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Quantitative botanical diversity descriptors to set conservation priorities in Bakhuis Mountains rainforest, Suriname

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Within the framework of a flora and vegetation study carried out in the Bakhuis Mountains in Suriname, South America, descriptors of plant species and habitat biodiversity were used to set local-scale botanical conservation priorities. Species' diversity and habitat heterogeneity indices, relative scarcity, fragility indices for habitats and ratios of species of concern, such as rare, endemic or subendemic taxa, were processed through a multi-criteria analysis to determine a conservation priority index. One of the main objectives of the study was the setting of defensible conservation priorities at a local and regional scale. Results are discussed, with a focus on land use planning and biodiversity conservation in one of the three major evergreen rainforest regions in the world. Among the 13 vegetation types described in the study perimeter, two that were restricted in area were considered to be of higher concern for wildlife conservation: meso-xeric dwarf thickets found on latero-bauxitic hardcap hilltops, with a distinctive floristic composition, and *Buxus citrifolia* mesic forest patches, described for the first time in Suriname. © 2011 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2011, **167**, 94–130.

ADDITIONAL KEYWORDS: biodiversity – *Buxus citrifolia* – meso-xeric thickets – quantitative analysis – vascular plants – vegetation.

INTRODUCTION

Setting conservation priorities in a vegetation mosaic as complex and remote as an evergreen rainforest is both essential and a great challenge. An adequate knowledge of each of the ecosystem components is necessary to enable comparison and ranking of the various habitats for conservation planning purposes. Traditional field methods can be employed to assess vegetation typology, species' composition, distribution and scarcity, species' and habitat diversity and structural characteristics to inform this ranking. However, when the study area is large and inaccessible, field results must be interpolated over the entire study area, and this requires the application of more interpretative techniques. Furthermore, a comparison of data at a regional scale is required to inform conservation planning, but this is limited by the heterogeneity of available datasets from other sites. The characterization of the vegetation and floristics that was undertaken as part of an Environment and Social Impact Assessment of a potential bauxite mining project in Suriname provided a unique opportunity to carry out this research.

Extensive field surveys were undertaken to provide relevant baseline information for the prediction and management of the potential impact of bauxite mining over the largely unstudied area in the Bakhuis Mountains, Suriname. This required the characterization of the diversity of forest habitats and the determination of the species' diversity and sensitivity of the terrestrial vegetation over an extensive area using standard analyses. However, the challenge arose in determining how to contextualize this information in a regional conservation framework. A

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multi-criteria analysis tool was required to enable a comparative assessment and ranking of conservation priorities at the regional scale; both the different habitats and the sensitivity of vegetation types distinguished at a local scale had to be taken into account.

A typology was proposed to distinguish the vegetation types observed in the study perimeter. Each vegetation type was characterized by the forest structure analysed through the population density and dimensions of the trees and woody climbers. Several quantitative and semi-quantitative indicators of species' and habitat biodiversity were proposed: (1) species' diversity and habitat heterogeneity indices; (2) ratio of species considered to be of concern for conservation; (3) habitat scarcity index; (4) habitat vulnerability index; and (5) ratio of monocotyledons to dicotyledons, the latter being paraphyletic. These indicators enabled an overall evaluation to be made of conservation importance, comparing these vegetation types through a unique multi-factor index combining them. One of the most important objectives of the study was the setting of defensible conservation priorities at local and regional scales.

MATERIAL AND METHODS

Regional context of the study area

The Guiana Shield covers approximately 2.5 million km^2 in the north-east of South America. The Shield is bordered by the Orinoco, Rio Negro and Amazon Rivers and lies between 4°S/11°N and 48°E/58°W. The Guiana Shield thus comprises the Venezuelan regions south and east to the Orinoco River (Bolivar, Amazonas and Delta Amaruco States), the part of Brazil north of the Rio Negro and Amazon Rivers (Amapa, Roraima, northern Para and Amazonas), eastern Columbia and an area referred to as 'the Guianas': Guyana (231 800 km^2), Suriname (173 840 km^2) and French Guiana (Guyane) (84 000 km^2). Harbouring over 15 000 vascular plant species, approximately one-third of which are endemic, the Guianas are considered to be one of the three major tropical wilderness eco-regions in the world (Mittermeier *et al.*, 1990).

The Guianas region is characterized by its Precambrian bedrock, the Guiana Shield itself. In the upland interior, this bedrock formed a peneplain. The peneplain is largely eroded, with fragments of residual laterite hardcaps forming tabular hills and mountains. These hills and mountains are eroded and incised by the hydrographic network and are sometimes covered by detrital crystalline materials, such as white sands, which harbour dry forests and savanna vegetation. In the lower lying coastal plain, Quaternary marine alluvia overlie the bedrock where it dips downwards. At a regional scale, the highest peaks are sandstone formations, such as the Roraima plateaus shared by Brazil, Guyana and Venezuela, the Pakaraima Mountains in Guyana, Tafelberg in Suriname and the tepuis in Venezuela (de Granville, 1991).

The vegetation of the Guiana Shield is composed of a patchwork of natural and anthropogenic ecosystems (forest, swamps, savannas and agriculture), with evergreen tropical rainforests covering the vast majority of the territory: the forest continuum in the Shield constitutes 25% of the remaining rainforests worldwide. The main vegetation types encountered in the Guiana Shield can be listed as follows, according to Lindeman & Mori (1989): strand vegetation (beach vegetation), mangrove, savanna, herbaceous swamp, swamp forest, marsh forest, seasonal evergreen forest (or seasonal wet forest), mountain vegetation and inselberg (granite outcrop) vegetation.

Suriname can be divided into three main geomorphological areas. The Coastal Plain is a strip of land along the coast, 50–70 km wide, lying 0–11 m above mean sea level (amsl). This area is differentiated into the 'Young Coastal Plain' (Demerara Formation), consisting largely of swampy, clay alluvial deposits, and the 'Old Coastal Plain' (Coropina Formation), consisting of swampy clays and sand ridges of marine and river origin. Mangroves cover the saltwater and brackish areas near the coastline, and are gradually replaced inland by fresh water swamps and shrub vegetation, followed by different types of herbaceous swamps, swamp forest and mesic forest on well-drained ground.

The Savanna Belt (Zanderij Formation) is situated at about 10 m amsl. This area is characterized by poor sandy soils with variable clay content, covered by shrub savannas, xeric to mesic forest and, in places, swamp forest and herbaceous swamp vegetation.

The Interior, covering some 85% of the country, consists of alternating hills and lowlands and low to medium mountains (reaching 1230 m at Juliana Top, the highest point), mostly covered by pristine evergreen tropical rainforests (FAO, 1996). The Bakhuis study area is located in the Interior (Fig. 1).

Low population pressure has contributed to the impressive record of Suriname of having among the highest proportions of intact natural forest (> 80%) compared with other tropical countries. The forests form a continuum with those of neighbouring Guyana and French Guiana, which are also largely undisturbed. There is a large overlap between the Surinamese flora and those of its neighbouring countries and, although there is a low rate of endemism in the country itself, endemism is much more significant at

Figure 1. Map of Suriname with the location of the Bakhuis Mountains Bauxite Exploration Concession and Central Suriname Natural Reserve.

the Guiana Shield regional scale (35%). In addition to the Bakhuis Mountains area, other ironstone and laterite-capped hills occur in the north-eastern and central parts of Suriname in the Brownsberg, Nassau and Lely Mountains and in the south-central parts of the country, to the west of Juliana Top and in the Kayser and Eilerts de Haan Mountains. Significant botanical data are available for Brownsberg, Lely and Nassau, but only limited and fragmentary knowledge exists for the southern regions. The Central Suriname Natural Reserve (CSNR) was declared in 1998 and was recognized as a World Heritage Site by the UNESCO World Heritage Committee in 2000. At its nearest point, the western boundary of the CSNR lies approximately 15 km east of the Bakhuis study area. Covering some 1.6 million ha, the reserve comprises a vast tract of undisturbed tropical rainforest, encompassing a variety of ecosystems, including the upper watershed of the Coppename River. Its forests harbour a high diversity of plant and animal life, and the CSNR represents one of the largest protected areas of undisturbed, uninhabited primary forest in the tropics. As a result of the enormous size of the reserve and difficult access, a characterization of the vegetation types and a detailed floristic inventory have yet to be carried out in the reserve.

Local context of the study area

The study area extends over almost 2800 km^2, representing approximately one-third of the Bakhuis Mountain range. The Bakhuis Mountains reach an elevation of 1000 m amsl in the most southerly extent, but are generally characterized by a series of hills and plateaus that reach a maximum elevation of 500 m amsl, interspersed with steep valleys and a few larger plains. Almost the entire area is covered with primary tropical rainforest. Except for the main track and network of secondary roads and exploration lines within the exploration concession area, the area is mostly inaccessible.

The first recorded botanical survey undertaken in the northern section of the Bakhuis Mountains was led by Maas and Florchultz in 1964–65 with vouchers housed at Utrecht University, now transferred to the Leiden Herbarium. Several specimens are cited in the *Flora of Suriname* (Pulle *et al*., 1932–1984) and in the first issues of the *Flora of the Guianas* (Görts-van Rijn *et al*., 1985–2009). The lowlands in the northern and north-western areas of the Bakhuis Mountains were surveyed during the 1970s as part of the development of the Bakhuis–Apoera railroad, increasing the knowledge of the vegetation and flora between the Kabalebo area and the upper Nickerie River (Maas, 1971; FAO, 1996) and along the railroad track. The Suriname State Forest Service (SBB) carried out a commercial timber inventory in 1985 in the north of the Bakhuis Mountains, with limited available quantitative data. Orchid collections were also made in the area with specimens housed at the BBS National Herbarium of Suriname (Werkhoven, 1986). In 1994, Teunissen & Van Troon studied the canopy trees in the northernmost area of the concession.

The main vegetation in the concession can be broadly described as follows:

Inundated forests ('wetland forest' or 'forest on hydromorphic ground'): *marsh forest* on temporarily or seasonally flooded soil and *swamp forest* on permanently inundated soil. Until now, few data were available on these forest types in the area (Lindeman & Moolenaar 1959). Teunissen (1978) provided a vegetation map of the Apoera area showing marsh forest dominated by *Mora excelsa* Benth. bordering the Corantijn River region.

Mesic forest ('high dryland forest' or 'terra firme forest'), occurring on relatively well-drained soils on hilltops and slopes. Mesic forest is the most abundant vegetation type in the Bakhuis area, with high levels of biodiversity and of commercial timber. *Mora bukea* forests, dominated by *Mora gonggrijpii* (Kleinh.) Sandwith, are mentioned without detailed forest records available for the area. 'Liana' forests, reported as being the remnants of pre-Columbian shifting cultivation fields, are mentioned by Lands Bosbeheer (LBB, Suriname Forest Service).

Meso-xeric vegetation (or 'savanna' forest) occurs on impermeable laterite and bauxite outcrops with sparse topsoil, alternately waterlogged during the rainy season and dry during the dry season. This vegetation type, ranging from medium height forest to dwarf brushy thicket, depending on soil depth, is the most mature sylvigenic state in all stony areas with very thin topsoil.

Field surveys and selection of study sites

Three field surveys were undertaken across a range of seasons: long dry season (24 September–21 October 2005), long rainy season (1–21 April 2006) and short rainy season (29 November–16 December 2006). To obtain a representative sample of the vegetation of the concession area, 50 study sites were selected for detailed assessment. Within the study sites, 10 transects with forest profiles and 11 plot series were studied. Additional floristic collections were carried out whilst traversing tracks and cut lines en route to study areas and in the vicinity of camps.

Floristic inventory

In order to understand the botanical diversity of the study area, a list of terrestrial vascular plant species, including monocotyledons, dicotyledons and ferns, was compiled. Except for a few records, the aquatic vegetation of the area was not specifically studied. Cronquist's classification of flowering plants, still commonly used by the flora of the Guianas botanists, was followed in this article (rather than APG III, 2009; the standard system used in this journal). Some plants were positively identified in the field and were thus not collected as herbarium specimens. Herbarium voucher specimens were collected and preserved, by pressing and drying, in order to deposit full sets at the University of Paramaribo Herbarium (BBS) with duplicates at the Cayenne Herbarium (CAY) and at the University of Utrecht Herbarium (U), now transferred to Leiden (L), when possible. In total, 626 vouchers were prepared, 308 in October 2005, 240 in April 2006 and 78 during December 2006. Vouchers were mainly identified on site and in CAY. Several taxonomic specialists also kindly contributed to the identification of some species. The species' list and herbarium collections were increased by a large photographic collection.

Vegetation typology and description

The vegetation types in the study area were described on the basis of the following factors.

Physical features: (1) geomorphology; (2) topography; and (3) soil moisture.
Floristic composition: (1) dominant and characteristic species (e.g. *Croton argyrophylloides* Müll.Arg., *Mora gonggrijpii* trees, *Euterpe oleracea* Mart. palms, terrestrial bromeliads); and (2) presence of distinctive life-forms (lianas, abundant mosses, palms, epiphytes).
Population structure: (1) tree and liana diameter [diameter at breast height (dbh) $\geq$ 5 cm for trees, dbh $\geq$ 2 cm for lianas]; (2) class distribution, height and tree density; (3) average canopy height and heterogeneity; and (4) presence of emergent trees.

Plot series: forest structure and biodiversity indices

Forest structure and biodiversity indices (species' diversity/alpha diversity and habitat heterogeneity/beta diversity) were compared for different vegetation types in the study area using plot series sampling. This allowed an in-depth analysis of vegetation to be made over a relatively small surface area. All vascular plants in the plots were sampled, including the understorey layer, trees and woody climbers. The data provided by these plot samples complement the floristic inventory by including sterile plant specimens that were not otherwise collected (although their identification is more difficult than that of fertile specimens). This sampling protocol also provides additional detailed data at a large scale (over a small surface area) of the vegetation described in the forest profiles, with information on the composition, dimensions and density of the understorey plant populations.

Eleven plot series, generally consisting of five 100-m^2 plots per series (but, in a few cases, three, four or six plots), were delimited in patches of homogeneous vegetation representative of the variety of vegetation types in the study area. Individual plots were circumscribed by a line fixed to flag-taped stakes, enabling a complete inventory to be made of all accessible species rooted inside the perimeter.

The following data were recorded for each plot:

1. Number and abundance of all vascular plants with preliminary identifications.
2. Number and abundance of individual trees (dbh $\geq$ 5 cm) with preliminary identification based on vernacular names provided by local 'tree spotters' (Surinamese residents, not trained in formal botanical sciences, but with extensive and reliable knowledge of trees and plants with their vernacular names).
3. Diameter at breast height of trees (dbh $\geq$ 5 cm) and lianas (dbh $\geq$ 2 cm).
4. Estimated height of trees (dbh $\geq$ 5 cm) and lianas (dbh $\geq$ 2 cm) using a measured reference tree for calibration.
5. Vouchers for taxonomic identification in cases in which the local name was ambiguous, including samples of fallen leaves and fruits, and notes on the characteristics of the bark and trunk, including the presence and shape of buttresses, to aid further identification.

Forest structure

Forest structure is presented graphically for each plot series with dbh on the *x*-axis and estimated height on the *y*-axis. The tree density (number of individual trees with dbh $\geq$ 5 cm per ha) is also indicated.

Species' diversity and habitat heterogeneity indices

From the species' count per plot and for each plot series at a study site, a graph of the average number of species (*y*-axis) was plotted against the surface area (*x*-axis), enabling the calculation of indices for species' diversity and for habitat heterogeneity, on the basis of a semi-logarithmic normal model species–area curve [$y = \lambda \ln(x) + \gamma$], where *y* is the number of species and *x* is the surface area (Gleason, 1922; Fisher, Corbet & Williams, 1943; Preston, 1948; Palmer, 1990). The slope λ is a determinant of the species' diversity (SDI) and the ratio $-\gamma/\lambda$ is a determinant of the habitat heterogeneity (HHI), both independent of the sampling area (Bordenave, 1996). Eleven plot series were assessed for all accessible vascular plants (i.e. terrestrial herbs, shrubs, treelets, trees and climbers).

Family importance value

The family importance value (FIV; Mori *et al*., 1987) was calculated for each plot series. This index enables a comparison to be made of species' composition with relative dominance (linked to tree size), relative abundance (linked to the number of individuals) and relative diversity (linked to the number of species) for families of trees (dbh ≥ 10 cm) present in the plots.

Profiles – distribution of vegetation types

At a smaller scale (over larger surface areas), the distribution of vegetation types was undertaken by generating forest profiles along transect lines. Sampling was limited to medium and large trees (dbh ≥ 10 cm) and climbers (dbh ≥ 5 cm). Nine profiles of 500–1000 m in length and 5 m in width were studied over forest transects, providing tree population structure and composition data over areas of 2500–5000 m^2 (0.25–0.5 ha) each. The total surface area covered by these profiles is 2.5 ha (25 250 m^2).

Vegetation profiles showing the change in vegetation type in conjunction with topography, soil moisture and pedological features were compiled along eight transects (Fig. 2). An additional transect was made in a dwarf meso-xeric thicket found in the southern part of the study area.

At each location, geomorphological features, such as rock outcrops, ridges, slopes, creeks and rivers, and soil moisture were noted. Linear distances and elevation were recorded or estimated by GPS, and were validated with a barometric altimeter. The average height of tree crowns, density of trees and lianas, and aspects of the undergrowth were also noted and sketched for each profile.

Species of concern for conservation

Species of concern were designated on the basis of a number of criteria: (1) listed as 'Rare' or 'Vulnerable' by the International Union for Conservation of Nature (IUCN), the World Conservation Monitoring Center of the United Nations Environment Program (UNEP-WCMC) and/or the Conservation and Sustainable Management of Trees Comity (CSMTC); (2) listed by the Convention on International Trade in Endangered Species (CITES) as species vulnerable to exploitation through trade; (3) listed as 'totally protected' in French Guiana (Ministry Bill, July 5th, 2001) – although most of these species are presumably also rare in Suriname, some may be more abundant outside French Guiana, especially if their distribution is disjunct from their main distributional range in French Guiana (Hoff *et al*., 2002); (4) listed on the French Guiana 'Natural Heritage Plant Species List' by the French Guiana Natural Heritage Scientific Board in1997 (CSRPN, Conseil Scientifique Régional du Patrimoine Naturel); (5) endemics at regional or country scale, or eco-endemics (endemism for a distinctive and restricted biota, e.g. inselberg outcrop or laterite hardcap) at the limit of or disjunct from their main distributional range or with a circum-Amazonian distribution [species with distributional ranges extending throughout northern South America and sometimes Central America, but with a large gap in the Amazonian region, explained by past climatic changes (Prance, 1973; de Granville, 1992, 1994)].

The CSRPN criteria for the determination of species with conservation value (Bordenave, 1997) are as follows.

1. Endemism to a country or phytogeographical region (e.g. the Guiana Shield).
2. Natural rarity of a species (including those present in well-represented habitats).
3. Limit/disjunction to main distributional range: subpopulations found in restricted areas.
4. Fragility as a result of seasonal dependence on different biota.
5. Link to a particularly restricted or threatened habitat.
6. Increasing rarity as a result of habitat reduction or exploitation, particularly for species with slow renewal of generations.
7. Unique characteristics of the species: cultural, pedagogic or historical value.
8. Particular agronomic, forestry, pharmaceutical or other economic value.
9. Phylogenetic uniqueness: single species representing a taxonomic group.
10. Vulnerability to pollution, particularly for riverine, aquatic and estuarine species.

Quantitative biodiversity indices for setting conservation priorities

To be able to determine which vegetation types in the study area should be considered of premium, moderate or lower conservation importance, a number of criteria were used.

Species diversity and habitat heterogeneity indices

In each plot set, the number of vascular plant species is considered as the sampling area increases.

The species diversity index (SDI), independent of surface area, is calculated from the slope of the lognormal species–area curve. In Bakhuis, it ranges from 18 to 40 in the most species-rich vegetation.

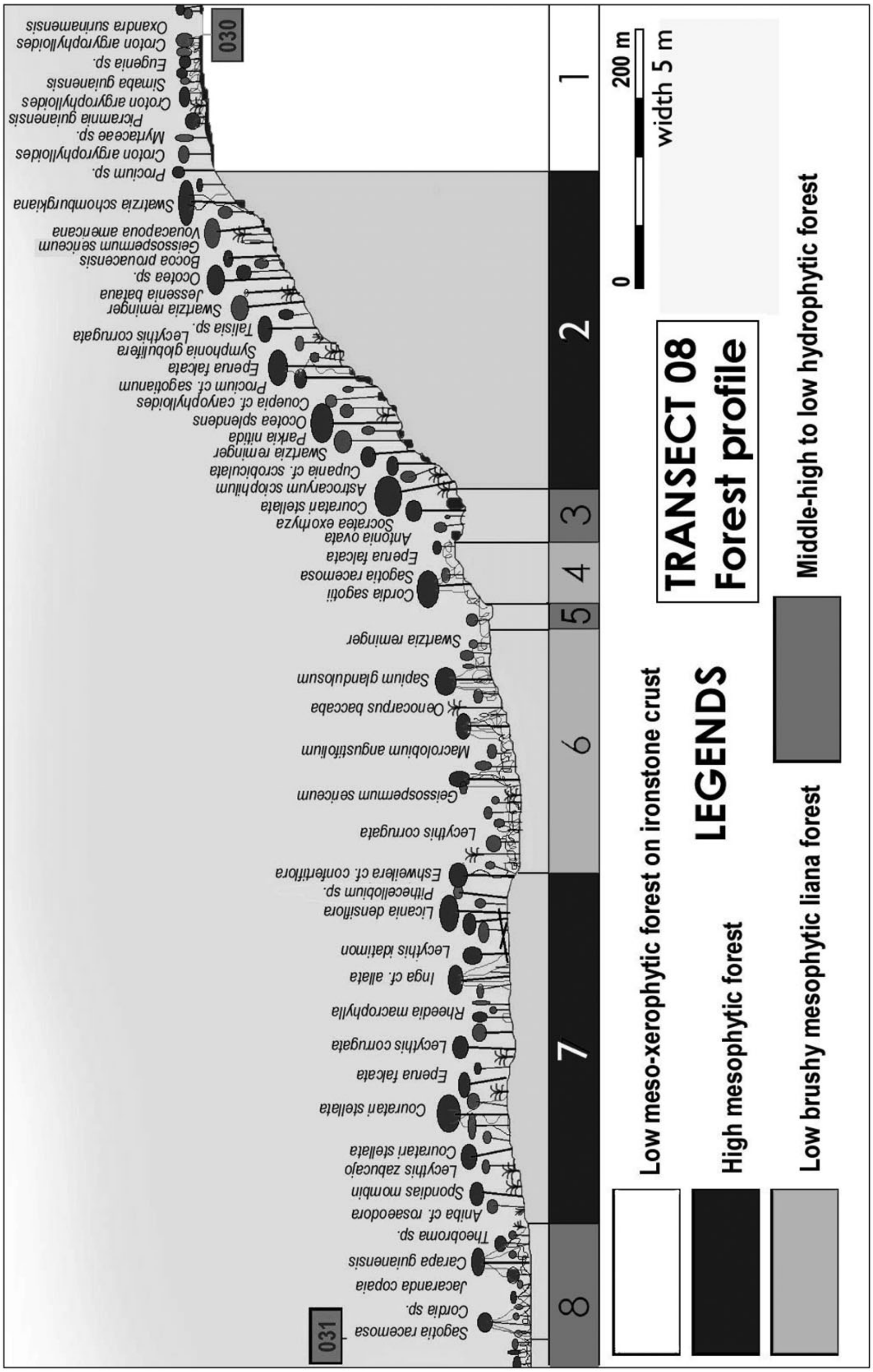


Figure 2. Transect 8 (1000 × 5 m) showing the gradient of vegetation habitats from foot to hilltop.

The habitat heterogeneity index (HHI) is a descriptor of habitat diversity, independent of surface area, also calculated from the species–area curve equation (β/α) (Bordenave, 1996; Bordenave, de Granville & Hoff, 1998). In the study area, it ranges from 2.5 to 4.0 in the most heterogeneous vegetation.

Ratio of species of concern
Among the identified vascular plant species, the ratio of those determined to be of concern for conservation (according to the criteria presented above) was calculated for each vegetation type. This ratio (ratio of species of concern, RSC) is one of the indicators used to compare the relative conservation value of these vegetation types.

Relative scarcity index
The surface area of each primary vegetation type was estimated from the vegetation map. The more restricted is a vegetation type in the study area, the more important it is in terms of local conservation priorities. The relative scarcity index (RSI) is inversely proportional to the relative surface area related to the actual extent of each habitat.

Habitat fragility index
The ability of vegetation to recover after disturbance is quantified through a habitat fragility index (HFI). Regeneration processes studied along mining lines on the Kaw Mountain in French Guiana between 1997 and 2004 showed that forests recovered differently depending largely on the soil conditions. Taking into account the specificity of the geomorphology and soils of different forest vegetation types, an index ranging from 1 to 5 (Bordenave, Raes & de Granville, 2000) provides a semi-quantitative indicator of habitat fragility and potential recoverability. The index values are defined as follows: (1) very favourable forest regeneration potential; (2) favourable forest regeneration potential; (3) uncertain forest regeneration potential, significant risks of organic soil erosion; (4) low forest regeneration potential, high risks of organic soil erosion; (5) very low forest regeneration potential and obvious risks of soil erosion and desertification.

Ratio of monocotyledons to dicotyledons
The ratio of monocotyledons to dicotyledons (M/D) is a good indicator of the levels of environmental limitation (de Granville, 1984). In the case of temporarily or permanently inundated vegetation, more monocot species are expected to be present as they are able to tolerate flooding and high groundwater levels better than dicot species. This is also the case in water deficit conditions, with monocots more resistant than dicots. In both cases, the M/D ratio will be higher, whereas a low M/D ratio is indicative of weak water stress, typical of mesic forest on deep, well-drained ground.

Overall evaluation of the conservation importance of different vegetation types
The analysis presented below combines the results of the five criteria described above, namely SDI, HHI, RSC, RSI and HFI. These five criteria provide quantitative and semi-quantitative data for this analysis. A determination index (DET) results from the multicriteria analysis of these indices for each habitat. DET is calculated as follows (Bordenave *et al*., 2000), with the choice of fixing an even weight to each individual index:

$$\mathrm{DET\ (hab.)} = \frac{\mathrm{SDI\ (hab.)}}{\sum \mathrm{SDI}} + \frac{\mathrm{HHI\ (hab.)}}{\sum \mathrm{HHI}} + \frac{\mathrm{RSC\ (hab.)}}{\sum \mathrm{RSC}} + \frac{\mathrm{RSI\ (hab.)}}{\sum \mathrm{RSI}} + \frac{\mathrm{HFI\ (hab.)}}{\sum \mathrm{HFI}}$$

RESULTS

Floristics

Species' inventory
In all, 584 vascular plant species were identified from voucher specimens (around 94% of the samples collected have been identified to species' level). In addition, 177 common or distinctive species that could be identified with certainty in the field were recorded but not collected. The total number of vascular plant species identified in the study area was therefore 763 (de Granville, Bordenave & Gonzalez 2008). These were distributed among 337 genera belonging to 112 families of vascular plants. The species' list for herbarium vouchers collected during this research is presented in the Appendix.

Of the 584 species in herbarium collections, 542 were spermatophytes (seed-plants), 541 of which were angiosperms (flowering plants) and one was a gymnosperm (a species of *Gnetum* L.). Forty-one were pteridophytes and one was a bryophyte.

Species of concern
Among the 584 vascular plant species identified from herbarium vouchers, 53 were considered to be of concern for conservation issues: six species were listed as 'totally protected' in French Guiana (Ministry Bill, April 9th, 2001); three were listed in the CITES protected species' lists; five were listed as 'Rare' or 'Vulnerable' by IUCN, UNEP-WCMC and/or CSMTC; 14 other species were listed on the French Guiana 'Natural Heritage Plant Species List' (CSRPN 2000) used as a reference tool for plant conservation

in the Guianas; the others were species' endemics at regional or country scale, or eco-endemics in disjunction of their distributional range.

Vegetation typology

A classification of all vegetation observed in the area was proposed, derived from the present study. The vegetation types (five classes, 13 types) of the Bakhuis Mountains are listed below.

A Inundated forest (IF) (forest on temporarily or permanently inundated soil).
- A.1 Marsh forest (IFM).
- A.2 *Euterpe oleracea* swamp forest (IFS).
- A.3 Riverine forest (IFR).

B Mesic forest (MF) (forest on well-drained ground).
- B.1 Mesic forest on plateaus, hilltops and slopes (MF).
- B.2 Mesic *Mora gonggrijpii* forest ('*Mora bukea*' forests) (MF-M).
- B.3 Mesic *Buxus citrifolia* Spreng. forest on slopes (MF-B).

C Low meso-xeric vegetation (LXV) (seasonally dry forests on laterite and bauxite hardcaps).
- C.1 Low meso-xeric *Croton argyrophylloides* Müll.Arg. forests on laterite hardcaps (LXF).
- C.2 Dwarf meso-xeric Myrtaceae and Euphorbiaceae thickets on hardcaps (DXT).

D Liana forest (L) (disturbed forest with impeded regeneration because of dense liana populations).
- D.1 Liana forest on hydromorphic ground (IF-L).
- D.2 Mesic liana forests (MF-L).
- D.3 Low meso-xeric liana forests (LXF-L).

E Secondary vegetation (SV) (early stages of forest regeneration after natural or anthropogenic disturbance).
- E.1 Low pioneer vegetation (LPV).
- E.2 Secondary forest (SF).

Plot sampling: forest structure and biodiversity indices

The structure of the vegetation in each plot series was elucidated through forest structure graphs, in which estimated plant height was plotted against trunk diameter measured at breast height (dbh). The density of trees and climbers, the average canopy height and the presence of emergent trees were represented in these graphs. An example is provided in Figure 3, but, because of the number generated in the study, each graph is not reproduced in this article.

SDI, HHI and FIV (Fig. 4) were calculated from these datasets to illustrate species–area relationships (Fig. 5).

Comparative summary of biodiversity indices for plot samples

Table 1 presents a synthesis of the data treatment of the 11 plot series sampled during this study. The number of families and species recorded in each sample, the average number of species per 100 m^2, and the M/D ratio, an indicator of the degree of environmental constraints of the habitat (de Granville, 1984), are given. The quantitative biodiversity indices SDI and HHI are provided, together with the log-normal correlation coefficients. These enable a comparative analysis to be made of biodiversity levels among samples and the estimated number of species per hectare for samples to be calculated. The average forest height and dimensions of the highest emerging trees are also noted, as well as the tree density for dbh ≥ 10 cm.

All species' biodiversity indicators (total number of families and species in each plot series, average number of species per 100-m^2 area, SDI and estimated number of species per hectare) demonstrate the following trends (Table 2). HHI mostly follows the same trend. The M/D ratios are also presented in the table.

Species' diversity by vegetation type can be ranked as follows: MF > IF >> LXF > MF-B > DXT.

Habitat diversity can be ranked in the following order: MF > IF > MF-B >> LXF/DXT.

The *M*/*D ratio* shows a value for inundated forests twice that for tall mesic forests, demonstrating the obviously stronger soil constraints in floodable vegetation. The values found in *Buxus citrifolia* forest and low meso-xeric forests are comparable with those of mesic forests. The most notable value is that for dry thickets showing the degree of specialization of the plant population to this habitat, which experiences high temperatures and dry conditions during parts of the year: monocot species are overwhelming here.

Floristic comparison of the different vegetation types

The species' and habitat diversity indices are useful for the analysis of the differences between distinct vegetation types, but it is noteworthy that the ratios of rare and endemic species (species of concern) do not necessarily follow the trends described above.

The ratios of species of concern recorded in each of the various vegetation types were compared as a function of the total number of species collected in each vegetation type. Among the forest types described in the study area, the driest, meso-xeric thickets support the highest proportion of species of concern (16.7%). The *Buxus citrifolia* forest, never

Table 1. Comparative summary of biodiversity indices for plot series samples

Plot series	FT	No. Fam	No. Sp	No. Sp/ 100 m^2	M/D	Sample size	SDI	HHI	R^2	Estim Sp/Ha	Canopy height (m)	Emerg.T (m)	Tree density
Site 6	MF	46	96	30	0.09	500	39.89	3.94	0.976	210	35–40	45	900
Site 8	MF	43	77	25	0.16	500	32.10	3.92	0.980	170	30	40	540
Site 15	MF	43	76	28	0.16	500	29.95	3.72	0.989	165	35–45	50	460
Site 19	MF	43	89	36	0.10	500	32.9	3.55	0.996	186	40	45–50	780
Mean MF	MF	43.8	84.5	29.8	0.13	500	33.71	3.78	0.985	182.8	37	46	670
Site 10	IF	36	58	24	**0.24**	600	**20.47**	3.50	0.993	117	40	50	620
Site 12	IF	45	95	30	**0.31**	500	35.30	3.81	0.993	191	30	40–45	590
Site 14	IF	40	98	28	**0.23**	500	35.76	3.81	0.987	193	35–40	55	480
Mean IF	IF	40.3	83.7	27.3	0.26	533	30.51	3.71	0.991	167	35.8	49	563
Site 13	LXF	35	63	31	0.06	400	**22.7**	**3.26**	0.996	135	15	20	800
Site 16	LXF	35	70	41	0.15	400	**20.85**	**2.67**	0.998	136	15–16	18	875
Mean LXF	LXF	35	66.5	36	0.105	400	21.78	2.97	0.997	135.5	15	19	838
Site 18	MF-B	25	42	21	0.17	300	19.21	3.55	0.994	109	30–40	45	667
Site 32	DXT	25	53	33	**0.79**	300	18.2	2.79	0.999	117	10–12	13	700
Average	**ALL**	**37.8**	**74.3**	**29.7**	**0.22**	**455.6**	**27.94**	**3.50**	**0.991**	**157.2**	–	**39**	**690**

FT, forest type (DXT, dwarf meso-xeric thicket; IF, inundated forest; LXF, low meso-xeric forest; MF, mesic forest; MF-B, *Buxus citrifolia* mesic forest). No. Fam, number of families; No. Sp, number of species; No. Sp/100 m^2, average number of species in 100 m^2; M/D, ratio of monocots/dicots; Sample size, plot series surface area in m^2; SDI, species diversity index; HHI, habitat heterogeneity index; R^2, log-normal correlation coefficient; Estim Sp/Ha, estimated number of species per hectare; Canopy height (m), average canopy height in metres; Emerg. T (m), emerging tree height in metres; Tree density, number of trees (diameter at breast height = 10 cm)/ha. Bold type in indicates the most distinctive values.

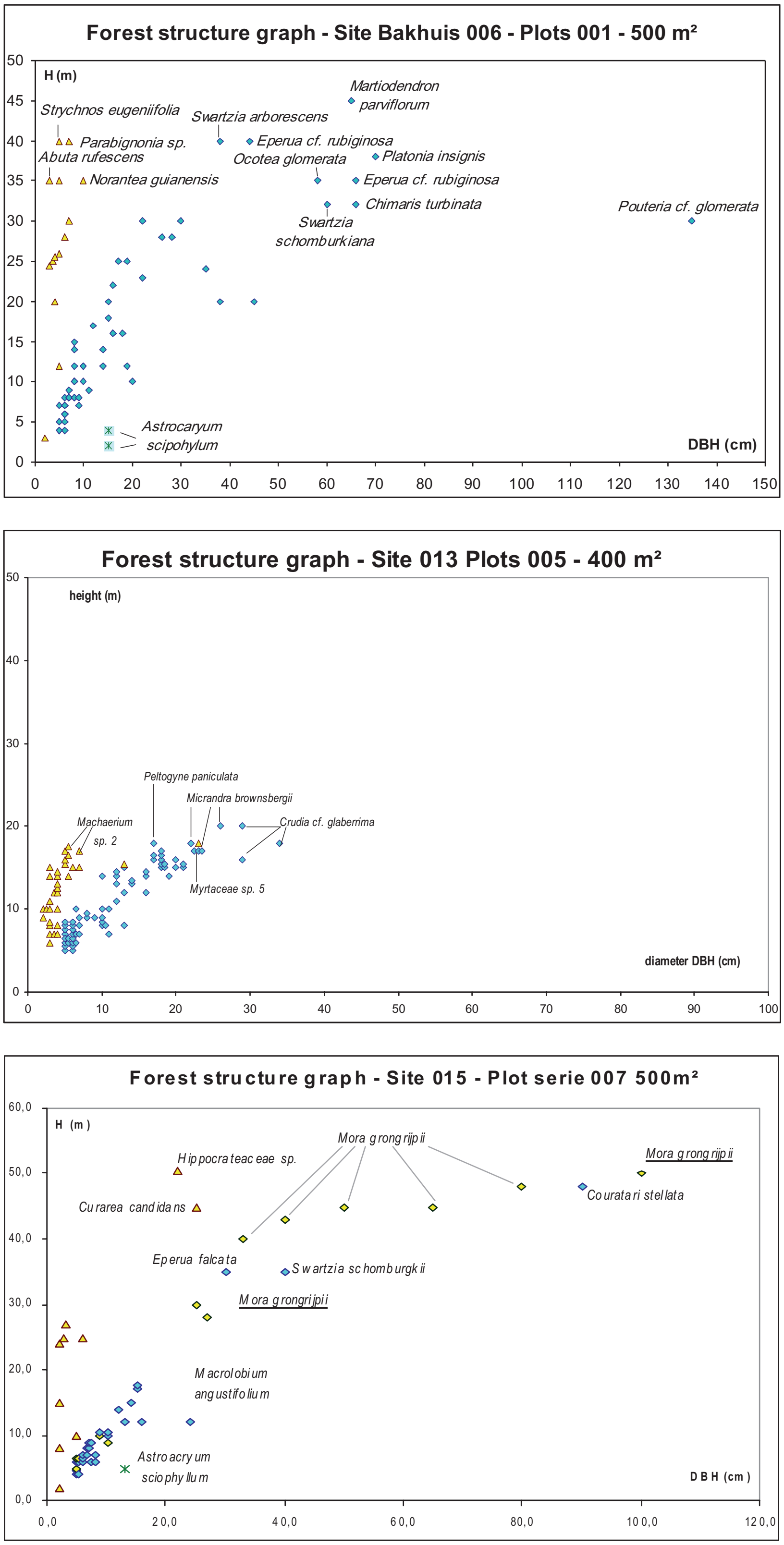
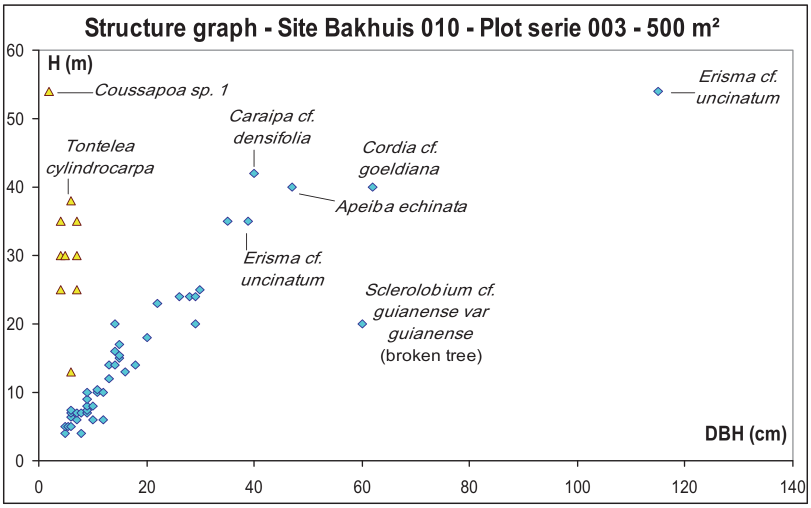
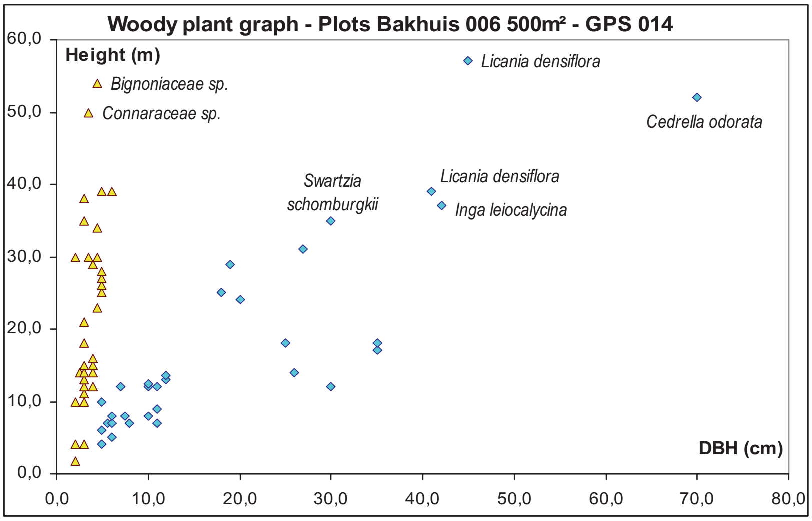


Figure 3. Example of rainforest structure graphs in plot series in the Bakhuis area: plot 1, tall mesic forest on hill top; plot 3, tall 'pina palm' inundated forest; plot 5, low meso-xeric forest on laterite/bauxite hardcap; plot 6, tall inundated forest on flat alluvial ground; plot 7, tall mesic '*Mora bukea*' forest; plot 9, *Buxus citrifolia* forest on bedrock.





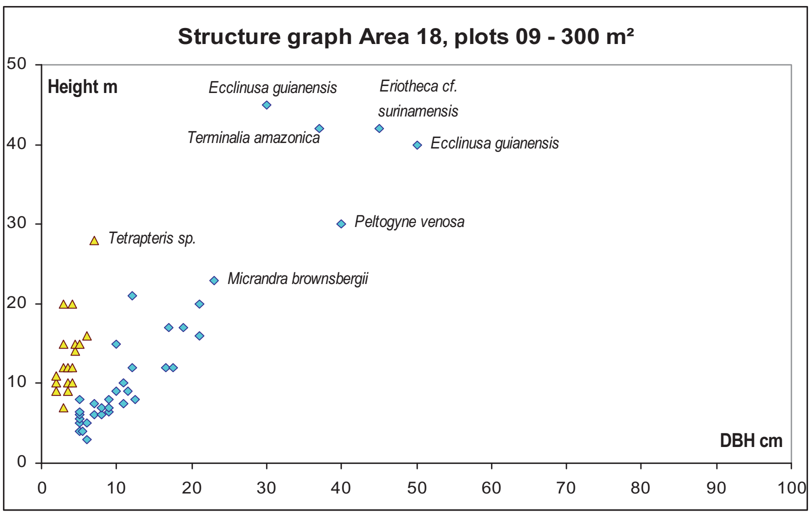


Figure 3. *Continued*

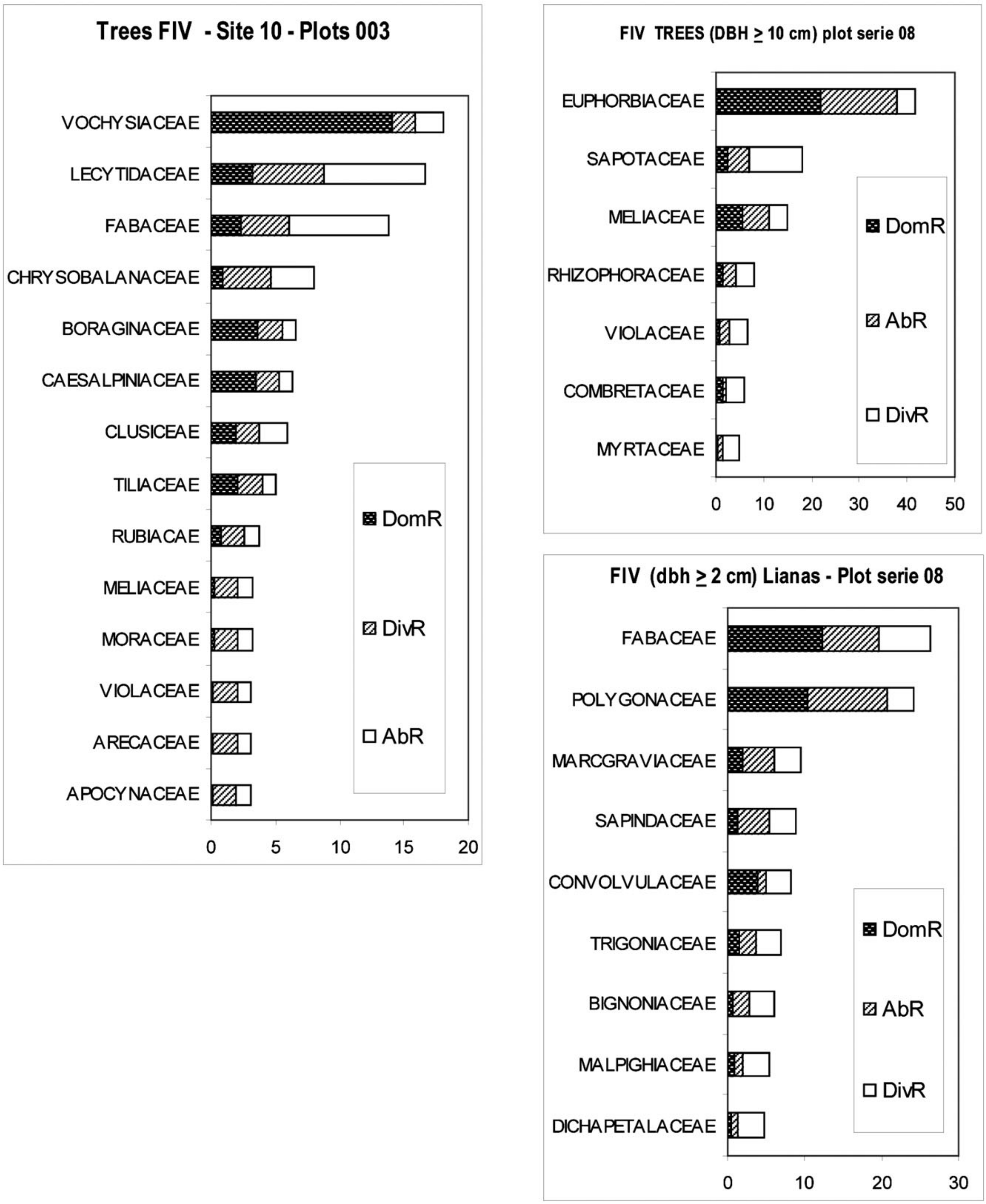


Figure 4. Examples of family importance value (FIV) graphs for trees with a diameter at breast height (dbh) > 10 cm in plot set 3 – tall 'pina palm' (*Euterpe oleracea*) inundated forest – and for both trees with dbh > 10 cm and woody climbers with dbh > 2 cm in plot set 8 – low meso-xeric forest on laterite hardcap. DomR is the relative dominance, DivR is the relative diversity and AbR is the relative abundance.

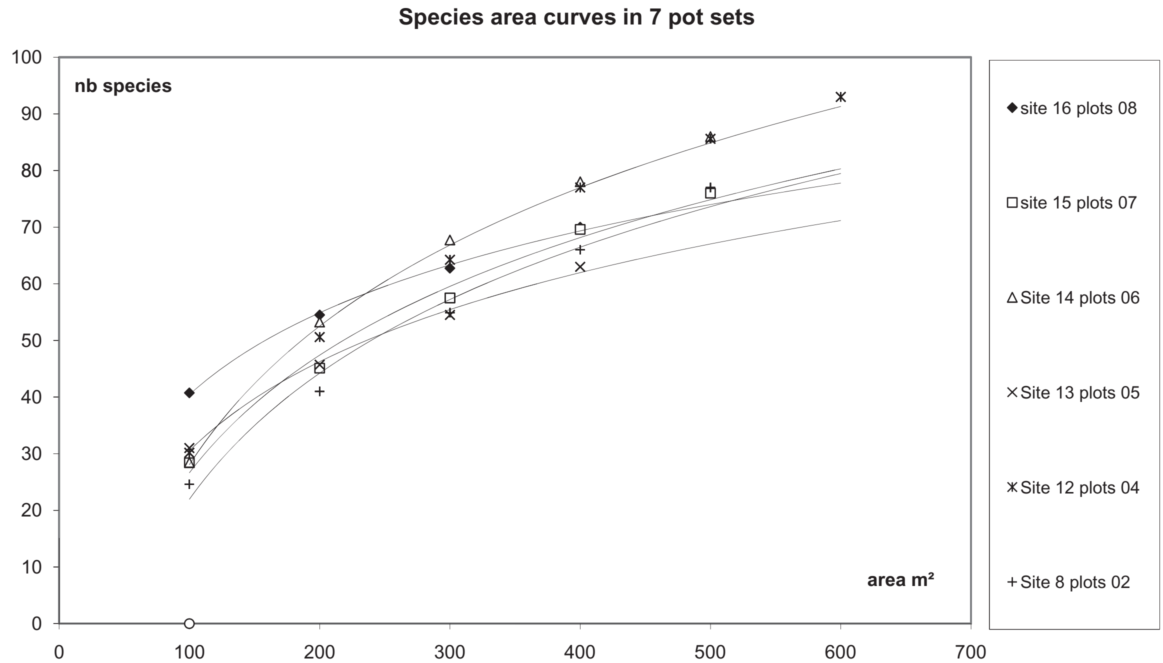


Figure 5. Examples of species–area curves in seven plot sets: plot 2, mature mesic forest on hill slope; plot 4, inundated forest on alluvial ground; plot 5, low meso-xeric forest on laterite/bauxite hardcap; plot 6, tall inundated forest on flat alluvial ground; plot 7, tall mesic '*Mora bukea*' forest; plot 8, *Buxus citrifolia* forest on bedrock.

Table 2. Average species' diversity (SDI) and habitat heterogeneity (HHI) indices and monocot/dicot ratio (M/D)

Vegetation type	SDI	HHI	M/D
Tall mesic forests	**33.71**	**3.78**	0.13
Tall inundated forest	**30.51**	**3.71**	**0.26**
Low meso-xeric forests	21.78	2.97	0.11
Buxus citrifolia forest	19.21	**3.55**	0.17
Dwarf meso-xeric thicket	18.2	2.79	**0.79**

Bold type indicates the most distinctive (highest) values.

previously described in the Guianas region, vulnerable because of its restricted occurrence and high RSC (14.3%), is regarded as being of high conservation value.

Tall mesic forest on ridges and slopes ranks third in terms of the proportion of species of concern, with a ratio of 8.9% of the total number of plants recorded. The low meso-xeric '*Croton*' forests show a lower percentage of 6.3%. Lastly, swamp and marsh forests appear to harbour the lowest RSC, with only 4.7%. No sensitive species were identified in liana forests, a forest habitat that appears to be a deviation from the normal sylvigenic cycle following some disturbance: it occurs on a variety of pedo-geological conditions (rock outcrops, hydromorphic and well-drained ground) and in most of the main vegetation types.

Some trends emerged from the comparison of the species of concern in each vegetation type:

1. Particularly in mesic forests, but also in inundated forests, the species of concern are mostly endemic and near-endemic species of the Guianas (eight for dryland and three for wetland forests), including two species restricted to the mountains of Suriname: *Oxandra surinamensis* Jans.-Jac. and *Malmea surinamensis* Chatrou.
2. Conversely, in drier low forests and dwarf thickets, as well as in *Buxus citrifolia* mesic forests on granite bedrock, the majority of species of concern recorded are species at the edge of their distributional range, some of which are listed as rare, sensitive or vulnerable species by various national and international bodies (CITES, UNEP-WCMC, IUCN, CSRPN). The species situated in the limit of their distributional range are almost exclusively species found in drier and more mountainous regions of Venezuela, Colombia, Ecuador and Peru (*Amphilophium* cf. *aschersonii* Ule, *Monotagma secundum* K.Schum., *Heisteria* cf. *insculpta* Sleumer), sometimes reaching Central America (*Buxus citrifolia*, *Dimerocostus strobilaceus* Kuntze, *Solanum* aff. *Adhaerens* Willd. ex Roem. & Schult.). One species, rare in the Guiana Shield, shows a circum-Amazonian distribution [*Selaginella* cf. *erythropus* (Mart. Spring)]. Two species are, however, endemic to Suriname and

Table 3. Determination index (DET) for habitat conservation prioritization

Habitats	SDIr	HHIr	RSCr	RSIr	HFIr	DET
Dwarf meso-xeric thicket (DXT)	2.32	2.86	**5.59**	**6.61**	**4.44**	**21.82**
Buxus citrifolia forest (MF-B)	2.44	**3.42**	**4.78**	**6.61**	**3.33**	**20.58**
Tall mesic forest crest (MFc)	**4.29**	**3.64**	2.98	1.65	3.16	17.72
Tall mesic forest slope (MFs)	**4.29**	**3.64**	2.98	1.10	**3.16**	15.17
Low meso-xeric forest (LXF)	2.78	2.86	**2.11**	2.36	**4.21**	14.32
Tall inundated forest (IF)	**3.88**	**3.57**	1.57	1.65	2.11	12.78
Total	20.00	20.00	20.00	20.00	20.00	100%

HFIr, relative habitat fragility index; HHIr, relative habitat heterogeneity index; RSCr, relative rare species of concern index; RSIr, relative scarcity index; SDIr, relative species diversity index. Bold type indicates the most distinctive values.

restricted to these drier habitats: *Oxandra surinamensis* Jans.-Jac. and *Byrsonima surinamensis* W.R.Anderson. One species, *Calycorectes batavorum* McVaugh, is thought to be a strict endemic to the Bakhuis Mountains.

Vegetation distribution

In terms of the overall distribution, tall mesic forest is overwhelmingly dominant in the study area, covering some 50% of the total surface area. For the purpose of later analysis, mesic forests on slopes (MFs) and on crests (MFc) are differentiated. Inundated forest types also cover a significant proportion of the study area (20%), and are distributed evenly throughout the concession. The *Buxus citrifolia* mesic forest covers only 5% of the surface area (estimated from ground studies), and is restricted to a few sites in the northern half of the concession; the dwarf meso-xeric thick*et* also covers around 5% of the surface area, and is located mainly in the southern half of the area.

Quantitative biodiversity indices for setting conservation priorities

Species' diversity and habitat heterogeneity indices

Quantitative indicators of both species' diversity (α diversity) and habitat heterogeneity (β diversity) for the various vegetation types are summarized and compared, providing crude SDI and relative (SDIr) values as a percentage of the overall cumulative values, as well as crude HHI and relative (HHIr) values.

Ratio of species of concern

The ratio of species of concern to the total number of species is recorded in each of the main forest habitats, as presented above.

Relative scarcity index

The scarcity index is also recorded in association with the relative surface area of each primary vegetation type. When considering RSI, *Buxus citrifolia* mesic forest and dwarf thickets are the most restricted habitats in terms of surface area. The values for low meso-xeric '*Croton*' forest are moderately high in the Bakhuis area, although it seems to occur infrequently outside this mountain range.

Habitat vulnerability index

The highest values (4) are given for low and dry vegetation with the shallowest soils, intermediate values (3) for mesic forests on slopes, and lowest values (2) for forest on crests and inundated forests on flat ground with generally deep alluvial soils.

Overall evaluation of the conservation importance of different vegetation types

DET for the prioritization of habitats for conservation purposes, as calculated above, is presented in Table 3 and represented graphically in Figure 6, indicating the contribution of each criterion given as relative values (r). It enables a comparison to be made of a conservation value for each forest type. It should be noted that these values consider the forest types in relation to the other forest types in the study area, not to forest types outside the study area.

The relative ratio of species of concern (RSCr) and the relative surface index (RSIr) appear to be the main drivers of DET. This comparative analysis of the main primary vegetation types described in this study highlights two restricted forest habitats as being of highest concern for habitat and species' conservation:

1. Dwarf meso-xeric thicket is the most floristically distinct, vulnerable to disturbance and restricted vegetation type, very rich in rare and sensitive species, although its SDI and HHI are low.
2. *Buxus citrifolia* forest is equally restricted in surface area, less vulnerable to disturbance but harbours a large proportion of species of concern. Its species' diversity is slightly higher and this

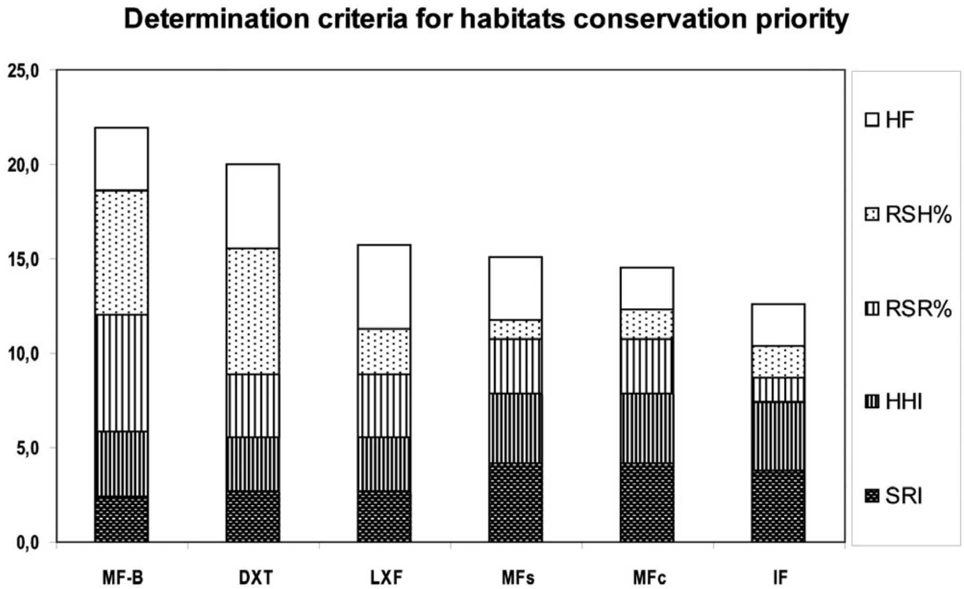


Figure 6. Multi-criteria analysis for a conservation priority determination index in the forest types in the study area. MF-B, *Buxus citrifolia* mesic forest; DXT, dwarf meso-xeric thicket; LXF, low meso-xeric forest; MFs, mesic forest on slopes; MFc, mesic forest on crests; IF, inundated forest.

vegetation type is slightly more heterogeneous when compared with dwarf meso-xeric thicket.

Tall mesic forest (MF) on both crests (MFc) and slopes (MFs) has intermediate DET. MF shows high species' diversity and habitat heterogeneity and a significant proportion of species of concern, many of which are endemic to the region or the area. However, this forest type is widespread in the region, particularly MFs.

Low meso-xeric forest also displays intermediate values for conservation issues. However, the scarcity of laterite plateaus (on which it stands together with DXT) as a habitat at a regional scale (not taken into account in the estimation of the relative surface area of vegetation types, which is restricted to the study area) should be considered for the conservation of this vegetation. Inundated forests have the lowest value. They are less species rich and more likely to recover from disturbance because of more favourable environmental factors. Furthermore, these forests host the lowest proportion of species of concern and cover a significant proportion of the study area (estimated at 20%). However, this vegetation is closely linked with the hydrological regime and its disturbance may have serious consequences for the biological and physical characteristics of the aquatic environment. It was noted in a few places that, where stream and river crossings were constructed in the concession without adequate drainage, the upstream-inundated forest was drowned, sometimes over significant areas. These forests are particularly sensitive to fairly small changes in water levels. Therefore, although showing the lowest conservation priority values, wetlands should be considered to be important for hydrological and ecological regulation.

Distinctive vegetation description

Among the 13 vegetation groups found in the study area, the following two are the most distinctive, according to both physiognomy and biodiversity determination index.

Buxus citrifolia mesic forest (MF-B)

This highly restricted forest type has not yet been described in the Guianas region. It was only observed on three sites midway up hill slopes in the northern part of the study area. The pedological conditions were characterized by the presence of outcropping crystalline bedrock boulders. The generally low canopy (*c*. 15–25 m) is discontinuous, allowing significant light to reach the forest floor. The forest is characterized by the dominance of *Buxus citrifolia* (Buxaceae), a rare species in Suriname (UNEP-WCMC 'Rare', at the easternmost limit of its distributional range), which is usually associated with *Esenbeckia pilocarpoides* Kunth (Rutaceae) and *Vitex compressa* Turcz. (Lamiaceae). The latter two species, present at each site, are small- to medium-sized trees. The understorey harbours many small trees, but the density of shrubs and herbs is low and the floristic composition is highly variable: in places, *Rinorea* cf.

riana Kuntze (Violaceae) is generally dominant, whereas, elsewhere, a dense population of *Conchocarpus heterophyllus* (A.St.-Hil.) Kallunki & Pirani (Rutaceae) is present. In addition to *Buxus citrifolia*, two other very rare species are found in MF-B, namely *Malmea surinamensis* Chatrou (Annonaceae), endemic to the mountains of Suriname, and *Selaginella* aff. *erythropus*, which is a potentially new species or related/co-specific to *S. erythropus*, and therefore a new record for the Guiana Shield.

Dwarf meso-xeric Myrtaceae and Euphorbiaceae thickets on hardcaps (DXT)

This vegetation type occurs in very restricted patches in the southern part of the study area. It is characterized by shrubby growth along its margins and a very low tree layer (on average 5 m high). It represents the most reduced form of forest on laterite and bauxite hardcaps as a result of the following limiting environmental conditions: (1) an almost complete absence of organic soil over the outcropping hardcap; and (2) significant temporary drought during the dry season because of the minimal water retention capacity of the substrate. Physiognomically, it most closely resembles the thicket vegetation observed on granite inselbergs (rock savannas) in other parts of Suriname and the Guianas, despite growing on a quite different substrate. Only four patches of this vegetation type were encountered during the field surveys, although several other patches were seen during the aerial survey over the study area, and a number of other such patches were located during analysis of the satellite imagery. Although this thicket vegetation contains several species in common with low meso-xeric forest (LXF), significant differences in the species of treelets and shrubs present within the two plant families were noted. Many Myrtaceae (*Myrcia guianensis* DC., *M.* aff. *pyrifolia*, *M. saxatilis* (Amshoff) McVaugh, *M. sylvatica* DC.) and Rubiaceae (*Chiococca nitida* Benth., *Guettarda spruceana* Müll.Arg., *Ixora graciliflora* Benth., *Psychotria bracteocardia* Müll.Arg., *P. hoffmannseggiana* Müll.Arg. and the rare *Rudgea crassiloba* B.L.Rob.) were found only in the thicket. A rare, small-leaved treelet in Ochnaceae, *Quiina* aff. *wurdackii* Pires (potentially new to science), was relatively frequent and characteristic of this particular habitat. Another characteristic species is the small Malpighiaceae tree *Byrsonima surinamensis*, 'Secrepatu kers', endemic to Suriname, and probably an eco-endemic of laterite hardcaps. Woody climbers of moderate dimensions are also well represented: *Mandevilla scabra* K.Schum., *Matelea cremersii* Morillo, a species of Connaraceae, *Norantea guianensis* Aubl., *Coccoloba* sp. (potentially new to science) and, above all, Bignoniaceae species (*Anemopaegma* cf. *chrysoleucum*, *Lundia erionema*, *Memora* sp.). The species found in this vegetation type tend to be more restricted in occurrence compared with those found in the surrounding mesic and inundated forests. In addition to the species of concern listed above, the following species are considered rare and restricted to this vegetation type: *Calliandra hymenioides* (Fabaceae Mimosoideae), *Neea* cf. *constricta* Spruce ex J.A.Schmidt (Nyctaginaceae), *Ouratea leblondii* (Tiegh.) Lemée (Ochnaceae) and *Phoradendron strongyloclados* Eichler (Santalaceae). Dense populations of terrestrial bromeliads, well adapted to these dry conditions, may proliferate, sometimes forming almost monospecific undergrowth populations, e.g. *Guzmania* aff. *lingulata* Mez and *Vriesea splendens* (Brongn.) Lem. *Aechmea bromeliifolia* Baker ex Benth. & Hook.f., *A. melinonii* Hook. and *Tillandsia flexuosa* Mez also occurred in scarce populations. The presence of populations of two infrequent species of wild pineapple, *Ananas ananassoides* (Baker) L.B.Sm. and *A. nanus* (L.B.Sm.) L.B.Sm., must be highlighted, following World Bank Guidelines as wild gene banks for important agricultural plants: both of these relatively rare species are endemic to the Guiana Shield.

Within this vegetation, at moderately high elevation (mostly > 300 m), the nocturnal dew and persistent mists favour the growth of herbaceous epiphytes, especially orchids and Araceae. In one single site, > 60 species of orchid, including two wild species of *Vanilla* Mill., were distinguished. Although some of the orchids found at Bakhuis are common with Brownsberg, Lely and Nassau Mountain species, several distinctive species, including some extremely rare taxa, were present.

The other vegetation types, although showing some differences in species' composition when compared at a regional scale, are more common and widespread throughout the Guianas. These were described in some detail in the original baseline study, but these descriptions are not presented in this article.

DISCUSSION

The conservation of rainforest biodiversity in the Guianas is a major challenge for the coming decades, as development progresses and population pressures increase (Gentry & Dodson 1987; Bordenave & de Granville 1998). How do we reconcile wildlife and biodiversity conservation with fair and equitable sustainable development in these tropical countries? The sound management of the natural heritage of the Guianas requires a combined effort from scientists, local and indigenous people, nature conservation institutions, nongovernmental organizations, corporations and institutional decision-makers.

The method presented in this article to set local-scale conservation priorities takes into account a variety of biodiversity criteria (species' and habitat diversity, proportion of rare species, relative surface area and regeneration capacity of habitats) at the scale of a large, but localized, study area. It identifies areas within the study area in which regional-scale conservation efforts should be focused. However, this method has its limitations. In this work, the study perimeter was large (2800 km^2) and a significant proportion of the area was inaccessible. Therefore, the sampling undertaken for the study only provided a relatively small sample of the actual flora and vegetation of the area. A total area of 5000 m^2 (0.5 ha), delimited in 11 plot sets in the various identified vegetation types, was comprehensively inventoried for all vascular plant species, which provides detailed information on the flora and vegetation in each habitat, over a small area. The diversity of understorey species is considered to be well represented over this area and captured by the plot samples. The larger, woody species (trees and large climbers) require a larger sampling area to gather in-depth floristic diversity data. To this end, transects and profiles were sampled, covering a much larger area of 2.5 ha. The difficulty in harvesting fertile vouchers (fertile specimens of trees and lianas are often at heights of 30–50 m above ground level) remains a major limitation to species' identification in the field. The same limitation arises with tall-standing epiphyte species, which are hardly taken into account in forest species' diversity. Vernacular names provided by skilled 'tree spotters' improve the evaluation of actual tree species' diversity, but new species and subspecies are difficult to distinguish from similar known taxa in this manner. The collection of vouchers from low branches, juvenile trees and fallen flowers or fruit helps to identify taxa. However, there are unavoidable instances when fertile vouchers are lacking.

Despite the limitations caused by the lack of regional-scale information, the conservation priority setting protocol and the resultant analysis, derived from a large set of field data (with precise species' composition and structure of the various vegetation types present in a given area), provides an effective tool for the ranking of conservation priorities and for the consequent management of development programmes.

The distribution of vegetation types in the study area is an intricate patchwork, determined largely by factors such as the type and degree of fracturing of the substrate, slope and soil drainage and seasonal changes in wetness of the habitat. Other factors, such as palaeoclimatic changes, dispersal limitations and density dependence (Volkov *et al.*, 2005), and natural disturbances caused by storms and floods, may have played a role in structuring the present-day forest: a mosaic of vegetation types dominated by mesic and inundated forests, with distinctive remnants of xeric flora, represented by low, dry thickets and by low *Buxus citrifolia* forest patches. Among the 13 vegetation types observed during this study, two habitats emerged as restricted in distribution, vulnerable to disturbance, with distinctive vegetation harbouring a significant proportion of rare and endemic species: dwarf meso-xeric thicket and *Buxus citrifolia* forest. According to the results of the multi-criteria analysis, these habitats are considered to be of a higher level of conservation concern at a regional scale than the other vegetation types present in the study area. In addition, low '*Croton*' forest is also of conservation concern, as the potential for this forest to regenerate on its very thin topsoil is limited. The other vegetation types, more widespread at both the local and regional scale, nevertheless also require protection as far as possible: these forest types harbour a large set of plant species of different life forms, including rare and endemic species, and a rich fauna that is currently almost totally unexposed to human activity.

An understanding of the changes that have occurred to the vegetation of the Guianas region through geological time can provide useful insights into the current distribution patterns and diversity of vegetation. Palaeoclimatic studies have elucidated the climate variations that occurred during the Quaternary era (Ab'Saber, De Boer, Van Geel & Tricart, cited by de Granville, 1994). The cold, drier climate that occurred during the Tertiary era glacial ages alternated with warmer, wetter interstadial periods. During the last long glacial episode (the Würm period between 22 000 and 13 000 BP), the ensuing drought probably caused a significant retreat of the rainforest in tropical South America, which remained only along rivers as gallery forests and in deep, sheltered valleys in hilly and mountainous areas. The remaining vegetation appeared to harbour an association of more drought-resistant species with semi-deciduous forests and more extensive savannas. At the end of these extended drying periods, the rainforest species once again spread from the remnant patches in which they had persisted, whereas the more xerophytic species retreated to drier, more exposed areas, namely the white sands, rocky outcrops and laterite hardcaps. This improves the prediction of the conservation priorities for the future, in the light of the adaptation potential of ecosystems and plant populations. Considering the potential for climate change and the consequent implications for conservation, it is also important to place the current distribution and pattern of vegetation types in a palaeo-historical context.

For mid- to long-term conservation planning, it is important to consider that the maintenance of habitat diversity is essential to ensure adaptation potential for climate change: if the climate becomes drier, xeric species found in meso-xeric dwarf thicket and low forest vegetation require adequate representation in gene and seed banks to facilitate a range extension; conversly, if the climate becomes wetter, remnant patches of more xeric vegetation will tend to disappear locally, increasing their conservation importance. The two xeric vegetation types present in the study area are ranked as the highest priority for conservation within this area. However, the vegetation types that dominate the study area, low and dry '*Croton*' forest, tall mesic and inundated forests, also merit conservation and protection in terms of the maintenance of the high biodiversity that they support.

CONCLUSIONS

Reconciling development and land use planning pressures with biodiversity conservation needs remains one of the key challenges in one of the three major remaining evergreen rainforest eco-regions in the world. This often directly conflicting issue was highlighted by this study, where a vegetation type, such as the dwarf meso-xeric thicket, with a high conservation priority, is restricted to the substrate that contains a valuable mineral. A common limitation of detailed biological studies in remote and largely unstudied areas, such as the Bakhuis Mountains, is that the study area immediately becomes a 'hot spot' for biodiversity conservation, as the distribution and occurrence of species and habitats outside of the study area are poorly acknowledged. To ensure that the conservation value of species and vegetation types is properly understood and correctly prioritized in order to inform decisions regarding sustainable development of natural resources, it is essential that conservation prioritization at a local scale is integrated and contextualized at a regional scale. Given the small geographical area of each of the constituent countries of the Guiana Shield, this regional context generally extends beyond national boundaries. It is therefore essential that cooperation and knowledge sharing within the region should continue to be fostered, particularly in the fields of botany, forest ecology and conservation science.

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APPENDIX: SPECIES' LIST – BOTANICAL CONSERVATION PRIORITIES IN A SURINAME RAINFOREST

1. Spermatophyta

Family	Taxon	Coll. No.	Veg.	Herbaria
ACANTHACEAE	*Anisacanthus secundus* Leonard	8579	LXF	CAY, BBS, US
	Anisacanthus secundus Leonard	8008	LXF	CAY, L, NY, US, BBS
	Anisacanthus secundus Leonard	8190	LXF	CAY, L, NY, US, BBS
	Aphelandra pulcherrima (Jacq.) Kunth	8042	IF	CAY, L, US, BBS
	Hygrophila costata Nees	8099	MF	CAY, BBS
	Justicia calycina (Nees) V.A.W.Graham	8460	IF	CAY, BBS, L, K, US
	Mendoncia hoffmannseggiana Nees	8511	LF	CAY, BBS, US
	Ruellia rubra Aubl.	8171	IF	CAY, L, US, BBS
	Ruellia rubra Aubl.	8295	IF	CAY, US, BBS
ACHARIACEAE	*Carpotroche surinamensis* Uittien	8358	IF	CAY
	Carpotroche surinamensis Uittien	8469	MF	CAY, BBS, L
	cf. *Carpotroche*	8056	MF	CAY, BBS
AMARYLLIDACEAE	*Hymenocallis tubiflora* Salisb.	NC	IF	
ANACARDIACEAE	*Anacardium spruceanum* Benth. ex Engl.	8302	MF	CAY
	cf. *Anacardium* sp.	NC	MF	
	cf. *Loxopterygium*	8538	LXF	CAY
	Loxopterygium sagotii Hook.f.	8249	LXF	CAY, L, K, NY, BBS
ANNONACEAE	*Anaxagorea dolichocarpa* Sprague & Sandwith	8287	IF	CAY, L, BBS
	Anaxagorea dolichocarpa Sprague & Sandwith	8057	MF	CAY, BBS
	Anaxagorea dolichocarpa Sprague & Sandwith	8070	MF	CAY, BBS
	Anaxagorea dolichocarpa Sprague & Sandwith	8237	MF	CAY, L, US, BBS
	Anaxagorea sp.	8223	LXF	CAY, BBS
	Duguetia calycina Benoist	8419	MF	CAY, BBS
	Duguetia riparia Huber	8102	IF	CAY, L, NY, BBS
	Duguetia riparia Huber	8162	IF	CAY, L, K, NY, BBS
	Duguetia cf. *riparia* Huber	8216	IF	CAY
	Duguetia sp.	NC	MF	
	Guatteria wachenheimii Benoist	8027	IF	CAY, L, BBS
	Malmea surinamensis Chatrou	8256	MF-B	CAY, L, NY, BBS
	Malmea surinamensis Chatrou	NC	MF	
	Oxandra surinamensis Jans.-Jac.	8120	IF	CAY, L, MO, BBS
	Oxandra surinamensis Jans.-Jac.	8179	LXF	CAY, L, BBS
	Oxandra surinamensis Jans.-Jac.	NC	MF	
	Unonopsis glaucopetala R.E.Fr.	8463	IF	CAY, BBS, L, US
APOCYNACEAE	*Ambelania acida* Aubl.	8069	MF	CAY, P, L, BBS
	Aspidosperma oblongum A.DC.	8039	MF	CAY, BBS
	Aspidosperma sp.	NC	MF	
	Geissospermum argenteum Woodson	8483	MF	CAY, BBS, P
	Geissospermum sp.	NC	MF	
	Himatanthus drasticus (Mart.) Plumel	8186	LXF	CAY, BBS
	Lacmellea aculeata (Ducke) Monach.	NC	MF	
	Malouetia tamaquarina (Aubl.) A.DC.	8043	IF	CAY, BBS
	Mandevilla scabra (Roem. & Schult.) K.Schum	8409	DXT	CAY, BBS
	Mandevilla scabra (Hoffmanns. ex Roem. & Schult.) K.Schum.	8426	LXF	CAY, BBS
	Mandevilla symphitocarpa (G. Mey.) Woodson	8459	MF	CAY, BBS
	Matelea cremersii Morillo	8368	DXT	CAY, BBS
	Matelea cremersii Morillo	8567	LXF	CAY, BBS, MERF
	Prestonia cayennensis (A. DC.) Pichon	8615	DXT	CAY, BBS, P
	Prestonia aff. *megagros* (Vell.) Woodson	8108	MF	CAY, BBS
	Tabernaemontana albiflora (Miq.) Pulle	8447	LXF	CAY, BBS, P

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Tabernaemontana albiflora (Miq.) Pulle	8547	LXF	CAY, BBS, P
	Tabernaemontana albiflora (Miq.) Pulle	8583	DXT	CAY, BBS
	Tabernaemontana albiflora (Miq.) Pulle	8624	DXT	CAY, BBS, P
	Tabernaemontana albiflora (Miq.) Pulle	8182	LXF	CAY, L, P, BBS
	Tabernaemontana albiflora (Miq.) Pulle	8395	LXF	CAY, BBS, L, P
	Tabernaemontana angulata Mart. ex Müll.Arg.	8362	MF	CAY
	Tabernaemontana angulata Mart. ex Müll.Arg.	8276	MF	CAY
	Tabernaemontana heterophylla Vahl.	8167	IF	CAY, L, P, BBS
	Tabernaemontana macrocalyx Müll.Arg.	8528 B	MF	CAY, BBS
	Tabernaemontana undulata Vahl).	8125	MF	CAY, L, P, K, NY, BBS
	Tabernaemontana undulata Vahl) .	8215	IF	CAY, P, BBS
	Tabernaemontana sp.	NC	MF	
ARACEAE	*Anthurium gracile* (Rudge) Schott	8326	MF	CAY, BBS
	Anthurium pentaphyllum (Aubl.) G.Don	8270	MF-B	CAY
	Anthurium trinerve Miq.	8433	LXF	CAY, BBS
	Caladium bicolor (Aiton) Vent.	NC	IF	
	Dieffenbachia sp.	NC	MF	
	Dieffenbachia paludicola N.E.Br. ex Gleason	8118	IF	CAY, BBS
	Philodendron billietiae Croat	8444	LXF	CAY, BBS
	Philodendron billietiae Croat	8456	LXF	CAY, BBS
	Philodendron linnaei Kunth	8525	DXT	CAY, BBS
	Philodendron linnaei Kunth	NC	LXF	
	Philodendron solimoesense A.C.Sm.	8280	MF	CAY, BBS
	Philodendron sp. 1	NC	IF	
	Philodendron sp. 2	NC	MF-B	
	Philodendron sp. 2	NC	IF	
	Syngonium podophyllum Schott	8482	MF	CAY, BBS, MO
	Xanthosoma cf. *conspurcatum* Schott.	8510	IF	CAY
ARECACEAE	*Astrocaryum gynacanthum* Mart.	NC	MF/IF	
	Astrocaryum sciophilum (Miq.) Pulle	NC	MF/IF	
	Attalea guianensis (Glassman) Zona	8630	MF	CAY
	Attalea maripa (Aubl.) Mart.	NC	MF/IF	
	Attalea microcarpa Mart.	NC	MF/LXF	
	Attalea (*s.l.*) sp.	8194	LXF	CAY
	Bactris acanthocarpa Mart.	NC	MF/IF	
	Bactris maraja Mart.	8142	IF	CAY
	Bactris maraja Mart.	NC	MF	
	Bactris cf. *maraja* Mart.?	NC	MF	
	Bactris simplicifrons Mart.	NC	MF/IF	
	Desmoncus cf. *polyacanthos* Mart.	NC	IF	
	Euterpe oleracea Mart.	NC	IF	
	Geonoma baculifera (Poit.) Kunth	NC	IF	
	Geonoma leptospadix Trail	8481	MF	CAY, BBS, NY
	Geonoma maxima (Poit.) Kunth	8620	MF	CAY, BBS
	Geonoma maxima (Poit.) Kunth	8496	MF	BBS
	Hyospathe elegans Mart.	8294	IF	CAY, AA, BBS
	Hyospathe elegans Mart.	8388	MF	CAY
	Oenocarpus bacaba Mart.	NC	MF/IF	
	Oenocarpus bataua Mart.	NC	IF	
	Socratea exorrhiza (Mart.) H.Wendl.	NC	IF/MF/MF-B	
ASTERACEAE	*Unxia camphorata* L.f.	8570	LXF	CAY, BBS

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
BIGNONIACEAE	***Amphilophium*** cf. ***aschersonii*** Ule	8474	LXF	CAY, BBS, L, K, MO
	Anemopaegma cf. *chrysoleucum* (Kunth) Sandwith	8373	DXT	CAY, BBS
	Anemopaegma sp.	8036	MF	CAY, MO, BBS
	cf. *Anemopaegma* sp.?	8512	SV	CAY, BBS, MO
	Arrabidaea aff. *pubescens* (L.) A.H.Gentry	8123	MF	CAY, BBS, L, US, MO, K, B
	Arrabidaea trailii Sprague	8201	MF	CAY, BBS, L, US, MO, K, B
	Ceratophytum tetragonolobum (Jacq.) Sprague & Sandwith	8199	MF	CAY
	Lundia erionema DC.	8370	DXT	CAY, BBS, MO
	Memora moringifolia (DC.) Sandwith	NC	MF/MF-B	
	Memora racemosa A.H.Gentry	8007	LXF	CAY, L, K, MO, BBS
	Memora racemosa A.H.Gentry	8154	MF	
	Memora racemosa A.H.Gentry	8172	IF	CAY, L, P, K, MO, BBS
	cf. *Memora*	8528 A	DXT	CAY
	cf. *Memora* sp.	NC	MF	
	Pithecoctenium crucigerum (L.) A.H.Gentry	NC	LF	
	Pleonotoma cf. *clematis* (Kunth) Miers	8105	MF	CAY, BBS
	Genus indet.	8153	MF	CAY, L, BBS
BORAGINACEAE	***Cordia laevifrons*** I.M.Johnston	8127	MF	CAY, L, K, B, US, BBS
	Cordia laevifrons I.M.Johnston	8323	MF	CAY, BBS, US
	Cordia nodosa Lam.	NC	MF	
	Cordia sp.	8385	MF	CAY, BBS
	Tournefortia bicolor Sw.	8079	LXF	CAY, L, US, BBS
	Tournefortia cuspidata Kunth	8597	IF	CAY, BBS, US, K
	Varronia polycephala Lam.	8349	MF	CAY, BBS, US
	Varronia schomburgkii (DC.) Borhidi	8093 B	MF	CAY, L, K, US, BBS
BROMELIACEAE	*Aechmaea bromeliifolia* (Rudge) Baker	8400	DXT	CAY, BBS
	Aechmaea bromeliifolia (Rudge) Baker	8490 B	DXT	CAY, BBS
	Aechmaea melinonii Hook.	8429	LXF	CAY, BBS
	Ananas ananassoides (Baker) L.B.Sm.	8490 A	DXT	CAY, BBS, L
	Ananas cf. ***nanus*** (L.B. Sm.) L.B.Sm.	8454	LXF	CAY
	Ananas cf. ***nanus*** (L.B. Sm.) L.B.Sm.	8614	DXT	CAY, BBS
	Araeococcus micranthus Brongn.	8397	LXF	CAY, BBS, L, NY
	Guzmania lingulata (L.) Mez.	8403	DXT	CAY, BBS
	Mesobromelia pleiosticha (Griseb.) Utley & H.Luther	8601	DXT	CAY, BBS
	Pitcairnia cf. ***leprieurii*** Baker	NC	IF	
	Racinaea spiculosa (Griseb.) var. *spiculosa* M.A.Spencer & L.B.Sm.	8602	DXT	CAY, BBS
	Tillandsia flexuosa Sw.	8493	DXT	CAY, BBS, L
	Tillandsia monadelpha (E.Morren) Baker	8137	IF	CAY, BBS
	Tillandsia monodelpha (E.Morren) Baker	NC	LXF	
	Vriesea heliconioides (Kunth) Hook. ex Walp.	8168	IF	CAY
	Vriesea splendens (Brongn.) Lem.	8473	LXF	CAY
	Werauhia aff. *gladiolifolia* (H.Wendl.) J.R.Grant	8497 A	SV	CAY, BBS
BURSERACEAE	*Protium sagotianum* Marchand	8265	IF	CAY
BUXACEAE	***Buxus citrifolia*** (Willd.) Spreng.	8253	MF-B	

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
CACTACEAE	*Epiphyllum phyllanthus* (L.) Haw. var. *phyllanthus*	NC	LF	
	Epiphyllum phyllanthus (L.) Haw. var. *phyllanthus*	8573	LXF	CAY, BBS, B
CANNABACEAE	*Celtis iguanaea* (Jacq.) Sarg.	8499	MF	CAY, BBS, L
	Trema micrantha (L.) Blume	8095	MF	CAY, L, BBS
CAPPARACEAE	*Capparis flexuosa* (L.) L. ssp. *polyantha* (Triana & Planch.) H.H.Iltis	8519	SV	CAY, BBS, L,WIS
	Capparis frondosa Jacq.	8613	DXT	CAY, BBS
	Capparis aff. *frondosa* Jacq.	8520	SV	CAY, BBS, L, US, WIS
	Capparis cf. *maroniensis* Benoist	8273	MF	CAY, BBS
	Capparis sola J.F.Macbr.	8598-B	DXT	CAY, BBS, WIS, US, L
	Capparis sp.	8177	LXF	CAY
CELASTRACEAE	*Maytenus* cf. *guyanensis* Klotzsch ex Reissek	8146	IF	CAY, L, US, NY, BBS
	Maytenus cf. *myrsinoides* Reissek	NC	MF	
	Peritassa laevigata (Hoffmanns. ex Link A.C.Sm.	8383	DXT	CAY
	Peritassa laevigata (Hoffmanns. ex Link) A.C.Sm.	8413	DXT	CAY, BBS
	Prionostemma aspera (Lam.) Miers	8097	MF	CAY, L, MO, HRCB, BBS
	Tontelea cylindrocarpa (A.C.Sm.) A.C.Sm.	8134	MF	CAY, L, BBS
CHRYSOBALANACEAE	*Hirtella hispidula* Miq.	8187	LXF	CAY, L, K, BBS
	Hirtella paniculata Sw.	8115	IF	CAY, L, K, NY, BBS
	Licania cf. *alba* (Bernouilli) Cuatrec.	8542	IF	CAY
	Licania sp.	NC	MF	
CLEOMACEAE	*Cleome aculeata* L.	8394	SV	CAY
CLUSIACEAE	*Clusia nemorosa* G. Mey.	8494	DXT	CAY, BBS, FTG
	Clusia cf. *schomburgkiana* (Planch. & Triana) Benth. ex Engl.	8414	DXT	CAY, BBS
	Garcinia benthamiana (Planch. & Triana) Pipoly	8274	MF	CAY, BBS
	Garcinia macrophylla Mart.	NC	MF	
	cf. *Moronobea coccinea* Aubl.	NC	MF	
	Symphonia globulifera L.f.	NC	IF	
	Tovomita sp.	NC	MF	
COMBRETACEAE	*Buchenavia tetraphylla* (Aubl.) R.A.Howard	NC	MF	
	Terminalia dichotoma G.Mey.	NC	IF	
	Terminalia cf. *guyanensis* Eichler	8144	IF	CAY, BBS
COMMELINACEAE	*Commelina rufipes* Seub. var. *glabrata* (D.R.Hunt) Faden & D.R.Hunt	8166	IF	CAY, L, K, US, BBS
	Dichorisandra hexandra (Aubl.) Standl.	8518	MF	
CONNARACEAE	*Cnestidium guianense* (G.Schellenb.) G.Schellenb.	8330	MF	CAY, BBS, L, US
	Connarus patrisii (DC.) Planch.	8522	SV	CAY, BBS
	Rourea cf. *frutescens* Aubl.	8086	MF	CAY, L, BBS
	Rourea sp.??	8418	LXF	CAY, BBS, COL
	Rourea sp.??	8379	DXT	CAY, BBS
CONVOLVULACEAE	*Ipomoea phillomega* (Vell.) House	8344	MF	CAY, BBS
	Maripa cf. *densiflora* Benth.	8322	MF	CAY, BBS
	Maripa reticulata Ducke	8192	LXF	CAY, BBS
	Operculina sericantha (Miq.) Ooststr.	8498	IF	CAY, BBS, ARIZ

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
COSTACEAE	*Costus claviger* Benoist	8387	MF	CAY-BBS
	Costus claviger Benoist	8325	MF	CAY-BBS
	Costus congestiflorus Rich. ex Gagnep.	8402	LHF	CAY
	Costus scaber Ruiz & Pav.	8160	IF	CAY–BBS
	Dimerocostus strobilaceus Kuntze ssp. *gutierrezii* (Kuntze) Maas	8514	LHF	CAY, BBS, L, NY
CUCURBITACEAE	*Gurania bignoniacea* (Poepp. & Endl.) C.Jeffrey ♀ Flowers	8479	LXF	CAY, BBS, NY
	Gurania bignoniacea (Poepp. & Endl.) C.Jeffrey ♂ Flowers	8480	LXF	CAY, BBS, NY
	Gurania lobata (L.) Pruski	8195	MF	CAY, K, NY, BBS
	Gurania aff. ***robusta*** Suess.	8009	MF	CAY, L, BBS
	Gurania subumbellata (Miq.) Cogn.	8324	MF	CAY, BBS, L, K, P, NY
	Psiguria triphylla (Miq.) C.Jeffrey	8159	IF	CAY, BBS
CYCLANTHACEAE	*Asplundia brachyphylla* Harling	NC	IF	
CYPERACEAE	*Bisboeckelera microcephala* (Boeck.) T.Koyama.	NC	IF	
	Calyptrocarya bicolor (H. Pfeiff.) T.Koyama	8251	MF	CAY, L, P, NY, BBS
	Calyptrocarya glomerulata (Brongn.) Urban	8540	IF	CAY, BBS
	Diplasia karataefolia Rich.	8516	DXT	CAY, BBS
	Diplasia karataefolia Rich.	NC	MF/IF	
	Mapania sylvatica Aubl. ssp. *sylvatica*	8098	IF	CAY, K
	Mapania sylvatica Aubl. ssp. *sylvatica*	NC	MF	
	Rhynchospora cephalotes (L.) Vahl	8116	IF	CAY, L, BBS
	Rhynchospora cf. *cephalotes* (L.) Vahl	NC	IF	
	Scleria latifolia Sw.	8140	IF	CAY, L, NY, BBS
DICHAPETALACEAE	*Dichapetalum rugosum* (Vahl) Prance	8059	MF	CAY, BBS
	Tapura guianensis Aubl.	8049	MF	CAY, L, BBS
	Tapura guianensis Aubl.	8328	MF	CAY, BBS, K
	Tapura guianensis Aubl.	NC	IF	
DILLENIACEAE	Genus indet.	NC	MF/IF	
DIOSCOREACEAE	*Dioscorea altissima* Lam.	8357	MF	CAY, BBS
	Dioscorea piperifolia Humb. & Bonpl. ex Willd.	8406	LXF	CAY, BBS, L
	Dioscorea polygonoides Humb. & Bonpl. ex Willd.	8422	LXF	CAY, BBS, IZTA
	Dioscorea cf. *syringifolia* Kunth & R.H.Schomb.	8021	LXF	CAY, L, BBS
ELAEOCARPACEAE	*Sloanea* sp.	8279	LF	CAY
ERIOCAULACEAE	*Paepalanthus fasciculatus* (Rottb.) Kunth	8407	DXT	CAY, BBS, B, F
ERYTHROXYLACEAE	*Erythroxylum macrophyllum* Cav. var. *macrophyllum*	8327	IF	CAY, BBS
	Erythroxylum squamatum Sw.	8175	LXF	CAY, BBS
	Erythroxylum squamatum Sw.	8581	DXT	CAY, BBS, L, NY
EUPHORBIACEAE	*Croton argyrophylloides* Müll.Arg.	8018	LXF	CAY-BBS
	Croton argyrophylloides Müll.Arg.	8448	LXF	CAY
	Croton argyrophylloides Müll.Arg.	8586-B	LXF	CAY, BBS, WIS
	Croton cajucara Benth.	8180	LXF	CAY, WIS, BBS
	Croton cajucara Benth.	8580	LXF	CAY, BBS, WIS
	Croton cf. *nutians* Croizat? (Juvenile form?)	8124	MF	CAY, BBS
	Croton schiedeanus Schltdl.	8492	MF	CAY, BBS, WIS
	Croton schiedeanus Schltdl.	8193	IF	FC

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Croton schiedeanus Schltdl.	8393	LF	CAY
	Croton trinitatis Millsp.	8150	MF	CAY, L, BBS
	cf. *Croton*	8305	MF	CAY, BBS
	Dalechampia tiliifolia Lam.	8084	MF	CAY, ALA, BBS
	Mabea aff. *speciosa* Müll.Arg.	8015	MF	CAY, L, US, BBS
	Mabea aff. *speciosa* Müll.Arg.	NC	MF/IF	
	Manihot cf. *anomala* Pohl	8513	SV	CAY, BBS
	Manihot sp.	8111	IF	CAY
	Maprounea guianensis Aubl.	8411	DXT	CAY, BBS, L
	Maprounea guianensis Aubl.	NC	MF/LXF	
	Micrandra brownsbergensis Lanj.	8421	LXF	CAY, BBS, L
	Micrandra brownsbergensis Lanj.	8535	LXF	CAY, BBS, B
	Pausandra martinii Baill.	8293	MF	CAY, BBS
	Pausandra cf *martinii* Baill.	8058	MF	CAY
	Sagotia racemosa Baill.	8001	LXF	CAY, L, K, BBS
	Sagotia racemosa Baill.	8109	MF	CAY, L, BBS
	Genera indet.	8225	LXF	CAY
FABACEAE (CAESALP.)	***Bauhinia*** cf. ***longicuspis*** Spruce ex Benth.	8291	MF	CAY
	Bauhinia siqueiraei Ducke	8000	LXF	CAY, L, BBS
	Bauhinia siqueiraei Ducke	8278	LF	CAY, L, K, US, BBS
	Bauhinia siqueiraei Ducke	8352	MF	CAY, BBS
	Chamaecrista nictitans (L.) Moench cf.var. *disadena* (Steud.) H.S.Irwin & Barneby	8083	MF	CAY, L, NY, BBS
	Crudia aff. *aromatica* (Aubl.) Willd.	8104	IF	CAY, BBS
	Crudia aff. *aromatica* (Aubl.) Willd.	8241	MF	CAY, K, BBS
	Crudia aff. *aromatica* (Hub.) Willd.	8267	IF	CAY
	Crudia cf. *spicata* (Aubl.) Willd.	8621	MF	CAY, BBS
	Dimorphandra cf. *pullei* Amshoff	8004 A	LXF	CAY, L
	Macrolobium cf. *angustifolium* (Benth.) R.S.Cowan	8174	LXF	CAY, BBS
	Mora gonggrijpii (Kleinhoonte) Sandwith	NC	MF	
	Paloue guianensis Aubl.	8354	MF	CAY, BBS, L
	Peltogyne venosa (Vahl) Benth.	NC	IF	
	Peltogyne paniculata Benth. ssp. *pubescens* (Benth.) M.F.Silva	8006	LXF	CAY
	Senna bicapsularis (L.) Roxb.	8202	MF	CAY, L, K, US, BBS
	Senna chrysocarpa (Desv.) H.S.Irwin & Barneby	8082	LXF	CAY, BBS
	Senna latifolia (G. Mey.) H.S.Irwin & Barneby	8093 A	MF	CAY, BBS
	Vouacapoua americana Aubl.	NC	MF	
FABACEAE (MIMOS.)	*Abarema mataybifolia* (Sandwith) Barneby & J.W.Grimes	8521	SV	CAY
	Acacia tenuifolia (L.) Willd. var. *tenuifolia*	8090	MF	CAY, K, L, BBS
	Calliandra hymenioides (Rich.) Benth.	8416	LXF	CAY, P, L, K, NY, US
	Cedrelinga cateniformis (Ducke) Ducke)	NC	MF	
	Inga alba (Sw.) Willd.	NC	MF	
	Inga retinocarpa Poncy	8277	MF	CAY, BBS
	Inga stipularis DC.	8243	LXF	CAY
	Inga stipularis DC.	8371	DXT	CAY, BBS, P
	Inga stipularis DC.	8472	MF	CAY, BBS, P
	Inga stipularis DC.	NC	LXF	
	Inga cf. *umbellifera* (Vahl) Steud ex DC.	8176	LXF	CAY, P, BBS
	Inga cf. *virgultosa* (Vahl) Desv.	8222	LXF	CAY
	Inga cf. *virgultosa* (Vahl) Desv.	8226	LXF	CAY, L, P, K, BBS

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Inga cf. *virgultosa* (Vahl) Desv.	NC	MF	
	Mimosa sp.	NC	IF	
	Pithecellobium sp.	8004 B	LXF	CAY, L
	Pseudopiptadenia cf. *psilostachya* (DC.) G.P.Lewis & M.P.Lima	8333	MF	CAY, BBS
	Zygia racemosa (Ducke) Barneby & J.W.Grimes	8052	MF	CAY, BBS
FABACEAE (PAPILION.)	*Alexa wachenheimii* Benoist	8495 A	IF	CAY, BBS, K
	Andira sp.	NC	MF	
	Bocoa prouacensis Aubl.	NC	MF	
	Bocoa viridiflora (Ducke) R.S.Cowan	8005	LXF	CAY, L, BBS
	Bocoa viridiflora (Ducke) R.S.Cowan	8533	MF	CAY, BBS
	Bocoa sp.	NC	IF	
	Candolleodendron brachystachyum (DC.) R.S.Cowan	8275	MF	CAY
	Centrosema plumieri (Turpin ex Pers.) Benth	8206	IF	CAY
	Clitoria sagotii Fantz	8332	IF	CAY, BBS
	Dioclea scabra (Rich.) R.H.Maxwell var. *scabra*	8152	MF	CAY, L, K, BBS
	Dioclea macrocarpa Huber	8122	MF	CAY, BBS
	Lonchocarpus cf. *heptaphyllus* (Poir.) DC.	NC	MF	
	Machaerium quinatum (Aubl.) Sandwith var. *parviflorum* (Benth.) Rudd	8307	FDH	CAY
	Mucuna urens (L.) Medik	8158	MF	CAY, BBS
	Pterocarpus officinalis Jacq.	NC	IF	
	Pterocarpus santalinoides L'Hér. ex DC.	8156	MF	CAY, L, P, K, BBS
	Rhynchosia phaseoloides (Sw.) DC.	8089	MF	CAY, K, BBS
	Rhynchosia sp.	8133	MF	CAY, L, K, BR, NY, BBS
	Swartzia arborescens (Aubl.) Pittier	8064	MF	CAY, BBS
	Swartzia benthamiana Miq.	NC	MF	
	Swartzia grandifolia Bong. ex Benth.	8334	MF	CAY, BBS
	Swartzia cf. *schomburgkii* Benth.	NC	MF	
	Swartzia panacoco (Aubl.) R.S.Cowan	NC	MF	
	Vigna caracalla (L.) Verde	8384	SV	CAY, BBS, K, NY
GENTIANACEAE	*Voyria caerulea* Aubl.	8053	MF	CAY
GESNERIACEAE	*Drymonia coccinea* (Aubl.) Wiehler	8299	IF	CAY
	Paradrymonia cf. *campostyla* (Leeuwenb.) Wiehler	8298	IF	CAY, BBS
GNETACEAE	*Gnetum urens* (Aubl.) Blume	8306	MF	CAY, L, K, NY, BBS
GOUPIACEAE	*Goupia glabra* Aubl.	NC	IF	
HAEMODORACEAE	*Xiphidium caeruleum* Aubl.	8065	IF	CAY, L, BBS
	Xiphidium caeruleum Aubl.	NC	IF	
HELICONIACEAE	*Heliconia acuminata* Rich. ssp. *acuminata*	8092	MF	CAY, L, BBS
	Heliconia acuminata Rich. ssp. *acuminata*	NC	IF	
	Heliconia bihai (L.) L.	8343	MF	CAY
	Heliconia bihai (L.) L.	NC	IF	
	Heliconia chartacea Lane ex Barreiros	8501	IF	CAY, BBS
	Heliconia hirsuta L.f.	8130	MF	CAY, L, NY, BBS
	Heliconia hirsuta L.f.	NC	IF	
	Heliconia lourteigiae Emygdio & E.Santos	8163	IF	CAY, L, BBS
	Heliconia lourteigiae Emygdio & E.Santos	8500	LHF	CAY, BBS, P, L, US
	Heliconia richardiana Miq.	8203	IF	CAY

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Heliconia richardiana Miq.	NC	MF	
	Heliconia spathocircinata Aristeg.	NC	IF	
HYPERICACEAE	*Vismia cayennensis* (Jacq.) Pers.	8198	MF	CAY, L, BBS
ICACINACEAE	***Pleurisanthes artocarpi*** Baill.	8476	MF	CAY, BBS
LAMIACEAE	*Aegiphila racemosa* Vell.	8497 B	MF	CAY, BBS, L
	Aegiphila villosa (Aubl.) G.F.Gmel.	8548	IF	CAY, BBS, L, K, US
	Vitex compressa Turcz.	8272	MF-B	CAY, BBS
	Vitex cf. *compressa* Turcz.	NC	MF-B	
	Vitex triflora Vahl	8321	IF	CAY, BBS, L
	Vitex triflora Vahl	8571	IF	CAY, BBS, L
LAURACEAE	*Aniba megaphylla* Mez	8508	IF	CAY, BBS, MO
	cf. *Aniba* sp.?	8550	IF	CAY
	Endlicheria sp.?	8361	MF	CAY, BBS, MO
LECYTHIDACEAE	*Couratari stellata* A.C.Sm.	NC	MF	
	Couratari sp.	NC	MF	
	Eschweilera pedicellata (Rich.) S.A.Mori	8173	IF	CAY, L, P, NY, BBS
	Eschweilera aff. pedicellata (Rich.) S.A.Mori	8263	IF	CAY, BBS
	Eschweilera sp.	NC	MF	
	Lecythis zabucajo Aubl.	NC	MF	
LOGANIACEAE	*Spigelia hamelioides* Kunth	8296	IF	CAY, U, P, B, NY, MO, BBS
	Strychnos erichsonii M.R.Schomb. ex Progel	8390	LF	CAY, BBS
	Strychnos cf *erichsonii* M.R.Schomb. ex Progel	8073	MF	CAY
	Strychnos eugeniifolia Monach.	8063	MF	CAY, BBS
	Strychnos medeola Sagot ex Progel	8020	LXF	CAY, BBS
	Strychnos medeola Sagot ex Progel	8410	DXT	CAY, BBS, L, US
	Strychnos medeola Sagot ex Progel	NC	MF	
LORANTHACEAE	*Phthirusa stelis* (L.) Kuijt	8233	LXF	CAY, NY, BBS
	Phthirusa stelis (L.) Kuijt	8380	DXT	CAY, BBS
MALPIGHIACEAE	*Bunchosia argentea* (Jacq.) DC.	8165	IF	CAY, L, BBS
	Byrsonima cf. *laevigata* (Poir.) DC.	NC	LXF	
	Byrsonima surinamensis W.R.Anderson	8364	DXT	CAY, BBS, MICH
	Byrsonima surinamensis W.R.Anderson	8452	LXF	CAY, BBS, MICH
	Byrsonima surinamensis W.R.Anderson	8565	LXF	CAY, BBS, K, L, US, MICH
	Byrsonima surinamensis W.R.Anderson	8582	DXT	CAY, BBS, MICH
	Heteropterys nervosa A.Juss.	8244	LXF	CAY, BBS
	Hiraea affinis Miq.	8503	IF	CAY, BBS, L, P, MICH
	Hiraea fagifolia (DC.) A.Juss.	8386	LF	CAY, BBS, MICH
	Mascagnia surinamensis (Kosterm.) W.R.Anderson	8091	MF	CAY, L, K, NY, MICH, BBS, WRA
	Mezia includens (Benth.) Cuatrec.	8478	MF	CAY, BBS, L, MICH
	Stigmaphyllon convolvulifolium A.Juss.	8106	MF	CAY, L, B, K, US, MICH, BBS
	Stigmaphyllon sinuatum (DC.) A.Juss.	8081	LXF	CAY, L, MICH, BBS
	Tetrapterys styloptera A.Juss.	8231	LXF	CAY, L, US, HRCB, BBS
	Genus indet.	8060	MF	CAY
MALVACEAE	*Apeiba glabra* Aubl.	NC	MF	
	Apeiba petoumo Aubl.	NC	IF	
	cf. *Bombax* sp.	8453	LXF	CAY
	Pachira dolichocalyx Robyns	8103	MF	CAY, L, B, BBS

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Sterculia pruriens (Aubl.) K.Schum.	8268	IF	CAY
	Sterculia cf. *pruriens* (Aubl.) K .Schum.	NC	MF	
	Theobroma subincanum Mart.	8504	SV	CAY, BBS, US
MARANTACEAE	*Calathea altissima* (Poepp. & Endl.) Körn.	NC	IF	
	Calathea elliptica (Roscoe) K.Schum.	8389	LF	CAY, BBS
	Calathea elliptica (Roscoe) K.Schum.	NC	IF/MF	
	Calathea zingiberina Körn.	8114	IF	CAY, BBS
	Calathea zingiberina Körn.	NC	MF	
	Hylaeanthe unilateralis (Poepp. & Endl.) A.M.E.Jonker & Jonker	8506 A	IF	CAY, BBS, UMF, B
	Ischnosiphon arouma (Aubl.) Körn.	8303	MF	CAY, BBS
	Ischnosiphon arouma (Aubl.) Körn.	NC	IF	
	Ischnosiphon gracilis (Rudge) Körn.	8537	IF	CAY, BBS
	Ischnosiphon obliquus (Rudge) Körn.	NC	IF	
	Ischnosiphon puberulus Loes.	NC	IF/MF	
	Monotagma secundum (Petersen) K.Schum.	8502	LHF	CAY, BBS
	Monotagma spicatum (Aubl.) J.F.Macbr.	8259	IF	CAY, BBS
MARCGRAVIACEAE	*Marcgravia pedunculosa* Triana & Planch..	8235	IF	CAY, BBS
	Norantea guianensis Aubl.	8515	DXT	CAY, BBS, L
MAYACACEAE	*Mayaca longipes* Mart. ex Seub.	8242	A	CAY
MELASTOMATACEAE	*Aciotis purpurascens* (Aubl.) Triana	8161	IF	CAY, L, NY, BBS
	Aciotis aff. *rubricaulis* (Schrank & Mart. ex DC.) Triana	8038	MF	CAY, L, US, BBS
	Clidemia conglomerata DC.	8034	IF	CAY, BBS
	Henriettella caudata Gleason	8028	IF	CAY, P, L, NY, BBS
	Miconia cf. *affinis* DC.	8037	MF	CAY, L, US, BBS
	Miconia chrysophylla (Rich.) Urb.	8598-A	DXT	CAY, BBS, US
	Miconia lateriflora Cogn.	8470	MF	CAY, BBS, US
	Miconia plukenetii Naudin	NC	IF	
	Miconia prasina (Sw.) DC.	8467	MF	CAY, BBS, P, US
MELIACEAE	*Trichilia* cf. *surinamensis* (Miq.) C.DC.	8178	LXF	CAY, BBS
MENISPERMACEAE	*Abuta rufescens* Aubl.	8072	MF	CAY
	Abuta rufescens Aubl.	8339	IF	CAY, BBS
	Cissampelos fasciculata Benth.	8568	MF-B	CAY, BBS, B
	Curarea candicans (Rich. ex DC.) Barneby & Krukoff	NC	MF/IF	
	Disciphania sp.?	8405	LXF	CAY, BBS, B, MO
	Orthomene schomburgkii (Miers) Barneby & Krukoff	8468	SV	CAY, BBS, US
	Sciadotenia cayennensis Benth.	8626		CAY, BBS, P, L, B, US
MORACEAE	*Bagassa guianensis* Aubl.	8035	MF	CAY, BBS
	Brosimum rubescens Taub.	NC	MF	
	Brosimum sp.	NC	MF	
	Ficus nymphaeifolia Mill.	NC	MF	
MYRISTICACEAE	*Iryanthera hostmannii* (Benth.) Warb.	8618	LXF	CAY, BBS, P, L, US
	Virola cf. *michelii* Heckel	NC	MF	
MYRTACEAE	***Calycorectes batavorum*** McVaugh	8229	LXF	CAY, L, K, US, SEL, BBS
	cf. *Calyptranthes forsteri* O.Berg?	8423	LXF	CAY, SEL
	Calyptranthes pullei Burret ex Amshoff	8396	LXF	CAY, BBS, SEL
	Eugenia cucullata Amshoff	8543	LXF	CAY, BBS, SEL
	Eugenia excelsa O.Berg	8628	LXF	CAY, BBS, SEL

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Eugenia aff. *feijoi* O.Berg	8348	MF	CAY, BBS, K, SEL
	Eugenia aff. *feijoi* O.Berg	8457	MF	CAY, BBS, SEL
	Eugenia macrocalyx (Rusby) Mc Vaugh	8181	LXF	CAY, L, BBS
	Eugenia macrocalyx (Rusby) McVaugh	8392	LF	CAY, SEL
	Eugenia patrisii Vahl	8629	LXF	CAY, BBS
	Eugenia cf. *ramiflora* Desv.	8544	LXF	CAY, BBS
	Eugenia wullschlaegeliana Amshoff	8353	SV	CAY, BBS, SEL
	Eugenia wullschlaegeliana Amshoff	8539	LXF	CAY, BBS, SEL-K
	cf. *Eugenia* sp. 1	8545	LXF	CAY, BBS, SEL
	Myrcia citrifolia (Aubl.) Urb.	8608	DXT	CAY, BBS, P, K, L, SEL
	Myrcia guianensis (Aubl.) DC.	8378	DXT	CAY, BBS, SEL
	Myrcia aff. *pyrifolia* (Desv. ex Ham.) Nied.	8446	LXF	CAY, BBS
	Myrcia aff. *pyrifolia* (Desv. ex Ham.) Nied.	8523	DXT	CAY, BBS, SEL
	Myrcia saxatilis (Amshoff) McVaugh	8367	DXT	CAY, BBS, SEL
	Myrcia saxatilis (Amshoff) McVaugh	8489	DXT	CAY, BBS, K
	Myrcia sylvatica (G.Mey.) DC.	8527 A	DXT	CAY
	Myrcianthes prodigiosa McVaugh	8617	DXT	CAY, BBS
	Genus indet.	8269	MF-B	CAY, BBS
	Genus indet.	NC	LXF	
	Genus indet.	8526 A	DXT	CAY
NYCTAGINACEAE	***Neea* cf. *constricta*** Spruce ex J.A.Schmidt	8572	LXF	CAY, BBS, K, MO
OCHNACEAE	cf. *Elvasia elvasioides* (Planch.) Gilg	8220	LXF	CAY
	Ouratea leblondii (Tiegh.) Lemée	8369	DXT	CAY, BBS, P
	Ouratea leblondii (Tiegh.) Lemée	8372	DXT	CAY, BBS, P
	Ouratea leblondii (Tiegh.) Lemée	8420	LXF	CAY, BBS
	Ouratea schomburgkii (Planch.) Engl. vel ***Ouratea rigida*** Engl.	8604	DXT	CAY, BBS
	Quiina* aff. *wurdackii Pires?	8376	DXT	CAY, BBS, MO
	Quiina* aff. *wurdackii Pires?	8487	DXT	CAY, BBS
	Quiina* aff. *wurdackii Pires?	8488	DXT	CAY
OLACACEAE	*Heisteria cauliflora* Sm.	8236	IF	CAY, L, B, US, BBS
	Heisteria cf. ***insculpta*** Sleumer	8016	MF	CAY, BBS
	Minquartia guianensis Aubl.	NC	MF	
	Ximenia americana L. *var. americana*	8428	LXF	CAY, BBS, L, US
ONAGRACEAE	*Ludwigia* sp.	8264	A	CAY
ORCHIDACEAE	*Brassia lawrenceana* Lindl.	8596	DXT	CAY, BBS, MO
	Elleanthus cf. *caravata* (Aubl.) Rchb.f.	8434	LXF	CAY
	Epidendrum purpurascens H.Focke	8449	LXF	CAY
	Gongora sp.	8430	LXF	CAY, BBS
	Heterotaxis villosa (Barb. Rodr.) F.Barros	8432	LXF	CAY
	Jacquiniella globosa (Jacq.) Schltr.	8435 A	LXF	CAY
	Koellensteinia kellneriana Rchb.f.	8458	LXF	CAY
	Macradenia lutescens R.Br.	8401	LHF	CAY, BBS
	Maxillaria alba (Hook.) Lindl.	8436	LXF	CAY, BBS
	Maxillaria discolor (Lodd. ex Lindl.) Rchb.f.	8442	LXF	CAY
	Maxillaria uncata Lindl.	8440	LXF	CAY, BBS
	Palmorchis prospectorum Veyret or *P. pubescens* Barb. Rodr.	8068	IF	CAY, BBS
	Palmorchis pabstii Veyret or *P. guianensis* (Schltr.) Schweinf. & Correl	8054	MF	CAY
	Pleurothallis archidiaconi Ames	8609	DXT	CAY, BBS
	Polystachya concreta (Jacq.) Garay & H.R.Sweet	8441	LXF	CAY

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Polystachya amazonica Schltr.	8022	LXF	BBS
	Prosthechea aemula (Lindl.) W.E.Higgins.	8431	LXF	CAY
	Scaphyglottis cf. *graminifolia* (Ruiz & Pav.) Poepp. & Endl..	8435 B	LXF	CAY
	Scaphyglottis sp.	8438	LXF	CAY, BBS
	Schomburgkia marginata Lindl.	8524	DXT	CAY, BBS
	Stanhopea grandiflora (Lodd.) Lindl.	8491 A	DXT	CAY, BBS
	Stelis argentata Lindl.	8437	LXF	CAY, BBS
	Stelis santiagoensis Mansf.	8610	DXT	CAY, BBS
	Vanilla sp.	8517	MF	CAY, BBS, MO, CICY
OXALIDACEAE	***Oxalis juruensis*** Diels	8204	IF	CAY, L, NY, BBS
PASSIFLORACEAE	*Dilkea* sp.	8363	MF	CAY, BBS
	Dilkea sp.	8477	LXF	CAY, BBS, US
	Passiflora amoena L.K.Escobar	8560	MF-B	CAY, BBS
	Passiflora coccinea Aubl.	8085	MF	CAY, BBS
	Passiflora fuchsiiflora Hemsl.	8129	MF	CAY, L, P, US, BBS
	Passiflora fuchsiiflora Hemsl.	NC	IF	
	Passiflora garckei Masters	8350	SV	CAY, BBS, US
	Passiflora cf. *garckei* Mast.	8107	MF	CAY, L, US, BBS
	Passiflora cf. *garckei* Mast.	NC	LXF	
	Passiflora glandulosa Cav.	8290	LF	CAY, BBS
	Passiflora laurifolia L.	8382	DXT	CAY, BBS
	Passiflora laurifolia L.	8464	MF	CAY, BBS
	Passiflora cf. ***oerstedii*** Mast.	8356	MF	CAY, BBS, US
	Passiflora retipetala Mast.	8564	LXF	CAY, BBS, US
	Passiflora rubra L.	8205	IF	CAY, BBS
	Passiflora serrato-digitata L.	8600	IF	CAY, BBS, US
	Passiflora vespertilio L.	8029	IF	CAY, BBS
	Passiflora vespertilio L.	8066	IF	CAY
	Passiflora vespertilio L.	8451	LXF	CAY
	Passiflora vespertilio L.	8465	MF	CAY, BBS
	Turnera rupestris Aubl.	8044	IF	CAY, L, US, STR, BBS
	Turnera rupestris Aubl.	8563	MF-B	CAY, BBS, P
	Turnera rupestris Aubl.	8577	LXF	CAY, BBS, P
	Turnera cf. *rupestris* Aubl.	8594	DXT	CAY, BBS
PICRAMNIACEAE	*Picramnia guianensis* (Aubl.) Jans.-Jac.	8040	MF	CAY, L, NY, BBS
	Picramnia guianensis (Aubl.) Jans.-Jac.	8534	LXF	CAY, BBS, NY
	Picramnia latifolia Tulasne	8200	MF	CAY, L, P, K, NY, BBS
PIPERACEAE	*Peperomia glabella* (Sw.) A.Dietr.	8292	LF	CAY, L, P, US, HUA, BBS
	Peperomia macrostachya (Vahl) A.Dietr.	8576	LXF	CAY, BBS, L
	Piper anonifolium (Kunth) C.DC.	8170	IF	CAY, L, BBS
	Piper anonifolium (Kunth) C.DC.	8217	IF	CAY, L, BBS
	Piper cf. *anonifolium* (Kunth) C.DC.	NC	IF	
	Piper arboreum Aubl.	8301	IF	CAY, L, US, HUA, BBS
	Piper arboreum Aubl.	8398	LHF	CAY, BBS, L
	Piper cf. *arboreum* Aubl.	8262	IF	CAY
	Piper bartlingianum (Miq.) C.DC.	8075	MF	CAY, L, BBS
	Piper bartlingianum (Miq.) C.DC.	8250	MF	CAY, BBS
	Piper demeraranum (Miq.) C.DC.	8141	IF	CAY, L, BBS

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Piper demeraranum (Miq.) C.DC.	8261	IF	CAY
	Piper demeraranum (Miq.) C.DC.	8030	IF	CAY, BBS
	Piper hispidum Sw.	8088	MF	CAY, L, HUA, BBS
	Piper hosmannianum (Miq.) C.DC.	8087	MF	CAY, L, HUA, BBS
	Piper humistratum Görts & K.U.Kramer	8260	IF	CAY
	Piper cf. *pulleanum* Yunck.	8139	IF	CAY
	Piper trichoneuron (Miq.) C.DC.	NC	IF	
	Piper sp.	NC	IF	
PLANTAGINACEAE	*Scoparia dulcis* L.	8157	MF	CAY, L, US, NY, BBS
POACEAE	*Ichnanthus nemoralis* (Schrad. ex Schult.) Hitchc. & Chase	8117	IF	CAY, L, MO
	Ichnanthus panicoides P.Beauv.	8014	MF	CAY, L, BBS
	Ichnanthus panicoides P.Beauv.	NC	IF	
	Panicum cf. *miliaceum* L. (introduced?)	8445	LXF	CAY, BBS
	Parodiolyra micrantha (Kunth) Davidse & Zuloaga	NC	MF/IF	
	Pharus latifolius L.	8207	IF	CAY
	Pharus parvifolius Nash ssp. *parvifolius*	8208	IF	CAY, L, BBS
	Piresia goeldii Swallen	NC	IF	
PODOSTEMACEAE	*Mourera fluviatilis* Aubl.	8196	A	CAY, P, BBS
	Rhyncholacis guyanensis P.Royen	8002	A	CAY
	Rhyncholacis guyanensis P.Royen	8003	A	CAY
	Rhyncholacis guyanensis P.Royen	8197	MF	CAY, L, US, BBS
POLYGALACEAE	*Securidace* cf. *paniculata* Rich.	8491 B	IF	CAY-BBS-L-K-NY
POLYGONACEAE	*Coccoloba excelsa* Benth.	8228	LXF	CAY, L, K, AAU, BBS
	Coccoloba excelsa Benth.	8585		CAY, BBS
	Coccoloba cf. *excelsa* Benth.	8546	LXF	CAY, BBS
	Coccoloba cf. *excelsa* Benth.	8341	MF	CAY, BBS, L, AAU
	Coccoloba cf. *excelsa* Benth.	8607	DXT	CAY, BBS, MO
	***Coccoloba* sp. 1**	8381	DXT	CAY
	Coccoloba sp. 2	8616	DXT	CAY, BBS, MO
PRIMULACEAE	*Clavija lancifolia* Desf. ssp. *lancifolia*	8147	IF	CAY, L, BBS
	Cybianthus cf. *penduliflorus* Mart.	8505	IF	CAY, BBS, FTG
PROTEACEAE	*Panopsis sessilifolia* (Rich.) Sandwith	8151	MF	CAY
PUTRANJIVACEAE	*Drypetes variabilis* Uittien	NC	IF/MF	
RHAMNACEAE	*Gouania blanchetiana* Miq.	8248	LXF	CAY, L, K, NY, MO, BBS
RHIZOPHORACEAE	*Cassipourea guianensis* Aubl.	8185	LXF	CAY, L, K, B, NY, BBS
	Cassipourea guianensis Aubl.	8283	MF	CAY, L, K, NY, BBS
RUBIACEAE	*Chiococca alba* (L.) Hitchc.	8337	MF	CAY, BBS, L, P, K, B, NY, MO
	Chiococca alba (L.) Hitchc.	8096	MF	CAY, L, MO, BR, BBS
	Chiococca alba (L.) Hitchc.	8584	DXT	CAY, BBS, UFG
	Chiococca nitida Benth.	8377	DXT	CAY, BBS, MO, UFG
	Chomelia malaneoides Müll.Arg.	8417	LXF	CAY, BBS, MO, UFG
	Coussarea micrococca Bremek.	8351	SV	CAY, BBS, L, MO
	Coussarea sp.	8606	DXT	CAY, BBS, MO
	Coutarea hexandra (Jacq.) K.Schum.	8531	MF	CAY, BBS, L, P
	Duroia aquatica (Aubl.) Bremek.	NC	IF	
	Duroia eriopila L.f.	8234	LXF	CAY

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Duroia cf. *eriopila* L.f.	NC	IF	
	Faramea quadricostata Bremek. emend. Steyerm.	8023	LXF	CAY, L, MO, BBS
	Faramea quadricostata Bremek. emend. Steyerm.	8221	LXF	CAY
	Faramea quadricostata Bremek. emend. Steyerm.	NC	MF	
	Faramea sessilifolia (Kunth) DC.	8245	LXF	CAY
	Faramea sessilifolia (Kunth)DC.	8605	DXT	CAY, BBS, MO
	Genipa spruceana Steyerm.	8110	IF	CAY, L, BBS
	Gonzalagunia dicocca Cham. & Schltdl..	8297	IF	CAY, L, BR, MO, BBS
	Guettarda argentea Lam.	8566	LXF	CAY, BBS, MO
	Guettarda spruceana Müll.Arg.	8415	DXT	CAY, BBS
	cf. *Guettarda* sp.?	8355	LXF	CAY, BBS, MO
	Ixora graciliflora Benth.	8076	LXF	CAY, L, MO, BBS
	Ixora graciliflora Benth.	8230	LXF	CAY, L, B, BR, MO, BBS
	Ixora graciliflora Benth.	8239	MF	CAY, L, B, BR, MO, BBS
	Ixora graciliflora Benth.	8412	DXT	CAY, BBS
	Ixora graciliflora Benth.	8574	LXF	CAY, BBS, MO
	Ixora sp.	8126	MF	CAY, MO, BBS
	Manettia alba (Aubl.) Wernham	8320	MF	CAY, BBS, L, MO
	Margaritopsis guianensis (Bremek.) C.M. Taylor	8575	LXF	CAY, BBS
	Morinda cf. *brachycalix* (Bremek.) Steyerm.	8051	MF	CAY, BBS
	Morinda surinamensis (Bremek.) Steyerm.	8282	MF	CAY, BBS
	Morinda tenuiflora (Benth.) Steyerm.	8424	LXF	CAY
	cf. *Pagamea* sp.	8078	LXF	CAY, L, BR, MO, BBS
	Palicourea cf. *amapaensis* Steyerm.	8527 B	MF	CAY, BBS
	Palicourea crocea (Sw.) Roem. & Schult.	8188	LXF	CAY, L, K, NY, MO, BBS
	Palicourea croceoides Desv ex Ham.	8019	LXF	CAY
	Palicourea guianensis Aubl.	NC	MF	
	Posoqueria latifolia (Rudge) Roem. & Schult. ssp. *gracilis* (Rudge) Steyerm.	8532	MF	CAY, BBS, L, UFG
	Posoqueria latifolia (Rudge) Roem. & Schult. ssp. *latifolia*	8041	IF	CAY, BBS
	Posoqueria latifolia (Rudge) Roem. & Schult. ssp. *latifolia*	8121	IF	CAY, BBS
	Psychotria apoda Steyerm.	8017	MF	CAY, BBS
	Psychotria apoda Steyerm.	NC	IF	
	Psychotria bracteocardia (DC.) Müll.Arg.	8345	SV	CAY, BBS
	Psychotria bracteocardia (DC.) Müll.Arg.	8541	LXF	CAY, BBS, MO, UFG
	Psychotria cf. *carthagenensis* Jacq.	8347	MF-B	CAY, BBS, L, MO
	Psychotria hoffmannseggiana (Willd. ex Roem. & Schult.) Müll.Arg.	8374	DXT	CAY, BBS, L, MO
	Psychotria iodotricha Müll.Arg.	8025	LXF	CAY, BBS
	Psychotria iodotricha Müll.Arg.	8529	MF	CAY, BBS
	Psychotria kappleri (Miq.) Müll.Arg. ex Benoist.	8331	MF	CAY, BBS

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Psychotria moroidea Steyerm.	8013	MF	CAY, L, NY, MO, BBS
	Psychotria moroidea Steyerm.	8184	LXF	CAY, L, MO, BBS
	Psychotria muscosa (Jacq.) Steyerm.	8119	IF	CAY, MO, BBS
	Psychotria muscosa (Jacq.) Steyerm.	8143	IF	CAY, L, BR, MO, BBS
	Psychotria muscosa (Jacq.) Steyerm.	8526 B	MF	CAY, BBS, MO, UFG
	Psychotria racemosa Rich.	8399	LHF	CAY, BBS, MO
	Psychotria sp.	8213	IF	CAY
	Rudgea crassiloba (Benth.) B.L.Rob.	8365	DXT	CAY, BBS, P, MO
	cf. *Rudgea* sp.	8619	DXT	CAY, BBS
	Genus indet.	8271	MF-B	CAY, BBS
RUTACEAE	*Conchocarpus heterophyllus* (A.St.-Hil.) Kallunki & Pirani	8252	MF-B	CAY, L, K, NY, MO, BBS
	Conchocarpus heterophyllus (A.St.-Hil.) Kallunki & Pirani	8336	MF-B	CAY
	Erythrochiton brasiliensis Nees & Mart.	8486	MF	CAY, BBS, L, B, NY
	Esenbeckia cf. *pilocapoides* Kunth	8338	MF-B	CAY, BBS, L
	Esenbeckia cf. *pilocarpoides* Kunth	8254	MF-B	CAY, L, K, NY, MO, BBS
	Pilocarpus microphyllus Stapf ex Wardleworth	8219	LXF	CAY, BBS
	Pilocarpus microphyllus Stapf. ex Wardleworth	8536	LXF	CAY, BBS
	Ticorea foetida Aubl.	8045	MF	CAY, L, NY, BBS
	Ticorea foetida Aubl.	NC	IF	
	Ticorea foetida Aubl.	NC	MF-B	
	Zanthoxylum cf. *apiculatum* (Sandwith) P.G.Waterman	8010	MF	CAY, BBS
	Zanthoxylum sp. 2	NC	MF	
SALICACEAE	*Casearia* cf. *combaymensis* Tul.	8625	MF	CAY, BBS, MO
	Casearia decandra Jacq.	8366	DXT	CAY, BBS, MO
	Casearia aff. *decandra* Jacq.	8475	LXF	CAY, BBS, MO
	Casearia cf. *javitensis* Kunth.	8346	MF	CAY, BBS
	Casearia aff. *mariquitensis* Kunth	8375	DXT	CAY, BBS, K, MO
	Casearia negrensis Eichler	8240	MF	FC
	Casearia aff. *prunifolia* Kunth?	8329	MF	CAY, BBS, MO
	Xylosma benthamii (Tul.) Triana & Planch.	8561		CAY, BBS
	Xylosma sp.	NC	MF	
SANTALACEAE	*Phoradendron northropiae* Urb.	8304	MF	CAY, L, UVIC, BBS
	Phoradendron strongyloclados Eichler	8599	DXT	CAY, BBS, P, L, UVIC
SAPINDACEAE	*Cupania* aff. *diphylla* Vahl	8189	LXF	CAY, L, K, NY, US, BBS
	Cupania hirsuta Radlk.	NC	MF/IF	
	Cupania rubiginosa (Poir.) Radlk.	8455	LXF	CAY, BBS, L, P, US
	Cupania rubiginosa (Poir.) Radlk.	8627	LXF	CAY, BBS, US
	Paullinia acuminata Uittien	8183	LXF	CAY, BBS
	Paullinia alata (Ruiz & Pav.) G.Don	8212	IF	CAY, L, BBS
	Paullinia anodonta Radlk.	8507	SV	CAY, BBS, US
	Paullinia latifolia Benth. ex Radlk.	8506 B	SV	CAY, BBS, US
	Paullinia plagioptera Radlk.	8077	LXF	CAY, L, K, US, NY, BBS
	Paullinia plagioptera Radlk.	8578	LXF	CAY, BBS, US
	Paullinia stellata Radlk.	8335	MF	CAY, BBS

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Pseudima frutescens (Aubl.) Radlk.	8131	MF	CAY, L, US, BBS
	Talisia guianensis Aubl.	8342	MF	CAY, BBS
	Talisia guianensis Aubl.	8588	SV	CAY, BBS, US
	Talisia aff. *guianensis* Aubl.	8425	LXF	CAY
	Talisia macrophylla (Mart.) Radlk.	8061	MF	CAY
	Talisia macrophylla (Mart.) Radlk.	8340	MF	CAY, BBS
	Talisia macrophylla (Mart.) Radlk.	8391	LF	CAY, BBS, US
	Talisia mollis Kunth ex Cambess.	8071	MF	CAY, US, BBS
	Talisia pilosula Sagot ex Radlk.	8232	LXF	CAY, L, BBS
	Talisia sp.	8247	LXF	CAY, BBS
SAPOTACEAE	*Manilkara bidentata* (A.DC.) A.Chev.	NC	MF	
	Pouteria aff. ***sagotiana*** (Baill.) Eyma	8360	SV	CAY, BBS, K
	Pouteria cf. ***sagotiana*** (Baill.) Eyma	NC	MF	
	Pouteria sp.	8266	IF	CAY
	Pouteria sp.	NC	MF	
	Genus indet.	8450	LXF	CAY, BBS
SIMAROUBACEAE	*Simaba guianensis* Aubl. ssp. *guianensis*	8128	MF	CAY, L, BBS
	Simaba guianensis Aubl. ssp. *guianensis*	8132	IF	CAY, L, BBS
	Simaba guianensis Aubl. ssp. *guianensis*	8224	LXF	CAY, BBS
SIPARUNACEAE	*Siparuna decipiens* (Tul.) A.DC.	8214	IF	CAY, L, P, BBS
	Siparuna guianensis Aubl.	8050	MF	CAY, P, L, BBS
	Siparuna guianensis Aubl.	8238	MF	CAY, L, P, NY, BBS
SMILACACEAE	*Smilax lasseriana* Steyerm.	8603	DXT	CAY, BBS, B
	Smilax staminea Griseb.	8408	DXT	CAY, BBS, B, MO
	Smilax sp.	8012	MF	CAY, BBS
SOLANACEAE	*Cestrum schlechtendalii* G.Don	8284	IF	CAY, L, K, NY, BBS
	Solanum aff. ***adhaerens*** Roem. & Schult.	8404	LXF	CAY, BBS
	Solanum asperum. Rich.	8094	MF	CAY, L, NY, BBS
	Solanum velutinum Dunal	8427	LXF	CAY, BBS
THURNIACEAE	*Thurnia sphaerocephala* (Rudge) Hook.f.	NC	A	
TRIGONIACEAE	*Trigonia microcarpa* Sagot ex Warm.	8484	LXF	CAY, BBS
	Trigonia microcarpa Sagot ex Warm.	8048	MF	CAY, L, K, MO, US, BBS
URTICACEAE	***Urera baccifera*** (L.) Gaudich. ex Wedd.	8586-A	SV	CAY, BBS, BG
VERBENACEAE	*Petrea volubilis* L.	8047	MF	CAY, L, BBS
	Petrea cf. *volubilis* L.	NC	IF	
VIOLACEAE	*Amphirrhox longifolia* (A.St-Hil.) Spreng.	8562	MF	CAY, BBS, BHO
	Paypayrola hulkiana Pulle	8011	MF	CAY, L, BHO, BBS
	Paypayrola cf. *hulkiana* Pulle.	NC	IF/MF	
	Paypayrola sp.	8055	MF	CAY
	Rinorea neglecta Sandwith	8471	MF	CAY, BBS, BHO
	Rinorea pubiflora (Benth.) Sprague & Sandwith	8218	IF	CAY, L, K, NY, BHO, BBS
	Rinorea pubiflora (Benth.) Sprague & Sandwith	8289	IF	CAY, BHO, BBS
	Rinorea pubiflora (Benth.) Sprague & Sandwith var. *pubiflora*	8191	LXF	CAY, L, BHO, BBS
	Rinorea pubiflora (Benth.) Sprague & Sandwith	8589	SV	CAY, BBS, BHO
	Rinorea aff. *pubiflora* (Benth.) Sprague & Sandwith	8255	MF-B	CAY, BBS
	Rinorea cf. *pubiflora* (Benth.) Sprague & Sandwith	NC	IF	

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
	Rinorea aff. *pubiflora* ('Benth.') Sprague & Sandwith	8569	MF-B	CAY, BBS, BHO
	Rinorea riana Kuntze	8062	MF	CAY, BHO, BBS
	Rinorea riana Kuntze	8155	MF	CAY, P, L, BHO, BBS
	Rinorea riana Kuntze	8227	LXF	CAY, BHO, BBS
	Rinorea cf. *riana* Kuntze	NC	MF	
	Rinorea cf. *riana* Kuntze	NC	MF-B	
VITACEAE	*Cissus haematantha* Miq.	8026	LXF	CAY, BBS
	Cissus verticillata (L.) Nicolson & C.E.Jarvis	8080	LXF	CAY, L, BHCB, BBS
	Cissus verticillata (L.) Nicolson & C.E.Jarvis	8466	SV	CAY, BBS, HRCB
VOCHYSIACEAE	*Ruizterania albiflora* (Warm.) Marc.-Berti	NC	MF	
ZINGIBERACEAE	*Renelamia guianensis* Maas	8288	IF	CAY
	Renelamia guianensis Maas	NC	MF	
	Renelamia sp.	NC	MF-B	
INDET FAMILY	Species indet.	8549	IF	CAY

2. Bryophyta

Family	Taxon	Coll. No.	Veg.	Herbaria
BRYOPHYTA indet.	Species indet.	8148	A	CAY

3. Pteridophyta

Family	Taxon	Coll. No.	Veg.	Herbaria
ASPLENIACEAE	*Asplenium serratum* L.	8164	IF	CAY, L, BBS
CYATHEACEAE	*Cyathea pungens* (Willd.) Domin	8461	IF	CAY, BBS, P
DRYOPTERIDACEAE	*Bolbitis semipinnatifida* (Fée) Alston	NC	IF/ MF	
	Bolbitis semipinnatifida (Fée) Alston	8169	IF	CAY, L, BBS
	Cyclodium inerme (Fée) A.R.Sm.	NC	MF/IF	
	Cyclodium meniscioides (Willd.) C.Presl. var. *meniscioides*	8033	IF	CAY, L, BBS
	Elaphoglossum glabellum J.Sm.	8443	LXF	CAY, BBS
	Elaphoglossum luridum (Fée) H.Christ	8593	DXT	CAY, BBS
	Elaphoglossum plumosum (Fée) T.Moore	8439	LXF	CAY
	Lastreopsis effusa (Sw.) Tindale var. *divergens* (Willd. ex Schkuhr) Proctor	8210	IF	CAY
	Polybotrya caudata Kunze	8462	IF	CAY, BBS
HYMENOPHYLLACEAE	*Hymenophyllum decurrens* (Jacq.) Sw.	8611	DXT	CAY, BBS
	Hymenophyllum polyanthos (Sw.) Sw.	8612	DXT	CAY, BBS
	Trichomanes pedicellatum Desv.	8135	IF	CAY, BBS
	Trichomanes pinnatum Hedw.	8281	IF	CAY
	Trichomanes pinnatum Hedw.	8530	MF	CAY
LINDSAEACEAE	*Lindsaea lancea* (L.) Bedd. var. *falcata* (Dryand.) Rosenst.	8100	IF	CAY, L, BBS
LOMARIOPSIDACEAE	*Lomariopsis prieuriana* Fée	NC	IF/MF	
LYCOPODIACEAE	***Huperzia linifolia*** (L.) Trevis. var**. *jenmanii*** (Underw. & F.E.Lloyd) B.Øllg. & P.G.Windisch	8623	DXT	CAY, BBS
METAXYACEAE	*Metaxya rostrata* (Kunth) C.Presl	NC	MF	

APPENDIX *Continued*

Family	Taxon	Coll. No.	Veg.	Herbaria
POLYPODIACEAE	*Campyloneurum phyllitidis* (L.) C.Presl	8592	DXT	CAY, BBS, P
	Dicranoglossum desvauxii (Klotzsch) Proctor	8246	LXF	CAY, BBS
	Pecluma pectinata (L.) M.G.Price	8622	MF	CAY, BBS
	Pecluma plumula (Humb. & Bonpl. ex Willd.) M.G.Price	8595	DXT	CAY, BBS
	Pleopeltis percussa (Cav.) Hook. & Grev.	8591	DXT	CAY, BBS, P
PTERIDACEAE	*Adiantum argutum* Splitg.	8509	IF	CAY
	Adiantum argutum Splitg.	8211	IF	CAY, L, P, UC, BBS
	Adiantum cajennense Willd. ex Klotzsch	8300	IF	CAY, BBS
	Adiantum cf. *cajennense* Willd. ex Klotzsch	8074	MF	CAY, BBS
	Adiantum fuliginosum Fée	8024	MF	CAY, L, BBS
	Adiantum paraense Hieron.	8138	IF	CAY–BBS
	Adiantum phyllitidis J.Sm.	8258	IF	CAY, L, P, UC, BBS
	Adiantum terminatum Kunze ex Miq.	8285	MF	CAY, BBS
	Pityrogramma calomelanos (L.) Link var. *calomelanos*	8113	IF	CAY, L, BBS
SCHIZAEACEAE	*Schizaea elegans* (Vahl) Sw.	8257	MF	CAY, BBS
SELAGINELLACEAE	***Selaginella* cf. *erythropus*** (Mart.) Spring	8359	FR	CAY, BBS
	Selaginella parkeri (Hook. & Grev.) Spring	8101	IF	CAY, L, P, BBS
	Selaginella parkeri (Hook. & Grev.) Spring	8286	IF	CAY, BBS
	Selaginella suavis (Spring) Spring	8587	MF	CAY, BBS
	Selaginella sp.	NC	IF	
TECTARIACEAE	***Cyclopeltis semicordata*** (Sw.) J.Sm.	8590	SV	CAY, BBS
	Dracoglossum sinuatum (Fée) Christenh.	8032	IF	CAY, P, L, BBS
	Tectaria incisa Cav.	8485	MF	CAY, BBS
	Tectaria trifoliata (L.) Cav.	8067	IF	CAY, BBS
	Triplophyllum cf. *dicksonioides* (Fée) Holttum	8136	IF	CAY
	Triplophyllum sp.	NC	MF	
THELYPTERIDACEAE	*Thelypteris opulenta* (Kaulf.) Fosberg	8112	IF	CAY, P, BBS
	Thelypteris poiteana (Bory) Proctor	8209	IF	CAY

Coll. No. (Collectors Bordenave & Granville): NC, not collected. Veg. (Vegetation type): A, aquatic (stream) vegetation; DXT, dwarf meso-xeric thicket; IF, inundated forest; LXF, low meso-xeric forest; MF, mesic forest; MF-B, *Buxus citrifolia* forest; SV, secondary vegetation. Bold type indicates species of concern for conservation.