camps at Fazenda Ipiranga (16°36'S/56°24'W, altitude: 110 m) and Fazenda Nova Berlim (16°45'S/56°58'W, alt.: 100 m) (Fig. 3).

The floodplains of the Pantanal are used for extensive cattle breeding for more than 200 years (WILCOX 1992). In the study area, intensified ranching, implying annual burning of the grassy campos during the dry season, deforestation of slightly elevated woodlands, introduction of exotic grass species, and constructions for flood control partly occur (REMPPIS 1995). Nevertheless, extensive landuse systems or even abandoned farmland can frequently be found along the Transpantaneira highway.

## 3. Methods

Collecting of plant specimens and phytosociological studies were restricted to herbaceous vegetation types and carried out over a two year period from 1991 to 1993. Most of the plant species collected belong to herbaceous communities, but some are found in woody formations as well. More than 400 "relevés" (sample plots) were sampled by means of the Zürich–Montpellier techniques (BRAUN–BLANQUET 1964, MUELLER–DOMBOIS & ELLENBERG 1974). A detailed phytosociological classification of the different plant communities, an evaluation of the 50 soil profiles sampled and data of inundation regime monitored at 31 sample plots will be published elsewhere.

Species are classified according to the life form system of MUELLER–DOMBOIS & ELLENBERG 1974. The following life form groups are distinguished: the phanerophytes including woody plants such as trees and shrubs differ from chamaephytes (dwarf shrubs) forming woody branches only up to 25–50 cm in height. Phanerophytic lianas with woody stems are distinguished from hemicryptophytic lianas, characterized by predominently herbaceous trunks or occasionally with basal lignification. Excluded from the groups of hemicryptophytes, geophytes or therophytes are the free floating hydrophytes and parasitic plants (parasites).

## 4. Floristic Survey

More than 50% of the 637 collected species in the lowlands studied (Tab. 1), belong to only 10 species-rich families (Fig. 4). Comparison with other floodplain regions in South America reveals relatively little floristic similarity on species level, but considerable similarity on familiy level (Fig. 5).

Tab. 1: Checklist of plants of floodplain vegetation in the study area

Identifications were made or revised by the persons indicated following the family names, otherwise by the author. If only some species belonging to one familiy were identified by a specialist, or more than one specialist identified specimens belonging to the same family, each specimen is marked (with asterics or circle) to indicate individually it's status of identification. Several species of *Poaceae* were identified by J. F. M. VALLS (CEN), V. J. POTT and A. POTT (CPAP) examined several Pantanal specimens, especially *Poaceae* and aquatic macrophytes. The first set of voucher specimens is deposited at UFMT (Cuiabá), duplicates are deposited at ULM. Collection numbers represent plants collected by M. SCHESSL.

Abreviatiations for the major life form-types: (P) = phanerophyte; (C) = chamaephyte; (H) = hemicryptophyte; (G) = geophyte; (T) = therophyte; (LP) = phanerophytic (woody) liana; (LH) = hemicryptophytic (herbaceous) liana; (Hyd) = hydrophyte; (R) = parasite.

Abbreviations for the habitats: (hs) = hyperseasonal savanna grasslands, sometimes divided in: (cdm) = small tussock grassland interspersed by termite mounds, (tg) = tall tussock grassland, (sg) = shortgrass floodplains with (sgi) = sg when inundated, (sgp) sg when paludous, and (sgd) when dried up; (ba) = floating meadows; (a) = aquatic; (p) = paludous; (mu) = termite mounds; (s) = scrub; (dw) terra firme forest; (if) = inundated forest; (cd) = Cerrado; (be) = margin and beaches of rivers and lagoons; (c) = cultivated or planted species; (r) = ruderal.

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *I. Phycophyta, Bryophyta,Pteridophyta* | | | |
| *Azollaceae* (det. K. MEHLTRETER) | | | |
| *Azolla filiculoides* LAM. | 3306 | Hyd nat | a, |
| *Characeae* (det. B. BORSTELMANN) | | | |
| *Chara fibrosa* AG. ex BRUX. em. R. D. WOOD | | | |
| cf. var. *hydropytis* (REICH) R. D. WOOD | | | |
| em. R.D. Wood | 3364 | T hyd | a, |
| *Nitella acuminata* A. BR. ex WALLM. | | | |
| em. R. D. WOOD | 2603 | T hyd | a, |
| *Dicranellaceae* (det. O. YANO) | | | |
| *Dicranella hilariana* (MART.) MITT. | 3551 | C herb(pulv) | cdm, |
| *Hemionitidaceae* (det. K. MEHLTRETER) | | | |
| *Pityrogramma calomelanos* (L.) LINK | 4073 | T? scap? | ba, |
| *Lycopodiaceae* (det. K. MEHLTRETER) | | | |
| *Lycopodium* cf. *cernuum* L. | 2388b | C herb | r, |
| *Marsileaceae* (det. K. MEHLTRETER) | | | |
| *Marsilea polycarpa* HOOK & GREV. | 2633 | H hyd | a, p, sgi, |
| *Ophioglossaceae* (det. K. MEHLTRETER) | | | |
| *Ophioglossum* cf. *crotalophoroides* Walt. | 3396 | G rhiz | sgd, |
| *Parkeriaceae* | | | |
| *Ceratopteris pteridoides* (HOOK.) HIERON. | 2567 | Hyd nat | a, |
| *Ricciaceae* | | | |
| *Ricciocarpus* cf. *natans* (L.) CORD. | 2085 | Hyd nat | a, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Salviniaceae* (det. De la Sota) | | | |
| *Salvinia* cf. *auriculata* Aubl. | 321/1-2, 3307 | Hyd nat | a, |
| II. *Angiospermae* | | | |
| *Acanthaceae* (* det. D. Wasshausen) | | | |
| *Justicia anagallis* Lindau* | 10/3-2 | H rept | sgd, sgi, |
| *Justicia laevilinguis* (Nees) Lindau* | 48/3-16 | H rept | sgd, sgi, |
| *Justicia lavandulaefolia* (Nees) Pohl ex Nees* | 103/1-1 | H rept | sgd, sgi, |
| *Lophostachys pubiflora* Lindau* | 2600 b | H rept | sgd, |
| *Staurogyne diantheroides* Lindau* | 060891-2-9 | H rept | ba, |
| *Alismataceae* (* det. R. R. Haynes) | | | |
| *Echinodorus grandiflorus* (Cham. & Schltdl.) Micheli subsp. *grandiflorus** | 2783 | H ros | sgi, p, sgp, |
| *Echinodorus macrophyllus* (Kunth) Micheli subsp. *scaber* (Rataj) Haynes & Holm-Nielsen* | 3327 a | H ros | sgi, p, sgp, |
| *Echinodorus paniculatus* Micheli in DC.* | 3229 | H/T ros | sgi, p, sgp, |
| *Echinodorus tenellus* (Mart.) Buchenau | 2017 | T ros | sgp, |
| *Echinodorus teretoscapus* Haynes & Holm-Nielsen* | 2399 | H ros | a, p, sgp? |
| *Sagittaria guyanensis* Kunth in H. B. K. subsp. *guyanensis* * | 3170 | H hyd | sgi, |
| *Sagittaria rhombifolia* Cham.* | 3088 | H hyd | sgi, |
| *Amaranthaceae* (* det. T. M. Pedersen) | | | |
| *Alternanthera kurtzii* Schinz ex Pedersen* | 221191-4-1 | H? rept | s, |
| *Alternanthera paronichyoides* A. St. Hil. subsp. *chacoënsis* (Morong) Pedersen ined. | 011191-1-2 | H rept? | sgd, r, |
| *Alternanthera philoxeroides* (Mart.) Griseb. | 5167 | H rept/hyd | ba, sgi, a, |
| *Amaranthus spinosus* L.* | 131291-1-2 | T scap | r? |
| *Amaranthus viridis* L.* | 270991-1-1 | T scap | r? |
| *Gomphrena celosioides* Mart. | 3380 | H caes | r, |
| *Gomphrena vaga* Mart.* | 2810c | C? suff | s, |
| *Pfaffia iresinoides* (H.B.K.) Spreng.* | 030192-2-3 | C? suff | s, |
| *Amaryllidaceae* | | | |
| cf. *Zephyranthes* sp. | 3444 | G bulb | mu, |
| *Anacardiaceae* | | | |
| *Anacardium humile* St. Hil. | 3447 | N P caes | mu, |
| *Astronium fraxinifolium* Schott in Sprengel | 3440 | Mes P scap | mu, |
| *Annonaceae* (det. H. Rainer) | | | |
| *Annona aurantiaca* Barb. Rodr. | 051191-1-1 | N P caes | mu, |
| *Annona cornifolia* A. St. Hil. | 3020 | N P caes | mu, |
| *Annona dioica* A. St. Hil. | 3443 | N P caes | mu, |
| *Annona phaeoclados* Mart. | 211091-1-7 | N P caes | mu, |
| *Apiaceae* (det. L. Constance) | | | |
| *Eryngium ebracteatum* Lam. | 193/1-1 | H ros | cdm, |
| *Hydrocotyle ranunculoides* L.f. | 2643, 3252a | H/G hyd/rhiz | ba, a, |
| *Apocynaceae* (* det. J. M. Leeuwenberg) | | | |
| *Catharanthus roseus* (L.) G. Don* | 2326 | H rept | r, |
| *Himatanthus obovatus* (Müll. Arg.) Woodson | 2970 | Mi P caes/scap | r, s, |
| *Mesechites trifida* (Jacq.) Müll. Arg.* | 159/1-1 | LH | hs, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Rauvolfia mollis* S. MOORE* | 011191-2-5 | N P caes | s, |
| *Rhabdadenia pohlii* MÜLL. ARG.* | 120991-1-3 | LH? | hs, |
| *Tabernaemontana siphilitica* (L.f.) LEEUWENB.* | 221192-1-2 | N P caes | s, |
| *Thevetia peruviana* (Pers.) K. SCHUM.* | 301091-1-6 | C suff | hs, |
| *Araceae* (det. J. BOGNER) | | | |
| *Pistia stratiotes* L. | 3308, 2601 | Hyd nat | a, |
| *Taccarum weddellianum* Brongn. | 5081 | G bulb | mu, |
| *Xanthosoma striatipes* (KUNTH & BOUCHÉ) MADISON | 4991 | G bulb | mu, |
| *Arecaceae* | | | |
| *Allagoptera leucocalyx* (DRUDE) O. KUNTZE | 2802 | Mi P ros | mu, |
| *Bactris glaucescens* DRUDE | 2819 | Mi P ros | sgd, sgi, |
| *Copernicia australis* BECC. | 3448 | Mes P ros | mu, |
| *Desmoncus* sp. | 2299 | LP | hs, s, |
| *Aristolochiaceae* | | | |
| *Aristolochia* cf. *esperanzae* O. KUNTZE | 3290 | LP | mu, cd, |
| *Asclepiadaceae* (det. S. LIEDE) | | | |
| *Asclepias mellodora* A. ST. HIL. | 4828 | H scap | hs, |
| *Funastrum clausum* (JACQ.) SCHLTR. | 3219, 3283, 3660 | LH | sgp, |
| *Oxypetalum* cf. balansae MALME | 4814 | LH? | r, |
| *Schubertia grandiflora* MART. | 2532 | LP | s, |
| *Tassadia berterianum* (SPRENG.) W. D. STEVENS | 4574 | LH | r, hs, p, |
| *Asteraceae* (* det. G. M. BARROSO) | | | |
| *Ageratum conyzoides* L. | 260992-1-12 | T scap | sgd, r, |
| *Aspilia latissima* MALME* | 3361 | T scap | be, |
| *Baccharis medullosa* DC.* | 3404 | H scap | p, |
| *Bidens gardneri* BAKER | 2610c | C(T) frut(scap) | r, |
| *Bidens* cf. *pilosa* L. | 081192-1-1a | T scap | r, |
| *Conyza bonariensis* (L.) CRONQUIST* | 311291-1-1 | T scap | r, |
| *Eclipta prostrata* (L.) L.* | 270992-2-1b | H scap | r, |
| *Erechtites hieraciifolia* (L.) RAF. ex DC. | 311291-1-2 | H,(C) ros | mu, |
| *Eupatorium asperulaceum* BAKER* | 4575 | H caes? | sgp, r, |
| *Eupatorium candolleanum* HOOK. & ARN.* (= *Barrosoa candolleana* (HOOK. & ARN.) R. M. KING & H. ROB.) | 3302, 3250 | T scap | ba, p, be, |
| *Eupatorium hecatanthum* (DC.) BAKER | 131291-1-2 | T scap | ba, |
| *Eupatorium macrocephalum* Less.* (= *Campuloclinium macrocephalum* (LESS.) DC.) | 201091-1-8 | H caes | r, (cdm,) |
| *Eupatorium myriocephalum* GARDNER* (= *Chromolaena myrocephala* (Gardner) R. M. KING & H. ROB.) | 277/1-14 | Mi P caes | mu, |
| *Eupatorium odoratum* L.* (= *Chromolaena odorata* (GARDNER) R. M. KING & H. ROB.) | 4992 | N P caes | mu, |
| *Melanthera latifolia* (GARDNER) CABRERA* | 2860 | T scap | hs, |
| *Mikania* cf. *micrantha* H. B. K. | 3301 | LH | mu, ba, hs, s, |
| *Orthopappus angustifolius* (SW.) GLEASON | 201091-1-10 | H ros | mu, |
| *Pacourina edulis* AUBL.* | 120292-2-2 | H? scap | p, ba, |
| *Porophyllum ruderale* (JACQ.) CASS.* | 48/3-28 | T scap | r, |
| *Trichospira menthioides* H. B. K. | 2777 | H caes | hs, |
| *Tridax procumbens* L.* | 311291-1-3 | T rept | r, |
| *Vernonia* aff. *cognata* LESS. var. *screptum* (CHODAT) CABR.* | 275/1-4 | N P caes | mu, |
| *Vernonia brasiliana* (L.) DRUCE* | 2025 | N P caes | mu, r, |
| *Vernonia* cf. *rubricaulis* HUMB. & BONPL. | 2723 | N P caes | mu, |
| *Wedelia brachycarpa* BAKER* | 131092-6-1 | H caes | cdm, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Bignoniaceae* (* det. S. BIDGOOD) | | | |
| *Arrabidaea* sp. (#1) | 2177 | LP | r, |
| *Arrabidaea* sp. (#2) | 3378 | LP | r, |
| *Arrabidaea* sp. (#3) | 2579 | LP | r, |
| *Arrabidaea* sp. (#4) | 2271 | LP | r, |
| *Arrabidaea* sp. (#5) | 131092-2-3 | LP | r, |
| aff. *Cybistax antisyphilitica* (MART.) MART. | 3450, 4944 | Mi P scap | mu, r, |
| *Melloa quadrivalvis* (JACQ.) A. GENTRY * | 3413 | Mi P scap | mu, r, |
| *Tabebuia* sp. (#3) | 3439 | Mi P scap | mu, r, |
| *Phryganocydia corymbosa* (VEATT.) BUREAU ex K. SCHUM. * | 2724a | LP | r, |
| *Macfadyena ungis-cati* (L.) A. GENTRY * | 2724b | LP | r, |
| indet. sp. (#2) | 2389 | Mi P caes? | r, |
| indet. sp. (#3) | 3416a | LP | cd, |
| indet. sp. (#6) | 2265 | LP | r, |
| indet. sp. (#7) | 4721 | LP | hs, |
| *Bixaceae* | | | |
| *Bixa orellana* L. | 2556 | Mi P caes | r, |
| *Boraginaceae* (* det. H. FÖRTHER) | | | |
| *Cordia* cf. *glabrata* (MART.) A. DC. | 2179 | Mes P scap | r, |
| *Heliotropium filiforme* LEHM.* | 2319 | T scap? | hs, |
| *Heliotropium indicum* L.* | 2342 | T caes | r, |
| *Heliotropium lagoense* (WARM.) GÜRKE* | 5252, 2831 | T rept | hs, |
| *Heliotropium procumbens* MILL.* | 2187 | T rept | hs, |
| *Bromeliaceae* | | | |
| *Ananas ananassoides* (BAKER) L. B. SM. | 3046 | G rhiz | mu, cd, |
| *Bromelia balansae* MEZ | 3033 | G rhiz | mu, cd, df, |
| *Burmanniaceae* (det. P. J. M. MAAS) | | | |
| *Burmannia capitata* (WALT. ex J. F. GMEL.) MART. | 2631c | T(S) ros | cdm, |
| *Burmannia flava* MART. | 2631d | T(S) ros | cdm, |
| *Cabombaceae* | | | |
| *Cabomba furcata* SCHULT. & SCHULT. f. | 2586, 2635 | T hyd | a, |
| *Cactaceae* (det N. P. TAYLOR) | | | |
| *Cereus* cf. *bicolor* RIZZINI & MATTOS FILHO | 3476 | Mi P succ. | df, |
| *Cereus kroenleinii* (KIESLING) N. P. TAYLOR | 3475 | C succ | df, |
| *Caesalpiniaceae* (* det. R. C. BARNEBY) | | | |
| *Bauhinia bauhinioides* (MART.) J. F. MACBR. * | 85/1-2 | N P caes | hs, |
| *Bauhinia glabra* JACQ.* | 3416b | LP | r, |
| *Cassia grandis* L.f. | 2222 | Mes P scap | r, |
| *Chamaecrista desvauxii* (COLLAD.) KILLIP var. *brevipes* (BENTH.) H. S. IRWIN & BARNEBY* | 110292-2-1 | C suff | cdm, r, |
| *Chamaecrista flexuosa* (L.) GREENE* | 2737a | N P caes | r, cdm, |
| *Chamaecrista kunthiana* (SCHLTDL. & CHAM.) H. S. IRWIN & BARNEBY* | 3125 | C(?) suff | cdm, |
| *Copaifera langsdorffii* DESV.* | 3071 | N P caes | r, cd, mu, |
| *Delonix regia* (BOJ. ex HOOK.) RAF. | 2340 | Mes P scap | c, |
| *Hymenaea* cf. *stigonocarpa* MART. ex HAYNE | 3521 | Mes P scap | mu, |
| *Sclerolobium* sp.* | 2548 | Mi P scap | r, |
| *Senna aculeata* (BENTH.) H. S. IRWIN & BARNEBY* | 2288 | N P caes | r, hs, p, |
| *Senna alata* (L.) ROXB. | 2617 | N P caes | r, hs, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Senna obtusifolia* (L.) H. S. IRWIN & BARNEBY* | 3194 | C suff | hs, r, |
| *Senna occidentalis* (L.) Link* | 108/1-16 | C suff | hs, r, |
| *Senna pendula* (WILLD.) H. S. IRWIN & BARNEBY* | 2623 | Mi P caes | hs, r, |
| *Senna* sp. | 3299 | Mi P caes | r, cd, |
| *Cannaceae* (det. P. J. M. MAAS) | | | |
| *Canna glauca* L. | 3674, 2339 | G rhiz | p, |
| *Capparaceae* | | | |
| *Cleome aculeata* L. | 2429 | T caes | r, |
| *Caryophyllaceae* | | | |
| indet sp. (3) | 2637a | T scap | hs, |
| indet sp. (4) | 2629c | T rept | hs, |
| *Celastraceae* | | | |
| *Maytenus* sp. | 3429 | Mi P caes | s, |
| *Plenckia* sp. | 3349 | Mi P caes | s, |
| *Chrysobalanaceae* (det. G. T. PRANCE) | | | |
| *Couepia uiti* (MART. ex ZUCC.) BENTH. ex HOOK. | 176/2-1 | Mi P scap | if, s, |
| *Licania parvifolia* HUBER | 2487 | Mi P scap | if, s, |
| *Cochlospermaceae* (det. H. H. POPPENDIECK) | | | |
| *Cochlospermum regium* (SCHRANK) PILG. | 3312 | N P caes | r, mu, |
| *Combretaceae* (det. C. A. STACE) | | | |
| *Combretum lanceolatum* POHL ex EICHLER | 3330 | Mi P caes | s, r, |
| *Combretum laxum* JACQ. | 3386 | Mi P caes | s, r, |
| *Commelinaceae* (det. R. FADEN) | | | |
| *Commelina erecta* L. | 211192-1-6, 3267 | G rhiz | r, s, |
| *Murdannia nudiflora* (L.) BRENAN | 2619c | G rhiz | r, |
| *Murdannia semifoliata* (C. B. CLARKE) G. BRÜCKN. | 2421a | G rhiz/bulb | hs, |
| *Murdannia* sp. nov. ined. | 2631g | T rept | hs, |
| *Convolvulaceae* (* det. F. AUSTIN) | | | |
| *Aniseia argentina* (BROWN) O'DONELL* | 3176 | LH | hs, |
| *Evolvulus convolvuloides* (WILLD.) STEARN | 3352 | H scap | r, |
| *Evolvulus filipes* MART.* | 277/1-11 | H caes? | r, hs, p, |
| *Evolvulus nummularius* L.* | 3535 | H rept | r, hs, |
| *Ipomoea alba* GARCKE* | 071192-1-1 | LP | r, |
| *Ipomoea asarifolia* (Desv.) ROEM. & SCHULT.* | 3278 | LH | hs, |
| *Ipomoea carnea* JACQ. | | | |
| subsp. *fistulosa* (MART. ex CHOISY) D. F. AUSTIN | 3331,3012091-1-1 | LP? | hs, |
| *Ipomoea rubens* CHOISY | 304/1-3 | LH | hs, |
| *Ipomoea tenera* MEISN. | 4593,2835 | LH | hs, r, s, |
| *Ipomoea* sp. (1) | 2603c,2348,2634 | LH | hs, |
| *Ipomoea* sp. (2) | 3536a | LP? | hs, |
| *Merremia umbellata* (L) HALLIER f.* | 3289,2557 | LH | hs, r, |
| *Cucurbitaceae* (*det. A. KRAPOVICKAS) | | | |
| *Cayaponia podantha* COGN.* | 3467 | LH | r, |
| indet. sp. (1) | 3244, 4711 | LH | r, |
| *Cyperaceae* (° det. K. CAMELBEKE, * det. T. M. PEDERSEN) | | | |
| *Bulbostylis scabra* (PRESL) LINDM. | | | |
| cf. f. *evolutina* LINDM. | 3224 | H caes | cdm, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| cf. *Bulbostylis tenella* C. B. CLARKE | 3028 | H caes | mu, |
| *Cyperus* aff. *aggregatus* (WILLD.) ENDL.* | 3039 | ? caes | cdm, |
| *Cyperus albomarginatus* MART. & SCHRAD. ex NEES* | 160991-4-2 | T caes | p, be, |
| *Cyperus diffusus* VAHL subsp. *chalaranthus* (C. & J. PRESL) KÜK*. | 3054 | G rhiz | mu, |
| *Cyperus gardneri* NEES | 3316 | T? caes | hs, |
| *Cyperus giganteus* VAHL° | 2459, 207/1-1 | G rhiz | p, |
| *Cyperus haspan* L.° | 103/2-3 | G rhiz | hs, |
| *Cyperus imbricatus* RETZ.° | 2458b | T caes | hs, |
| *Cyperus iria* L.° | 2608 | T caes | r, |
| *Cyperus luzulae* (L.) RETZ.° | 081192-1-1b | G rhiz | p, r, |
| *Cyperus obtusatus* (PRESL) MATTF. & KÜK.* | 2806 | G rhiz | hs, |
| *Cyperus odoratus* L. s.l.° | 3463 | H caes | hs, |
| *Cyperus reflexus* VAHL° | 177/2-2a | G rhiz | hs, |
| *Cyperus sphacelatus* ROTTB.° | 139/2-2 | H caes | mu, sgp, |
| *Cyperus surinamensis* ROTTB. | 3024 | H caes | hs, r, |
| *Eleocharis acutangula* (ROXB.) SCHULT.° | 103/2-4 | G rhiz | p, |
| *Eleocharis contracta* MAURY ex MICHELI* | 2500 | G rhiz | hs, |
| *Eleocharis elegans* (H. B. K.) R. & S. | 2151 | G rhiz | p, sgp, |
| *Eleocharis filiculmis* Kunth* | 3094 | G rhiz | sgd, |
| *Eleocharis geniculata* (L.) ROEM. & SCHULT.°* | 3393 | G? rhiz? | cdm, p, |
| *Eleocharis interstincta* (VAHL) ROEM. & SCHULT.° | 3319 | H caes | p, sgp, |
| *Eleocharis minima* KUNTH* | 3185,2827 | H/T caes | hs, a, |
| *Eleocharis nodulosa* (ROTH) SCHULT. in ROEM. & SCHULT.°* | 5/2-2 | G rhiz | sgd, |
| *Eleocharis plicarhachis* (GRISEB.) SVEN.* | 3300 | H caes | hs, |
| *Eleocharis viridans* KÜK.* | 73/1-3 | T caes | a, p, |
| *Fimbristylis complanata* (RETZ.) LINK° | 44/1-1 | G rhiz | mu, |
| *Fimbristylis dichotoma* (L.) VAHL* | 139/2-3 | T caes | hs, mu, |
| *Fimbristylis* sp. (4) | 65/1- | H caes | hs, |
| *Fuirena bulbipes* S. F. BLAKE* | 315/1-3 | H caes | s, p, |
| *Hemicarpha micrantha* (VAHL) BRITTON | 137/2-11 | T caes | hs, |
| *Kyllinga odorata* VAHL° | 177/2-1b | G rhiz | mu, |
| *Lipocarpha humboldtiana* NEES° | 150792-1-4 | T caes | cdm, |
| *Oxycarium cubense* (POEPP. & KÜK.) K. LYE | 3323 | T caes | ba, p, |
| *Pycreus macrostachyos* (LAM.) J. RAYNAL° | 149/1-6 | H caes | hs, |
| *Rhynchospora armerioides* C. & J. PRESL* | 3149 | G rhiz | cdm, |
| *Rhynchospora* cf. *barbata* (VAHL) KUNTH | 190592-3-6b | G rhiz | cdm, |
| *Rhynchospora brevirostris* GRISEB.* | 3100 | G rhiz | cdm, |
| *Rhynchospora globosa* (KUNTH) ROEM. & SCHULT. | 213/1-2 | G rhiz | cdm, |
| *Rhynchospora hirta* (NEES) BOECK.° | 3136 | G rhiz | cdm, |
| *Rhynchospora hispidula* (VAHL) BOECK.* | 263/1-2 | G rhiz | sgd, cdm, |
| *Rhynchospora holoschoenoides* (L. C. RICH.) HERTER° | 145/1-2 | G rhiz | hs, |
| *Rhynchospora* cf. *nervosa* (VAHL) BOECK.° | 44/1-2 | G rhiz | cdm, |
| *Rhynchospora setacea* (BERG.) BOECK.* | 2806 | G rhiz | mu, |
| *Rhynchospora tenerrima* NEES ex SPRENG. subsp. *tenerrima*° | 51/5-3 | G/T rhiz | sgd, |
| *Rhynchospora* cf. *tenuis* LINK° | 3156 | G/T rhiz | cdm, |
| *Rhynchospora trispicata* (NEES) STEUD.* | 149/1-2 | G/T rhiz | hs, |
| *Rhynchospora* sp. | 3358 | G rhiz | hs, |
| *Rhynchospora* sp. (13) | 2367 | G rhiz | hs, |
| *Scleria flagellum-nigrorum* BERG.° | 2407 | G rhiz | s, |
| *Scleria leptostachya* KUNTH.* | 3142 | H/T caes | cdm, |
| *Scleria lithosperma* (L.) SW.* | 3107 | T caes | cdm, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Scleria melaleuca* REICHENB. ex SCHLTDL. & CHAM.° (= *S. pterota* PRESL) | 315/1-3 | G rhiz | s,r, |
| *Scleria minima* C. B. CLARKE* | 129/1-4, 3158 | T caes | cdm, |
| *Scleria phylloptera* WRIGHT* | 3006 | G rhiz | cdm, |
| *Scleria reticularis* MICHX.° (= *S. setacea* POIR.) | 3115 | G rhiz? | p, r, |
| *Dilleniaceae* | | | |
| *Curatella americana* L. | 2308 | Mi P scap | mu, cd, |
| *Droseraceae* | | | |
| *Drosera sessilifolia* ST. HIL. | 2812, 3792 | T(?) ros | cdm, |
| *Eriocaulaceae* (°det. N. HENSOLD, *det. Th. STÜTZEL) | | | |
| *Eriocaulon guyanense* KÖRN.° | 123/1-7 | T ros | cdm, |
| *Eriocaulon melanocephalum* KUNTH* | 3123 | T ros | cdm, |
| *Paepalanthus lamarckii* KUNTH° | 278/1-4 | T ros | cdm, |
| *Philodice hoffmannseggii* MART.° | 2630b | T ros | r, |
| *Syngonanthus chrysanthus* (BONG.) RUHL. | 2629a | T ros | cdm, |
| *Syngonanthus gracilis* (BONG.) RUHL. var. *aureus* RUHL.° | 123/1-6 | T ros | cdm, |
| *Erythroxylaceae* (det. N. HENSOLD) | | | |
| *Erythroxylum anguifugum* MART. | 200991-2-2 | N P caes | mu, |
| *Erythroxylum* cf. *suberosum* ST. HIL. | 3069 | N P caes | mu, |
| *Euphorbiaceae* (° det. W. PUNT, * det. G. L. WEBSTER) | | | |
| *Alchornea castaneifolia* (WILLD.) A. JUSS.* | 3466 | Mi P caes | hs, |
| *Alchornea schomburgkii* KLOTZSCH° | 3062 | Mi P caesp | be, |
| *Caperonia castaneifolia* (L.) ST. HIL. | 130392-1-1 | T/G rept/rhiz | hs, |
| *Caperonia* cf. *palustris* (L.) ST. HIL.° | 149/1-5 | T scap | p, |
| *Chamaesyce potentilloides* (BOISS.) CROIZAT* | 132/2-3 | T rept | hs, |
| *Chamaesyce thymifolia* (L.) MILLSP. * | 3417 | T rept | hs, |
| *Croton* cf. *fuscus* (DIEDR.) MÜLL. ARG. | 187/1-1 | C frut | hs, |
| *Croton cuyabensis* PILG.* | 181092-1-1 | C suff | hs, |
| *Croton* aff. *reitzii* L. B. SMITH & DOWNS° | 213/1-7 | N P caes | hs, |
| *Croton trinitatis* MILLSP.* | 260992-1-7 | C suff | r, |
| *Dalechampia scandens* L.° | 2606a | LH | hs, r, |
| *Dalechampia* sp. | 061192-1-3 | LH | hs, |
| *Euphorbia hyssopifolia* L. ° | 2789 | T rept | hs, r, |
| *Julocroton* aff. *integer* CHOD. & HASSLER* | 176/2-3 | C suff | hs, |
| *Mabea paniculata* BRUCE ex BENTH.* | 2274 | N P caes | s, |
| *Phyllanthus* cf. *stipulatus* (RAF.) WEBSTER* | 3099 | T scap | hs, |
| *Phyllanthus* sp. | 102/4-12 | T scap | cdm, |
| *Sapium obovatum* KLOTZSCH. ex MÜLL. ARG.* | 116/1-7 | Mi P scap/caes | s, |
| *Sebastiania* cf. *bidentata* (MART.) PAX° | 3167 | C suff | cdm, |
| *Sebastiania glandulosa* (MART.) PAX° | 2375 | C suff | cdm, |
| *Sebastiana hispida* (MART) PAX° | 277/1-7 | C suff | cdm, |
| *Fabaceae* (* det. R. C. BARNEBY; ° det. S. BIDGOOD) | | | |
| *Aeschynomene fluminensis* VELL. | 3421b | N/Mi P caes | hs, |
| *Aeschynomene histrix* POIR. var. *histrix* | 142/1-1 | N P caes | hs, |
| *Aeschynomene sensitiva* SW.* | 192/1-1 | N P caes | hs, |
| *Andira cuiabensis* BENTH. | 3353 | Mes P scap | mu, |
| *Arachis* sp.* | 2381 | LH | cdm, r, |
| *Calopogonium mucunoides* DESV. | 190592-1-7 | LH | hs, |
| *Centrosema* sp.* | 190592-2-1 | LH | hs, |
| *Clitoria rubiginosa* JUSS. ex PERS. | 4289 | LH | hs, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Cratylia argentea* (Desv.) O. Kuntze* | 3415, 3379 | Mi P caes | r, cd, |
| *Desmodium barbatum* (L.) Benth. | 44/1-7 | H scap | r, hs, |
| *Dioclea* cf. *burkartii* R. H. Maxwell | 2047 | LP | if, |
| *Dioclea* sp.* | 3368 | N P caes | r, |
| *Dipteryx alata* Vog.* | 269/1-4 | Mes P scap | mu, |
| *Discolobium psoraliaefolium* Benth. | 5256 | N P saes | hs, |
| *Discolobium pulchellum* Benth. | 2240 | N P caes | hs, p, |
| *Eriosema longifolium* Benth.* | 221/1-1 | C suff | cdm, |
| *Eriosema simplicifolium* (Kunth) G. Don* | 2374 | C suff | cdm, |
| *Galactia glaucescens* Kunth* | 2272 | C frut | r, hs, |
| *Galactia* sp. | 3226, 163/1-13 | C frut | r, |
| *Indigofera lespedezoides* H. B. K. | 3131, 190592-1-3 | H cae | hs, |
| *Indigofera sabulicola* Benth.* | 3460 | C suff | hs, r, |
| *Machaerium* sp. | 3416 | Mi P scap/caes | df, |
| *Machaerium isadelphum* (E. May) Amshoff° | 2178 | LP | r, |
| *Macroptilium lathyroides* (L.) Urb.* | 2490c, 2624 | LH | hs, |
| *Pterocarpus* sp. | 3418, 2300 | Mes P scap | r, |
| *Sesbania emerus* (Aubl.) Urb.* | 3399 | N P/H caes/ | r, |
| *Sesbania virgata* (Cav.) Pers.* | 3277 | N P caes | r, |
| *Teramnus uncinatus* (L.) Sw.* | 2622, 2492b | LH | hs, |
| cf. *Vatairea* sp. | 190991-2-1 | Mi P scap | r, |
| *Vigna* sp. (#1) | 3768, 190592-2-2 | LH | hs, |
| *Vigna* sp. (#2) | 3770 | LH | hs, |
| *Vigna* sp.*(#3) | 2194 | LH | r, |
| *Vigna* sp. (#4) | 3248 | LH | ba, |
| *Gentianaceae* (* det. P. J. M. Maas, ° det. A. Jacobs-Brower) | | | |
| *Coutoubea ramosa* Aubl* | 5249 | T scap | hs, |
| *Curtia tenuifolia* (Aubl.) Knobl. subsp. *tenuifolia* | 2631b, 2626 | T scap | cdm, |
| *Schultesia brachyptera* Cham° | 3140 | T scap | cdm, |
| *Schultesia* aff. *pohliana* Progel* | 139/1-1,123/1-1 | T scap | cdm, |
| *Schultesia pohliana* Progel° | 125/2-4 | T scap | cdm, |
| *Haloragaceae* (det. A. E. Orchard) | | | |
| *Myriophyllum* cf. *aquaticum* (Vell.) Verdc. | 3084 | T hyd | a, |
| *Heliconiaceae* | | | |
| *Heliconia* cf. *marginata* (Griggs) Pittier | 3435 | Mi P herb | p, |
| *Heliconia* sp. | 120992-1-1 | H scap | p, |
| *Hydrocharitaceae* | | | |
| *Egeria najas* Planch. | 3321 | Hyd nat | a, |
| *Limnobium spongia* (Bosc.) Steud. subsp. *laevigatum* (Humb. & Bonpl. ex Willd.) Lowden | 3253 | Hyd nat | a, |
| *Hydrophyllaceae* (det. L. Davenport) | | | |
| *Hydrolea spinosa* L. var. *spinosa* | 2022 | C suff | hs, p, |
| *Iridaceae* | | | |
| *Cipura paludosa* Aubl. | 2481 | G bulb | cdm, |
| indet. sp. (2) | 200991-2-1 | G bulb | cdm, |
| *Lamiaceae* (* det R. M. Harley) | | | |
| *Hyptis brevipes* Poit*. | 270992-2-1 | T scap | hs, |
| *Hyptis crenata* Pohl ex Benth. | 213/1-4 | C suff | r, mu, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Hyptis hirsuta* KUNTH in H. B. K.* | 274/1-2, 3074 | H scap | mu, cdm,? |
| *Hyptis hygrobia* BRIQ.* | 2631h | H scap | cdm, |
| *Hyptis lappacea* BENTH.* | 221192-2-1 | T scap | sgd, |
| *Hyptis lorentziana* O. HOFFM.* | 2619b | T rept | hs, |
| *Hyptis lutescens* POHL ex BENTH.* | 280/1-1 | C suff | mu, |
| *Hyptis microphylla* POHL ex BENTH.* | 100/1-20 | C suff | mu, |
| *Hyptis mutabilis* (RICH.) BRIQ.* | 040192-1-2 | T scap | r, hs, |
| *Hyptis recurvata* POIT.* | 2728 | H rept | mu, |
| *Hyptis suaveolens* (L.) POIT*. | 2628 | C suff | mu, |
| *Hyptis velutina* POHL ex BENTH.* | 271/1-7 | T scap | mu, |
| *Leonotis nepetifolia* (L.) R. BR.* | 2630c | T scap | p, |
| *Plectranthus amboinensis* (LOUR.) SPRENG.* | 2328 | Mi P caes | r, |
| *Lauraceae* (det. L. J. MUSSELMAN) | | | |
| *Cassytha filiformis* L. | 316/1-1 | R | s, |
| *Lemnaceae* (det. V. J. POTT) | | | |
| *Lemna aequinoctialis* WELW. ex HEGELM. | 227/1, 4837 | Hyd nat | a, |
| *Lentibulariaceae* (* det. P. TAYLOR) | | | |
| *Utricularia amethystina* SALZM. ex A. ST. HIL. & GIR.* | 130/1-2 | T ros | cdm, |
| *Utricularia breviscapa* WRIGHT ex GRISEB.* | 3370 | Hyd nat | a, |
| *Utricularia cucullata* A. ST. HIL. & GIRARD* | 2752 | Hyd nat | a, |
| *Utricularia foliosa* L. | 2756 | Hyd nat | a, |
| *Utricularia gibba* L.* | 3411 | Hyd nat | a, |
| *Utricularia hydrocarpa* VAHL | 2763 | Hyd nat | a, |
| *Utricularia lloydii* MERL ex F. LLOYD* | 2750 | T ros | cdm, |
| *Utricularia meyeri* PILG.* | 2754 | T ros | cdm, |
| *Utricularia oliveriana* STEYERM.* | 2757 | T ros | cdm, |
| *Utricularia poconensis* FROMM-TRINTA* | 2761 | Hyd nat | a, |
| *Utricularia pusilla* VAHL* | 2753 | T ros | cdm, |
| *Utricularia simulans* PILGER* | 4590 | T ros | cdm, |
| *Utricularia viscosa* SPRUCE ex OLIVER* | 4430 | T ros | cdm, |
| *Limnocharitaceae* | | | |
| *Hydrocleys* cf. *parviflora* SEUB. | 3286, 3092 | T hyd | hs, |
| *Limnocharis flava* (L.) BUCHENAU | 21565, 2823b | G rhiz | sgp, |
| *Loranthaceae* (det. P. KUJIT) | | | |
| *Psittacanthus cordatus* (HOFFMGG. ex SCHULT.) BLUME | 2297 | R | s, |
| *Psittacanthus corynocephalus* EICHLER | 3332 | R | s, |
| *Lythraceae* (* det. A. LOURTEIG; ° det. T. CAVALCANTI) | | | |
| *Cuphea melvilla* LINDL.* | 3018 | N P caes | r, s, |
| *Cuphea micrantha* H. B. K.° | 166/2-2 | T scap | cdm, r, |
| *Cuphea retrorsicapilla* KOEHNE*° | 159/1-2, 214/1-5 | C suff | cdm, |
| *Rotala mexicana* CHAM. & SCHLTDL. | 58/3-1 | T scap | sgd, |
| *Rotala ramosior* (L.) KOEHNE* | 56/3-1, 59/2-3 | T scap | sgd, |
| *Malpighiaceae* (* det. W. R. ANDERSON, ° det. C. ANDERSON) | | | |
| *Banisteriopsis lutea* (GRISEB.) CUATREC.* | 3424 | LP | r, |
| *Banisteriopsis muricata* (CAV.) CUATREC.* | 010492-2-1 | LP | r, cd, |
| *Banisteriopsis pubipetala* (A. JUSS.) CUATREC.* | 3424 | LP | cd, |
| *Byrsonima cydoniifolia* A. JUSS. in A. ST.-HIL.* | 279/1-1 | Mi P caes | mu, hs, |
| *Heteropterys amplexicaulis* MORONG* | 3420 | LP | r, |
| *Heteropterys marginata* W. R. ANDERSON* | 2266,2274,190992-1-6 | LP | r,cdm |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Mascagnia stannea* (Griseb.) Niedenzu* | 2226, 2228 | LP | r, s, |
| *Peixotoa cordistipula* A. Juss.* | 3369 | LP | r, s, |
| *Stigmaphyllon calcaratum* N. E. Brown° | 48/3-18 | LH | hs, |
| *Malvaceae* (* det. A. Krapovickas, ° det. P. Fryxell) | | | |
| *Gossypium barbadense* L. | | | |
| var. *braziliense* (Macf.) Mauer* | 3388 | N P caes | r, |
| *Hibiscus sororius* L.* | 3481 | C suff | ba, |
| *Malachra radiata* L. | 4286 | T scap | r, |
| *Pavonia angustifolia* Benth.*° | 3016 | C suff | hs, |
| *Pavonia* cf. *aschersoniana* Gürke° | 91/1-3 | C suff | hs, |
| *Pavonia garckeana* Gürke* | 3336 | C suff | hs, |
| *Peltaea riedelii* (Gürke) Standley* | 108/1-12 | C suff | hs, |
| *Sida* cf. *ciliaris* L. | 2716 | T scap | hs, r, |
| *Sida* aff. *ciliaris* L.° | 3104 | T scap | hs, r, |
| *Sida linifolia* Cav.* | 277/1-4 | T scap | hs, |
| *Sida santaremensis* Monteiro* | 108/1-11 | C suff | hs, |
| *Sida spinosa* L.° | 108/1-10 | T scap | hs, |
| *Sida* cf. *viarum* St. Hil.* | 269/1-6 | T scap | hs, |
| *Sidastrum paniculatum* (L.) Fryxell | 3282 | T scap | r, |
| *Maranthaceae* | | | |
| *Thalia geniculata* L. | 3403 | G rhiz | p, |
| *Mayacaceae* (det. A. Lourteig) | | | |
| *Mayaca fluviatilis* Aubl. | 179/1-2 | T? caes? | cdm, hs, |
| *Melastomataceae* (det. S. S. Renner & J. Wurdack) | | | |
| *Acisanthera nana* Ule | 125/2-1 | T caes | cdm, mu, |
| *Acisanthera uniflora* (Vahl) Gleason | 2106 | | |
| *Clidemia bullosa* DC. | 3377 | Mi P caes | mu, |
| *Miconia albicans* (Sw.) Triana | 3384 | Mi P caes | mu, |
| *Miconia prasina* (Sw.) DC. | | | |
| var. *attenuata* (DC.) Cogn. | 3529 | Mi P caes | mu, |
| *Microlicia* sp. | 3334 | N P caes | mu, |
| *Mouriri guianensis* Aubl. | 2298 | | if, |
| *Rhynchanthera grandiflora* (Aubl.) DC. | 3303 | C suff | cdm, |
| *Rhynchanthera novemnervia* DC. | 190592-3-2 | C suff | cdm, |
| *Menispermaceae* (det. G. L. Webster) | | | |
| *Cissampelos pareira* L. | 160991-1-5 | LH | r, |
| *Menyanthaceae* (det. R. Ornduff) | | | |
| *Nymphoides grayana* (Griseb) Kuntze | 76/2-1 | G hyd | a, p, |
| *Mimosaceae* (° det. R. C. Barneby, * det. T. D. Pennington) | | | |
| *Inga disticha* Benth.* | 3406 | Mes P scap | hs, tg, |
| *Inga stenopoda* Pittier* | 2191 | Mes P scap | if? |
| *Inga* sp.* | 3427 | Mes P scap | r, |
| *Mimosa debilis* Benth.° | 211192-1-12 | N P caes | hs, |
| *Mimosa pellita* Humb. & Bonpl. ex Willd.° | 3192 | N P caes | hs, |
| *Mimosa setosa* Benth.° | 3384 | N P caes | hs, |
| *Mimosa somnians* Humb. & Bonpl. ex Willd.° | 190592-1-10 | N P caes | hs, |
| *Mimosa xanthocentra* Mart. | | | |
| var. *mansii* (Mart.) Barneby° | 269/1-1 | N P caes | hs, |
| *Moraceae* | | | |
| *Cecropia* cf. *pachystachya* Trécul | 3044 | Mi/Mes P ros | r, mu, ba, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Myrtaceae* (* det L. R. LANDRUM) | | | |
| *Eugenia biflora* (L.) DC.* | 283/1-3 | N P caes | mu, |
| *Eugenia* cf. *bimarginata* DC.* | 118/1-1 | N P caes | mu, |
| *Eugenia* cf. *punicifolia* (KUNTH) DC.* | 2323, 2551b | N P caes | mu, |
| *Najadaceae* (det. R. M. LOWDEN) | | | |
| *Najas conferta* (A. BR.) A. BR. | 3398 | T hyd | a, |
| *Nyctaginaceae* (det. A. FURLAN) | | | |
| *Boerhavia diffusa* LAM. | 2334 | H rept | r, |
| *Neea hermaphrodita* S. MOORE | 3043 | N P caes | mu, |
| *Nymphaeaceae* (det. J. H. WIERSEMA) | | | |
| *Nymphaea amazonum* MART. & ZUCC. | 3360 | G hyd | a, |
| *Nymphaea gardneriana* PLANCH. | 3081 | G hyd | a, |
| *Ochnaceae* (det. P. SASTRE) | | | |
| *Ouratea castaneifolia* (DC.) ENGL. | 2307 | N P caes | s, |
| *Sauvagesia erecta* L. subsp. erecta | 213/1-6 | H caes | cdm, |
| *Sauvagesia tenella* LAMARCK | 271/1-8 | T scap | mu, |
| *Onagraceae* (° det. E. ZARDINI) | | | |
| *Ludwigia affinis* (DC.) HARA° | 3485 | T? scap | ba, |
| *Ludwigia decurrens* WALTER | 2462 | N P scap | ba, |
| *Ludwigia elegans* (CAMB.) HARA° | 2821 | C suff | ba, hs, |
| *Ludwigia grandiflora* (MICHX.) GREUTER & BURDET° | 185/1-1 | T? caes | p, ba, |
| *Ludwigia helminthorrhiza* (MART.) HARA ° | 3305 | Hyd nat | a, |
| *Ludwigia hexapetala* (H. & A.) ZARD., GU. & RAVEN | 270992-3-2 | T? | ba, |
| *Ludwigia inclinata* (L.f.) GOMEZ | 77/4-3 | H rept/hyd | a, sgd, |
| *Ludwigia irwinii* T. P. RAMAMOORTHY° | 2815 | Mi C suff | sgd, |
| *Ludwigia lagunae* (MORONG) HARA° | 3313 | H? scap | r, |
| *Ludwigia leptocarpa* (NUTT.) HARA° | 3465a | T? scap | bs, |
| *Ludwigia longifolia* (DC.) HARA | 2814 | Mes T/H scap | hs, p, |
| *Ludwigia nervosa* (POIR.) HARA | 3304b | N P caes | ba, |
| *Ludwigia octovalvis* (JACQ.) RAVEN | 197/1-1 | N T scap | sgd, r, |
| *Ludwigia peploides* (H. B. K.) RAVEN° | 2813 | H rept/hyd | a, sgd, |
| *Ludwigia rigida* (MIQ.) SANDW° | 195/1-2 | H? scap | cdm, |
| *Ludwigia sedoides* (HUMB. & BONPL.) HARA | 3317 | H hyd | a,p, |
| *Orchidaceae* (det. P. J. CRIPP) | | | |
| *Galeandra styllomisantha* (VELL.) HOEHNE | 102/1-11 | G bulb | cdm, |
| *Habenaria aricaensis* HOEHNE | 3005 | G bulb | hs, p, |
| *Sarcoglottis hassleri* (COGN.) SCHLTR. | 132/2-4 | G bulb | cdm, |
| *Habenaria* sp. | 3010 | G bulb | hs, |
| indet. sp. (#5) | 141/2-3 | G bulb | cdm, |
| *Passifloraceae* | | | |
| *Passiflora cincinnata* MAST. | 131092-3-1 | LH | hs, |
| *Passiflora foetida* L. | 2203 | LH | hs, |
| *Passiflora giberti* N. E. BROWN | 3216 | LH | r, |
| *Passiflora misera* KUNTH in H. B. K. | 2575 | LH | hs, |
| *Piperaceae* | | | |
| *Piper* cf. *tuberculatum* Jacq. | 2259 | Mi P caes | r, |

*Poaceae* (*Paspalum* det. G. H. RUA; *Eragrostis, Aristida* det. S. DE CASTRO-BOECHAT; *Digitaria, Axonopus* det. Z. E. RÚGOLO DE GRASAR; *Luziola* det. M. PIEPENBRINK)

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Acroceras zizanoides* (H. B. K.) DANDY | 260392-1-10b | H caes | cdm, mu, |
| *Andropogon bicornis* L. | 3008 | H caes | r, hs, |
| *Andropogon gayanus* KUNTH | 3078 | H/C caes | r, |
| *Andropogon hypogynus* HACK. | 3337 | H/C caes | tg, hs, |
| *Andropogon selloanus* HACK. | 200/1-6 | H caes | cdm, tg, |
| *Aristida capillacea* LAM. | 132/1-1 | T caes | mu, |
| *Aristida setifolia* H. B. K. | 3409, 177/2-2 | H caes | mu, |
| *Aristida* sp. (#3) | 3048 | H caes | mu, |
| *Axonopus* cf. *complanatus* (NEES ex TRIN.) DEDECCA | 138/1-9 | T caes | hs, tg, |
| *Axonopus leptostachyus* (FLÜGGE) HITCH. | 061291-2-11 | H/C caes | tg, hs, |
| *Axonopus purpusii* (MEZ) CHASE | 051191-1-12 | H caes | hs, p, |
| *Brachiaria adspersa* (TRIN.) PARODI | 14/1-3 | T rept | hs, |
| *Brachiaria decumbens* STAPF | 3254, 3310 | G rhiz | ba, cd, c, |
| *Brachiaria fasciculata* (SW.) PARODI | 3223, 3234 | T caes | hs, r, |
| *Brachiaria humidicola* (RENDLE) SCHWEICKERDT | 190592-2-5 | H caes | hs, r, |
| *Brachiaria mutica* (FORSKAL) STAPF | 060892-1-1 | G rhiz | p, |
| *Brachiaria plantaginea* (LINK) HITCH. | 3367 | T caes | cdm, c, |
| *Cenchrus echinatus* L. | 040192-1-1a | T caes | r, |
| *Chloris* sp. | 2824 | T caes | r, |
| *Coelorhachis aurita* (STEUD.) CAMUS | 3022 | H caes | hs, |
| *Cynodon dactylon* (L.) PERS. | 3461 | H rept | r, |
| *Dactyloctenium aegyptiacum* (L.) WILLD. | 311291-1-5 | H caes | r, |
| *Digitaria bicornis* (LAM.) R. & S. | 020892-1-6 | T? caes | be, |
| *Digitaria fuscescens* (PRESL.) HENR. | 71/1-1 | H rept | p, sgd, |
| *Echinochloa colona* (L.) LINK | 2608c | T caes | r, p, |
| *Echinochloa crus-galli* (L.) P. B. | 131291-1-7 | T caes | r, |
| *Echinolaena gracilis* SWALLEN | 107/4-2 | H? rept | cdm, |
| *Eleusine indica* (L.) GAERTN. | 2090 | T caes | r, |
| *Elionurus muticus* (SPRENG.) O. KUNTZE | 5255 | H caes | hs, |
| *Eragrostis amabilis* (L.) WRIGHT & ARNOTT | 280991-1-2 | T caes | r, |
| *Eragrostis articulata* (SCHRANK) NEES | 77/2-2 | T caes | mu, |
| *Eragrostis bahiensis* (SCHRAD.ex SCHULT.) SCHULT. | 061291-2-12 | H caes | r, cd, |
| *Eragrostis hypnoides* (LAM.) BRITTON | 160991-4-1 | T rept | r, be, |
| *Eragrostis japonica* (THUNB.) TRIN. | 020892-1-4 | T rept/caes | be, |
| *Erianthus* cf. *asper* NEES | 3390 | H caes | cd, p, r, |
| *Eriochloa dystachia* H. B. K. | 129/1-1 | T? caes | cdm, |
| *Gymnopogon fastigiatus* NEES | 107/4-3 | G rhiz | cdm, |
| *Hemarthria altissima* (POIR.) STAPF & HUBB. | 17/2-2 | H? caes | hs, p, r, |
| *Hymenachne amplexicaulis* (RUDGE) NEES | 3255 | H/T hyd,rept | a, p, hs, |
| *Hymenachne donacifolia* (RADDI) CHASE | 010492-1-4 | H hyd | a, |
| *Hyparrhenia rufa* (NEES) STAPF | 190592-2-6 | H caes | r, |
| *Ichnanthus procurrens* (NEES ex STAPF) SWALLEN | 110292-4-1 | H caes | cdm, |
| *Imperata brasiliensis* TRIN. | 3400 | H caes | hs, r, |
| *Imperata tenuis* HACKEl | 107/4-4 | H caes | p, hs, |
| *Lasiacis* cf. *sorghoidea* (DESV.) A. HITCH. & CHASE | 3410 | H caes | df, r, |
| *Leersia hexandra* SWARTZ | 128/1-5 | G rhiz | hs, p, a, |
| *Leptochloa virgata* (L.) P. BEAUV. | 2609 | H rept | hs, p, a, |
| *Leptocoryphium lanatum* (H. B. K.) NEES | 3001 | H caes | cdm, |
| *Loudetia flammida* (TRIN.) HUBBARD | 3406 | T? caes | r, |
| *Luziola fragilis* SWALLEN | 3284 | H hyd | a, |
| *Luziola subintegra* SWALLEN | 3381 | H hyd | a, r, |
| *Mesosetum ansatum* (TRIN.) KUHLM | 110291-4-2 | H caes | cdm, |
| *Mesosetum cayennense* STEUD. | 3237 | H caes | cdm, |
| *Oryza* sativa L. | 3366 | T caes | c, |
| *Oryza* cf. *subulata* NEES | 3251 | H? caes | p, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Otachyrium piligerum* SEND. & SOD. | 190592-1-4 | H? caes | cdm, hs, |
| *Panicum* cf. *boliviense* HACKEL | 3007 | H caes/rept | hs, |
| *Panicum cayennense* LAM. | 115/1-1 | T caes | cdm, |
| *Panicum chloroticum* NEES in TRIN. | 49/4-3 | T rept/hyd | a, hs, p, |
| *Panicum laxum* SW. | 3003 | T caes | hs, |
| *Panicum maximum* JACQ. | 110292-1-1 | H caes | r, |
| *Panicum mertensii* ROTH | 5023 | H (G?)caes | p, |
| *Panicum repens* L. | 040892-2-2 | H rept/hyd | cdm, p, |
| *Panicum rudgei* ROEM. & SCHULT. | 040892-2-3 | H caes | cdm, |
| *Panicum stenodes* GRISEB. | 107/5-1 | H caes | cdm, |
| *Panicum tricholaenoides* STEUD. | 061291-2-13 | H/C caes/herb | hs, |
| *Panicum* sp. | 3374 | H caes | r, |
| *Paratheria prostrata* GRISEB. | 10/2-1 | H rept | hs, |
| *Paspalidium paludivagum* (HITCH. & CHASE) PARODI | 3220 | H rept/caes | hs, p, |
| *Paspalum almum* CHASE | 3000b | H caes? | hs, |
| *Paspalum conjugatum* SWARTZ | 2701 | H? caes? | hs, |
| *Paspalum coryphaeum* TRIN. | 110292-1-3 | H caes | mu, |
| *Paspalum delicatum* SWALLEN | 180/1-1, 136/1-1 | T rept/hyd | cdm, |
| *Paspalum denticulatum* TRIN. | 200/1-7 | H caes | cdm, |
| *Paspalum eucomum* NEES | 3096 | H caes | cdm, |
| *Paspalum* cf. *lenticulare* H. B. K. | 3097, 3021 | H caes | cdm, |
| *Paspalum lenticulare* H. B. K. f. *intumescens* (DOELL) KILLIP | 3013 | H caes | cdm, |
| *Paspalum limbatum* HENR. | 3000a | H caes | p, hs, |
| *Paspalum lineare* TRIN. | 3431 | H caes | cdm, |
| *Paspalum morichalense* DAVIDSE, ZULOAGA & FILGUEIRAS | 030891-1-1 | T? rept/hyd | a, cdm, |
| *Paspalum multicaule* POIR. | 3124 | T caes | cdm, |
| *Paspalum notatum* FLÜGGE | 251291-1-2 | | |
| *Paspalum pallens* SWALLEN | 2702a | H? caes | r, |
| *Paspalum paniculatum* L. | 251191-1-1 | H caes | r, |
| *Paspalum pictum* EKMAN | 166/2-1 | T caes? | cdm, |
| *Paspalum repens* BERG | 3249 | H rept/hyd | ba, r, |
| *Paspalum* Sect. *Parviflora* sp. | 3477 | H caes | r, |
| *Paspalum stellatum* HUMB. & BONPL. ex FLÜGGE | 107/3-1 | H caes | cdm, |
| *Paspalum subciliatum* CHASE | 190592-1-6a | H? caes | cdm, |
| *Paspalum wettsteinii* HACKEL | 114/1-2, 2694 | H caes | r, |
| *Paspalum wrightii* HITCH. & CHASE | | H caes | r, p, |
| *Pennisetum pedicellatum* TRIN. cf. subsp. *unispiculum* BRUNKEN | 020592-3-2a | H caes | r, |
| *Pennisetum* cf. *polystachion* (L.) SCHULT. | 020592-3-2b | H caes | r, |
| *Reimarochloa acuta* (FLÜGGE) HITCHC. | 10/2-2, 3230 | T/H caes | hs, |
| *Rhynchelytrum repens* (WILLD.) HUBB. | 040192-1-3 | H rept | r, |
| *Sacciolepis angustissima* (STEUD.) KUHLM. | 128/1-6 | H caes | cdm, |
| *Sacciolepis myura* (LAM.) CHASE | 190592-3-4 | H caes | cdm, |
| *Schizachyrium microstachyum* (DESV.) ROS., ARR. & IZAG. | 3751 | H caes/rept | r, |
| *Schizachyrium tenerum* NEES | 040892-2-6 | H caes/rept | r, cdm, |
| *Setaria parviflora* (POIR.) KERGUÉLEN | 60/2-4 | T/G rhiz | hs, |
| *Setaria vulpiseta* (LAM.) ROEM. & SCHULT. | 180892-3-1 | | |
| *Sorghastrum setosum* (GRISEB.) HITCHC. | 102/3-7 | | |
| *Sorghum bicolor* (L.) MOENCH subsp. *arundinaeum* (DESV.) STAPF in PRAIN | 251291-1-1 | H caes | r, |
| *Trachypogon* cf. *spicatus* (L.f.) O. KUNTZE | 117/1-1, 107/4-6 | H caes | cdm, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Polygalaceae* (° det. M. d. C. M. MARQUES) | | | |
| *Polygala* cf. *adenophylla* A. W. BENN | 2204 | T scap | hs, |
| *Polygala celosioides* A. W. BENN° | 2817 | T scap | cdm, |
| *Polygala* cf. *filiformis* A. ST. HIL | 198/1-2 | G bulb | cdm, |
| *Polygala hygrophila* H. B. K.° | 100/1-17 | | |
| *Polygala longicaulis* H. B. K. var. *maior* CHOD.° | 2423 | T scap | cdm, |
| *Polygala leptocaulis* TORR. & A. GRAY var. *leptocaulis*° | 219/1-3, 200/1-15 | T scap | hs, cdm, |
| *Polygala timoutoides* CHOD. var. *timoutoides*° | 131092-5-1 | T scap | cdm, |
| *Polygala violacea* AUBL.° | 050192-1-2 | H caes | cdm, |
| *Securidaca rivinaefolia* A. ST. HIL.° | 2275b | N P caes | cd, r, |
| *Polygonaceae* (° det. A. M. CIALDELLA; * J. BRANDBYGE) | | | |
| *Coccoloba mollis* CASAR. | 5039, 2810 | N P caes | s, |
| *Polygonum ferrugineum* WEDD.° | 2497b | T/H rept | a, p, |
| *Polygonum hydropiperoides* MICHX.° | | T/H rept | p,a, |
| *Polygonum punctatum* ELLIOT° | 2463 | T/H rept | p,a, |
| *Triplaris americana* L.* | 3469 | Mi P scap | hs, if, |
| *Triplaris gardneriana* L.* | 2296 | Mi P scap | if, |
| *Triplaris mato-grossensis* BRANDBYGE* | 3329, 2636 | Mes/Mi P scap | if, |
| *Pontederiaceae* | | | |
| *Eichhornia azurea* (SCHWARTZ) KUNTH | 5307 | H hyd | a, |
| *Eichhornia crassipes* (MART.) SOLMS | 2302 | Hyd nat | a, |
| cf. *Heteranthera reniformis* RUIZ. & PAV. | 3326 | H hyd | a, |
| *Pontederia cordata* L. var. *ovalis* (MART.) SOLMS | 2497a | G rhiz | p, |
| *Pontederia cordata* L. var. *lancifolia* (MUHL.) TORREY | 2282 | G rhiz | p, |
| *Pontederia rotundifolia* L.f. | 2311 | G rhiz | a, p, |
| *Pontederia subovata* (SEUB.) LOWDEN | 3079 | G rhiz | a, p, |
| *Portulacaceae* | | | |
| *Portulaca* cf. *fluvialis* LEGR. | 2470 | T scap | sgi, |
| *Portulaca* cf. *oleracea* L. | 4661 | T scap | sgi, |
| *Portulaca* sp. (2) | 2480 | T scap | hs, |
| *Rubiaceae* (° det. E. CABRAL;* det J. H. KIRKBRIDE) | | | |
| *Alibertia edulis* (L. C. RICH.) A. C. RICH.* | 3041 | P caes | mu, |
| *Alibertia myrciifolia* SPRUCE ex K. SCHUM.* | 3057 | P caes | mu, |
| *Borreria capitata* (RUIZ. & PAV.) DC.* | 2377 | T scap | sgd, |
| *Borreria* cf. *cupularis* DC.° | 115/1-2 | T scap | sgd, |
| *Borreria eryngioides* CHAM. & SCHLTDL.° | 2483b, 2709 | T scap | sgd, |
| *Borreria poaya* (ST. HIL.) DC.° | 214/1-10 | T scap | sgd, |
| *Borreria tenella* (H. B. K.) CHAM. & SCHLTDL.° | 99/3-12, 195/1-8 | T scap | sgd, |
| *Borreria tenuis* DC.* | 169/1-4 | T scap | sgd, |
| cf. *Borreria* sp. (#6) | 3151 | T rept | sgp, |
| cf. *Borreria* sp. (#5) | 3150b | T caes | sgp, |
| cf. *Borreria* sp. (#9) | 3134 | T caes | sgp, |
| *Chomelia* cf. *martiana* MÜLL. ARG.°. | 211192-1-1 | N P caes | hs, |
| *Diodia kuntzei* K. SCHUM.* | 2773 | T rept | sgd, |
| *Diodia wunschmannii* K. SCHUM.° | 3162 | T rept | sgd, |
| *Faramea sessilifolia* (H. B. K.) DC.* | 3526 | P caes | if, |
| *Genipa americana* L. | 2377b | Mi P scap/caes | s,r, |
| *Limnosipanea schomburgkii* HOOK f. | 4369 | T scap | hs, cdm, |
| *Limnosipanea* sp. | 4420, 180/1-6 | T scap | hs, cdm, |
| *Palicourea crocea* (SW.) ROEM. & SCHULT.* | 2409,2471 | N P caes | s, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Psychotria carthaginensis* JACQ.* | 210/1-1,319/1-2 | N P caes | s, |
| *Richardia grandiflora* (CHAM. & SCHLTDL.) SCHULT. & SCHULT.* | 2315 | T scap | sgd, |
| *Simira rubescens* (BENTH.) BREMEK. ex STEYERM.*° | 3522 | Mi P caes | s, |
| *Sipanea veris* S. MOORE* | 2524 | T? rept | (s), hs, |
| *Spermacoce tenuior* L.* | 149/1-7 | T? scap | sgd, |
| *Spermacoceodes glabrum* (MICHX.) O. KUNTZE var. *rectum* BACIG° | 2778 | T? scap | sgd, |
| *Sphinctanthus microphyllus* K. SCHUM. | 2224 | N P caes | hs, |
| *Tocoyena formosa* (CHAM. & SCHLTDL.) K. SCHUM. | 3042 | Mi/N P caes | r, mu, |
| indet. sp. (#12) | 3526 | N P caes | s, |
| indet. sp. (#1) | 2377 | H? | cdm, |
| *Rutaceae* (det. J. R. PIRANI) | | | |
| *Zanthoxylum rigidum* H. & B. ex WILLD. | 3060, 3076 | N P caes | mu, |
| *Sapindaceae* (det. M. S. FERRUCCI) | | | |
| *Cardiospermum halicacabum* L. var. *halicacabum* | 2080 | LH/T | sgd, |
| *Magonia* cf. *pubescens* ST. HIL. | 3385b | P scap | mu, |
| *Paullinia pinnata* L. | 2286 | LH | hs, p, r, |
| *Paullinia spicata* BENTH. | 5324 | LH | r, |
| *Sapindus saponaria* L. | 2229 | Mes P scap | if? |
| *Serjania glutinosa* RADLK. | 3291 | LH | hs, |
| *Serjania adenophylla* M. S. FERRUCCI | 2829 | LH | hs, |
| *Scrophulariaceae* | | | |
| cf. *Agalanis* sp. | 5327 | T scap | hs, |
| *Angelonia* cf. *angustifolia* BENTH. in DC. | 2486 | H scap | hs, |
| *Bacopa dubia* CHODAT & HASSL. | 5331a | T rept | hs, |
| *Bacopa* cf. *monnieroides* (CHAM.) ROB. | 4791, 5334 | T/H? rept | hs, |
| *Bacopa* cf. *repens* WETTST. | 5331b | T rept | hs, p, a, |
| *Bacopa myriophylloides* (BENTH.) WETTST. | 3285 | T rept | hs, p, |
| *Bacopa* sp.(#3) | 5140 | T hyd? | sgi, |
| *Bacopa* sp. (#7) | 2019, 10/4-5 | T hyd? | sgi, |
| *Bacopa* sp. (#11) | 3093 | T caes | hs, |
| *Buchnera palustris* (AUBL.) SPRENG. | 3165 | H scap | cdm, |
| *Conobea scoparioides* (CHAM. & SCHLTDL.) BENTH. | 2335, 3177 | T scap | sgd, |
| cf. *Geochorda* sp. | 3201 | T scap | hs, |
| cf. *Benjaminia reflexa* (BENTH.) EDWALL (= *Herpestis reflexa* BENTH.) | 2822a | T hyd | p, a, |
| *Mecardonia procumbens* L. | 5330 | H? rept | sgd, |
| *Schizosepala matogrossensis* G. M. BARROSO | 5310 | T scap | sgd, |
| *Scoparia dulcis* L. | 2208 | T scap | sgd, |
| *Scoparia montevidensis* (SPRENG.) R. E. FRIES | 4667 | T scap | sgd, |
| *Simaroubaceae* | | | |
| *Simarouba versicolor* ST. HIL. | 3055 | Mes P scap | mu, |
| *Smilacaceae* | | | |
| *Smilax* sp. | 3026 | LP | mu, |
| *Solanaceae* | | | |
| *Cestrum* sp. | 3019 | N P caes | r, |
| *Schwenckia* sp. | 3133, 3086 | T? caes | r, |
| *Solanum aculeatissimum* JACQ. | 3459 | H? scap | r, |
| *Solanum americanum* MIL. | 2599 | C suff | r, |
| *Solanum glaucophyllum* DESF. | 2781 | N P caes | hs, |

Tab. 1 (continued)

| Taxon | Voucher | life form type | Habitat |
|---|---|---|---|
| *Solanum sisymbriifolium* LAM. | 2176, 3458 | N P caes | r, |
| *Solanum* sp. (#6) | 4008, 2082 | H scap | r, |
| *Solanum* sp. (#5) | 4009, 3459b | C suff | r, |
| *Sterculiaceae* (det. C. L. CRISTÓBAL) | | | |
| *Byttneria genistella* TR. & PL. | 3371 | C suff | hs, |
| *Byttneria rhamnifolia* BENTH. | 321/1-5 | C frut | r, s, |
| *Byttneria scabra* L. | 3207 | C frut | cdm, |
| *Guazuma ulmifolia* LAM. var. *ulmifolia* | 2396 | Mes P scap | r, |
| *Guazuma ulmifolia* LAM. var. *tomentella* K. SCHUM. | 3430 | Mes P scap | r, |
| *Helicteres gardneriana* A. ST. HIL. & NAUD. | 138/1 | N P caes | hs, s, r, |
| *Melochia arenosa* BENTH. | 3080 | C frut | hs, |
| *Melochia parvifolia* H. B. K var. *parvifolia* | 3198, 2395 | C frut | hs, |
| *Melochia pyramidata* L. var. *hieronymi* K. SCHUM. | 3280 | P/C caes/frut | hs, |
| *Melochia simplex* A. ST. HIL. | 163/1-17, 99/3-13 | C frut | hs, |
| *Melochia spicata* (L.) FRYXELL | 3126, 2492 | C frut | hs, |
| *Tiliaceae* (det. M.S. FERRUCCI) | | | |
| *Corchorus argutus* Kunth in H. B. K. | 166/2-7, 163/1-16 | T? scap | hs, |
| *Turneraceae* (det. M. M. ARBO) | | | |
| *Piriqueta cistoides* (L.) GRISEB. subsp. *caroliana* (WALT.) ARBO | 100/1-16 | T/C scap | hs, r, |
| *Piriqueta* cf. *corumbensis* MOURA | 4182 | T/C scap | hs, r, |
| *Typhaceae* | | | |
| *Typha* cf. *domingensis* PERS. | 2826 | G rhiz | p, |
| *Ulmaceae* | | | |
| *Celtis* cf. *spinosa* SPRENG. | 3288 | Mi P scap | r, |
| *Verbenaceae* | | | |
| *Baillonia amabilis* BOCQ. ex BAILL. | 3433 | Mi P caes | hs, |
| *Lantana trifolia* L. | 211192-1-4 | H scap | hs, |
| *Lippia alba* (Mill.) N. E. BROWN | 2868 | C frut | hs, |
| *Stachytarpheta* cf. *elatior* SCHRAD. ex SCHULT. | 5337 | T scap | r, |
| *Vitex cymosa* BERT. ex SPRENG. | 2501 | Mes P scap | hs, |
| *Vitaceae* (° det. B. DESCOINGS; * det. S. BIDGOOD) | | | |
| *Gmelina arborea* ROXB. * | 2358 | Mi P caes | r, |
| *Cissus erosa* L. C. RICH° | 121/1-3 | LP | hs,p, |
| *Cissus verticillata* (L.) NICOLSON & JARVIS, subsp. *verticillata* (= *C. sicyoides* L.) | 4014, 2820 | LP | mu, r, p, |
| *Cissus* cf. *spinosa* CAMBESS. | 2290, 183/1-5 | LP | p, |
| *Cissus* sp. (#3) | 4354 | LP | r, p, |
| *Vitex* sp. | 2262, 3434 | LP | r, |
| *Vochysiaceae* | | | |
| *Vochysia divergens* POHL | 3309 | Mes P caes | hs, if, |
| *Xyridaceae* (det. P. J. M. MAAS) | | | |
| *Xyris* cf. *rigida* KUNTH | 3144 | H? ros | cdm, |
| *Xyris savannensis* MIQ. | 3193 | T ros | cdm, |
| *Zingiberaceae* (° det. P. J. M. MAAS) | | | |
| *Costus arabicus* L.° | 2533 | G rhiz | mu, |
| cf. *Hedychium coronarium* KÖNIG | 3141 | G rhiz | r, c? |

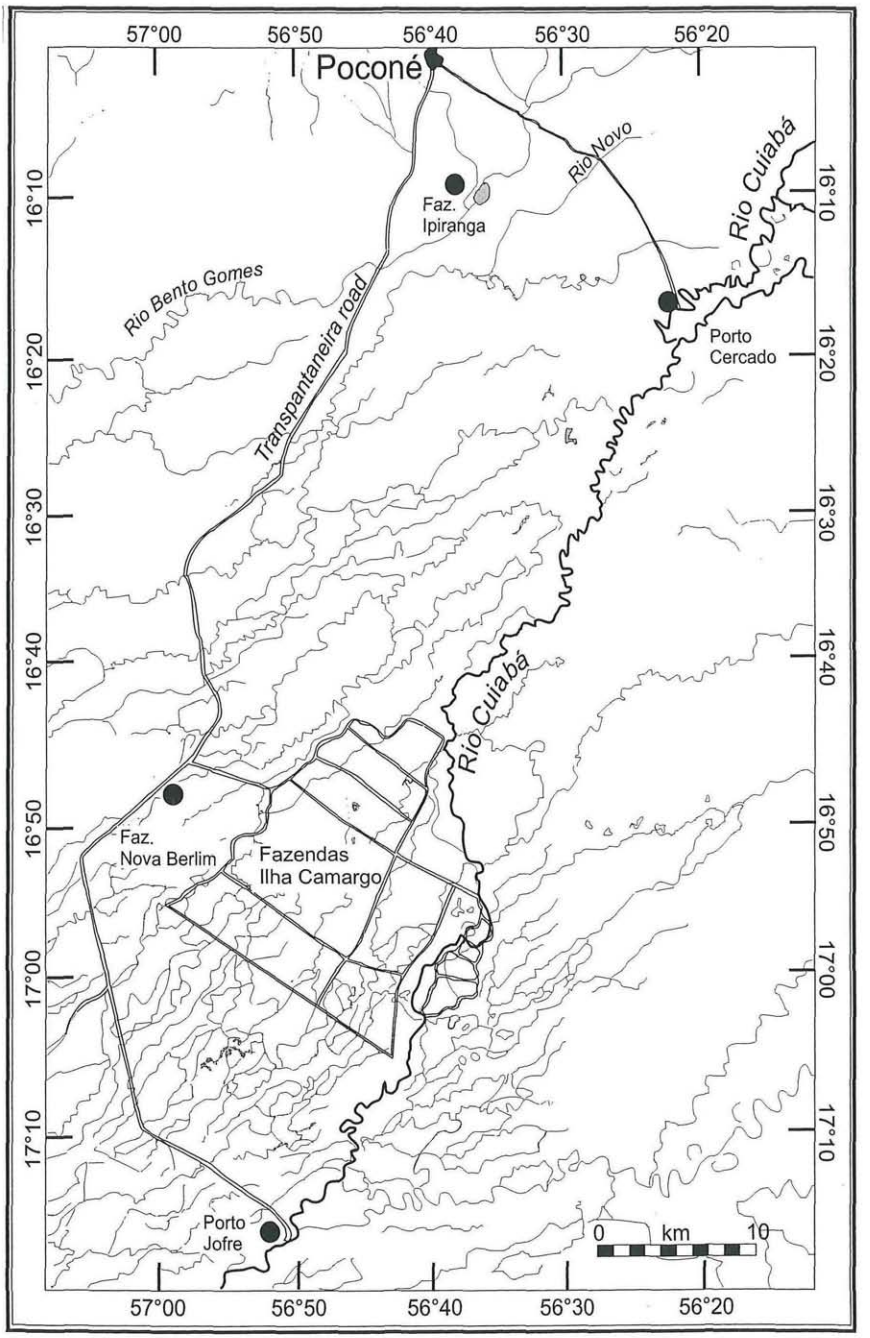



Fig. 3. Map of the study area.

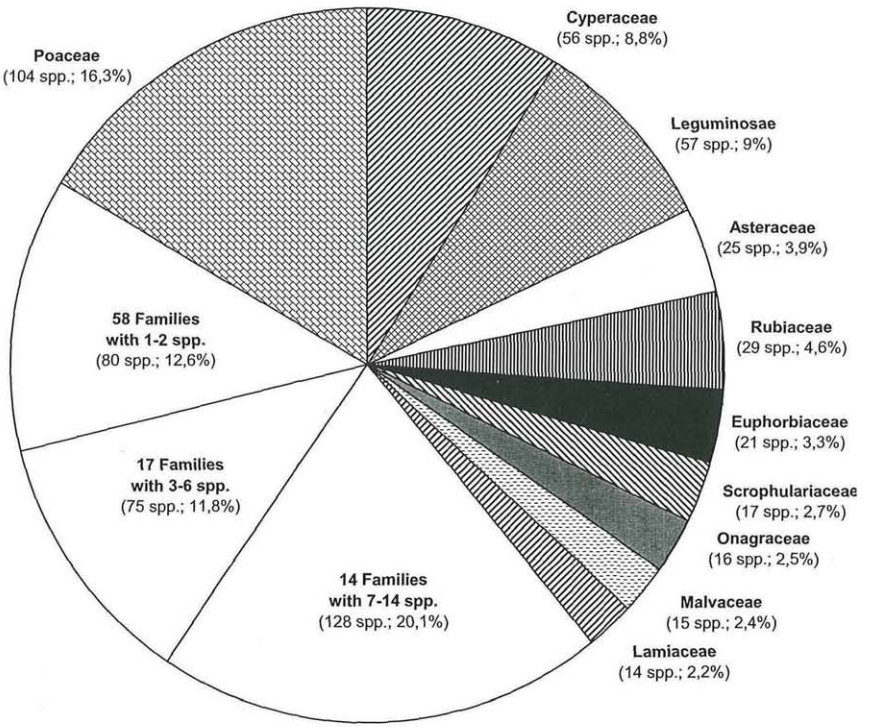



Fig. 4. Diagram of floristic composition with the ten families richest in species separately notated.

## 5. Major Vegetation Types

Within the lowlands of the study area, differences in elevation do not exceed several meters, but are decisive for duration and heigth of inundation during the wet season. Generally, the level of flooding increases from north to south but a considerable variation within each stand is due to a dentritic system of natural drainage channels forming a slighty undulating landscape. The five major herbaceous vegetation types and three woody vegetation types (Fig. 6) occurring in the lowlands can be arranged according to this gradient of inundation. Vegetation types are named according to local names or by dominant or indicating species if such termes are lacking.

### 5.1 Herbaceous Vegetation

There are three distinctive types of hyperseasonal savanna the study area, the small tussock grasslands on higher sites in the northern

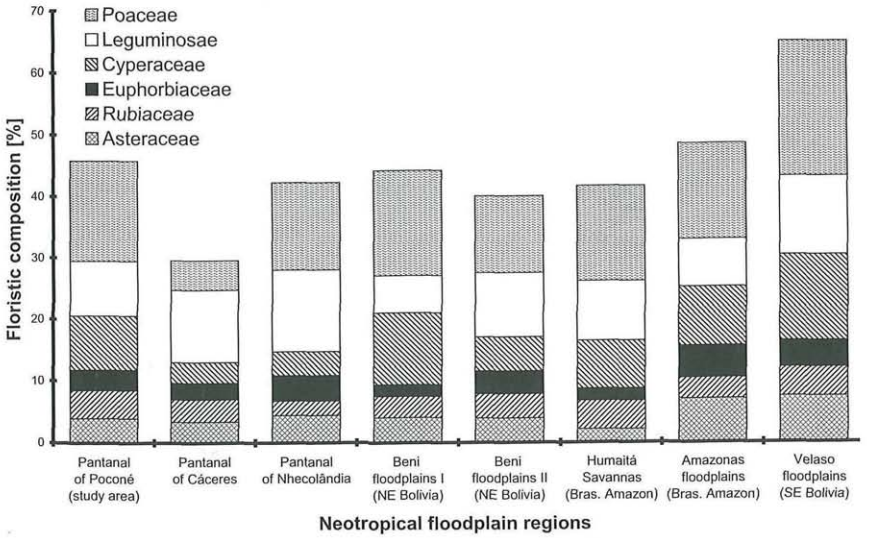



Fig. 5. Diagram of floristic similarity on family level of eight neotropical floodplains. Shown as portion of the six largest families in percentage of total species number respectively.

Data sources: "Pantanal of Cáceres": PRANCE & SCHALLER 1982; "Pantanal of Nhecolândia": POTT V. J. & al. 1986b; "Beni floodplains I": HAASE & BECK 1989; "Beni floodplains II": BECK 1984; "Humaitá savannas: JANSSEN 1986; "Amazon floodplains": JUNK & PIEDADE 1993; "Velaso floodplains": BRUDERRECK 1989.

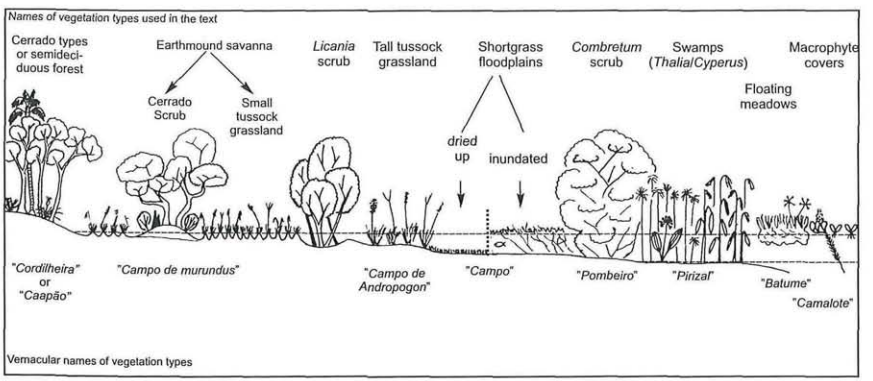



Fig. 6. Sketch profile showing vegetation types of flooded lowlands. Dotted lines represent high water and low water levels respectively.

part, the tall tussock grasslands covering the central part of the study area and shortgrass floodplains on stands underlying pronounced changes during wet and dry phase.

5.1.1 Small Tussock Grasslands – "Campos de murundus". – Extending over large areas in the northern part of the study area, this type is dominated by small bunchgrasses and -sedges. However, elevated earthmounds, regionally called "murundus", are interspersed within these grasslands (Fig. 7–10) forming a distinct and species rich (>250 spp.) type of hyperseasonal savanna. Although plains are flooded by rainwater up to a few decimeters for only 3–12 weeks during the year, the poorly drained soils are saturated with water for almost half a year. These grasslands consist mainly of perennial grasses such as *Panicum stenodes, Axonopus purpusii, Leptocoryphium lanatum, Andropogon selloanus* and *Mesosetum ansatum*. Similar to bunchgrass communities from floodplains in northern Bolivia, described by HAASE & BECK 1989 and BECK 1983, a pronounced microrelief of seasonally inundated depressions or gullies and nonflooded mounds ("micromounds") of a few decimeters in height can be observed. In the study area, termites, ants and earthworms contribute to the raising of these micromounds slightly above highwater level while being held together by the roots of caespitose herbs growing on them. Beside the species of bunchgrasses mentioned above, tussocks of sedges (e.g. *Rhynchospora hirta, R. barbata, R. armerioides*) and forbs such as *Hyptis hygrobia* are quite frequently occuring species on these micromounds. During the few weeks of drying up, shortliving annuals and saprophytes (e.g. *Burmannia* spp., *Utricularia* spp., *Syngonanthus gracilis, Eriocaulon guyanense*) rapidly develop in the gullies between the mounds. The remaining dry season, gullies are almost free from any vegetation.

5.1.2 Tall Tussock Grasslands – "Campo de *Andropogon*". – Another type of hyperseasonal savanna dominated by species of tall bunchgrasses (Fig. 11) such as *Andropogon hypogynus* and *Axonopus leptostachyus* covers to great extent the central part of the study area. The grasslands develop on loamy to clayey soils, which mainly belong to Dystric Planosol and Cambisol soil groups. In contrast to the small tussock grasslands mentioned above, water level during the three months of inundation can be as high as 0.5–1.0 m.

During flooding, dense macrophyte vegetation (e.g. *Leersia hexandra, Sagittaria guyanensis, Hyptis lorentziana*) develops between the grass tussocks, while most of these macrophytes starve away during dry season. Then, groundwater level can be as deep as 2.5 m and frequent burnings occur. Contrary to the small tussock grasslands of the earthmound savanna, no pronounced microrelief could be observed.

On slightly wetter sites, almost monodominant stands of *Paspalum wrightii* substitute the grasslands dominanted by *Andropogon hypogynus* and *Axonopus leptostachyus*.

5.1.3 Shortgrass-Floodplains. – On lowlands underlying a pronounced change between inundation (= aquatic phase) and severe drying

up of the soils during dry season (= dry phase), a seasonal change in vegetation cover occurs (Fig. 12, 13). During a hydrological cycle, floristic composition and vegetation cover changes drastically. However, some small prostrate herbs such as *Diodia kuntzei*, *Hyptis lorentziana, Ludwigia inclinata, Caperonia castaneifolia* or the decumbent dwarf shrub *Hydrolea spinosa* remain growing in both phases. These species show a remarkable dimorphorphism during one hydrologic cycle, surviving as nanous land forms with short leaves and creeping shoots during dry season. During aquatic phase, these species are growing as submerged aquatic macrophytes forming large, flexible leaves and shoots well adapted even to strong water flows; their flowering peak also occurs during the aquatic phase.

During dry season, grassy vegetation can consist up to 50% of small therophytes forming a sparse herblayer up to 15 cm tall. This grassland is heavily grazed and in many places burnt every year. Dominating species are the grasses *Reimarochloa acuta, Panicum laxum, Setaria parviflora* and sedges such as *Cyperus haspan* and *Eleocharis minima,* or a creeping forb (*Murdannia* sp. nov. inedit.). About 11 subtypes of this grassland vegetation can be distinguished according to soil type (sandy vs. clayey texture) and duration of inundation. Quite common species on clayey soils are *Thevetia peruviana, Sphinctanthus microphyllus*, several legume shrubs (e.g. *Mimosa* spp., *Senna* spp.) and *Cardiospermum halicacabum. Chamaesyce thymifolia, Croton trinitatis* and *Richardia grandiflora* are characteristic species of sandy alluvial sediments.

During the early part of the rainy season, usually from october onward, the lowlands begin to inundate. Generally, the low-lying floodplains are covered with blackwater for more than half of the year. Most of the species dominating during dry season decay rapidly and aquatic macrophytes (e.g. *Pontederia* spp., *Nymphoides grayana*) develop. They germinate from seeds stored in the upper soil horizon or regrow from storing organs (e.g. *Eleocharis* spp., *Nymphaea* spp).

Independent of textural differences of the underlying soils, floristic composition of the aquatic macrophyte vegetation is quite similar throughout the study area. Nevertheless, somewhat different vegetation types establish in the different types of natural channels draining the floodplains. Some of them, locally called "vazantes", dry up only for some weeks of the year, others never dry up. The latter, so called "corixos" with stagnant water or "corregos" with flowing water during dry phase are covered by species with emergent floating leaves. Some species such as *Eichhornia azurea*, or *Nymphaea amazonum* form almost pure stands (Fig. 14). Frequently occuring species within these vegetation types are stoloniferous grasses (e.g. *Hymenachne amplexicaulis, Leersia hexandra, Coelorhachis aurita*).

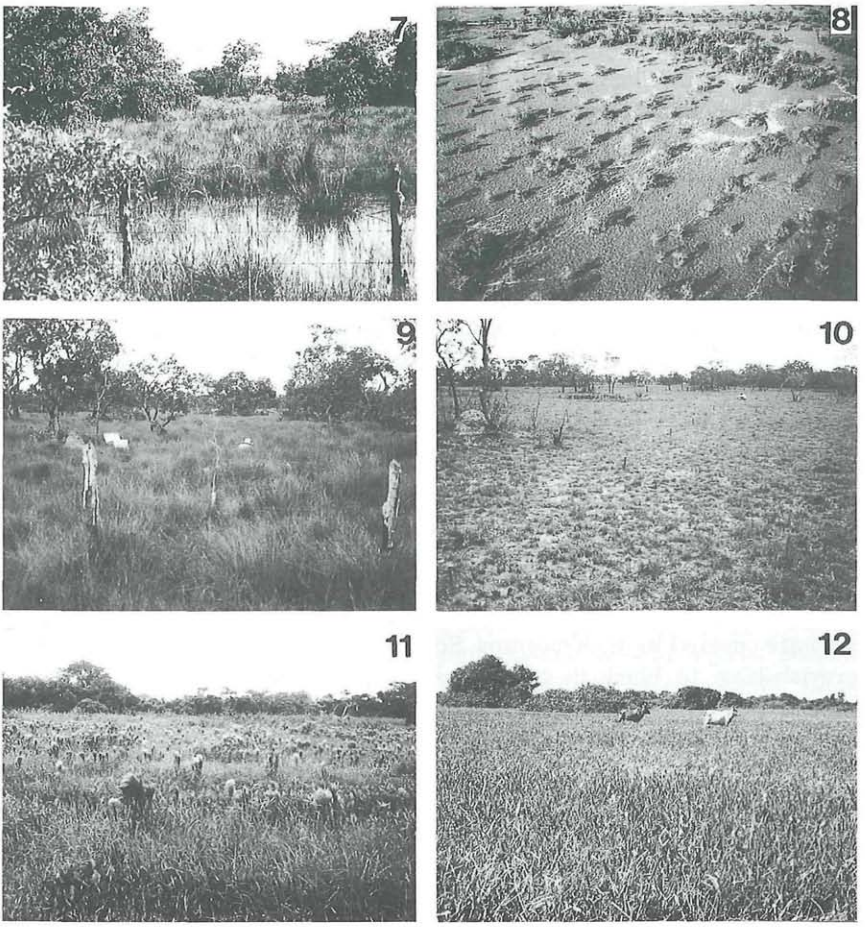
5.1.4 Floating Meadows – "Batume". – In the southern part of the study area, large flood-plains, permanently inundated or drying up for short periods in some years only, are covered by floating meadows. The vegetation of floating meadows consists merely of *Oxycarium cubense*, with a few additional species such as *Pityrogramma calomelanos, Pontederia cordata* var. *ovalis* and *Eupatorium candolleanum* (Fig. 15). Sometimes, meadows compacted by water flow can carry even bushes such as *Alchornea castaneifolia* or *Cecropia* trees. The roots and stolons of *Oxycarium* grow within finely textured detritus and decomposing plant parts, forming a solid detritus layer sometimes as thick as one meter. There is no problem for alligators (Caiman jacare) or rodents such as Capybara (Hydrochoeris hydrochaeris) to walk on these floating meadows and the alligators are known to build their nests on it. Different varieties of floating meadows, built up by *Brachiaria* cf. *decumbens*, *Leersia hexandra* or *Imperata brasiliensis,* can be found within the *Oxycarium* meadows.

5.1.5 Swamps of rhizomatous geophytes – Almost pure stands of the tall papyrus-like sedge *Cyperus giganteus* (Fig. 16) or the marantaceous *Thalia geniculata* (Fig. 17) occur in depressions, that are shallowly inundated for almost the whole year and flooded up to a depth to 1.5 m for three to five months. Large areas of the southern part of the study area are covered by such swamps. Soils of these stands are strongly anoxic greyish-blue to blackish-grey clays. Only a few species can establish themselves in such conditions. Both *Cyperus* and *Thalia* are characterized by thick rhizomes rich in aerenchymatic tissue and growing within the upper 10 cm of the soils. Other frequently occurring species in these swamps are the legume *Discolobium pulchellum,* and the vine *Cissus spinosa*. Less frequent herbs are *Echinodorus teretoscapus, E. paniculatus, Pontederia cordata* var. *ovalis, Nymphaea amazonum* and some winders such as *Tassadia berteriana* and *Ipomoea tenera*.

5.1.6 Free Floating Macrophyte covers. – *Salvinia auriculata* or *Pistia stratiotes* frequently form covers on shallow water bodies in drainage ditches along the Transpantaneira highway (Fig. 18). While dying off during dry season, *Salvinia* and *Pistia* recover rapidly during aquatic phase. Their stands additionally contain a variety of free floating macrophytes such as aquatic *Utricularia* spp., *Limnobium laevigatum, Lemna aequinoctialis, Azolla filiculoides, Egeria najas* or *Ricciocarpus* cf. *natans*. The somewhat more stable permanent water bodies of oxbow lakes are generally overgrown by covers of *Eichhornia crassipes*.

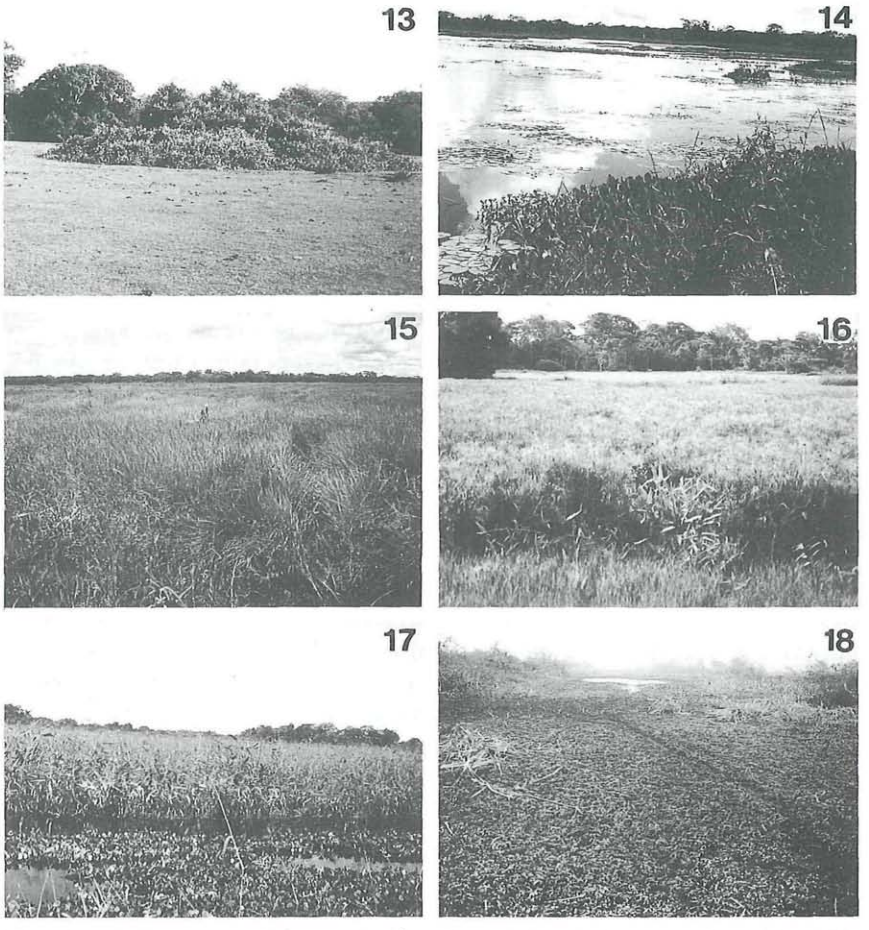
## 5.2 Woody Vegetation Types

5.2.1 Cerrado scrub on earthmounds – "Murundus". – The most striking type of vegetation in the study area is perhaps the "campo de murundu"-savanna (Fig. 6–10). "Murundus" are approximately circular




Figs. 7–12. Vegetation of the Pantanal region. – Fig. 7. General aspect of an earthmound savanna with small tussock grassland and (relatively grand) elevated earthmounds. – Fig. 8. Aerial view of an earthmound savanna with *Licania*-gallery forest in the background. – Fig. 9. Detailed view of an earthmound savanna: small tussock grassland with interspersed (relativelly little) earthmounds. – Fig. 10. Same site after being burned, showing the gully and micromound structure of the grassland soil and termite mounds on top of the earthmounds. – Fig. 11. Tall tussock grassland *of Andropogon hypogynus* with tussocks of *A. bicornis* interspersed (dense whitish inflorescences). – Fig. 12. Inundated shortgrass floodplain with dominance of *Pontederia cordata* var. *lancifolia*.

earthmounds dotted within the seasonally inundated small tussock grasslands described above. They raise 0.3 up to 1.0 m above the level of the surrounding lowlands. Measurements carried out in the study area using




Figs. 13–18. Vegetation of the Pantanal region. – Fig. 13. Same stand as in Fig. 12, now completely dried up and covered by short grasses (foreground); a scrub of *Combretum lanceolatum* (midground) and interspersed forest island (background). – Fig. 14. Natural drainage channel with running water throughout the year and floating leaves of *Nymphaea amazonum*. – Fig. 15. Floating meadows of *Oxycarium cubense*. – Fig. 16. Swamp of *Cyperus giganteus*. – Fig. 17. A permanently inundated swamp dominated by *Thalia geniculata*. – Fig. 18. Dried up drainage ditch with *Salvinia auriculata*.

point-centered-quarter method (MUELLER–DOMBOIS & ELLENBERG 1974) revealed that dimensions of these earthmounds vary considerably, ranging from 1 to 80 $m^2$. They occupy approximately 5–6% of total area of the "campo de murundu"-savanna. On top of these earthmounds, termite nests are usually found. Theories recently reviewed by PONCE & CUNHA 1993 at-

tribute the rising of earthmounds above surrounding soil surface to either abiotic factors such as abiotic erosion (ARAUJO NETO & al. 1986), to differential abiotic accumulation or to biotic accumulation due to termite activities (OLIVEIRA FILHO 1986, 1992).

The earthmounds studied feature woody vegetation with *Curatella americana* as the most frequently occurring species. Other common species are trees such as *Andira cuyabensis* and *Astronium fraxinifolium*, reaching more than 6 m in height, and the shrubs *Annona aurantiaca, Byrsonima orbignyana, Alibertia edulis, Eugenia biflora, Erythroxylum anguifugum, Zanthoxylum hasslerianum* and *Annona dioica*, forming a shrub layer of up to 2 m in height. Usually, a third vegetation layer of herbaceous plants such as *Hyptis recurvata, H. crenata, H. microphylla, Cyperus* aff. *aggregatus, Bromelia balansae* and species from the surrounding grassland, is developed. Altogether, floristic composition of 60 "murundus" examined comprises approximately 240 species of vascular plants.

5.2.2 *Combretum* Scrub – "Pombeiro". – Almost monodominant stands of *Combretum lanceolatum* or *C. laxum* or mixed stands of both species are widespread throughout the study area. In the northern part, they appear as scrub of 10–100 meters in diameter interspersed in grassy campos (Fig. 13), whereas large areas extending over several square miles may be covered or at least dominated by "pombeiro" in the southern part of the study area. The *Combretum* shrubs of the study area show a particular growth form. Branches of juveniles grow orthotropically while distal branches of older shrubs hang over as far as to touch the soil. Here, adventitious roots are formed, fixing the vinelike branches, which sprout into the surroundings. The dense scrub, up to 4 m high, establish themselves either on sandy or clayey soils and seem to tolerate both longlasting inundations and desiccation of soils. Therefore, *Combretum* species are regionally known as vigorous invaders of pasture and heavily combatted by local farmers. "Pombeiro" is poor in species and *Combretum* srub generally consists of a few species only. Common species comprise the vines *Cissus* cf. *spinosa* and *Paullinia pinnata*, treelets of *Licania parvifolia, Psychotria* sp., *Coccoloba mollis* or shrubs such as *Cuphea melvilla* and *Erythroxylum* cf. *anguifugum*.

5.2.3 *Baillonia* Scrub – "Sarã". – The *Salix*-like shrub *Baillonia amabilis* forms dense monodominant stands. They occupy up to 100 square meters within seasonally flooded swamps of *Thalia geniculata* or in grassy floodplain vegetation.

5.2.4 *Licania* Scrub. – Natural drainage channels within the "Campos de murundus" in the northern part of the study area are covered by a scrub or low gallery forest up to 6 m in height consisting mainly of *Licania parvifolia*. As the collection of plants from this vegetation type is far from being complete, only some common species can be

mentioned. Beside the dominant *Licania*, the most common species are *Alchornea schomburgkiana*, *Vochysia divergens*, *Triplaris* cf. *americana* and *Faramea sessilifolia*.

## 6. Conclusions

Distribution pattern of vegetation is primarily caused by small differences in relief not exceding a few centimeters or decimeters and resulting in slightly different water regimes, and secondly in different alluvial soil types.

The combination of these abiotic factors is reflected in by the preferencial occurrence of certain life form groups. Drier sites are occupied by vegetation types dominated by caespitose hemicryptophytes, whereas communities of rhizomateous geophytes dominate on wetter sites. Highest percentages of therophytes are found in communities on sites with pronounced changes of dry phase and aquatic phase.

Some of the vegetation types of the study area, especially those grouped as hyperseasonal savannas, resemble strongly those types described from other savanna regions in the neotropics, e.g. the shortgrass communities of the Beni savannas (BECK 1984, HAASE & BECK 1989, HAASE 1989, 1990), the hyperseasonal savanna types of the Llanos dos Mojos (BRUDERRECK 1989), or the herbaceous savanna types of the Humaitá savannas (JANSSEN 1986).

The study area shares about a hundred plant species with other neotropical floodplains.

At genus or familiy level, floristic similarity is even higher, but seems to decrease with increasing distance to the study area. Even thouth the area is relatively well studied due to ist good accessibility via the Transpantaneira highway, the floristic survey contains a number of species recorded for the first time for Mato Grosso and three new to science (see Tab. 1). Further phytogeographic and comparative taxonomic studies are necessary for a better understanding of floodplain vegetation throughout South America.

## 7. Acknowledgement

Many thanks to G. GOTTSBERGER for supervising the research project.

I am grateful to all persons who contributed to the identification of many of the collected specimen. Their names are listed in the Tab. 1. I wish to thank Sr. João LOSANO and Sr. DINIZ, owners of Fazenda Ipiranga and Faz. Nova Berlim, respectively, for the kind permission to carry out field work on their land and for providing us with lodging.

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