Plant diversity in a Central African rain forest

Implications for biodiversity conservation in Cameroon

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To my wife Quinta Ngombock and
children: Candy, Mireille, Thierry, Ruth and Mbock

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Photo: Forest community along the Bongola River in the Dipikar Island (Tchouto, M.G.P.)

Chapter 1

GENERAL INTRODUCTION

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1.1. BACKGROUND

During the last few decades, deforestation in tropical rain forest areas has accelerated at an alarming rate. Extensive areas of forest are being cleared every year and there is no reason to believe that this disastrous process will stop or even reduce in the near future. It has been estimated that more than 11 million hectares of forest have been cleared in the world between 1986-1990 of which 5 millions have become fallow (FAO, 1993). Furthermore, some 15-20% of species is likely to become extinct even before they are known to science (Davis *et al.*, 1994). With the growing awareness of the problem, tropical rain forest biodiversity is of great concern and its conservation has become an issue of increasing priority, though little has been done to counter the rapid disappearance of these rich ecosystems. The rain forest in Cameroon covers about 175,000 km^2 representing about 37% of the national territory (Gartlan, 1992). Uncontrolled logging and land conversion for agriculture are leading to forest degradation and deforestation. Estimates put the remaining areas of forest at about 160,000 km^2 with a further 60,000 km^2 currently under concession to timber companies (Sunderland *et al.*, 1997)

The Campo-Ma'an rain forest in south-western Cameroon covers about 7700 km^2 and is situated in the middle of the Biafran rain forest belt that extends from Southeast Nigeria to Gabon and the Mayombe area in Congo. The site is unique, combining many vegetation types with species of high conservation priorities such as endemic, rare, new and threatened plant species. It contains about 114 endemic species, 29 of which are only known from the area, 29 only occur in the southwestern part of Cameroon, and 56 are near endemics that also occur in other parts of Cameroon (Chapter 5). The site is also known for its rich fauna with 4 endemic fish species and 2 endemic bat species (Vivien, 1991; Djama, 2001; de Kam *et al.*, 2002). In addition, there are about 300 bird species of which 24 are rare or endangered (Languy & Demey, 2000). Thirteen threatened mammal species were listed in IUCN (2002), and up to half of the total mammal species found in Cameroon and two-thirds of those found in dense forest are recorded in the area (Vivien, 1991; Matthews & Matthews, 2000). The explanation for this high incidence of endemism and richness might stem partly from the fact that the site is part of a series of postulated rain forest refuge areas in Central and West Africa (Hamilton, 1982; Maley, 1987 & 1989; and Sosef, 1994).

The conservation value of the Campo-Ma'an forest is high at local, national, regional and global levels. The area is recognised to be an important site within the Guineo-Congolian Regional Centre of Endemism (White, 1979 & 1983). However, despite its great biological importance, the Campo-Ma'an rain forest has suffered and continues to suffer from intense human pressure that has led to the degradation of most of the forest along the coast and the lowland forest around settlements. The main conservation effort so far has been the creation of the Campo Faunal Reserve in 1932 to protect its rich fauna, and the Ma'an Production Reserve in 1980 to protect populations of the economically important timber species *Aucoumea klaineana* (Okoumé). These two reserves are currently merged into a single Technical Operational Unit (TOU) that was created in August 1999. Later on, the Campo-Ma'an National Park was created within this TOU in January 2000. So far, the National Park exists only on paper since in reality it has not yet been gazetted, and it has no boundary and management plan. Official control is weak and as a result, there is an increasing pressure on the forest ecosystem. However, since the creation of the TOU, the Campo-Ma'an Biodiversity Conservation and Management Project is working with the local communities and other stakeholders in order to prepare a strategic plan of the TOU and a management plan for the National Park. Although in the past some botanical research and collecting activities have been mainly carried out in the Edea-Kribi and Campo-Kribi-Akom II-Bipindi-Lolodorf areas, limited work has been done to describe and map the vegetation and flora of the Campo-Ma'an forest. There was still a large knowledge gap since very little was known about the biodiversity of the area. Therefore, taxonomic and ecological research has to be carried out to identify conservation priorities and hotspots for biodiversity conservation.

Research objectives
The main objective of this research was to assess the botanical diversity both in terms of vegetation and flora of the Campo-Ma'an rain forest in order to identify, locate and map biodiversity hotspots. More specifically, the aims of this study were:

- to assess the botanical diversity of the Campo-Ma'an rain forest, describe the vegetation and identify plant species with a high conservation priority such as endemic, rare, threatened and species new to science;
- to produce a plant species checklist of the Campo-Ma'an area with a red data list highlighting the conservation status of species with a high conservation priority;
- to map the distribution of these high conservation priority species and locate hotspots for biodiversity conservation;
- to provide baseline biological information, essential for the elaboration of the Campo-Ma'an strategic and management plans;
- to provide recommendations for the conservation and sustainable management of its natural resources and threatened species.

1.2. STUDY AREA

Location, policy and administrative framework
Cameroon has ratified or is a signatory of a number of international treaties affecting environmental issues amongst which the most important are the *Convention on Biological Diversity* and the *Convention on International Trade in Endangered Species of Wild Fauna and Flora*. In response to the increasing international concern for the protection of the global biological resources, the government of Cameroon began a series of reforms in 1990 aimed at ensuring the sustainable management of its natural resources. A Ministry of Environment and Forestry (MINEF) was created in 1992, a National Environmental Management Plan (NEMP) and a National Forestry Action Program (NFAP) were launched in 1995. Furthermore, a new forestry law based on a new policy, which explicitly recognises the unique richness and importance of the nation's biodiversity, and assigns a high priority to the protection of this heritage, was produced in 1994 (République du Cameroun, 1994, 1995 a & b and 1996). It is within this framework that a joint initiative of the Global

Environment Facility (GEF)-World Bank Biodiversity and Management Project and the government of Cameroon led to the creation of several conservation projects in Cameroon, and to the Campo-Ma'an Biodiversity Conservation and Management Project in 1996. Its objective is to ensure the conservation of biodiversity in the TOU and the sustainable management of its natural resources.

The Campo-Ma'an area is located between latitudes 2°10'-2°52' N and longitudes 9°50'-10°54' E. It is bounded to the west by the Atlantic Ocean and to the south by the border with Equatorial Guinea (Figure 1.1). As shown in Table1.1 and Figure 1.1, the main components of the TOU are a National Park, five forest management units (FMU) and two agro-industrial plantations.

Table 1.1 Present land use planning of the Campo-Ma'an Technical Operational Unit (TOU)

Land use	Area (ha)	% of TOU
Campo-Ma'an National Park	261443	34.0
Logging concessions (FMU 09021-25)	241809	31.4
FMU 09021 (Wijma)	*42410*	*5.5*
FMU 09022 (not yet attributed)	*14514*	*1.9*
FMU 09023 (Bubinga/HFC)	*11777*	*1.5*
FMU 09024 (HFC)	*76806*	*10.0*
FMU 09025 (HFC)	*96302*	*12.5*
Agro-forestry zone	196155	25.5
Agro-industrial plantations	57750	7.5
HEVECAM (Rubber plantation)	*41339*	*5.4*
SOCAPALM (Oil palm plantation)	*16411*	*2.1*
Proposed protected area	11968	1.6
Coastal zone	320	-
Total	769445	100

Adapted from de Kam *et al.* (2002). HEVECAM (Hévéa du Cameroun) and SOCAPALM (Société Camerounaise des Palmeraies).

The Campo-Ma'an National Park covers about 261,443 ha. It is a permanent state forest that represents 34% of the TOU and is solely used for forest conservation and wildlife protection. The following activities are therefore forbidden: logging, hunting and fishing, mineral exploitation, pastoral industrial, agricultural and other forestry activities. The logging concessions that are also called "Forestry management unit" (FMU) represent about 31.4% of the area. Agro-forestry zones are part of the non-permanent forest estate that can be used for purposes other than forestry. Added to agro-industrial plantations they represent 33% of the TOU and are mainly allocated for human activities such as agro-industry, agriculture, agro-forestry, community forest, communal forest, or private forest. The coastal zone is a narrow strip along the Atlantic Ocean from the Lobe waterfalls to the Ntem estuary in the Dipikar islands. It measures about 65 km long and extends about 2-3 km inland. The coastline is one of the most important marine turtle breeding habitats in Central Africa where four species of marine turtles come to feed or nest every year.

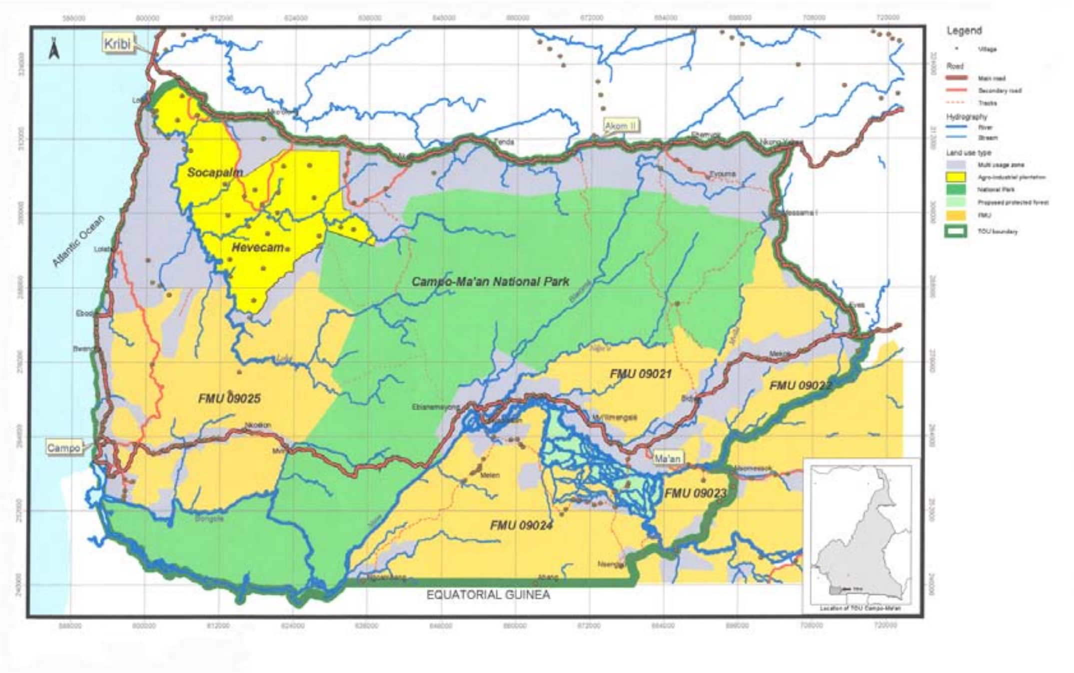

Figure 1.1 Present land use planning map of the Campo-Ma'an Technical Operational Unit (Annex 4).

Physical environment

Geology and soils

The Campo-Ma'an area is situated on the Precambrian shield, which is the most important and extensive geological formation in Cameroon. This Precambrian basement complex consists mainly of metamorphic rocks and old volcanic intrusions (Franqueville, 1973). Metamorphic rocks such as gneisses, migmatites, schists and quartzites dominate the geology in the area. Soils that are developed on these metamorphic rocks are acid and poor in nutrients. Sedimentary rocks of the Cretaceous can also be found in the Campo basin. The topography ranges from undulating to rolling in the lowland area, to steeply dissect in the more mountainous areas. In the Campo area, altitudes are mostly low, ranging from 0 m at sea level to about 500 m. In the eastern part, which is quite mountainous, the altitude varies between 400-1100 m and the rolling and steep terrain brings about a more variable landscape.

Following the FAO classification system, soils in the Campo-Ma'an area are generally classified as Ferrasols and Acrisols (Franqueville, 1973; Muller, 1979; van Gemerden & Hazeu, 1999). They are strongly weathered, deep to very deep and clayey in texture (except at the seashores and in river valleys where they are mainly sandy), acid and low in nutrients with pH (H_2O) values generally around 4. Although Ferric soils are the most widespread, poorly drained as Dystric Fluviosols or Gleyic Cambisols soils are commonly found in the river valleys and adjacent swampy areas throughout the Campo-Ma'an area. The dominant soils in the coastal plain are Plinthic Ferrasols, with patches of Haplic Acrisols and Acri-Xanthic Ferrasols. In the eastern part of the Campo-Ma'an area, soils are developed on ectinites including gneiss, micashist and quartzite. In the mountainous area, soils are developed on migmatites and granites and are mostly classified as Acri-Xanthic Ferrasols and Xanthic Ferrasols.

Climate and hydrology
The Campo-Ma'an area has a typical equatorial climate with two distinct dry seasons (November-March and July-mid-August) and two wet seasons (April-June and mid-August-October). The average annual rainfall generally decreases with an increasing distance from the coast, ranging from 2950 mm/year in Kribi and 2800 mm in Campo to 1670 mm in Nyabissan in the Ma'an area. The Ma'an forest has significantly less rainfall than other areas. This is probably due to a rain shadow effect caused by the Nkolebengue Hills (up to 1000 m) which forms a substantial upland block between Ma'an and the ocean. The average annual temperature is about 25°C and there is little variation between years. The hydrography of the area shows a dense pattern with many rivers, small river basins, fast-flowing creeks and rivers in rocky beds containing many rapids and small waterfalls. The main rivers draining the TOU are the Ntem, Lobe, Bongola, Biwome, Ndjo'o, Mvila and Nye'ete. Swamps are commonly found in the valley of these rivers.

Socio-economic settings

Population, ethnicity and settlements
A recent census carried out by ERE Développement in April 2001 has shown that about 61,000 people live in 167 towns, villages and agro-industrial or logging camps. Generally, the area has a low population density of about 10 inhabitants per km^2 and is sparsely populated with most people living around Kribi, along the coast, and in HEVECAM, SOCAPALM and HFC camps (ERE Développement, 2002; de Kam *et al.*, 2002). There are seven main ethnic groups in the area which are the Batanga, Mabea (or Mabi), Mvae, Yassa, Ntumu, Bulu and the Bagyeli (or Bakola) Pygmies. In addition to these ethnic groups, there are residents from other parts of Cameroon and Equatorial Guinea who depend on the work provided by the timber companies and agro-industrial plantations. The Bakola pygmies are mainly forest dwelling hunters and gatherers, although they seem to be in the process of sedentarisation (Annaud & Carriere, 2000). They are in small number and depend mostly on the forest for their livelihood. Their life style is seriously threatened by the ongoing logging activities. The Batanga, Mabea, and Yassa are mostly found in small fishing villages along the coast between Kribi and Campo. They rely mostly on the sea for their livelihood and have fishing as their main occupation. The Mvae, Ntumu and Bulu are mainly farmers, hunters and forest gatherers.

Logging and agro-industrial enterprises
There are two main logging enterprises in the Campo-Ma'an area which are "la Forestière de Campo" (HFC) and Wijma (GWZ). HFC is operational since 1966 and operates a sawmill and port facilities at Ipono near Campo. Other companies such as Wijma and CFK also have sawmill facilities. Log production is about 39,250 m^3/year and more than 135,000 m^3 of sawn woods are produced per year. Timber harvesting in the area provides about 115 millions FCFA/year ($ 201,754) to the

local communities concerned and direct employment of about 1000 jobs that represent wages of about 1 billion FCFA/year ($ 1,8 millions) (ERE Développement, 2002; de Kam *et al.*, 2002). HEVECAM and SOCAPALM are the two main agro-industrial companies located in the area. They are the major employers in the area, developed many infrastructures, and provided many services in their area of activities. They employ about 5625 workers who earn wages totalling about 5,5 billions FCFA/year ($ 9,7 millions).

Stakeholders

In the Campo-Ma'an area, stakeholder groups range from direct users to people who will be indirectly affected by any management decision. Although the Campo-Ma'an project will need the full support and participation of the local population to achieve its goal, it is of vital importance to involve other potential stakeholders such as the local administrative authorities, logging and agro-industrial companies, local common initiative groups, NGO's and other institutions which are operating in the area.

Economic activities and their influence on biodiversity conservation

Despite the low population density, there are few employment opportunities. The local people are very poor and so far rely solely on the forest resources to meet their basic needs. As a result, local pressure on the Campo-Ma'an rain forest is increasing and there are several activities that are carried out in the area with varying ecological impacts on the forest ecosystem. These activities include agriculture, logging, poaching and hunting.

Agriculture

Clearance of natural vegetation to provide land for industrial and subsistence agriculture is the biggest threat to the Campo-Ma'an forest. Large-scale agro-industrial plantations have destroyed about 7.5% of the forest cover. Small private owners are also involved in the clearing of a considerable portion of the coastal and lowland forests for the establishment of small plantations of oil palm, rubber or cash crops such as cocoa. The local population practises shifting or "slash and burn" agriculture in the area. It is a major cause of deforestation and forest degradation around settlements since it involves land conversion from forest to permanent agriculture land, reducing the soil fertility and the natural vegetation cover.

Logging

Timber exploitation is the main economic activity in the area and is dominated by HFC and Wijma. Logging concessions represent about 31.4% of the area. The southwestern part of the National Park and the coastal zone has been selectively logged at least twice during the past 30 years. Less than one tree/ha is felled and logging is limited to about 60 tree species (Jonkers & van Leersum, 2000). Although logging damage is moderate and has limited effect on the forest biodiversity (Jonkers & van Leersum, 2000; van Gemerden *et al.*, 2003) any degree of damage represents a capital loss in terms of trees and deterioration of the biotic and physical environment. Logging creates skid trails that allow easy access for poachers, and encourage settlers to establish forest camps, villages and farms. Furthermore, felling damage includes breakage of saplings and residual stems and hinders the growth of seedlings by discarded crowns of felled trees (Parren, 2003).

Hunting and fishing
Hunting is a major activity in the area. Several villages and local people are known to rely heavily on hunting as an important source of income and for subsistence. It is for the moment a lucrative way through which the local communities derive direct economic benefit from the forest. The use of cable snare trapping is the most common form of hunting in the area, and guns are mainly used during the night to kill large mammals. These animals are sold in urban areas where bush meat is in great demand. The use of indiscriminate and wasteful methods such as cable snares on long trap lines, as well as poaching, have severely depleted the primate and forest elephant populations in the area (Matthews & Matthews, 2000; Ngandjui *et al*., 2001). Fishing is the major economic activity in coastal villages. It is the main protein source and almost all local populations rely heavily on it for subsistence and as source of income. Fishing is also practised in some villages inland along the Ntem, Bongola, Lobe, Biwome and other rivers.

Non Timber Forest Products (NTFPs)
The Campo-Ma'an area has about 250 NTFPs (Tchouto *et al.*, 2002 unpublished). These forest products form an integral part of the rural economy, and contribute to all aspects of rural life, providing food, fuel, building material, medicine, craft material, other household items, ornamental and horticultural plants. The collection of NTFPs is mostly done in the area for local consumption, but few local people rely on it as a source of income. So far the collection of NTFPs has little or no effect on the Campo-Ma'an forest and its ecosystem (Tchouto *et al.*, 2002 unpublished).

Tourism and ecotourism
There is much potential for the development of tourism and in particular ecotourism in the Campo-Ma'an area. The site's advantages for ecotourism include the presence of a National Park, a coastline of 65 km with attractive beaches, many waterfalls (Lobe and Memve'ele), diverse ethnic groups with different cultural heritage and the presence of archaeological sites. So far, tourist activity is poorly developed and ecotourism is almost absent. Tourist industry is only focused on some beaches around Kribi. For the moment, the local community derives very little or no benefit from such type of tourism.

1.3. HISTORY OF BOTANICAL RESEARCH IN THE CAMPO-MA'AN AREA

The Campo-Ma'an area has been visited by many botanists over more than one century. The first collectors were Germans such as Braun (1887), Dinklage (1889-93), Zenker (1896-1922) and Staudt (1895-96). Their botanical explorations were largely confined around Kribi, Bipindi and Lolodorf areas because of easy accessibility. Later on, French, Dutch and other German botanists also collected around Kribi, along the coast from Kribi to Campo in the former Campo Faunal Reserve area, and in southwestern Cameroon. They included Schlechter (1900), Schultze-Rhonhof (1911), Mildbraed (1911 & 1914), Ledermann (1912), Fleury (1917), Letouzey (1962-68), W.J. de Wilde (1963-64), Raynal (1963 & 1965), Leeuwenberg (1965), Bos (1968-70) and J.J.F.E de Wilde (1964-76). Among these first botanists, Letouzey was the only one who visited the Ma'an area. These collections were used for the production of 37 volumes of the *Flore du Cameroun*.

Recently other botanists such as Beentje (1980), Hall (1991), Thomas (1992), Wieringa (1994), van der Burgt (1997), Parren (1997), van Gemerden (1997-99), van Andel (2000-2001), and botanists from the National Herbarium in Yaounde also collected in the area.

A first attempt to classify the vegetation types of Cameroon was made by Letouzey (1968 & 1985). He adopted the phytogeographic approach to interpret and map the vegetation of Cameroon at a scale of 1:500,000 with definitions and descriptions of the different vegetation types using black and white aerial photos taken during the 1960's. It should be noted that he did not cover the country evenly during his field trips in various parts of Cameroon and apparently the Campo-Ma'an area was not fully investigated. However, he described and mapped several vegetation types and sub-types in the Campo-Ma'an area by using indicator species such as *Calpocalyx heitzii* and *Sacoglottis gabonensis*. The main vegetation type was defined as Atlantic Biafran forest rich in Caesalpinioideae with 5 sub-types dependent on the occurrence of Caesalpinioideae, *Calpocalyx heitzii* (Leguminosae-Mimosoideae), *Sacoglottis gabonensis* (Humiriaceae) and other coastal indicators. Kaji (1985) studied the floristic composition and the structure of the Atlantic Biafran forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis* near Nkoelon and Mvini. In 1991, a three-month canopy raft expedition was organized in the former Campo Faunal Reserve by the "OPERATION CANOPEE" with the aim of carrying out scientific research in the canopy of a tropical rain forest. A canopy raft made of a hot air balloon was used to get access to the canopy in order to study the flora and its pollination ecology. Many scientists from different disciplines took part in this expedition. Each team was given a rather short time in the balloon, limiting data collection for their research. In addition to this botanical work, some information on timber species came from exploitation inventories carried out by ONADEF (1991) in the former Ma'an Reserve.

Thomas & Thomas (1993) executed a two-month biodiversity survey of the Campo-Ma'an area that included botanical, wildlife and socio-economic studies. The main aim of this rapid multidisciplinary assessment was to provide the GEF-World Bank Biodiversity and Management Project with a state of knowledge report on the Campo-Ma'an biodiversity and to provide recommendations for its conservation and sustainable management. Although during this study an effort was made to supply a description of the various vegetation types encountered, the report was largely based on existing literature, since two months of field work was not enough to carry out a sound biodiversity assessment in such a large area. Recently, Sunderland *et al.* (1997) established 3 plots of 1 ha each in the former Campo Faunal Reserve to study its vegetation. The report of this survey provided information on the vegetation types recorded in the plots, as well as their species composition, dominance and frequency. van Gemerden & Hazeu (1999) did a landscape ecological survey of the Bipindi-Akom II-Lolodorf region located north of the Campo-Ma'an area. The main objective of this study was to provide a scientific framework for the sustainable land use planning of the area.

Although many botanists have visited the Campo-Ma'an area, their main aim was to collect herbarium specimens essential for taxonomic studies and the production of the flora of Cameroon. Most other botanical research was sporadic and localized to areas of easy accessibility. Furthermore the output was often rather descriptive and aiming at the provision of rapid baseline information necessary for a sustainable management of the Campo Faunal Reserve. Therefore, the present study is the first systematic attempt to assess the botanical diversity of the Campo-Ma'an area in order to identify, locate and map hotspots for biodiversity conservation.

1.4. BOTANICAL AND ECOLOGICAL ASSESSMENT METHODS

In a large, heterogeneous and structurally complex forest ecosystem such as the Campo-Ma'an tropical rain forest, conservation cannot proceed without a thorough understanding of the components of the ecosystems that are to be preserved. We need to know what are the species of high conservation priorities and where are they located, so that we can target conservation resources to these locations. Therefore, an inventory or biological stocktaking is requisite for all conservation initiatives. However, the selection of the most appropriate methods for the rapid assessment of forest ecosystems is always a difficult matter, and a series of questions need to be addressed to decide on the best approach to be taken. Some of these questions are:

- What are the specific objectives, priorities and concerns?
- What information is available, essential and useful?
- How can the information needed be provided?
- How can it be recorded, analysed, reported and used?
- What limitations and problems can be perceived?

Furthermore, the traditional approaches of forest inventory are not sufficient for biodiversity assessment, because they are mainly limited to tree species (especially timber-sized trees), which are assumed to reflect the forest floristic composition and physical structure. More often, taxonomic attention is weak for other growth forms such as shrubs, small trees, herbs and epiphytes, and despite a widely accepted recommendation that herbarium specimens should be routinely collected, this is done very rarely, if at all. Therefore, to be effective, a botanical assessment method that provides both quantitative and qualitative information was used during our study.

Sampling criteria and field methods

After a literature review of existing botanical work done in the area, a study of aerial photographs, satellite images, topographic and vegetation maps, a preliminary reconnaissance trip was carried out in the study area to identify representative and homogeneous vegetation types for sampling. These representative vegetation types were selected subjectively on the basis of physical and human factors such as climate (especially rainfall), altitude, slope, soils, the proximity to the sea and degree of forest use. Two types of samples were used during the assessment, the measured samples and the qualitative samples. The measured samples provided quantitative information on stand structure and composition of the forest, while qualitative information on species richness, life form and guild was provided by the qualitative samples.

Measured samples

Since data collection was to provide a general indication as to which areas might be considered for priority action, sampling effort was spread throughout the research site by using small samples of 0.1 ha. They were located at irregular intervals along a line transect (more often 5 or 2 km long) or from a random starting point (riverbank, hunting and logging paths). The distance between two plots was generally more than 500 m (usually between 500 m and 1000 m). In mountainous areas, plots were located at an altitudinal interval of 200 m along the slope, on both sides of the ridge. In each 0.1 ha (20 x 50 m) plot, all vascular plants with DBH ≥ 1 cm (diameter at breast height, about 1.3 m above ground) were measured, recorded and identified. In the National Park, all vascular plants with DBH ≥ 5 cm were marked with a numbered aluminum tag. For unknown species, a voucher specimen was collected and a data sheet was filled out describing its vegetative characters. The geographic co-ordinates of each plot, sample or specimen were recorded using the Global Positioning System (GPS). The GPS was a Garmin 12XL model with estimated precision of ±10 m. These co-ordinates were used for mapping main vegetation types, species distribution, and biodiversity hotspots. Each plot was given a unique code number and a conspicuous red plastic pipe marked with the plot/sample number was buried at each corner of the plot to facilitate its identification at subsequent monitoring visits. Furthermore, subplots of 5 m x 5 m each were established in some 0.1 ha plots in which all vascular plants were recorded. In these subplots, the emphasis was on the herbaceous plants and other small vascular plants that were not taken into consideration during the enumeration of the 0.1 ha plot. Overall 147 plots of 0.1 ha each and 136 subplots were established in the Campo-Ma'an area (Figure 1.2 & Annex 1).

Qualitative samples

Qualitative samples aim to record all vascular plant species that occur in different forest types or microhabitats. They were located subjectively in the field by the principal botanist on the basis of differences in structure and composition of the vegetation, physical and human factors. Usually samples derived from the 0.1 ha plot and additional information on the shrub and herbaceous layers were collected. In each of these samples, a provisional plant species checklist was made in the field with information on their growth form, guild and frequency. Once the location was selected, we moved around and collected all vascular plants. These plants were recorded and identified by the botanist and the tree spotter. For unknown species, a single ecological specimen was collected for further checking and identification in the herbarium. Most of these ecological specimens were sterile materials made up essentially of leaves. A sample was considered completely surveyed when only few new records were added to the list, or when more than 40 canopy trees above 30 cm DBH were recorded (Hawthorne, 1995 & 1996). The principal botanist made sure the assessment was done only within the identified homogeneous vegetation/microhabitat type. In each plot/sample, general information on locality, geographic co-ordinates, topographic features, vegetation types, soil types, land use, forest condition, canopy cover percentage and height, etc. were recorded.

Specimen collection and identification

The study also involved the collection of all fertile plant material within sample/plot, particular habitats and vegetation types, and along footpaths and logging roads. At least 3 duplicates were taken for each fertile specimen. Taking into consideration the fact that the quality of the specimens and the label data determine the amount of information available for future reference, each specimen was as representative as possible with a good field description, and was tagged with a unique collection number. Each ecological specimen was also given a unique collection number that was made of the sample/plot code ending with an X and followed by the collection number. For example, KRIBI1X1 would mean ecological specimen number 1 collected in Kribi in plot 1. The X was used to differentiate the ecological specimens from the normal herbarium specimens which were numbered by the collector name/initials followed by the collection number (e.g. Tchouto 2766).

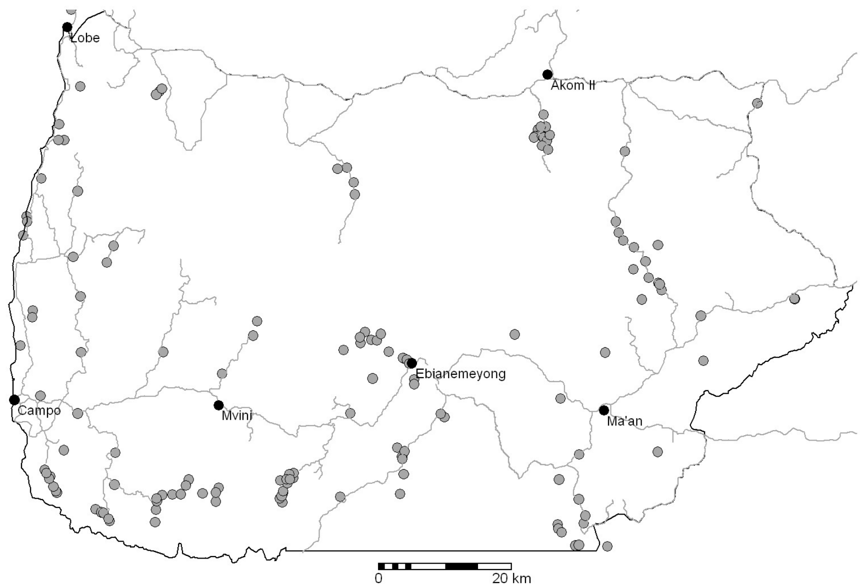

Figure 1.2. Botanical and ecological survey plots and samples

The credibility of a plant species checklist depends largely on the level of reliability of the identification of the species that it is made of. Therefore, a poor identification of specimens can easily mislead and upset the outcome of a biodiversity assessment. In order to avoid/reduce mistakes in identification, the determination of specimens was done at 3 levels. In the field by the principal botanist and tree spotter, in herbaria in Cameroon (Kribi, Limbe and Yaounde) and in Wageningen by senior botanists and family specialists. During the identification, specimens were allocated codes to reflect the confidence with which they were identified. The identification codes (ID) provide the means to filter out dubious determinations from sample/plot records prior to analysis. ID were applied at individual plant level and were written on the paper by the identifier (e.g. ID = 1 for full name with confidence, 2 for genus all right but cf. species, 3 cf. genus and species, etc.). A duplicate of each specimen was mounted and preserved in the Kribi Herbarium. Others duplicates were sent to the National Herbarium in Yaounde, Cameroon (YA) and the Nationaal Herbarium Nederland, Wageningen University Branch (WAG) for further identification and preservation.

Soil sampling

In order to assess the influence of soil characteristics on the vegetation, random soil samples were collected in the center of some plots located in representative vegetation types. Soils were described according to the FAO (1990) guidelines in selected representative soil profile pits of about 1 m depth. Soil horizons were described by auguring in the soil pit. Samples from the soil horizons were taken for 72 representative soil profiles (Annex 2). In each representative plot, soil samples were taken at four different depths (0-10 cm, 10-20 cm, 20-30 cm and 30-50 cm) in addition to the horizon samples. Each of these samples was made of a mixture of three samples collected at the same depth in the upper half, center and bottom half of the plot. Taking into consideration the financial constraints, only the soil pH and electric conductivity (EC) were measured for all the samples in the soil laboratory of the Tropical Nature Conservation and Vertebrate Ecology Group, Wageningen University.

Data analysis

All survey data were entered into TREMA (Tree Management) software for data management (Hawthorne, 1999). TREMA contains both species level and plots data, and can integrate the two directly in an analysis. Herbarium specimens data were entered into the BRAHMS (Botanical Research and Herbarium Management System) database (Filer, 1996). This database that is currently used at Kew, Wageningen, Yaounde and Limbe herbaria for the management of their botanical data, has a module known as RDE (Rapid Data Entry) which allows easy and rapid entry of label information. Once entered and stored in RDE, data can be imported directly into BRAHMS (or transferred into different packages) for the preparation of several taxonomic outputs such as labels, determination slips, distribution maps, simple and annotated checklists.

Detrended Correspondence Analysis (DCA or DECORANA) and its relative Canonical Correspondence Analysis (CANOCO or CCA) was used to detect patterns in the vegetation data (Hill, 1979a & 1979b; Jongman *et al.*, 1987; ter Braak, 1986a & 1987b; Kent & Coker, 1992). The distribution of species and samples in the ordination space given by DCA was used to identify species and site clusters, and to corroborate groupings derived from the two-way indicator species analysis (TWINSPAN). Phytosociological parameters such as basal area, relative density, relative dominance, relative frequency, important value index and Shannon diversity index (H') were used to describe the forest structure and composition, and to measure the species richness and diversity of the various vegetation types. They were calculated following Whittaker (1975), Kent & Coker (1992) and Magurran (1988).

Basal area = $(1/2d)^2\pi$ where d = DBH

$$\text{Relative density} = \frac{\text{Number of individuals of the species}}{\text{Total number of individuals}} \times 100$$

$$\text{Relative dominance} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all species}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species}}{\text{Frequency of all species}} \times 100$$

Importance value index (IVI) = Relative density + Relative dominance + Relative frequency

Shannon diversity index (H') = $- \Sigma p_i \ln p_i$

Where $P_i = n_i/N$, n_i = number of individuals of species, N = total number of individuals, and ln = log base_n

1.5. OUTLINE OF THE BOOK

The main objective of this thesis research is to provide baseline botanical information essential for the preparation of a strategic management plan for the Campo-Ma'an Technical Operational Unit and particularly for the conservation and management of the National Park. In order to make significant contributions to this management and conservation process, a study of the vegetation and the flora of the Campo-Ma'an rain forest is made. Chapter 1 presents a succinct state of knowledge of the Campo-Ma'an biodiversity. In Chapter 2, we identify, classify, describe and map the various vegetation types and analyse their structure and composition. Later on, we discuss the effect of environmental factors such as rainfall, altitude, soils, proximity to the sea and human disturbance that influence or delimit the found vegetation types.

Chapter 3 deals with the diversity of the flora in the Campo-Ma'an rain forest. We search for correlation between tree species diversity and the diversity of other growth forms such as shrubs, herbs and lianas, in order to understand whether, in the contest of the African tropical rain forest, tree species diversity tells it all. The Campo-Ma'an area falls within a series of postulated rain forest refugium in Central Africa. In Chapter 4, we study patterns in the distribution of sensitive bio-indicator forest species such as strict endemics and other well-known slow dispersal species to find out whether if the entire Campo-Ma'an area was part of a refugium or not. Special attention is given to these taxa because of their biology (life strategy) and/or distribution (endemism) they may act as indicators for refuge areas.

In Chapter 5, the forest inventory data and taxonomic collections are used to examine the distribution and convergence patterns of strict and narrow endemic species. We use conservation indices such as Genetic Heat Index (GHI) and Pioneer Index (PI) to analyse trends in endemic and rare species in the various forest types. GIS tools and geostatistical analyses were used to identify and map potential biodiversity hotspots. Finally, Chapter 6 discusses the implications of the output of this research for the conservation of the Campo-Ma'an rain forest. Recommendations are given for its conservation and effective management.

Chapter 2

CENTRAL AFRICAN TROPICAL RAIN FOREST STRUCTURE AND COMPOSITION: UNTANGLING THE EFFECTS OF RAINFALL, ALTITUDE, SOIL, SEA AND HUMAN DISTURBANCE

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2.1. INTRODUCTION

The Campo-Ma'an area is recognised as an important site within the Guineo-Congolian Centre of Endemism (White, 1983; Gartlan 1989; Davis *et al.*, 1994). Most of the area is covered by lowland evergreen tropical rain forests that extend from Southeast Nigeria to Gabon and the Mayombe area in Congo. Campo-Ma'an is situated at the middle of this belt and the main vegetation type is part of the domain of the dense humid evergreen forest that belongs to the Atlantic Biafran district and the Atlantic littoral district (Letouzey, 1968 & 1985). The Campo area is dominated by lowland evergreen forests rich in Caesalpinioideae, with *Calpocalyx heitzii* and *Sacoglottis gabonensis,* a vegetation type that is only known from this area. The drier Ma'an area in the rain shadow, to the east of Campo, is dominated by a mixed evergreen and semi-deciduous forest. The Campo-Ma'an area also supports a great diversity of habitats from coastal vegetation on sandy shorelines at sea level to the submontane forest at about 1100 m.

Man affects the forest ecosystem with his economic activities, through logging, agro-industrial and shifting agriculture, and hunting. Clearance of the natural forest to provide land for agro-industrial companies is the biggest and most destructive threat to the lowland forests. More than 7.5% of the area has been cleared to establish large plantations of oil palm and rubber. Another use of the forest that leads to impoverishment is logging. Logging concessions represent about 31.4% of the area and a considerable portion of forest has already been logged at least twice during the past 30 years. Although the Campo-Ma'an area has been disturbed by logging and agriculture, the area is still mostly forested. In order to save these remaining forests, a sound botanical assessment should be carried out to provide the baseline data essential for the description and mapping of the existing forest types. The first attempt to classify the vegetation types of Cameroon was made by Letouzey (1968 & 1985) who adopted the phytogeographic approach to map the vegetation of Cameroon at a scale of 1:500,000. These maps were based on aerial photos taken during the 1960's with ground checking and descriptive observations done during field trips in various parts of Cameroon. However, he did not cover the country evenly and the Campo-Ma'an area was apparently poorly investigated, although some major forest types were identified and described.

The importance of environmental variables, past and present human disturbance as well as Pleistocene history in determining plant species richness along ecological gradients in the tropical rain forest has been studied by several authors. It is largely argued that the number of tree species in the tropical rain forest tends to increase with rainfall, seasonality (Gentry, 1988; van Rompaey, 1993; Clinebell *et al.*, 1995; Condit *et al.*, 1996; Swaine, 1996; Givnish, 1999) and soil fertility (Hart *et al.*, 1989; Duivenvoorden & Lips, 1995; Swaine, 1996), and decreases with altitude (Hedberg, 1951; Lebrun, 1960; Gentry, 1988; Tchouto, 1995; Lieberman *et al.*, 1996; Givnish, 1999). Some of these authors argued that rainfall and altitude are likely to lead to stronger distributional patterns than those of soil nutrients. In the present study, we will classify, describe and map the various vegetation types in the Campo-Ma'an area and analyse its forest structure and composition. In order to study the effect of rainfall, altitude, soils, proximity to the sea and human disturbance that influence or delimit these vegetation types, we will test the following predictions:

- Increasing distance from the sea is linked with decreasing annual rainfall gradually changing the forest from a coastal type at sea level to a mixed evergreen and semi-deciduous forest in the interior;
- A change in forest structure and species composition with increasing altitude: the species composition will change progressively with increasing altitude coupled to a decrease in species richness;
- Well-drained nutrient-rich soils support high number of species while poorly drained soils with low nutrient concentrations are associated with species-poor forests;
- Human disturbance in the forest increases the frequency of secondary forest species and lowers species diversity.

2.2. METHODS

Botanical and ecological assessments
A preliminary reconnaissance field trip was carried out in 2000 to identify representative homogeneous vegetation types for sampling. These representative vegetation types were selected on the basis of physical and human factors such as climate (especially rainfall), altitude, slope, soils, the distance from the sea and degree of forest use. Sampling effort was spread throughout the study area by using small plots of 0.1 ha at irregular intervals along a line transect from a random starting point. In mountainous areas, plots were located at an altitudinal interval of 200 m along the slope, on both side of the slope. A total of 147 plots covering 14.7 ha were established, and in each 0.1 ha plot, all trees, shrubs, herbs and lianas with DBH $\geq$ 1 cm were measured, recorded and identified. For unknown species, a voucher specimen was collected. Furthermore, 136 subplots of 5 m x 5 m each were established in some plots (Annex 1) with more emphasis on the herbaceous and ground layer vascular plants for vegetation description. Herbarium specimens were also collected within plot, vegetation types, and specific habitats. In order to assess the influence of soil characteristics on the vegetation, random soil samples were collected in the center of 72 plots located in representative vegetation types as described in Chapter 1(Annex 2).

Data analysis
All information recorded was entered into TREMA (Tree Management) software for data management. TREMA contains both species level and plots data, and can integrate the two directly in analysis. Detrended Correspondence Analysis (DCA or DECORANA) and its relative Canonical Correspondence Analysis (CANOCO or CCA) was used to detect patterns in the vegetation data (Hill, 1979a & 1979b; Jongman *et al.*, 1987; ter Braak, 1986a & 1987b; Kent & Coker, 1992). The distribution of species and samples in the ordination space given by DCA was used to identify species and site clusters, and to corroborate groupings derived from the two-way indicator species analysis (TWINSPAN). CCA ordination methods help to examine relationships between species distribution and the distribution of associated environmental factors. For both methods, species were first arranged in a raw data matrix. Within the data matrix, species were scored for either presence/absence. Environmental factors such as altitude, rainfall (mean annual rainfall in mm year^{-1} recorded between 1937-1977), proximity to the sea (distance from the sea in km)

and soil characteristics such as soil types, composition, pH (H_20), electricity conductivity in $mS.cm^{-1}$, and texture at 0-10 cm depth were used to explain patterns in the vegetation data set. Furthermore, all species with doubtful identification were removed from the analyses and only species that occurred in more than one plot were included in the ordination analysis.

The GIS software ARCVIEW version 3.2 was used to produce the vegetation maps. The phytosociological parameters (basal area, relative density, relative dominance, relative frequency and important value index) as well as the diameter class distribution were used to describe the forest structure and composition. In addition, the physical forest structure such as the height and cover of the various strata (emergent, canopy, midstorey, understorey and ground layer) recorded in each plot were used for vegetation description. Standard physiognomic indices were calculated following Whittaker (1975), Kent & Coker (1992) and Magurran (1988). The SPSS package version 10.0 for Windows was used for statistical analyses and the Pearson's correlation test was used to correlate the species richness with the various environmental variables.

2. 3. RESULTS

Multivariate analyses

TWINSPAN analysis
A cluster analysis of 147 plots with TWINSPAN led to 12 convincing divisions. As shown in Figure 2.1, the data set was initially divided into two groups. All plots located in the mangrove forest, characterised by a distinct floristic composition, edaphic conditions and physiognomy were placed on one side. The remaining plots were divided into 11 groups on the basis of the abundance of Caesalpinioideae, *Calpocalyx heitzii* or *Sacoglottis gabonensis*. Plots from small patches of *Aucoumea klaineana* (Okoumé) communities were put either with the lowland evergreen forest rich in Caesalpinioideae (Okoumé 1) or with the mixed evergreen and semi-deciduous forest (Okoumé 2) group depending on their geographical location. Eleven main forest types were distinguished and can be summarised as follows (Table 2.1, Figures 2.1 & 2.2).

1. Lowland evergreen forest rich in Caesalpinioideae (Caesalp)
It occurs mainly on hills and gentle slopes where the vegetation is still intact and consists of evergreen trees forming a fairly continuous canopy with emergent trees poking through it. This forest type is characterised by its dominance of Caesalpinioideae (more than 70 tree species) with many species that occur gregariously. Many emergent and canopy trees have large buttresses (up to 5-6 m tall) and large diameters (up to 2-3 m above the buttress). Trees are more or less arranged in three strata. Large emergent and upper canopy tree species (about 35-50 m tall) such as *Anthonotha fragrans, Aphanocalyx margininervatus, Brachystegia cynometroides, Desbordesia glaucescens, Erythrophleum ivorensis, Lovoa trichilioides* and *Pterocarpus soyauxii* occur as scattered individuals in the upper storey. The intermediate storey, about 20-35 m high, is dominated by trees species such as *Calpocalyx dinklagei, Dialium pachyphyllum, Dichostemma glaucescens,*

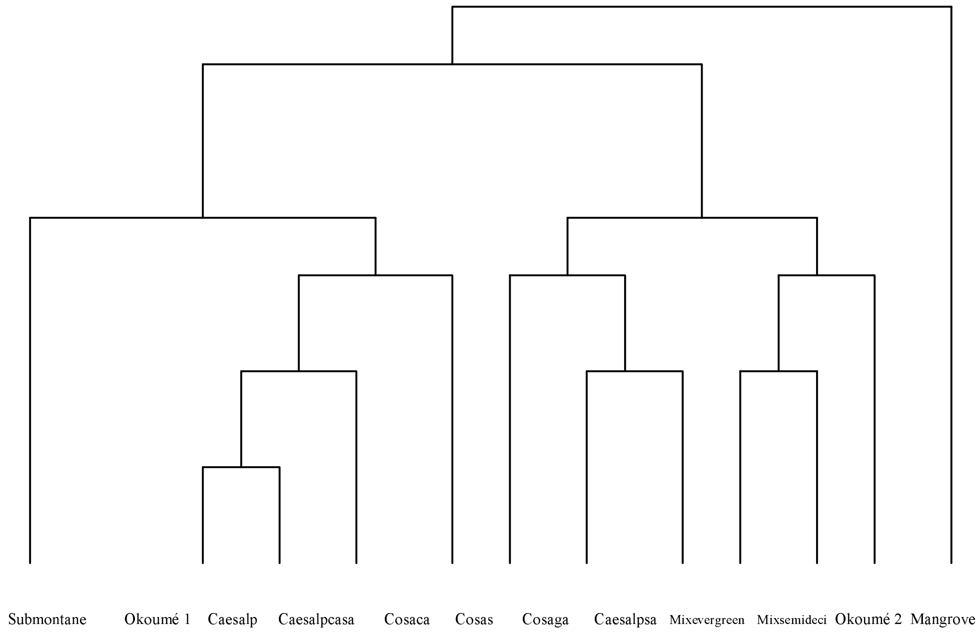

Figure 2.1 TWINSPAN dendrogram of 958 species of vascular plants with DBH ≥ 1 cm recorded in 147 plots of 0.1 ha each in the Campo-Ma'an rain forest. TWINSPAN groups: Submontane: Submontane forest on hill tops; Okoumé 1&2: Okoumé forest; Caesalp: Lowland evergreen forest rich in Caesalpinioideae; Caesalpcasa: Lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis;* Cosaca: Coastal forest with *Sacoglottis gabonensis* and *Calpocalyx heitzii*; Cosas: Coastal forest on sandy shorelines; Cosaga: Coastal forest with *Sacoglottis gabonensis*; Caesalpsa: Lowland evergreen forest rich in Caesalpinioideae and *Sacoglottis gabonensis*; Mixevergreen: Mixed evergreen and semi-deciduous forest with elements of evergreen forest predominant; Mixsemideci: Mixed evergreen and semi-deciduous forest with semi-deciduous elements predominant; Mangrove: Mangrove forest.

Diogoa zenkeri, Greenwayodendron suaveolens, Santiria trimera, Strombosia grandifolia, S. pustulata and *Tetraberlinia bifoliolata.* The understorey is about 10 m high, discontinuous, and consists of immature trees of the upper strata and other small trees and shrubs. They include species such as *Diospyros preussii*, *Jollydora duparquetiana, Lasianthera africana, Massularia acuminata, Podococcus barteri, Asystasia macrophylla,* and *Cola, Crotonogyne, Diospyros, Drypetes, Psychotria, Rinorea* and *Scaphopetalum* species. Beneath the tree and shrub layers is the ground layer that is dominated by seedlings of the above layers and many herbaceous species such as *Costus englerianus, Marantochloa monophylla, Microcalamus barbinoides, Palisota barteri, Puella schumanniana* and *Stylochaeton zenkeri*. Common large woody liana species are *Agelaea pentagyna, Neuropeltis incompta* and many species of the genera *Combretum, Dichapetalum, Millettia, Salacia* and *Strychnos*.

2. Lowland evergreen forest rich in Caesalpinioideae, with Calpocalyx heitzii and Sacoglottis gabonensis (Caesalpcasa).

This forest type is unique in Cameroon and only occurs in the Campo area between 50-200 m above sea level (Letouzey, 1985; Kaji, 1990; Thomas & Thomas, 1993; Sunderland *et al.*, 1997). Although it is similar in structure and composition to the lowland evergreen forest rich in Caesalpinioideae, it is characterised by its abundance in Caesalpinioideae, *Calpocalyx heitzii* and *Sacoglottis gabonensis.* These species often occur in association with *Alstonia boonei, Calpocalyx dinklagei, Desbordesia glaucescens, Greenwayodendron suaveolens, Irvingia gabonensis, Meiocarpidium lepidotum, Piptadeniastrum africanum, Ochthocosmus calothyrsus*, and *Terminalia superba.*

Table 2.1 Vegetation types derived from multivariate analyses with map code, altitudinal range, annual rainfall and degree of disturbance.

Map code	Vegetation types	Altitudinal range (m)	Rainfall (mm/year)	Degree of disturbance*
Caesalp	Lowland evergreen forest rich in Caesalpinioideae	100-700	1750-2000	a, b, c & d
Caesalpcasa	Lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis*	50-200	2200-2800	b, c & d
Caesalpsa	Lowland evergreen forest rich in Caesalpinioideae with *Sacoglottis gabonensis* and other coastal indicators	50-350	2600-2950	b, c & d
Cosaga	Coastal forest rich in *Sacoglottis gabonensis*	0-100	2800-2950	b, c & d
Cosaca	Coastal forest rich in *Sacoglottis gabonensis* and *Calpocalyx heitzii*	0-100	2700-2800	b, c & d
Mixevergreen	Mixed evergreen and semi-deciduous forest, with elements of evergreen forest predominant	100-700	1750-2000	a, b, c & d
Mixsemideci	Mixed evergreen and semi-deciduous forest, with semi-deciduous elements predominant	100-700	1670-1750	b, c & d
Submontane	Submontane forest on hilltops	800-1100	1800-2000	a
Swamp	Seasonally flooded and swamp forests	0-500	1670-2950	a & b
Mangrove	Mangrove rich in *Rhizophora racemosa* and *Pandanus* species	0-30	2800-2950	a & b
Cosas	Coastal vegetation on sandy shorelines	0-20	2800-2950	d & e
Hevecam	Industrial rubber plantation	0-100	2600	e
Socapalm	Industrial oil palm plantation	0-100	2950	e

* Where, a: virtually undisturbed except for hunting and the collection of non timber forest products; b: small patches (<25%) of human disturbance; c: significant areas (25-50%) of forest degradation; d: large areas (>50%) of forest degradation; and e: no natural vegetation left. Cosas forms a narrow strip along the coast that cannot be depicted on the vegetation map because of its scale.

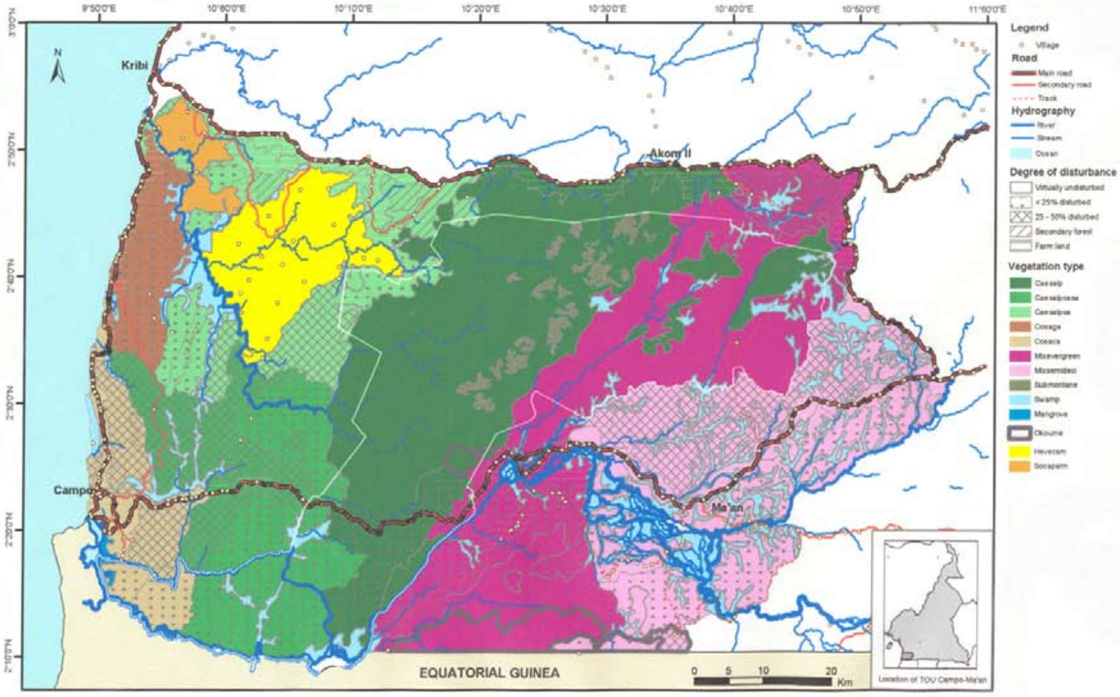

Figure 2.2 Vegetation map of the Campo-Ma'an area (Annex 5)

3. *Lowland evergreen forest rich in Caesalpinioideae, with Sacoglottis gabonensis and other coastal indicators* (Caesalpsa).

Generally, these are found along the coast and around Massif des Mamelles, Mont d'Eléphant, Nyete and Lobe between 50-350 m above sea level. The forest is characterised by its richness in Caesalpinioideae and the presence of many coastal indicators amongst which *Sacoglottis gabonensis* is the most frequent. They are often associated with other tree species such as *Anthonotha fragrans, Brachystegia cynometroides, Coelocaryon preussii, Coula edulis, Dichostemma glaucescens, Leonardoxa africana, Lophira alata, Ochthocosmus calothyrsus, Odyendeya gabonensis, Scyphocephalium mannii, Strombosia pustulata* and *Tetraberlinia bifoliolata*. The understorey is dominated by shrub and herb species such as *Allexis cauliflora, Asystasia macrophylla, Crotonogyne manniana, Diospyros obliquifolia, Jollydora duparquetiana, Lasianthera africana, Massularia acuminata, Palisota ambigua, Rinoria albidiflora* and *Scaphopetalum blackii.*

4. *Coastal forest rich in Sacoglottis gabonensis* (Cosaga)

These forests are predominantly found along the coast between Kribi and Campo at altitudes between 10-100 m above sea level. This forest type is similar to the lowland evergreen forest rich in Caesalpinioideae with *Sacoglottis gabonensis,* but it contains many more coastal indicator species and less Caesalpinioideae than the former. It is characterised by the frequent occurrence of *Sacoglottis gabonensis* that occurs in association with other tree species such as *Coula edulis, Cynometra hankei, Lophira alata, Ochthocosmus calothyrsus* and *Pycnanthus angolensis*. This forest type is heavily affected by human activities such as agriculture, logging, road construction, and urbanisation. It is rather difficult to find traces of undisturbed forest of this type despite its primary appearance in some areas.

5. Coastal forest rich in Calpocalyx heitzii and Sacoglottis gabonensis (Cosaca).
This vegetation type occurs in the Campo area between 0-100 m above sea level and represents a transitional zone where the evergreen forest rich in Caesalpinioideae, *Calpocalyx heitzii* and *Sacoglottis gabonensis* mixes with the coastal forest. As a result, it contains many more coastal indicator species and much less Caesalpinioideae than the latter. In addition to *Calpocalyx heitzii* and *Sacoglottis gabonensis,* the forest is dominated by tree species such as *Alstonia boonei, Calpocalyx dinklagei, Coelocaryon preussii, Desbordesia glaucescens, Distemonanthus benthamianus, Greenwayodendron suaveolens, Lophira alata, Ochthocosmus calothyrsus, Pterocarpus soyauxii, Staudtia kamerunensis* var. *kamerunensis* and *Terminalia superba*.

6. Coastal vegetation on sandy shorelines (Cosas).
It occurs along the coastline between Kribi and Campo, supporting a species-poor belt of low-canopy woody vegetation, often with herbaceous and shrubby maritime plant species. The foreshore is dominated by the typical Atlantic shore species *Ipomea pes-caprae* spp. *brasiliensis* that occurs on a low sandy coastline. Additional species are *Andira inermis* ssp. *inermis, Remirea maritima, Dioda serrulata, Canavalia rosea, Ipomea cairica, Flagellaria guineense, Cassytha filiformis* and *Stylosanthes erecta*. The seaward side bordering this formation is rich in maritime tree species such as *Terminalia catappa, Syzygium guineense* var. *littorale, Phoenix reclinata, Chrysobalanus icaco* spp. *icaco, Manilkara obovata, Calophyllum inophyllum, Carapa procera,* and *Cocos nucifera. Hibiscus tiliaceus*, a species characteristic of tropical shores also occurs here in association with other coastal species such as *Dodonaea viscosa, Craibia atlantica, Lonchocarpus serieus, Dalbergia ecastaphyllum, Mucuna flagellipes* and *Tetracera alinifolia*.

*7. Mixed evergreen and semi-deciduous forest, with elements of evergreen lowland forest predominan*t (Mixevergreen).
This vegetation type occurs mostly in the western part of Ma'an, and in the eastern part of the Campo-Ma'an National Park at altitudes between 100-700 m. Here the forest has a fairly closed canopy though, patches of open areas are occasionally found where the forest is poorly developed. It contains many more elements of the lowland evergreen forest rich in Caesalpinioideae and the canopy is dominated by tree species such as *Anthonotha fragrans, Calpocalyx dinklaigei, Canarium schweinfurthii, Erythrophleum ivorense, Plagiostyles africana, Petersianthus macrocarpus, Pycnanthus angolensis, Santiria trimera, Strombosiopsis tetrandra, Tabernaemontana crassa*, *Stachyothyrsus staudtii* and *Uapaca guineensis*. The understorey is dominated by shrub species such as *Alchornea floribunda*, *A. hirtella*, *Asystasia macrophylla, Haumania danckelmaniana, Heisteria parviflora,*

Microdesmis puberula, Palisota ambigua, Podococcus barteri, Scaphopetalum blackii and *S. thonneri*.

8. Mixed evergreen and semi-deciduous forests, with semi-deciduous elements predominant (Mixsemideci).

This forest type which occurs in the south and eastern parts of Ma'an is similar to the forest type described above, but it contains many more semi-deciduous elements than the former. The forest is characterised by a discontinuous canopy with considerable patches of open forests covered by *Haumania danckelmaniana* and rattan species such as *Calamus deerratus, Laccosperma opacum, L. robustior, L. secundiflorum,* and *Oncocalamus mannii*. The forest canopy is irregular with scattered tree species such as *Alstonia boonei, Celtis milbraedii, C. tessmannii, Coula edulis, Dacryodes buettneri, D. macrophylla, Dichostemma glaucescens, Distemonanthus benthamianus, Erythrophleum ivorense, Lophira alata, Pentaclethra macrophylla, Petersianthus macrocarpus, Pterocarpus soyauxii, Pterygota macrocarpa, P. mildbraedii, Pycnanthus angolensis, Stachyothyrsus staudtii, Tabernaemontana crassa* and *Triplochiton scleroxylon*.

9. Submontane forest on hilltops (Submontane).

It occurs mainly between 800-1100 m on Nkolmedjabambon and Ongongo hills south of Akom II, on the Nkolebengue Hills west of Ebianemeyong, and on other hills northeast of Biwome. The lowland forest rich in Caesalpinioideae gradually gives way to the submontane forest, which occurs on steep slopes with distinctive ridge top and slope communities. It is characterised by a low canopy (25-30 m high) with scattered large trees (up to 35 m tall). Common tree species include *Afrostyrax lepidophyllus, Anisophyllea polyneura, Aphanocalyx hedinii, A. microphyllus, Dacryodes macrophylla, D. klaineana, Endodesmia calophylloides, Fillaeopsis discophora, Garcinia gnetoides, G. mannii, Klaineanthus gaboniae, Leonardoxa africana, Newtonia duparquetiana, Plagiosiphon emarginatus, Protomegabaria stapfiana, Santiria trimera, Scorodophloeus zenkeri, Syzygium staudtii, Tetraberlinia bifoliolata* and *Uapaca guineensis*. Between 900 and 1100 m, trees are densely covered by bryophytes (mosses) and vascular epiphytes including ferns and orchids.

10. Seasonally flooded and swamp forests (Swamp).

They are found throughout the Campo-Ma'an area along rivers, in river basins and creeks in areas which are permanently or seasonally inundated. Many species have breathing or aerial roots that give a conspicuous physiognomy to this vegetation when combined with the unusual architecture of other species such as *Lasiomorpha senegalensis*, a giant spiny aroid, *Ficus vogeliana* with long sinuous spreading buttresses bearing flagelliform infructescences and the sprawling, highly thorny *Pandanus*. Others common species include *Berlinia bracteosa, Cola hypochrysea, Gilbertiodendron dewevrei, Hallea stipulosa, Homalium longistylum, Lasiodiscus mannii, L. marmoratus, Pachypodanthium barteri, Plagiosiphon multijugus, Spondianthus preussii, Sclerosperma mannii* and *Uapaca guineensis.* Some swamps are dominated by *Raphia* species. Riparian forest communities are mostly found on seasonally exposed rocks along riverbanks that are seasonally submerged. Their species composition includes normal forest species and species adapted to a seasonally high water table. Common tree species found include *Aphanocalyx* *hedinii, Anthonotha macrophylla, Diospyros gracilescens, Ficus vogeliana, Gilbertiodendron demonstrans, G. dewevrei, Millettia griffoniana, Neolemornniera batesii, Spondianthus preussii, Synsepalum brevipes, Syzygium guineense* var. *littorale, Uapaca guineensis, U. heudelotii, U. staudtii,* and *Vitex doniana*. Narrow-leaved rheophytic shrubs such as *Alsodeiopsis zenkeri, Ixora fastigata, Garcinia sp., Ouratea dusenii,* and *Rinorea sp.* nov. are commonly found along the Ntem and Bongola rivers.

11. Mangroves

There are many small creeks, sometime with small estuaries and wetlands in the Campo-Ma'an area. Occasionally, these habitats either support a few clumps of tall mangroves dominated by tall *Rhizophora racemosa* and *Pandanus candelabrum* species or a population of short mangroves dominated by small *Rhizophora racemosa* and *Pandanus satabiei*. These mangrove trees (20-30 m tall) bear spectacular aerial roots forming a dense matrix on which one can cross the mangrove one or two metres above the mud during dry seasons. More often short mangroves are fringed by seasonally flooded forests which are dominated by *Crudia klainei, Guibourtia demeusei*, *Hallea stipulosa, Hibiscus tiliaceus, Lonchocarpus sericeus, Phoenix reclinata, Syzygium guineense* var. *littorale, Raphia* and *Uapaca* species.

12. Aucoumea klaineana forest (Okoumé 1&2)

Although Okoumé communities do not form a vegetation type per se in the Campo-Ma'an area, it is worth mentioning its occurrence in Cameroon since *Aucoumea klaineana* is reaching its northern limit of distribution in the area. It only occurs in small patches around Ebianemeyong on exposed steep hills or to the south of Ma'an close to the border with Equatorial Guinea around Nsengou and Ngo'ambang. In Ebianemeyong, the forest is opened and dominated by *Aucoumea klaineana* sometimes forming a distinctive near mono-dominant stands on exposed steep hills. In the Ma'an area, small clumps of Okoumé occur in open areas dominated by species of *Haumania danckelmaniana* and many rattans species. Despite the apparent virgin nature of this forest type, it has a strong secondary character in terms of species composition.

In addition to these vegetation types, degraded coastal forest, lowland evergreen rain forest or mixed evergreen and semi-deciduous forests are mostly found along roads and logging paths, near settlements and industrial sites. Secondary forests are often dominated by pioneer trees species such as *Albizia adianthifolia, Alchornea cordifolia, Anthocleista schweinfurthii, Bridelia micrantha, Cleistopholis patens, Dichaetanthera africana, Harungana madagascariensis, Musanga cecropioides, Rauvolfia caffra, R. vomitoria, Trema orientalis,* and *Macaranga* species.

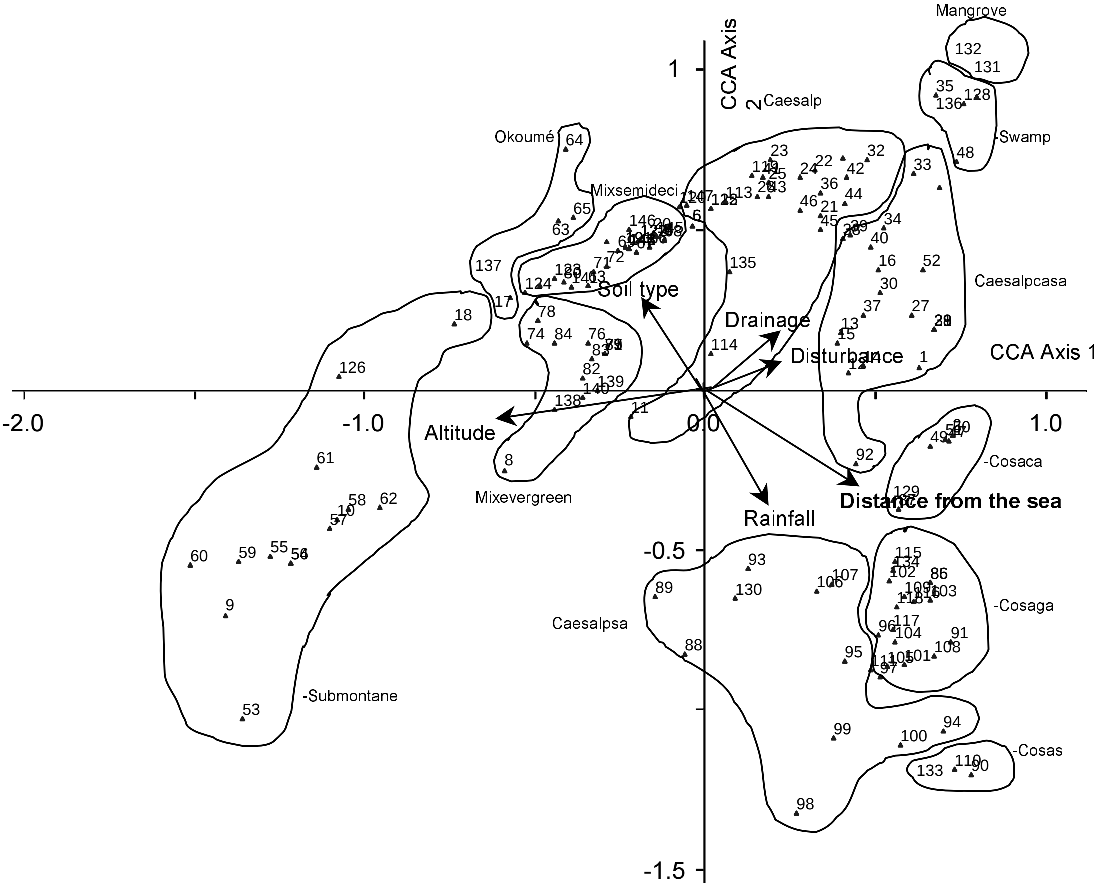

Figure 2.3 CCA ordination graph based on 958 vascular plant species with DBH ≥ 1 cm recorded in 147 plots showing the influence of environmental variables such as rainfall, altitude, distance from the sea, main soil type, drainage and human disturbance on the various vegetation types. Environmental factors with long arrows are more closely correlated in the ordination than those with short arrows and therefore are more important in influencing the vegetation groupings

In some areas where degradation is very severe, only few trees are left standing in a secondary vegetation consisting of pioneer woody and herbaceous species such as *Chromolaena odorata, Lycopodiella cernua, Nephrolepis bisserata*, *Selaginella myosurus* and *S. kraussiana.* Marantaceae and Zingiberaceae forests are mainly found along abandoned logging paths. They form thickets of about 2-3 m high and are generally dominated by Marantaceae species such as *Haumania danckelmaniana, Marantochloa leucantha, Megaphrynium macrostachyum, Sarcophrynium prionogonium* and many species of *Aframomum, Renealmia* and *Costus* of the Zingiberaceae and Costaceae families respectively. This vegetation type also supports scattered small and medium sized pioneer tree species such as

Alchornea cordifolia, Anthocleista schweinfurthii, Bridelia micrantha, Harungana madagascariensis, Musanga cecropioides, Trema occidentalis and *Macaranga* species. This forest association appears to be the main habitat for forest elephant, buffalo, gorilla, chimpanzee and many other large primates because of its good cover and high food production.

DCA and CCA analyses

The species-environment biplot from the CCA analysis is presented in Figure 2.3. As shown in Table 2.2, the first two axes of the DCA and CCA analyses of the data set have eigenvalues above 0.5, which denotes a good separation of the species along these axes despite a low amount of species variance explained. TWINSPAN and correspondence analyses have produced a similar classification since most of the plots that were found together in the various TWINSPAN groups were also put together in the CCA classification groups.

Table 2.2 Summary table of DCA and CCA of 147 plots recorded in the Campo-Ma'an area.

	Axis 1	Axis 2	Axis 3	Total inertia
DCA				20.83
Eigenvalues	0.92	0.74	0.66	
Lengths of gradient	9.38	4.35	4.71	
Cumulative percentage variance of species data	17.26	4.75	4.73	
CCA				20.83
Eigenvalues	0.68	0.61	0.54	
Species-environment correlation (Pearson correlation)	0.97	0.95	0.95	
Cumulative percentage variance of species data	3.4	6.2	8.8	

Table 2.3. CCA canonical coefficients of 10 important environmental variables recorded in 147 plots distributed over the Campo-Ma'an area.

Environmental factors	Axis 1	Axis 2	Axis 3
Mean annual rainfall (mm.y-^{1})	0.13	-0.60	-0.21
Altitude (m above sea level)	-0.76	0.38	-0.12
Distance from the sea (km)	-0.01	-0.62	-0.14
Disturbance	0.34	0.10	0.09
Soil characteristics			
Main soil type	0.07	0.02	-0.36
Parent material	-0.03	-0.10	-0.09
Drainage	0.07	-0.03	-0.61
Top soil texture (0-10 cm)	-0.06	-0.02	-0.04
PH ($H_2$0) of the top soil (0-10 cm)	-0.04	-0.09	-0.11
Electricity conductivity of top soil (0-10 cm)	0.03	-0.01	0.10

Environmental factors such as rainfall, proximity to the sea and altitude are more closely correlated with the vegetation ordination than soil characteristics. Almost all the coastal plots (Cosaca, Cosaga and Cosas), mangrove, swamps and lowland evergreen forest rich in Caesalpinioideae (Caesalp, Caesalpcasa and Caesalpsa) are negatively correlated with altitude and positively with increasing rainfall. Plots that were located in the rain shadow in the Ma'an area (Mixevergreen and Mixsemideci) are characterised by a lower rainfall. The effect of altitude is also well illustrated by all high altitude plots grouped together (submontane). The relative importance of environmental variables is shown in Table 2.3. Altitude (-0.76) and disturbance (0.34) are highly correlated with the first axis, distance from the sea (-0.62) and mean annual rainfall (-0.60) with the second axis, and drainage (-0.61) and soil type (-0.36) with the third axis.

Soils

Following the FAO classification system, soils in the Campo-Ma'an area were generally classified as Ferrasols and Acrisols (Franqueville, 1973; Muller, 1979; van Gemerden & Hazeu, 1999). They are strongly weathered, acid and low in nutrients with pH (H_2O) values generally around 4 (Annex 2). The soils are deep to very deep and clayey in texture, except at the seashores and river valleys where they are often sandy. Based on drainage characteristics and texture, four major soil types can be distinguished in the area. Poorly drained soils that are commonly found in the river valleys and adjacent swamp areas throughout the Campo-Ma'an area. They were classified as Dystric Fluviosols or Gleyic Cambisols. The texture is often sandy to gravely with clay interlayer. Moderately well to well drained soils are frequent in other parts of the research area. The dominant soils in the coastal plain are Plinthic Ferrasols, with patches of Haplic Acrisols and Acri-Xanthic Ferrasols. They are sandy clay loam soils developed on granites and gneiss with high pyrocene content. In the eastern part of the Campo-Ma'an area, soils are developed on ectinites including gneiss, micaschist and quartzite. Xanthic Ferrasols are predominant though Ferralic Cambisols and Ferric Acrisols are also found around the Massif des Mamelles. In the mountainous area, soils are developed on migmatites and granites and are mostly classified as Acri-Xanthic Ferrasols and Xanthic Ferrasols. They are deep clay soils with a sandy clay loam to sandy clay topsoil.

Forest structure and floristic composition

Diameter class distribution and basal area

In total 78086 trees, shrubs, climbers and other vascular plants with DBH ≥ 1cm in 147 plots (14.7 ha) were recorded in the various vegetation types (Table 2.4). They belonged to 1116 species, 421 genera and 98 families. Of all the records 75% were identified at species level, 23% at generic level and 2% at family level. The diameter distribution pattern of stems was similar among the various vegetation types and all plots were characterized by a high density of stem 1-30 cm DBH and a paucity of trees above 50 cm DBH, with a tendency of smaller canopy trees in the submontane forest, mangrove and swamps. As shown in Table 2.4, the mean number of stems/ha for all vascular plants ≥ 1cm DBH varies from 4380 in the lowland evergreen forest rich in Caesalpinioideae to 8630 in the mangrove. The mean basal area/ha varies from 49.86 in the coastal forest on sandy shorelines to 88.73 in lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis*. In general, the area is characterized by a high mean basal area/ha because of the high frequency of canopy trees with large buttresses.

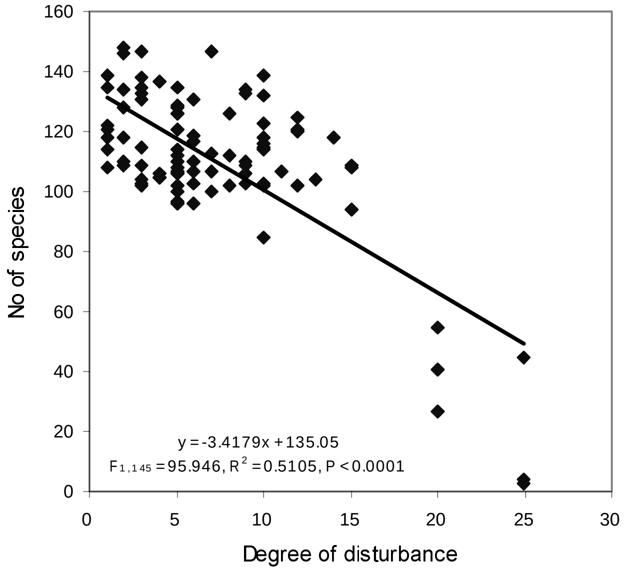

Figure 2.4 Correlation between the degree of human disturbance (% of degraded forest) and the number of species recorded in 147 plots of 0.1 ha each.

Floristic composition and species richness

As shown in Table 2.4, the number of species for all vascular plants ≥ 1cm recorded varies from 4 in the mangrove to 557 in the lowland evergreen forest rich in Caesalpinioideae. The mangrove, swamps and coastal forest on sandy shorelines were species poor and less diverse than the other forest types. Overall, the Rubiaceae family has the highest number of species (159 species of vascular plants with DBH ≥ 1cm), followed by Euphorbiaceae (80 species), Leguminosae-Caesalpinioideae (72 species), Annonaceae (61 species), Sterculiaceae (50 species), Sapindaceae (37 species), Apocynaceae (34 species), Ochnaceae (28 species), Sapotaceae (26 species), Ebenaceae, Guttiferae and Meliaceae (25 species each), Dichapetalaceae and Leguminosae-Papilionoideae (22 species each).

Generally, the Campo-Ma'an area is characterized by a rich and diverse flora. The Shannon diversity index was relatively high and varied from 0.12 in the mangrove to 5.33 in the submontane forest. Results from the enumeration of all vascular plant species showed and confirmed that the lowland evergreen forest rich in Caesalpinioideae is characterized by its abundance in Caesalpinioideae (72 species).

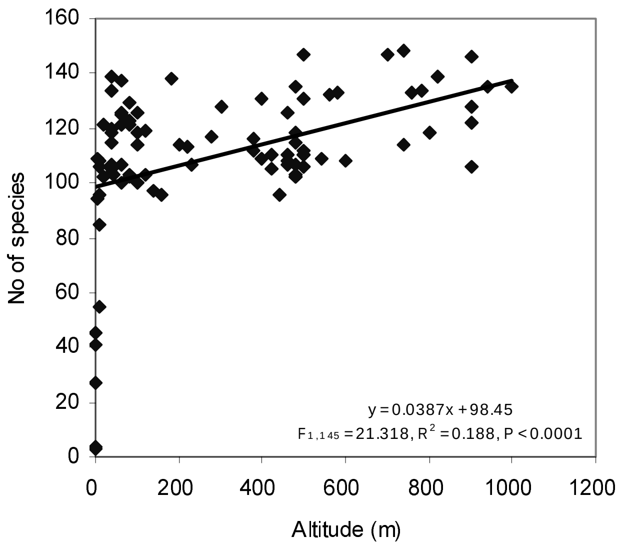

Figure 2.5 Correlation between altitude and the number of species recorded in 147 plots of 0.1 ha each.

The important value index (IVI) of the Caesalpiniaceae was high in most of the vegetation types encountered and varied from 38.09 in lowland evergreen forest rich in Caesalpinioideae to 14.01 in the lowland evergreen forest rich in Caesalpinioideae with *Sacoglottis gabonensis*. In terms of species richness, there was a strong significant negative correlation between the number of species recorded in the various plots and the level of human disturbance (Figure 2.4) and a relatively weak correlation with rainfall ($F_{1,\ 145}$ = 10.094, R^2 = 0.099, P = 0.002), altitude (Figure 2.5), and distance from the sea ($F_{1,\ 145}$ = 10.797, R^2 = 0.105, P = 0.001), or pH ($F_{1,\ 145}$ = 7.200, R^2 = 0.073, P = 0.009).

Table 2.4 Summary of the number of species, number of stem/ha, mean basal area/ha, canopy height and Shannon diversity index (H') of the various vegetation types for all plants with DBH ≥ 1 cm recorded in the Campo-Ma'an area. Minimum and maximum values are given between brackets.

Vegetation types	No of plots	No of species	Average No of stems/ha	Mean basal area/ha	Height of upper canopy	Shannon diversity index (H')
Caesalp (2.3 ha)	23	557 (75-128)	4380 (2500-5750)	75.89 (37.95-121.90)	50 (40-55)	5.12
Caesalpcasa (2.5 ha)	25	555 (93-139)	5326 (3120-7020)	88.73 (41.00-146.75)	50 (40-55)	5.01
Caesalpsa (1.4 ha)	14	474 (86-138)	5935 (4350-7120)	85.73 (58.94-161.98)	45 (40-50)	5.09
Cosaga (0.9 ha)	9	303 (81-140)	5810 (4940-8010)	86.1 (35.82-113.67)	45 (40-50)	4.58
Cosaca (0.9 ha)	9	326 (78-108)	5864 (4740-7570)	87.69 (32.40-140.31)	45 (40-50)	4.38
Cosas (0.4 ha)	4	100 (27-55)	4710 (3630-5700)	49.86 (34.88-65.08)	30 (25-35)	3.54
Mixevergreen (2.1 ha)	21	523 (63-135)	4983 (3890-6980)	78.22 (45.36-135.03)	45 (40-50)	4.70
Mixsemideci (1.6 ha)	16	481 (86-147)	5460 (4390-6340)	69.73 (68.88-131.25)	45 (40-50)	4.59
Submontane (1.4 ha)	14	499 (79-148)	6094 (3680-8449)	57.66 (40.74-67.90)	30 (25-35)	5.33
Swamps (0.5 ha)	5	246 (18-108)	4276 (2070-5960)	62.77 (41.15-100.01)	30 (25-35)	4.35
Mangrove (0.2 ha)	2	4 (3-4)	8630 (8150-9100)	75.16 (66.03-84.30)	30 (20-35)	0.12
Okoumé forests (0.5 ha)	5	234 (18-107)	4802 (3720-5800)	64.28 (42.47-91.95)	40 (30-45)	4.10
Total for the Campo-Ma'an area (14.7 ha)	147	1116 (3-148)	5312 (2070-9100)	76.71 (34.88-161.98)	50 (20-55)	5.54

2.4. DISCUSSION

General vegetation patterns

There is a good correspondence between the TWINSPAN, DCA and CCA classifications and the comparable outputs from these analyses efficiently illustrate the influence of the main environmental factors on the various vegetation types. This probably indicates that all relevant environmental variables were included in the analyses and that the sampling design, based on small plots of 0.1 ha in which all vascular plants with DBH ≥ 1 cm are recorded, may be successfully applied in detecting species environment relationships in a tropical rain forest (Hall & Swaine, 1976; Gartlan *et al.*, 1986; Duivenvoorden & Lips, 1995; Newbery *et al.,* 1996). However, the data presented some difficulties to TWINSPAN and CCA analyses because some species were commonly found throughout the area thus resulting in the presence of a few outlying plots.

The vegetation in the Campo-Ma'an area falls within the Lower Guinea subdivision of the Guineo-Congolian rain forest region and is part of the Biafran forest type that extends from Southeast Nigeria to Gabon and the Mayombe area in Congo (White, 1983; Letouzey, 1968 & 1985). The Campo-Ma'an forest is situated in the middle of this belt and shares with other sites the overall characteristic of the Atlantic Biafran forest mainly with evergreen but also some semi-deciduous elements. Although this vegetation type is widespread, there is a considerable variation in dominant species and species composition between localities. This study demonstrated that the area has a diverse and rich forest with more than 10 vegetation types and sub-types that include the coastal vegetation, lowland evergreen forest rich in Caesalpinioideae, mixed evergreen and semi-deciduous forest, mangroves, seasonally flooded and swamp forests, riparian vegetation and secondary forests (Figure 2.2). The Campo area was dominated by the lowland evergreen forest rich in Caesalpinioideae and the Ma'an area by the mixed evergreen and semi-deciduous forest.

In terms of relative density, the Caesalpinioideae was the dominant sub-family throughout the area. Its species were co-dominant and their abundance varied within the various vegetation types. Some of them were gregarious with a high regeneration capacity and many juvenile trees. Many species were emergent or big canopy trees with large buttresses that partly account for the high basal area recorded in the area. More than 65% of the forest types recorded have at least 250 species with a Shannon diversity index > 4. Moreover, 56% of all the plots recorded have more than 100 species/0.1 ha for all vascular plants above 1 cm DBH. The submontane forest has the highest frequency of species-rich plots (93% of all plots recorded has more than 100 species/0.1 ha). Other rich vegetation types include the lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis* (81%), the lowland evergreen forest rich in Caesalpinioideae with *Sacoglottis gabonensis* (78%), the lowland evergreen forest rich in Caesalpinioideae (76%) and the mixed evergreen and semi-deciduous forest (67%). The mangroves, swamps and the coastal vegetations on sandy shorelines were species-poor.

The impact of environmental and human factors

Rainfall and proximity to the sea

There was a strong positive correlation between the various vegetation types, rainfall and proximity to the sea. These three factors were highly correlated with the first two axes of the CCA ordination graph. The average annual rainfall generally decreases with increasing distance from the sea, ranging from 2950 mm/year in Kribi to 2000 mm around Akom II and 1670 mm in the Ma'an area (Olivry, 1986). The Ma'an area has significant less rainfall than other areas. This is probably due to a rain shadow effect caused by the range of hills that start from Ebianemeyong to Akom II and which forms a substantial upland block between Ma'an and the ocean. As a result the vegetation changes from the mangrove or coastal forest with many coastal indicator species, through the lowland evergreen forest rich in Caesalpinioideae to the mixed evergreen and semi-deciduous forest in the drier Ma'an area. The number of species recorded was relatively influenced by the proximity of the sea and rainfall, thus resulting in a gradual variation in dominant species and an increase in species richness with increasing distance from the sea and decreasing annual rainfall. The submontane forests and the Caesalpinioideae forests of the interior were more diverse and species rich than the coastal forests (Table 2.4).

Altitude

Altitude also had a positive influence on the general vegetation patterns and species composition in the area (Figure 2.5). It is worth mentioning that the effect of altitude on the vegetation is less pronounced in the Campo-Ma'an area than in others mountainous areas in Cameroon. This is partly due to the fact that Campo-Ma'an is not a mountain and the hills found here are low (up to 1100 m above sea level) and do not show a clear altitudinal gradient in the vegetation from sea level to the top. On these hills the forest composition was almost the same on both sides of the slope. Generally, on high mountains, the number of species tends to decrease with increasing altitude. But in the Campo-Ma'an area, there was rather a relative increase of species richness with increasing altitude. High altitude forest appeared to be relatively more species-rich than the lowland and coastal forests. In the submontane forest, more than 93% of the plots had at least 100 species/0.1 ha. Furthermore, the structure and composition of the forest, as well as the physiognomy of the species change progressively as one moves from the lowland to the submontane forest. In the lowland forest, trees were taller (up to 50 m) and a considerable number of emergent and canopy trees have large buttresses. Many small trees and shrubs bear their flowers and fruits directly on the trunk or large branches. The submontane forest was lower (25-35 m) than the lowland forest and between 900-1100 m many trees were covered with bryophytes and vascular epiphytes. Furthermore, special physiognomic features characteristic of the lowland forest such as large woody lianas, buttressing and cauliflory were less common.

Soils

The relationships between soil characteristics and the vegetation types was less clear than other environmental variables such as rainfall, proximity to the sea and altitude, though soil type showed highest correlation with the third axis of the CCA result. Mangroves and swampy forests on hydric soils with poor drainage conditions have low nutrient concentrations and are species-poor. This must stem partly from the fact that, in exception to mangrove and swamps that are characterised by a distinctive edaphic condition, soils in the research area are well drained, strongly weathered, and acid with pH (H_2O) values generally around 4. However, soil type and drainage were correlated with plots recorded in mangrove and swamps forests (Figure 2.3). Gartlan *et al.* (1986) and Newbery *et al.* (1996) undertook similar analyses in Korup National Park and the Douala-Edea Forest Reserve in Cameroon and found that the main environmental factors affecting vegetation were rainfall, altitude, slope, drainage, and potassium and phosphorus concentrations in the soil. They argued that rainfall and seasonality are likely to lead to stronger distributional gradients than soil nutrients in equatorial Africa rain forests. Although we did not carry out soil nutrient analyses, we found that in addition to rainfall, proximity to sea and altitude, human disturbance, drainage and soil type are the most important characteristics influencing the vegetation types in the Campo-Ma'an area. However, it is noteworthy to mention that many of the present-day distributions of plant species in the tropical Africa region are also dependent on the Pleistocene history and the continuing influence of Quaternary glacial and inter-glacial periods (Hamilton, 1982; White, 1983; Maley 1987, 1989, 1993, 1996 & 2001; Sosef, 1994 & 1996).

Human disturbance

The vegetation patterns as well as the forest composition and species richness were strongly influenced by the degree of human disturbance. Disturbance was positively correlated with the first axis of the CCA ordination graph and the number of species recorded in the various plots (Table 2.3 and Figure 2.4). Coastal forests appeared to be more disturbed with many secondary species, less species-rich and less diverse than other forest types recorded. This is mainly due to the fact that the replacement of the Campo-Ma'an rain forests into other land use types began centuries ago, and the coastal area is more degraded. So far, large tracts of the primary lowland forests have been affected by agriculture, shifting cultivation, urbanisation and more recently by logging. Clearance of natural vegetation to provide land for settlements and subsistence agriculture (28% of the total area) and commercial agriculture (7.5%) is the biggest threat to the lowland forests and its unique vegetation. Timber exploitation is the main economic activity in the area and logging concessions cover 31.4% of the area. It is rather difficult to find undisturbed forest of this type, despite its primary appearance in some areas (Table 2.1 and Figure 2.2). Particularly, the coastal forest and the lowland evergreen forest rich in Caesalpinioideae suffered from logging and agricultural activities. Pockets of undisturbed primary forest mainly remain on hills and gentle slopes because of difficult access.

Long before these recent human activities on the Campo-Ma'an rain forests, man has had a marked influence on the coastal vegetation (Reynaud & Maley, 1994; Oslisly, 2001; Maley & Brenac, 1998; Maley 1999, 2001 & 2002). Recent archeological exploration in the area has identified village sites located along the coast (Bwambé, Bwendjo, Campo, Ebodje, Lobé and Lolabé) and within the forest (Biyan, Efoulan II, Nemeyong, Nkoelon, Nkolebengue and Nkolmekok) dated 3.000-2.500 years BP (Kuete, 1990; Ossa Mvondo, 1994 & 1998; Oslisly *et al.*, 2001). This has brought several authors to argue that the coastal forests and the mixed evergreen and semi-deciduous forests in the Ma'an area may have undergone a great change in the past that is probably caused by man. A strong indication of past human disturbance is the frequent occurrence of *Alstonia boonei, Ceiba pentandra, Lophira alata, Pycnanthus angolensis* and *Terminalia superba* which are characteristic of mature secondary vegetation. Letouzey (1968 & 1985) classified most of the coastal forest as "Forêts atlantiques littorales à *Lophira alata* et *Sacoglottis gabonensis*" because of the abundance of *Lophira alata.* Today it is very difficult to find a mature stem of *Lophira alata* in these forests since they have been selectively logged at least twice during the past 30 years. Logging also accounts for the low density of mature timber tree species recorded in the coastal and lowland forest rich in Caesalpinioideae. However, despite this human influence on the Campo-Ma'an rain forest, there is still a considerable portion of rich and diverse forest in the Campo-Ma'an National Park and its surroundings. Furthermore, recent studies carried out by van Gemerden *et al.* (2003) in the Bipindi-Akom II-Lolodorf forests adjacent to the Campo-Ma'an area has shown that vegetation recovery in gaps caused by selective logging is relatively quick (5-14 years after logging) in Central African rain forest.

2.5. CONCLUSION

There was a good correspondence between the TWINSPAN, DCA and CCA classifications and the analyses illustrated the influence of the main environmental factors on the various vegetation types. The present study demonstrated that the vegetation of the Campo-Ma'an area is determined by rainfall, the proximity to the sea, altitude, soils and human disturbance. There was a strong impact of rainfall, proximity to the sea and human disturbance on the various vegetation types. As a result the vegetation changes from the coastal forest on sandy shorelines, through the lowland evergreen forest rich in Caesalpinioideae to the mixed evergreen and semi-deciduous forest in the drier Ma'an area. There is also a gradual variation in dominant species and an increase in species richness from the coast to the interior. Altitude and slope factors seem to have less influence on the general patterns of the vegetation distribution and species composition in the Campo-Ma'an area than rainfall and proximity to the sea. The overall relationship between soil characteristics and the various vegetation types was less clear than other environmental variables. However, drainage and soil type were the most important soil characteristics. Soil texture, pH and electricity conductivity values had less impact on the forest composition. The strong relationship between human disturbance and the vegetation patterns has implications on the floristic composition and species richness of various forest types. Coastal forests appeared to be more disturbed with many secondary species, less species-rich and less diverse than other forest types recorded.

Photo: Large buttress of *Desbordesia glaucescens* (Engl.) Tiegh. (Irvingiaceae) (Tchouto, M.G.P.)

Chapter 3

DIVERSITY PATTERNS IN THE FLORA OF THE CAMPO-MA'AN RAIN FOREST, CAMEROON: DO TREE SPECIES TELL IT ALL?

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3.1. INTRODUCTION

In a large, heterogeneous and structurally complex forest ecosystem such as the Campo-Ma'an tropical rain forest, selection of the most appropriate methods for the assessment of plant biodiversity is a difficult matter. So far, many botanical biodiversity studies in tropical rain forest are often limited to tree species (mainly medium and large trees, or for some cases trees with DBH ≥ 10 cm) which are assumed to reflect the forest floristic composition and physical structure (Letouzey, 1968; Reitsma, 1988; Hart *et al.*, 1989; Mosango, 1990; Koubouana, 1993; Wolter, 1993; Lejoly, 1995a & 1995b; Newbery & Gartlan 1996; White, 1996; Sonké, 1998, Sonké & Lejoly 1998; van Valkenburg 1998). Moreover, for most of these studies tree species accounted for more than 50% of the overall species composition. This traditional approach of forest inventory might not be sufficient for biodiversity assessment because other taxa such as shrubs, small trees, woody lianas, herbaceous climbers, herbs and epiphytic flora are not or under-represented. Furthermore, it has been shown in Central and West Africa that many plant species of high conservation value such as endemic and rare species are shrub and herbaceous species (Letouzey, 1968 & 1985; Robbrecht, 1996; Sosef, 1996; Achoundong, 2000; Cable & Cheek, 1998). Therefore, assessments based solely on trees might be inadequate for conservation purposes.

In Chapter 2, we classified, described and mapped the various vegetation types recorded in the Campo-Ma'an area and analysed the forest structure and composition. In this Chapter we will study the diversity and distribution of the flora in the Campo-Ma'an rain forest, and find out whether there is a correlation between tree species diversity and diversity of other growth forms such as shrubs, herbs and lianas. This will help us to understand if, in the contest of African tropical rain forest, tree species diversity tells it all. Are forests that are rich in tree species also rich in other life forms?

3.2. METHODS

Field sampling

Representative and homogeneous vegetation types were selected on the basis of physical and human factors such as altitude, slopes, rainfall, soils and land use (Chapter 2). Sampling was carried out in small plots of 0.1 ha at irregular intervals along a line transect from a random starting point. In mountainous areas, plots were located at an altitudinal interval of 200 m along the slope and on both sides of the ridge. In total 147 plots covering 14.7 ha were established and in each 0.1 ha plot, all trees, shrubs, herbs and lianas with DBH ≥ 1 cm were measured, recorded and identified as far as possible. For unknown species, a voucher specimen was collected. Herbaceous species and seedlings of trees, shrubs and climbers were sampled in subplots of 5 m x 5 m each that were established in the 0.1 ha plots. These subplots were not used for the analyses, the output was only used to illustrate the contribution of the ground layer and herbaceous species when all vascular plant species are included in the floristic assessment of the forest.

Data analysis

The analysis focussed on family and species level floristic richness and diversity of the various life forms and forest strata within 145 plots recorded in the area. Although 11 vegetation types were identified for the Campo-Ma'an area (Chapter 2), the analysis was done on 6 main vegetation types by grouping some of the forest types for a better illustration of the diversity patterns. All coastal forest types were grouped as coastal forest, all Caesalpinioideae forests as forest rich in Caesalpinioideae, the *Calpocalyx* and *Sacoglottis* forests as forest rich in *Calpocalyx heitzii* and *Sacoglottis gabonensis*, and the mixed forests as mixed evergreen and semi-deciduous forest. The 2 plots recorded in mangroves were excluded from the analysis because mangroves form a mono-dominant community with only 4 species. In this study tree layer comprised all vascular plant species with DBH ≥ 10 cm, shrub layer (1.5 cm ≤ DBH < 10 cm) and herbaceous layer (1 cm ≤ DBH < 1.5 cm). Diversity was measured by recording the number of species (species richness) and their relative abundance in the different plots and vegetation types. This study focused on the α diversity (species richness), which is defined as the number of species within a chosen area, given equal weight on each species, and the β diversity, which is the difference in species diversity between areas or communities (Kent & Coker, 1992; Bisby, 1995). β diversity was quantified with the Shannon diversity index (H') using all individuals above 1 cm DBH and all species per plot. Phytosociological parameters (relative density and relative frequency) and Shannon diversity index were calculated following Whittaker (1975), Kent & Coker (1992) and Magurran (1988). The SPSS package version 10.0 for Windows was used for statistical analyses. The Pearson's correlation test was used to correlate the species richness and diversity between the various growth forms and forest layers. We compared the diversity and species richness within forest layers and within growth forms using a General Linear Model (GLM) followed by a Tukey Multiple Comparison test ($P < 0.05$).

3.3. RESULTS

General patterns of species richness and diversity within forest types

A total of 76360 trees, shrubs, climbers and other vascular plants with DBH ≥ 1 cm was recorded in 145 plots of 0.1 ha each in the various vegetation types. They belonged to 1112 species, 420 genera and 97 families. In addition, 759 species of vascular plants (herbs, hemi-epiphytes, shrubs and seedlings of tree species) belonging to 101 families and 327 genera were recorded in the subplots of 5 m x 5 m each located within the 0.1 ha plots. Overall, 1471 species of vascular plants, including ferns and fern allies belonging to 542 genera and 126 families were recorded. More than 73% of all specimens collected were identified at species level, 23% at generic level, 3% at family level and 1% unidentified. As shown in Table 3.1, the number of stems/ha for all vascular plants ≥ 1 cm DBH varied from 5798 in swamps to 6912 in the submontane forest. The number of species/ha for all vascular plants ≥ 1 cm recorded varied from 293 in swamps to 468 in the lowland evergreen forest rich in Caesalpinioideae. The Shannon diversity (H') varied from 4.73 in coastal forests to 5.16 in forests rich in Caesalpinioideae. More than 57% of the plots have above 100 species/0.1 ha and a Shannon diversity (H') > 4 with the most

Table 3.1 Summary of the number of species, number of families, number of stems/ha and Shannon diversity (H') recorded in each vegetation types for all vascular plants with DBH ≥ 1 cm.

Vegetation types	No of species	No of families	No of stems/ha	Shannon diversity index (H')
Coastal forest (mangroves excluded)	381	69	6208	4.73
Swamps	293	58	5798	4.58
Forest rich in Caesalpinioideae	468	68	6033	5.16
Forest rich in *Calpocalyx heitzii* and *Sacoglottis gabonensis*	416	65	5990	4.93
Mixed evergreen and semi-deciduous forest	441	66	5867	4.77
Submontane	412	64	6912	5.14

diverse and species-rich plots located in the submontane forests, forests rich in Caesalpinioideae, and forests rich in *Calpocalyx heitzii* and *Sacoglottis gabonensis.*

Species richness and diversity within forest strata

The number of stems/ha and the number of vascular plant species recorded were generally higher in the shrub layer (all vascular plant with diameter between 1.5 cm ≤ DBH <10 cm) compared to the herbaceous layer (DBH < 1.5 cm) and the tree layer (DBH ≥ 10 cm). The number of stems/ha (Table 3.2) in the shrub layer varied between 3914 (mixed evergreen and semi-deciduous forest) to 4572 (coastal forest), in the herbaceous layer between 905 (swamps) to 1963 (submontane forest) and in the tree layer between 489 (coastal forest) to 785 stems/ha (submontane forest). The number of species in the shrub layer varied between 231 species (swamps) to 413 (mixed evergreen and semi-deciduous forest), in the herbaceous layer between 99 (swamps) to 229 (*Calpocalyx heitzii* and *Sacoglottis gabonensis* forest) and in the tree layer between 100 (swamps) to 183 species (submontane forest).

The shrub layer was the most diverse followed by the tree and herbaceous layers (Table 3.2). The Shannon diversity (H') varied in the shrub layer between 4.39 (swamps) to 5.13 (forest rich in Caesalpinioideae), in the tree layer between 3.82 (swamps) to 4.83 (forest rich in Caesalpinioideae) and in the herbaceous layer between 3.76 (swamps) to 4.66 (submontane forest). The Shannon diversity (H') was significantly different among forest layers ($F_{2, 26.7} = 38.905$, $P < 0.001$) when correcting for differences in vegetation types, by including vegetation type as a random factor in a generalized linear model ($F_{10, 20} = 6.605$, $P < 0.001$). A Tukey multiple comparison test showed that all layers were significantly different from each other ($P < 0.05$) with the shrub layer having the highest mean value (H' = 3.57) and the herbaceous layer the lowest (H' = 2.73). The species richness was also significantly different among forest layers ($F_{2, 24.2} = 151.28$, $P < 0.001$) when correcting for differences in vegetation types (GLM, with vegetation type as a random factor, $F_{10, 20} = 4.412$, $P < 0.01$), with highest values also recorded in the shrub layer.

Table 3.2 Summary of the number of species, number of families, number of stem/ha and Shannon diversity (H') recorded in the tree, shrub and herbaceous layers for each vegetation types for all vascular plants with DBH ≥ 1 cm. Note that species may overlap within forest strata.

Forest types Floristic composition	Coastal forest	Swamps	Forest rich in Caesalpinioideae	Forest rich in *Calpocalyx* and *Sacoglottis*	Mixed evergreen and semi-deciduous forest	Submontane forest
Tree layer: DBH ≥ 10 cm						
No of stems/ha	489	741	586	603	562	785
No of species	147	100	181	143	181	183
No of families	43	37	48	45	48	44
Shannon diversity index (H')	4.62	3.82	4.83	4.26	4.70	4.75
Shrub layer: 1.5 cm ≤ DBH < 10 cm						
No of stems/ha	4572	4152	4219	4316	3914	4164
No of species	332	231	399	349	413	344
No of families	69	53	66	57	65	53
Shannon diversity index (H')	4.63	4.39	5.13	4.82	4.93	5.05
Herb layer: DBH < 1.5 cm						
No of stems/ha	1147	905	1228	1071	1391	1963
No of species	190	99	225	229	217	225
No of families	53	34	54	47	52	51
Shannon diversity index (H')	4.20	3.76	4.58	4.65	3.97	4.66
Total no of stems/ha	6208	5798	6033	5990	5867	6912
Total no of species	381	293	468	416	441	412
Total no of families	69	58	68	65	66	64
Shannon diversity index (H')	4.73	4.58	5.16	4.93	4.77	5.14

The shrub layer generally contributed more than 80% to the total number of species recorded in each vegetation type (Tables 3.2 & 3.3), followed by the herbaceous layer (40%) and tree layer (35%). There was a significant positive correlation between the total number of vascular plant species recorded in the tree layer and that of the shrub ($F_{1,\ 143}$ = 24.059, R^2 = 0.144, $P < 0.001$) and herbaceous ($F_{1,\ 143}$ = 15.702, R^2 = 0.099, $P < 0.001$) layers. In terms of diversity, there was also a significant positive correlation between the diversity of the tree layer and that of the shrub and to a lesser extent with that of the herbaceous layers (Figures 3.1 & 3.2).

Species richness and diversity by life forms

Tree species richness was relatively higher than that of the shrubs, lianas and herbs (Table 3.4). The total number of species varied from 172 species (swamps) to 237 (forest rich in Caesalpinioideae) for trees, 71 (swamps) to 164 (forest rich in Caesalpinioideae) for shrubs, 42 (swamps) to 63 (forest rich in Caesalpinioideae) for lianas and 4 (submontane) to 9 (mixed evergreen and semi-deciduous forest) for herbs. About 63% of the total number of tree species was recorded in the tree layer, 82% in the shrub layer and 41% in the herbaceous layer. Less than 10% of the total number of shrub/small tree species was found in the tree layer, 90% in the shrub layer and 62% in the herbaceous layer. No herbaceous species was found in the tree layer, 70% was recorded in the shrub layer and 97% in the herb layer. The contribution of herbaceous species was very low in the 0.1 ha plots since many herbaceous species do not have a DBH ≥ 1 cm. However, their contribution was well illustrated in the 5 m x 5 m subplots where there was a considerable increase in

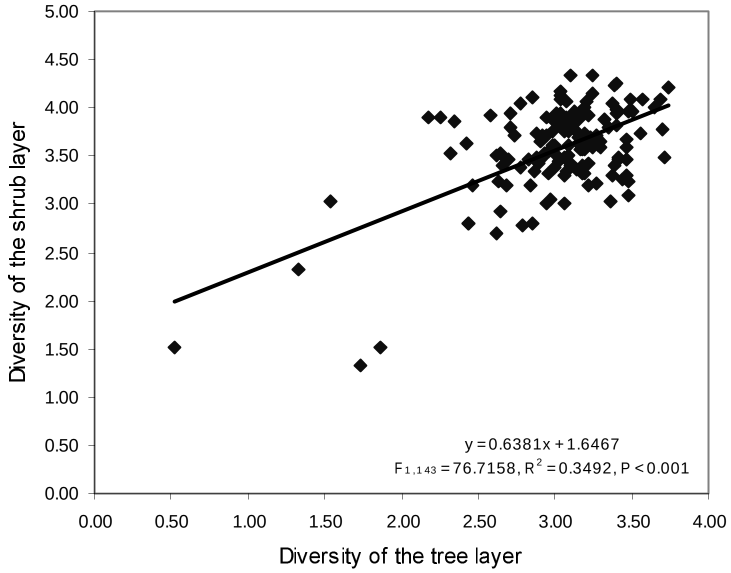

Figure 3.1 Correlation between the Shannon diversity (H') of all vascular plant species recorded in the tree layer and that of the shrub/small tree layer within 145 plots of 0.1 ha each.

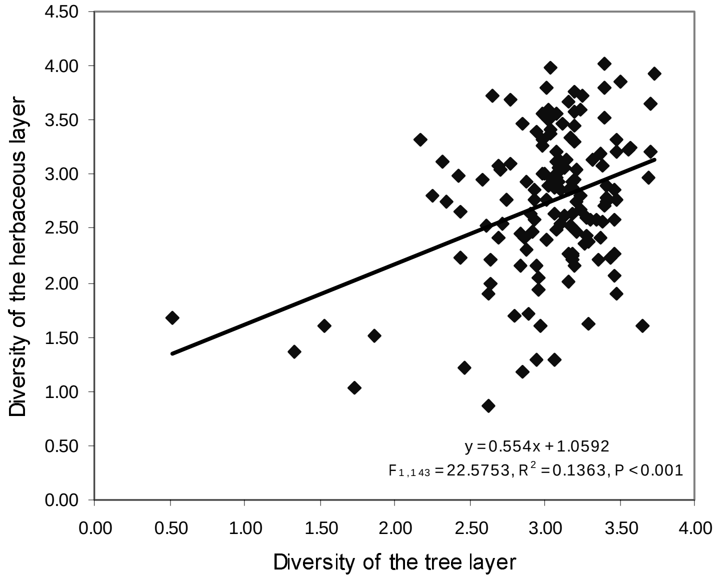

Figure 3.2 Correlation between the Shannon diversity (H') of all vascular plant species recorded in the tree layer and that of the herbaceous layer within 145 plots of 0.1 ha each.

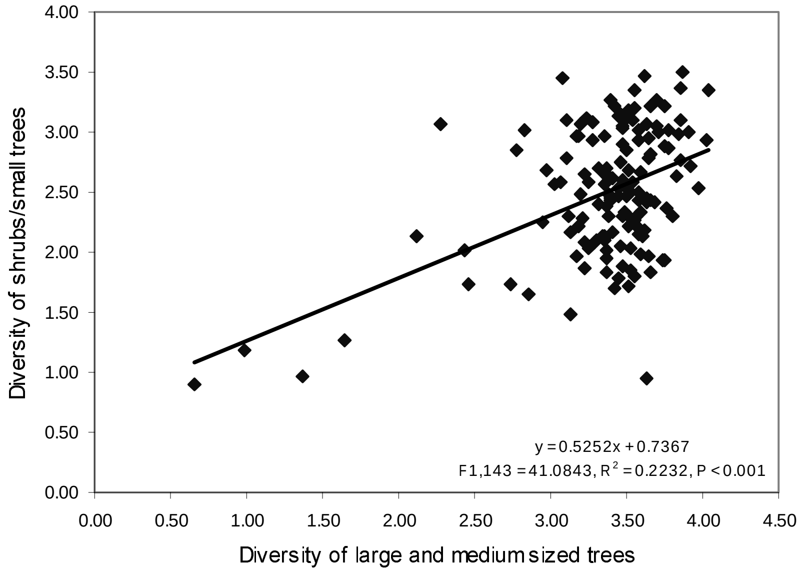

Figure 3.3 Correlation between the Shannon diversity (H') of large and medium sized tree species and that of the shrub/small tree species within 145 plots of 0.1 ha each.

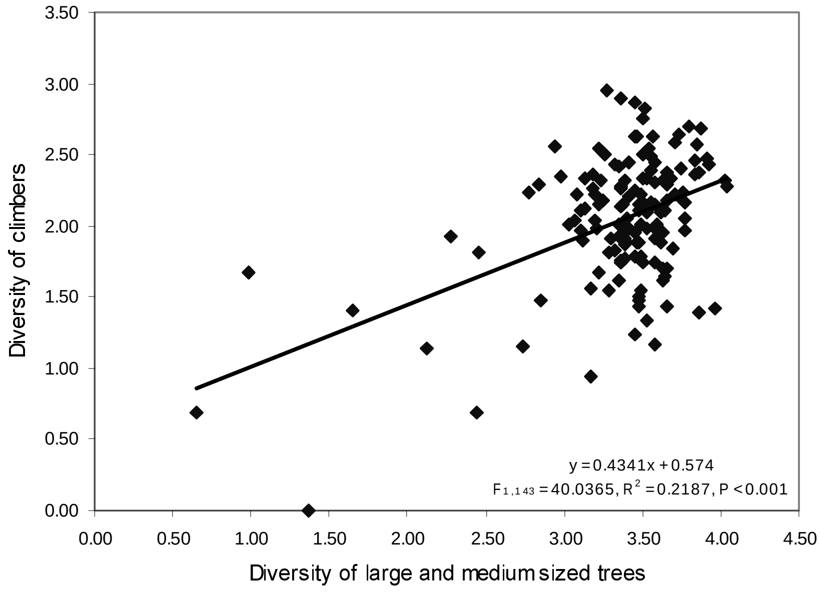

Figure 3.4 Correlation between the Shannon diversity (H') of large and medium sized tree species and that of the herbaceous species within 145 plots of 0.1 ha each.

Table 3.3 Contribution to the total species richness from the various forest strata in 6 main vegetation types. Note that some species may overlap within forest strata.

Forest strata / Forest types	Total No of species	Tree layer DBH ≥ 10 cm Species	%	Shrub layer 1.5 cm ≤ DBH <10 cm Species	%	Herbaceous layer DBH < 1.5 cm Species	%
Coastal forest	381	147	39	332	87	190	50
Swamps	293	100	34	231	79	99	34
Forest rich in Caesalpinioideae	468	181	41	399	90	225	51
Forest rich in *Calpocalyx heitzii* and *Sacoglottis gabonensis*	416	143	34	349	84	229	55
Mixed evergreen and semi-deciduous forest	441	181	39	413	88	217	46
Submontane forest	412	183	44	344	83	225	55

Table 3.4 Summary of the total number of species for the various growth forms recorded in 6 main vegetation types for all vascular plants with DBH ≥ 1 cm. Herbaceous species include herbs, herbaceous climbers and hemi-epiphytes. Lianas include small and large woody climbers. Note that species may overlap within forest strata.

Forest types / Growth form	Coastal Forest	Swamps	Forest rich in Caesalpinioideae	Forest rich in *Calpocalyx* and *Sacoglottis*	Mixed evergreen and semi-deciduous forest	Submontane forest
Total No of tree species	207	172	237	211	222	216
Tree layer: DBH ≥ 10 cm	128	82	158	126	156	162
Shrub layer: 1.5 cm ≤ DBH <10 cm	177	132	198	169	192	173
Herb layer: DBH < 1.5 cm	94	44	97	100	86	102
Shannon diversity (H')	4.26	3.96	4.47	4.13	4.44	4.67
Total No of shrubs/small tree species	127	71	164	155	161	152
Tree layer: DBH ≥ 10 cm	11	10	20	10	13	12
Shrub layer: 1.5 cm ≤ DBH <10 cm	113	58	153	143	152	137
Herb layer: DBH < 1.5 cm	76	37	105	104	100	101
Shannon diversity (H')	3.32	4.39	4.26	4.08	4.32	4.66
Total No of herbaceous species	8	7	5	4	9	4
Tree layer: DBH ≥ 10 cm	0	0	0	0	0	0
Shrub layer: 1.5 cm ≤ DBH <10 cm	7	4	3	3	6	3
Herb layer: DBH < 1.5 cm	8	6	5	4	8	4
Shannon diversity (H')	0.53	0.54	0.78	1.03	0.85	0.90
Total No of liana species	46	42	63	50	59	43
Tree layer: DBH ≥ 10 cm	8	7	7	8	12	6
Shrub layer: 1.5 cm ≤ DBH <10 cm	40	39	60	8	54	36
Herb layer: DBH < 1.5 cm	16	11	25	26	23	21
Shannon diversity (H')	3.13	3.29	3.34	3.27	3.65	3.19

Table 3.5 Summary of the number of species of the various growth forms recorded in 136 vegetative subplots of 5 m x 5 m each covering 0.34 ha.

Forest types / Floristic composition	Coastal Forest	Swamps	Forest rich in Caesalpinioideae	Forest rich in *Calpocalyx* and *Sacoglottis*	Mixed evergreen and semi-deciduous forest	Submontane forest
Trees	27	6	35	38	37	26
Shrubs/small trees	87	14	148	102	134	74
Herbs	88	14	142	98	105	77
Lianas	30	3	36	33	32	11
Total No of species	232	37	368	271	308	188
Total No of families	67	27	76	63	68	47

Table 3.6 Pearson correlation coefficients between the Shannon diversity (H') of the various growth forms recorded for all vascular plants with DBH ≥ 1 cm in 145 plots of 0.1 ha each.

Life forms	Large trees	Shrubs/small trees	Herbs	Lianas
Large trees	1			
Shrubs/small trees	0.47**	1		
Herbs	0.46**	0.29**	1	
Lianas	0.003	0.20*	0.19*	1

Pearson correlation is significant for * P < 0.05 and ** P < 0.01

the number of herbaceous species (Table 3.5), moving from 25 species (in 145 plots of 0.1 ha each) to 257 species (in 136 subplots of 25 m² each covering 0.34 ha).Trees and shrubs were the most diverse growth forms followed by lianas and herbaceous species respectively (Table 3.4). The Shannon diversity (H') of trees varied from 3.96 (swamps) to 4.67 (submontane forest), for shrubs from 3.32 (coastal forests) to 4.66 (submontane forest) and for herbaceous species from 0.53 (coastal forests) to 1.03 (forest rich in *Calpocalyx* and *Sacoglottis*).

There was a significant positive correlation between the number of large and medium sized tree species and that of shrubs/small trees ($F_{1, 143}$ = 112.033, R^2 = 0.439, P < 0.001) and woody climbers ($F_{1, 143}$ = 26. 986, R^2 = 0.159, P < 0.001). There was also a significant positive correlation between the diversity of large and medium sized trees and that of the shrubs/small trees and woody climbers (Figures 3.3 & 3.4). The correlations between the diversity/species richness of large and medium sized trees and that of the herbaceous species were not significant ($F_{1, 143}$ = 0.001, R^2 = 0.00002, P = 0.975 for Shannon diversity and $F_{1, 143}$ = 0.0387, R^2 = 0.0003, P = 0.844 for species richness). The Shannon diversity (H') was significantly different among the various growth forms ($F_{3, 34.6}$ = 151.290, P < 0.001) when correcting for differences in vegetation types (GLM: $F_{10, 30}$ = 2.727, P < 0.01 for vegetation type included as a random factor). A Tukey multiple comparison test showed that all growth forms were significantly different from each other (P < 0.05) with trees having the highest mean value (H' = 3.37) and the lowest (H' = 0.24) for the herbaceous species.

The species richness was also significantly different between growth forms (GLM: $F_{3, 33.2} = 221.889$, $P < 0.001$ for layer and $F_{10, 30} = 2.973$, $P < 0.01$ for vegetation type included as a random factor), with similar relative difference. Overall, there was a decrease in diversity and the total number of species recorded/plots with decreasing sampling resolution (Figures 3.5 & 3.6). About 30% of the total number of species recorded was lost when the sampling design only took into account all vascular plants with DBH ≥ 5 cm and more than 50% were lost when only vascular plants with DBH ≥ 10 cm are collected. Moreover, there was a very strong significant positive correlation between the number of stems/ha and the total number of species recorded ($R^2 = 0.956$, $P < 0.0001$), and a considerable drop in diversity when the sampling was limited to all vascular plants with DBH ≥ 10 cm. In terms of sampling effort, less than 30% of the total number of stems/ha were recorded when the sampling design only took into consideration all vascular plants with DBH ≥ 5 cm. Furthermore, only 15% of the total number of stems/ha were recorded for all vascular plants with DBH ≥ 10 cm.

Species richness within families

Overall, shrubs/small trees show the highest number of families (75) followed by medium trees (61), herbs and hemi-epiphytes (58), large trees (54) and woody climbers (37). Rubiaceae was by far the most species rich family (204 species) followed by Euphorbiaceae (88), Leguminoseae-Caesalpinioideae (85), Annonaceae (63), Sterculiaceae (50), Apocynaceae (47) and Sapindaceae (40). Leguminoseae (especially the sub-family Caesalpinioideae) was the dominant family for the large trees species (DBH ≥ 30 cm) in terms of relative density and frequency in the Campo-Ma'an area (Table 3.7). Dominant large tree species included *Brachystegia cynometroides, Calpocalyx heitzii, Desbordesia glaucescens, Erythrophleum ivorensis, Lophira alata, Lovoa trichilioides, Piptadeniastrum africanum, Pterocarpus soyauxii, Pycnanthus angolensis, Sacoglottis gabonensis* and *Terminalia superba*. Common shrubs and small tree species included *Jollydora duparquetiana, Lasianthera africana, Massularia acuminata, Podococcus barteri* and many species of the genera *Campylospermum, Cola, Crotonogyne, Diospyros, Drypetes, Microdesmis, Psychotria, Rinorea* and *Scaphopetalum*. Common large woody climber species were from the genera *Agelaea, Dichapetalum, Combretum, Laccosperma, Landolfia, Millettia, Salacia* and *Strychnos*. The most important herb species were *Costus englerianus, Haumania danckelmaniana, Leptaspis zeylanica, Marantochloa monophylla, Microcalamus barbinodis, Puella ciliata, P. schumanniana,* and many species of the genera *Asystasia, Begonia, Cercestis, Culcasia, Dorstenia, Geophila, Hymenocoleus, Mapania,* and *Palisota*.

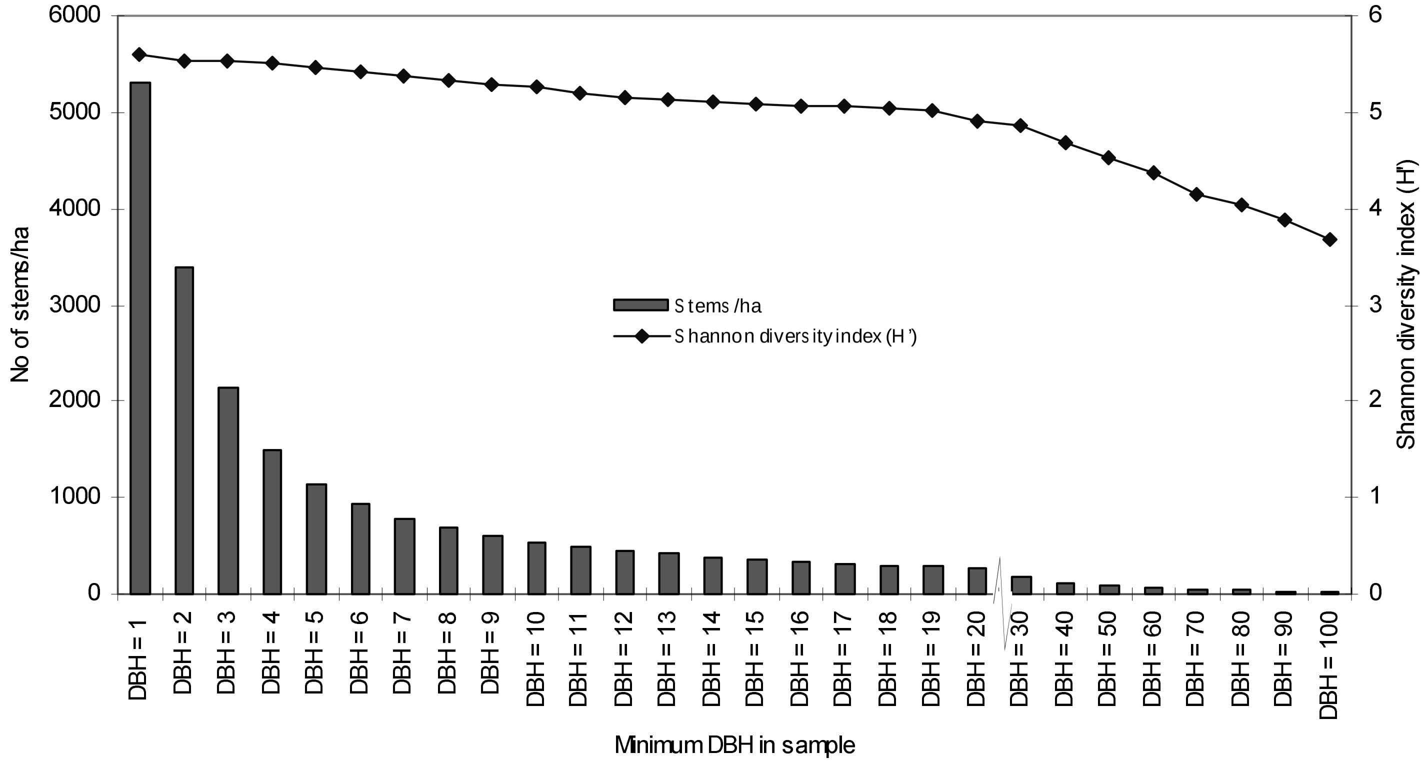

Figure 3.5 Change in Shannon diversity (H') and the number of stems/ha for 145 plots of 0.1 ha each taking into account a different minimum cut-off level size. For example, DBH = 1 cm means when all vascular plants with diameter ≥ 1 cm are recorded.

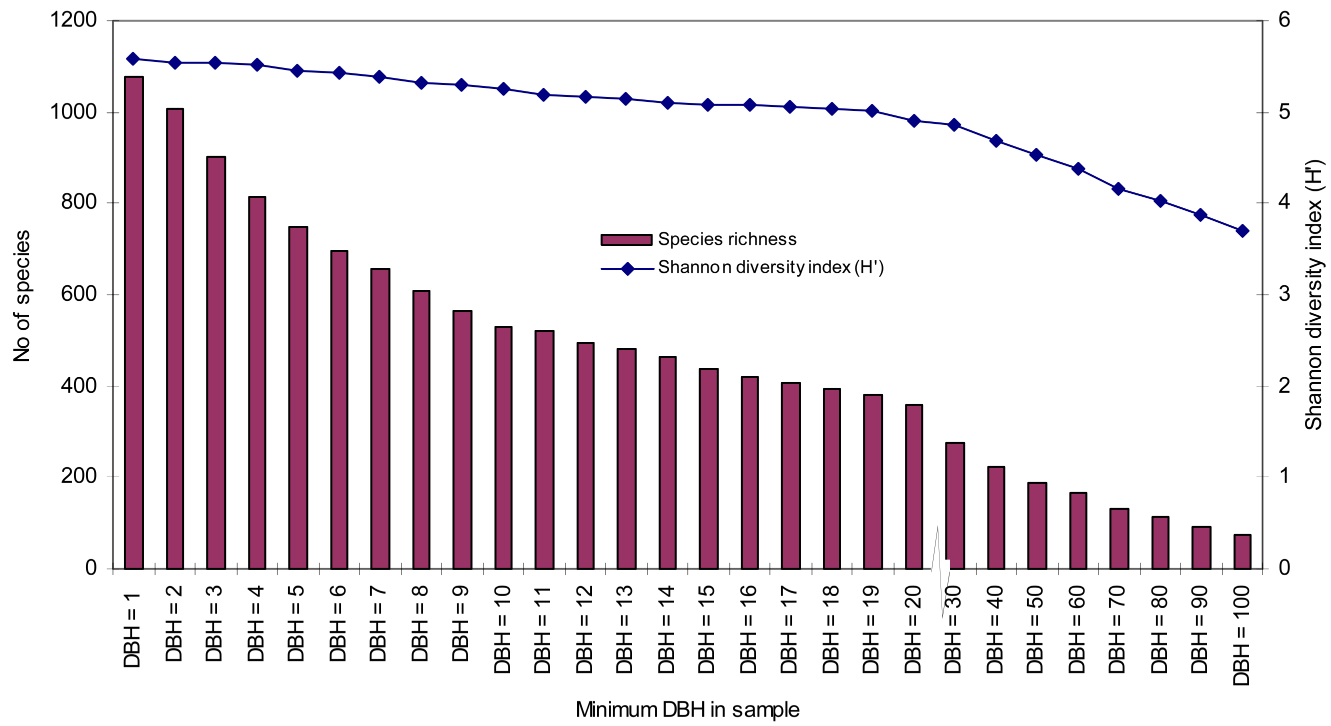

Figure 3.6 Change in species richness and Shannon diversity (H') for 145 plots of 0.1 ha each taking into account a different minimum cut-off level size. For example, DBH = 1 cm means when all vascular plants with diameter ≥ 1 cm are recorded.

Table 3.7 Five most important families/sub-families recorded for the various growth forms in 145 forest plots (0.1 ha each) and the vegetative subplots. Note that species may overlap between size classes.

Family/sub-family	Relative density	Relative frequency
Canopy tree: DBH ≥ 30 cm (286 species & 54 families)		
Leguminosae-Caesalpinioideae	15.00	9.03
Olacaceae	9.72	8.49
Burseraceae	8.23	6.00
Euphorbiaceae	7.94	6.93
Myristicaceae	6.44	5.22
Medium sized trees: 10 cm ≤ DBH < 30 cm (316 species & 61 families)		
Olacaceae	14.47	3.23
Leguminosae-Caesalpinioideae	13.25	2.96
Euphorbiaceae	11.19	3.01
Annonaceae	8.48	2.45
Burseraceae	5.70	1.94
Shrub/small trees: 1.5 cm ≤ DBH < 10 cm (389 species & 75 families)		
Euphorbiaceae	13.60	3.59
Rubiaceae	8.50	3.64
Leguminosae-Caesalpinioideae	7.01	3.59
Olacaceae	6.33	3.51
Ebenaceae	6.07	3.41
Small and large climbers (158 species & 37 families)		
Dichapetalaceae	26.65	12.29
Palmae	13.48	8.03
Connaraceae	12.24	11.06
Loganiaceae	8.99	8.79
Celastraceae	8.30	8.51
Herbs and hemi-epiphytes (257species & 58 families)		
Araceae	20.43	11.32
Marantaceae	12.69	10.78
Gramineae	8.94	8.20
Commelinaceae	8.42	8.91
Cyperaceae	7.34	7.13
Rubiaceae	6.66	6.33

3.4. DISCUSSION

General patterns of species richness and diversity within forest types

The Campo-Ma'an area is dominated by the lowland evergreen rain forest rich in Caesalpinioideae and is characterized by a rich and diverse flora (Chapters 2 & 5). The number of species/ha for all vascular plants ≥ 1 cm recorded varied from 293 in swamp forest to 468 in the lowland evergreen forest rich in Caesalpinioideae. The Shannon diversity (H') varied from 4.73 in coastal forests to 5.16 in forests rich in Caesalpinioideae. Swamps appeared to be species poor and less diverse than other forest types because of their distinctive edaphic conditions. The explanation for the high level of species richness and diversity might stem partly to the fact that the area is part of a series of postulated rain forest refugia in Central and West Africa (Hamilton, 1982; White, 1983; Maley, 1987 & 1989; Sosef, 1994). Furthermore, the Campo-Ma'an forest falls within the Guineo-Congolian Centre of Endemism (White, 1983; Gartlan 1989; Davis *et al.*, 1994). It is situated in the middle of the rich Biafran forest type that extends from south east Nigeria to Gabon and the Mayombe area in Congo (White, 1983; Letouzey, 1968 & 1985) and shares with these sites the overall characteristic of lowland evergreen rain forest with some semi-deciduous species.

In general, the difference in species richness and diversity within forest strata or life forms followed the same trend within the various vegetation types, with the shrub layer being the most diverse and species rich layer, followed by the herbaceous and tree layers respectively. As for the growth forms, tree species appeared to be more diverse and species rich than the shrub/small trees, climbers and herbaceous species in almost all the vegetation types. However, it is worth mentioning that this trend was more stable in undisturbed forest types than in the coastal forests where there was a pronounced impact of human disturbance. With the exception of swamps and mangroves, the coastal forest types were floristically poorer with a lower diversity index (H') than other forest types recorded. The degree of human disturbance seems to have an impact on the general patterns of species richness and diversity within the various forest types. The number of herbaceous species and climbers tend to increase with increasing degree of disturbance. Many plots recorded in the coastal forest and in past logging areas were characterized by a high number of pioneer species and an increase in number of herbaceous and climber species. Furthermore, forest types with open canopy, such as the mixed evergreen and semi-deciduous forest, were also characterized by a high proportion of herbaceous and climber species. In return the number of herbaceous and climber species was very low in swamps because of their edaphic conditions.

Species richness and diversity within forest strata

The number of stems/ha, species diversity and number of vascular plant species/ha recorded were generally higher in the shrub layer than in the herbaceous and tree layers. This must stem partly from the fact that the shrub layer is made up of many life forms such as shrubs, small trees, immature large trees and woody climbers, small herbaceous and woody climbers, tall herbs and hemi-epiphytes, which are not found in the upper tree layer. In terms of species richness, the shrub layer generally contributes for more than 80% of the total number of species recorded in each forest type, followed by the herbaceous layer (40%) and tree layer (35%). It is worth mentioning that there was some floristic overlap between the different forest layers, since more than 50% of the species occurs in more than one stratum. Many large tree and woody liana species were found in all the strata depending of their stage of development (seedlings, juveniles and immature or mature individuals). Generally, the shrub layer has the highest diversity followed by the tree and herbaceous layers respectively. There was a positive correlation between the diversity of the tree layer and that of the shrub layer. This is partly attributed to the fact that a high proportion of the immature large tree and liana species of the upper tree layer was also recorded in the shrub layer.

Species richness and diversity by life forms

The species richness of large, medium and small trees and shrubs were higher compared to that of the climbers and herbs. The number of tree species was higher in the various vegetation types than that of the shrubs, lianas, and herbs. The apparently low species densities and richness of the herbs in the 0.1 ha plots is partly due to the fact that many herbaceous species were below 1 cm DBH and could not be sampled within the 0.1 ha plots. As a result, herbaceous species contributed less than 1% of the total vascular plant species count. Their diversity was also very low in the 0.1 ha plots with a Shannon diversity (H') ranging from 0.53 (swamps) to 1.03 (forest rich in *Calpocalyx heitzii* and *Sacoglottis gabonensis*). In order to assess the real contribution of the herbaceous species, small subplots of 5 m x 5 m were located within the 0.1 ha plots. The output was only used to show the contribution of the ground layer and herbaceous species when all vascular plant species are included in the assessment. As a result there was a considerable increase in the average number of herbaceous species (Table 3.5) moving from 25 species (in 145 plots of 0.1 ha each) to 257 species (in 136 subplots of 25 m² each covering a total area of 0.34 ha). In terms of diversity, the large and medium sized trees were more diverse (average H' = 4.35) than the shrubs/small trees (4.12), climbers (3.34) and the herbs (0.78). Although there was a significant positive correlation between the species richness and diversity of trees and that of the shrubs/small trees and woody climbers, the correlations between the species richness and diversity of trees and that of the herbaceous species were not significant. Furthermore, there was a significant positive correlation between the diversity of shrubs/small trees and that of herbaceous species. This is partly due to the fact that most of the shrubs, small trees and herbaceous plants are understorey species that live under the same physiological and biological conditions. They are either shade bearers or non-pioneer light demanding species that require little sun light for survival. More than 40% of the herbaceous layer species contribution came from shade hemi-epiphytes that are often restricted to the lower trunk of shrubs and small trees. Hemi-epiphytes species of the genera *Culcasia* and *Cercestis* (Araceae) and several fern genera such as *Lomariopsis, Hymenophyllum* and *Trichomanes* were very common (Table 3.7).

Does tree diversity tell it all?

Many botanical studies in tropical rain forest emphases the structural aspect of the forest, assuming that the diversity of large and medium sized trees (DBH ≥ 10 cm) reflect the overall diversity of the forest. When comparing the tree diversity and floristic composition in 6 different forest types in the Campo-Ma'an area, we noticed that tree species accounted for 46% of the total vascular plant species with DBH ≥ 1 cm, shrubs/small trees 39%, climbers 13% and herbs less than 1%. Only 22% of the diversity of shrubs and lianas could be explained by the diversity of large and medium sized trees, and less than 1% of herb diversity was explained by the tree diversity (Figures 3.3 & 3.4). A higher percentage of tree, shrub and climber species occurred in the shrub layer than in the tree and herbaceous layers. Moreover, only 63% of the tree species were recorded in the tree layer against 82% in the shrub layer. Less than 10% of the total number of shrub/small tree species was found in the tree layer compared to 90% in the shrub layer. Furthermore, shrubs contributed for 38% of the 114 strict and narrow endemic plant species recorded in the area, herbs 29%, trees only 20% and climbers 11% (Chapter 5). It is worth mentioning that, although there was a significant positive correlation between the diversity of trees and that of shrubs and woody climbers, the correlation between tree and herb diversity was not significant.

This study also demonstrated that the shrub layer was by far the most species rich in the different plots and vegetation types. It was significantly more diverse and species-rich than the tree and herbaceous layers. More than 82% of tree species, 90% of shrubs, 78% of lianas and 70% of herbaceous were recorded in this layer.

The high number of species found in this layer can be attributed to the fact that, in addition to immature large trees and woody climbers, the shrub layer comprises shrubs, small trees, tall herbs, small climbers and hemi-epiphytes which are not found in the upper tree layer. This leads to the conclusion that tree diversity does not always reflect the overall diversity of the forest. In addition, more than 75% of plant species of high conservation values such as endemic species are shrub and herbaceous species (Chapter 5). Similar studies carried out by Duivenvoorden & Lips (1995) in Colombia, ter Steege (2000) and van Andel (2001) in Guyana have also shown that tree diversity is not a good indicator for the diversity of shrubs and herbs.

In our study, large and medium sized tree species richness seems to have a strong positive correlation with that of lianas, indicating that tree species richness may be a relatively good indicator for the liana species richness. This is partly explained by the fact that woody climbers are dependent on the presence of trees for their support. Although tree diversity may not be a good predictor for the diversity of shrubs and herbaceous species, the floristic composition of trees and their physiognomy are important factors influencing the species composition and diversity of other life forms. However, there was a significant positive correlation between the total number of tree species recorded within the different vegetation types and that of the other life forms, suggesting that an increase in the number of tree species is linked to an increase in shrub and herbaceous species. Furthermore, there was a decrease in the total number of species and the number of stems/ha recorded/plots with decreasing sampling resolution (Figures 3.5 & 3.6). There was also a very strong significant positive correlation between the number of stems/ha and the total number of species recorded. Although, less than 15% of the total number of stems/ha were recorded when the sampling design only took into account all vascular plants with DBH ≥ 10 cm, more than 50% of the total number of species recorded were left over. It is worth mentioning that, the decrease in the sampling resolution led to the reduction of the sampling effort and a significant drop of the total number of species recorded. This suggests that sampling design, based on small plots of 0.1 ha, in which all vascular plants with DBH ≥ 1 cm are recorded, is a more appropriate sampling method for biodiversity conservation purposes, than assessments based solely on large and medium sized trees. Although, it requires additional effort, time and financial involvement, it provides more information on other growth forms such as shrubs, climbers and herbs that are under-represented when the sampling design only takes into consideration large and medium sized trees (DBH ≥ 10 cm).

3.5. CONCLUSION

There is a general perception among scientists that, in the tropical rain forest, the diversity of large and medium sized tree (DBH ≥ 10 cm) can be used to predict the diversity of other life forms, since, in most of these studies tree species account for more than 50% of the overall species composition. This study has demonstrated that the diversity of trees does not always reflect the overall diversity of forest in the Campo-Ma'an area and, therefore, it may not be a good indicator for the diversity of shrubs and herbaceous species. However it is a relatively good indicator for the diversity of lianas. In terms of floristic composition, the number of tree species can be used to some extent to predict the number of species of other growth forms. Furthermore, the shrub layer (1.5 cm ≤ DBH < 10 cm) was by far the most species rich in the different vegetation types sampled and appeared to be more diverse and species-rich than the tree and herbaceous layers. This suggests that sampling design, based on small plots of 0.1 ha, in which all vascular plants with DBH ≥ 1 cm are recorded, is a more appropriate sampling method for biodiversity conservation purposes than assessments based solely on large and medium sized trees (DBH ≥ 10 cm).

Chapter 4

BIO-INDICATOR SPECIES AND CENTRAL AFRICAN RAIN FOREST REFUGES: A CASE STUDY FROM THE RAIN FOREST IN CAMEROON

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4.1. INTRODUCTION

Although there is much debate about the Pleistocene forest refuge theory in South America (van der Hammen & Hooghiemstra, 2000 ; Colinvaux *et al.*, 2001; Haffer & Prance, 2001), some authors dealing with the African situation generally agree that during the glacial periods limited and isolated patches of tropical rain forest (tropical rain forest refuges) persisted and survived the unfavourable climatic conditions. In Central Africa, a number of these so-called Pleistocene forest refuges are found in Gabon and Cameroon, amongst which the Campo-Ma'an area (Aubreville, 1962; White, 1979 & 1983, Hamilton, 1982; Maley, 1987; Sosef, 1994). However, there is some debate and disagreement about the exact location of these refuges within these areas (Robbrecht, 1996; Sosef, 1996; Leal, 2001). This is probably because tropical rain forest refuges are often studied on a large scale, and hence results, for example to the postulation of a single large refuge in the South-western Cameroon/Gabon area (Maley, 1987 & 1989). Understanding the present-day location of tropical rain forest refuges requires the use of direct evidences or "Paleo-evidence" such as palynological, paleobotany and related proxies records or indirect evidence such as the distribution patterns of endemic and slow dispersal species. More often, endemism and patterns in the distribution of slow dispersal taxa have been used by many authors to identify the location and extent of regional forest refuges (Rietkerk *et al.*, 1996; Robbrecht, 1996; Sosef, 1996; Achoundong, 2000). These studies interpreted localities with a high degree of endemicity and plant diversity to coincide with former forest refuge areas. Although, paleo-evidence seems the best indicators for the study and location of tropical rain forest refuges, direct and indirect evidences complement each other.

Bio-indicator species are usually defined as species whose status and ecology provide information on the overall condition of the ecosystem and relative abundance reflect the quality and changes in environmental conditions, both biotic and abiotic (Heywood & Watson, 1995). Therefore, refuge indicators should be ecologically discriminating with limited dispersal and colonisation abilities. Sosef (1994) argued that it should be extremely difficult for such species to survive outside a rain forest refuge and that their present day distributions will likely coincide with the late Pleistocene refuges. The distribution patterns of strict and narrow endemic species, together with well known slow dispersal taxa, and species that reach their northern limit of distribution in the Campo-Ma'an area were used to study or confirm the position of a postulated Pleistocene rain forest refuge in south-western Cameroon. Special attention was given to taxa with slow dispersal abilities such as those within *Begonia* sect. *Loasibegonia* and sect. *Scutobegonia*, *Rinorea* spp., Caesalpinioideae and Rubiaceae. This study aims to examine the geographical position of late Pleistocene forest refuges by analysing the distribution of selected bio-indicator species. The distribution patterns of selected species are used to find out if they are concordant with the postulated rain forest refuge area or not, and then we interpret and discuss it both in terms of its historical causes and contemporary conditions. Furthermore, we will also study the ecology of *Aucoumea klaineana* (Okoumé) at its northern limit of distribution in order to find out if its distribution under the present climatic conditions in Cameroon is expanding or contracting.

Pleistocene vegetation changes in Central Africa

Maley (1993) has identified four main climatic phases of the late Quaternary in Central Africa. The *Maluekian* (c. 70,000 to 40,000 BP) which corresponds to a relatively dry period marked by extensive forest retreat. The *Njilian*, lasting from 40,000 to 30,000 BP that was relatively wet and marked by a definite extension of forest. The *Leopoldian* (c. 30,000 to 12,000 BP) that culminated around 18,000 BP was relatively dry and marked by a new extension of open savanna environments. The *Kibangian* (c. 12,000 BP to the present) was relative wet until c. 3500 BP (Kibangian A) and marked by a new phase of forest extension. Later, came another drier period from 3500 BP to present (Kibangian B) corresponding to the begining of another extension of savanna in some parts of Central Africa. According to the refugium theory, Central African rain forest underwent a series of climatic fluctuations in the late Pleistocene during which a considerable portion of the tropical lowland rain forest was repeatedly reduced to relatively small isolated patches, called forest refuges, due to unfavourable climatic conditions (Hamilton, 1982; White, 1993; Maley, 1989, 1990 & 1996). During the dry-out phases, some forest species were captured in these refuges, and some surviving species were not or hardly capable of migrating out of these again, due to their extreme low dispersal abilities (White, 1993).

Geological and palynogical research conducted on lake sediments from several sites, has shown that c. 2500 BP the Central African forest experienced a “catastrophic destruction” that led to a major extension of the savanna (Maley & Brenac, 1998; Maley, 2002). Detailed pollen records from lake Barombi Mbo in western Cameroon, lake Ossa in south Cameroon, lake Kitinia in western Congo, lakes Mboandong and Njupi in south Congo reveal the presence of pseudo-periods of about 2000 to 2500 BP for several tree taxa typical of mature undisturbed forest (Maley & Elenga, 1993; Elenga *et al.*, 1994 & 1996; Reynaud-Ferrera *et al*., 1996). During this phase, the rainfall suddenly became more seasonal, reducing the moisture available for the vegetation, and therefore leading to a mass disappearance of mature forest tree species in several parts of Central Africa (Reynaud & Maley, 1994; Maley & Brenac, 1998; Maley, 1987 & 2001). Reynaud & Maley (1994) argued that punctual climatic perturbations may have taken place in the 13th century followed by a phase with favourable climatic conditions from the 18th century onward that may have favoured the natural reforestation process that is being observed today. This is well illustrated in Cameroon and Gabon where the transgression of forest into the savanna at forest edges (coastal and inland savanna) is reported in some areas (Letouzey, 1968; White *et al.*, 2000).

Several climatological studies have shown that the southern part of Cameroon has suffered from a series of climatic crises marked by a severe decrease in rainfall that repeatedly occurs every 10 to 15 years, such as in 1973 and 1983 (Reynaud & Maley, 1994). In this region, the contrast of excess or deficit of rainfall is particularly pronounced in the Atlantic littoral zone, as described by Letouzey (1968 & 1985), where the coastal forest with *Lophira alata* and *Sacoglottis gabonensis* is found. More so than further inland where the lowland evergreen rain forests rich in Caesalpinioideae is located. These past climatic changes must have seriously influenced the vegetation pattern found in the area, since lowland Caesalpinioideae forests normally develop where the dry seasons do not exceed about 2 months, while semi-deciduous forests prevail when the dry season varies between 2 to 3 months (Reynaud & Maley, 1994). Therefore, closed evergreen rain forests are mainly found in areas with high precipitation (above 2000 mm/year). Between 1500-2000 mm, the number of deciduous and semi-deciduous elements increase and below 1500 mm there is rather a dry deciduous forest. As a result, in the Campo-Ma'an area, the vegetation varies from the lowland evergreen rain forest rich in Caesalpinioideae in the wetter Campo area to a mixed evergreen and semi-deciduous forest in the drier Ma'an area (Chapter 2). The past climatic oscillations presumably have also resulted in the fluctuation of the sea level along the Campo-Ma'an coastline. Oslisly (2001) argued that between 35,000 to 40,000 BP the present coastline was at – 40 m below sea level and the sea was warmer than at present. From 30,000 BP onward, a new arid period began with a further regression of the coastline that reached its lowest level at – 120 m below the present sea level. During this period Bioko Island (Equatorial Guinea) was still attached to the continent. It is only between c. 10,000 to 11,000 BP that the sea level started to rise to reach its present level towards 5000 BP.

There is an ongoing debate on refuges and speciation. A small minority of authors more or less refute the idea that speciation is linked to fragmentation and isolation of forest biomes, while other authors suggest that these isolations are at the origin of a great number of taxa (Maley, 2001). Although many authors have discussed these issues, it is difficult to come to any conclusions given the problems of dating the appearance of different taxa. However, several authors pointed out that speciation in ecologically isolated environments (niches) and speciation in geographically isolated environments (vicariance), particularly under the effect of arid periods, are not incompatible, and seem to rather complement each other (Maley, 2001). For the reasons mentioned above and due to the lack of information related to the dating of endemic species, we did not classify the endemic species recorded during our study into neo- or paleoendemic categories.

4.2. METHODS

Criteria for taxa selection

The distribution patterns of species that are strictly endemic to the Campo-Ma'an area and those of narrow endemic species that also occur in south-western Cameroon (area that extends from Campo-Ma'an to Bipindi and Lolodorf) were used to verify the geographic position of late Pleistocene forest refuges. Other bio-indicator species comprise taxa with limited ecological and biological features. They are slow dispersing lowland rain forest species with restricted seed dispersal abilities, ecologically selective and intolerant to changing environmental conditions. Furthermore, species that occur in other proposed rain forest refuges and that reach their northern limit of distribution in the Campo-Ma'an area were also taken into consideration, as well as the availability of floras, monographs or taxonomic expertise giving sound identification and providing good distribution data. The various maps obtained were mainly based on the distribution of botanical specimens collected in the Campo-Ma'an area during the present study, and by previous scientists. In order to cover most of the area, we used a random stratified sampling method during which representative vegetation types were selected on the basis of human and physical factors such as rainfall, altitude, slopes, soils, the proximity to the sea and land use. Furthermore, additional collections also came from specimens collected during the study in specific habitats such as river/stream banks and exposed rocks, and from specimens previously collected in the area by other scientists.

Endemic species

Strict and narrow endemic species are suitable to serve as bio-indicators because they generally have lower overall reproductive capacity and poorer dispersal abilities than widespread species. They are often susceptible to environmental changes and disturbance. Therefore, patterns of congruence of narrow endemism are important for the identification of forest refuges since areas with unusually high number of endemics are likely to coincide with areas where forests persisted during glacial periods (Williams, 1993).

Begonia

In the revision of the *Begonia* sect. *Loasibegonia* and sect. *Scutobegonia*, Sosef (1994) used these *Begonia* species to study the location of Pleistocene refuges in West and Central Africa. In our study we will only focus on those *Begonia* species that are endemic to the Lower-Guinea region as defined by White (1979). Begonias from these groups are understorey rhizomatous terrestrial herbs, which are often found on the soil or on wet rocks in mature and old secondary forests. They have indehiscent fruits that remain some months on the mother plant and bend towards the substrate before disintegration (Sosef, 1994). While rotting away, they release their seeds slowly at the base of the parent plant. Sosef (1994) argued that in addition to the fact that many of these species have a self-incompatibility system of reproduction, dispersal over a long distance will probably not occur since the seeds are so slowly dispersed. However, some seeds might also be transported by animals (with mud on the legs of passing animals) or by water because a number of species also occur near small streams (de Lange & Bouman, 1992; Sosef, 1994).

Caesalpinioideae

Several studies on the distribution patterns of Caesalpinioideae do suggest that they are suitable bio-indicators for locating late Pleistocene tropical rain forest refuges in Central Africa (Rietkerk *et al.*, 1996; Wieringa, 1999; Leal, 2001). Caesalps belong to the dominant canopy tree species in the Atlantic Biafran forest (Letouzey 1968 & 1985). They are often found in undisturbed mature and in old secondary rain forests and contained many species that occur gregariously. The explanation for the gregarious nature of these species might stem partly from the fact that they have ballistic seed dispersal abilities that limits dispersal distance, ectomychorrhizal relationships, and large cotyledons with copious nutrients that enable their seedlings to realise initial growth under dark conditions (van der Burgt, 1994; Newbery & Gartlan, 1996; Wieringa, 1999; Leal, 2001). Most Caesalps show seeds that disperse through the explosion of the pods. Their pods explode and the seeds are ejected to a maximum of 60 m from the mother tree (van der Burgt, 1994).

Rinorea

Achoundong (1996 & 2000) carried out studies on the distribution of *Rinorea* species in Cameroon. He found that *Rinorea* species are sensible bio-indicators for forest typification. *Rinorea* species are understorey shrubs or small trees that are usually found in the lowland rain forest and sometimes in high altitude forest. They are characterised by slow seed dispersal ability. The capsule of most species dehisces with 3 valves. Each valve contains 1-4 seeds that are released in the vicinity of the parent plant, a reason why they are often locally frequent. Hekking (1988) argued that ants might also disperse part of the seeds because there is a caruncle at the base of the seed that may attract ants. He went further to mention that nearly all species are restricted to their natural habitats, thus implying that their history of distribution and speciation is strictly connected with that of the tropical rain forest in which they occur.

Rubiaceae
All species used in our study are small trees, shrubs and herbs that are confined to the understorey of the lowland evergreen rain forest. Robbrecht (1996) argued that although most Rubiaceae species have fleshy fruits (drupes or berry-like) that allow for long distance dispersal by birds, they possess some advanced morphological syndromes by which cross-pollination becomes obligatory. As a consequence, their breeding system probably renders isolated cases of long distance dispersal of single diaspores ineffective because a self-incompatibility system is present in the majority of the species (Robbrecht, 1988 & 1996). Therefore, one may expect that relict populations of such forest Rubiaceae will need a long time to gradually recolonize the expanding spread of forest when favourable climatic conditions return after a period of forest reduction during a glacial period (Robbrecht, 1996).

Data analysis
After a taxonomic search in existing floras, monographs and herbaria, taxa were selected using the criteria discussed above. A list of selected taxa was given to specialists for further checking and the resulting distribution maps of species of each group mentioned above were analysed in a search for species showing discrete patterns. Then we compared the distribution patterns of each group in order to identify areas of frequent occurrence of these bio-indicator species. The overall distribution patterns found were used to identify the position of late Pleistocene rain forest refuges in south-western Cameroon.

4.3. RESULTS

Distribution patterns of bio-indicator species
In total 178 bio-indicator species (Table 4.1) were selected on the basis of their biology (life strategy) and/or distribution (endemic). The list includes 58 strict and narrow endemics, 59 species of Rubiaceae, 32 species of Caesalpinioideae, 13 species of *Begonia*, 13 species of *Rinorea* and 24 species that reach their northern limit of distribution in the Campo-Ma'an area. As shown in Table 4.2, 77% of the total numbers of selected bio-indicator species were recorded in the National Park, 66% in the Kribi-Campo-Mvini area and 46% in the Nyabissan-Ma'an-Mekok area.

Table 4.2 Contribution of selected bio-indicator species in the Campo-Ma'an area

Area	Strict and narrow endemic	*Begonia*	Caesalps	*Rinorea*	Rubiaceae	Northern limit of distribution	Total No of bio-indicator species	%
Campo-Ma'an National Park	39	10	26	11	51	16	153	77
Kribi-Campo-Mvini area	33	7	25	10	46	11	132	66
Nyabissan-Ma'an-Mekok area	9	4	18	9	29	23	92	46
Campo-Ma'an area	58	13	32	13	59	24	199*	

*Note that the total number of bio-indicator species in this table (199) is higher than the total number of species listed in Table 4.1 (178) because some species occur in more than one group. The Kribi-Campo-Mvini area is located in the western part of the Campo-Ma'an area while the Nyabissan-Ma'an-Mekok area is situated in the south-eastern part.

Several maps were produced to display the distribution patterns of bio-indicator species within their respective groups (Figures 4.2 to 4.8). Overall, there was a high concentration of bio-indicator species in the Park and the Kribi-Campo-Mvini area and a relatively low concentration of these species in the Nyabissan-Ma'an-Mekok area (Table 4.2 & Figure 4.7). A similar pattern was observed for the distribution of strict and narrow endemic species (Figure 4.2). The lowland evergreen forest rich in Caesalpinioideae and the submontane forest located in the National Park and in the western part of the Campo-Ma'an area were rich in bio-indicators species, while the mixed evergreen and semi-deciduous forest was characterised by a low concentration of these species (Figures 4.1 & 4.8). The distribution of *Begonia* showed that some species were often found in mountainous areas between Ebianemeyong and Akom II, or along slopes near hilltops in the lowland forest, and others were located along small streams in the lowland forest. Surprisingly, many of these Begonias were not recorded in the mixed evergreen and semi-deciduous forest in the Ma'an area. As for the Caesalps, their distribution showed a high concentration of species in the park and in the Kribi-Campo-Mvini area (Figure 4.4). There was also a decrease in the number of Caesalps in the coastal forest rich in *Sacoglottis gabonensis* (Campo area) and in the mixed evergreen and semi-deciduous forest with a predominance of semi-deciduous elements (Ma'an area). In *Rinorea*, many indicator species were mostly confined to the lowland forest, particularly in the evergreen forest rich in Caesalpinioideae (Figure 4.5). There was a decrease in the number of these species with increasing altitude and some of them were most frequent in the coastal forest. There was a relatively even distribution of bio-indicator species from the Rubiaceae family within the Campo-Ma'an area although the Ma'an area showed a relatively low concentration of these species (Figure 4.6). As for species that reach the northern limit of their distribution in the Campo-Ma'an area, there was a decrease in numbers from the border with Equatorial Guinea to the Kribi–Akom II area further north (Figure 4.7). Some species such as *Aucoumea klaineana, Dacryodes buettneri, Deinbollia pycnophylla* and *Testulea gabonensis* were limited to the southern part of Campo-Ma'an in the Ma'an area, to the Dipikar island and around Ebianemeyong and Mvini.

Diameter class distribution of *Aucoumea klaineana* (Okoumé)
As shown in Table 4.3 and Figure 4.9, there was a significant difference between the number of Okoumé stems/ha recorded in the Ma'an (270 stems/ha) and Ebianemeyong forests (1855 stems/ha). The diameter distribution pattern of Okoumé stems was similar in the two communities, with each community showing a reversed-J curve with a typical reduction of Okoumé stem frequency with increasing size classes (Figure 4.9). However, this curve was very sharp in the Okoumé community found on exposed hill slopes around Ebianemeyong because many stems were recorded below 10 cm DBH (more than 35%), few stems in the large and medium sized classes, and no stems above 80 cm DBH. In the Ma'an community, there was also a gradual reduction of stems within the various DBH classes, but about 30 large Okoumé trees were recorded with a diameter above 100 cm (in 0.2 ha).

Table 4.3 Summary of the number of species, number of stems/ha, mean basal area/ha, and the number of Okoumé stems/ha recorded in 2 plots of 0.1 ha each in the Ma'an forest close to the border with Equatorial Guinea and on exposed hill slopes around Ebianemeyong in the Campo-Ma'an National Park (Figure 4.10).

Location of the Okoumé forest	No of species	No of stems/ha	Mean basal area/ha	Okoumé DBH range (cm)	No of Okoumé stems/ha	Contribution of Okoumé from the total number of individuals recorded in 0.2 ha.
Ebianemeyong	62	3925	41.3	1-80	1855	43.7% (371 out of 785 recorded)
Ma'an	154	5615	73.6	1-175	270	4.8% (54 out of 1123 recorded)

Note that in the Ma'an area, the Okoumé community was found in the mixed evergreen and semi-deciduous forest at altitudes between 400 to 500 m, while in the Ebianemeyong area, they were mostly found in the Caesalpinioideae forest on exposed hill slopes between 600 to 700 m.

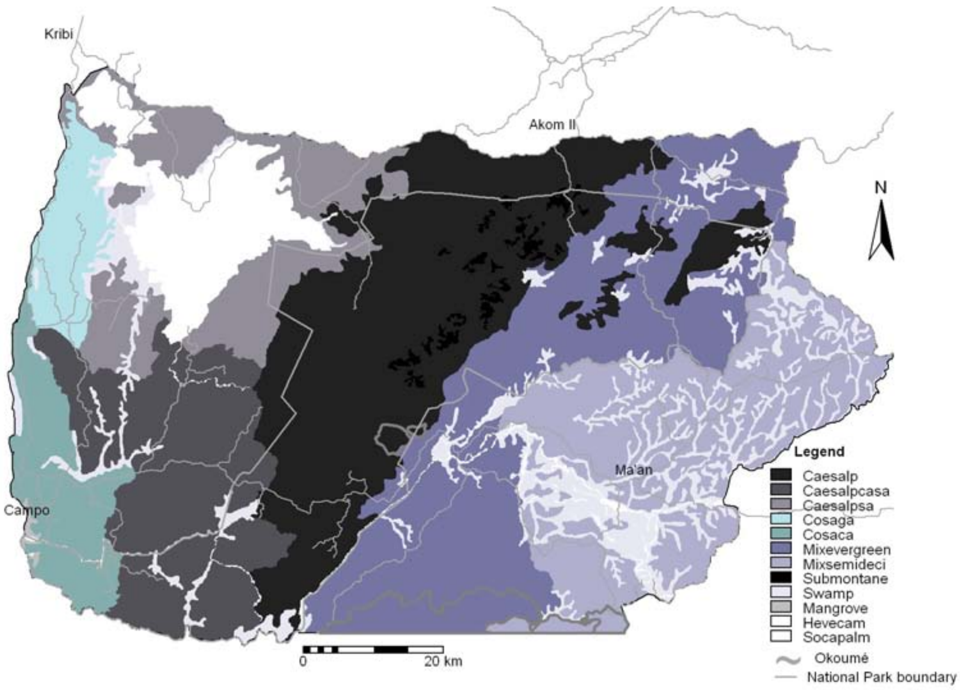

Figure 4.1 Vegetation map of the Campo-Ma'an area. Where Caesalp: Lowland evergreen forest rich in Caesalpinioideae; Caesalpcasa: Lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis*; Caesalpsa: Lowland evergreen forest rich in Caesalpinioideae and *Sacoglottis gabonensis*; Cosaga: Coastal forest with *Sacoglottis gabonensis*; Cosaca: Coastal forest with *Sacoglottis gabonensis* and *Calpocalyx heitzii*; Mixevergreen: Mixed evergreen and semi-deciduous forest with elements of evergreen forest predominant; Mixsemideci: Mixed evergreen and semi-deciduous forest with semi-deciduous elements predominant; Submontane: Submontane forest on hill tops; Okoumé: small patches of Okoumé populations; Hevecam & Socapalm: agro-industrial plantations (Annex 5).

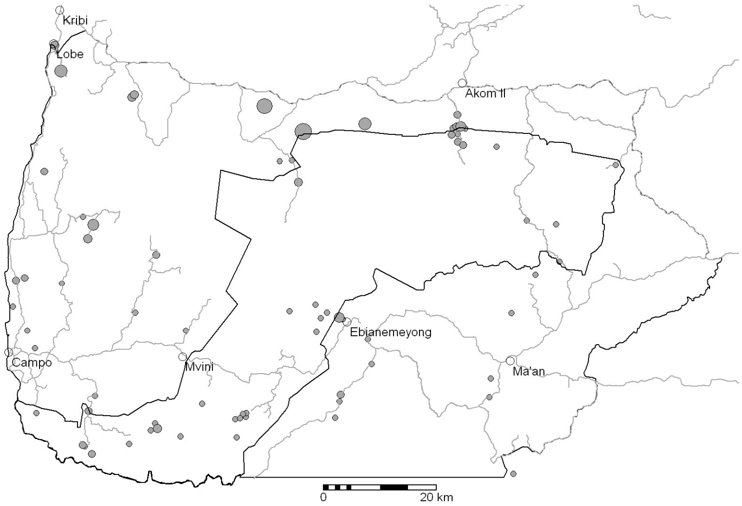

Figure 4.2 Distribution of 58 strict and narrow endemic plant species that only occur in the Campo-Ma'an area, and south-western Cameroon. Note that the size of the circle is proportional to the number of different species that occur in a given locality (a big circle means many different species in a given locality).

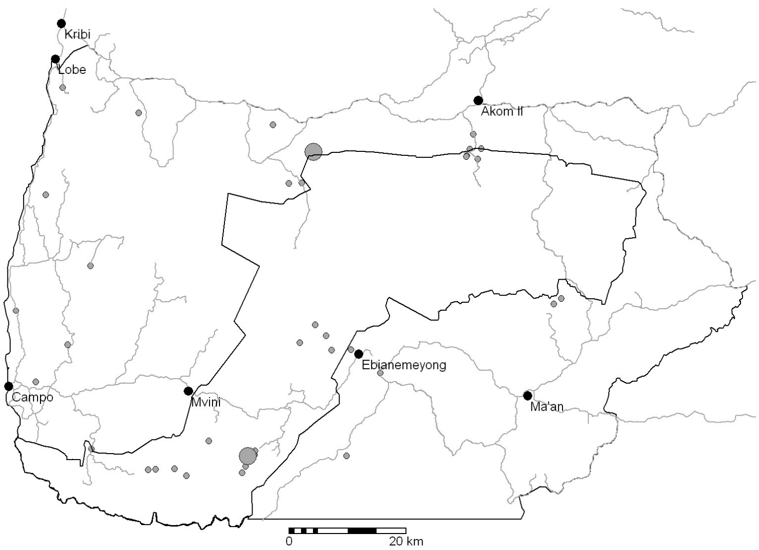

Figure 4.3 Distribution of 13 species of the *Begonia* sect. *Loasibegonia* and sect. *Scutobegonia* that are strictly endemic to the Campo-Ma'an and south-western Cameroon, or that reach their northern limit of distribution in Campo-Ma'an. The size of the circle is proportional to the number of different species that occur in a locality.

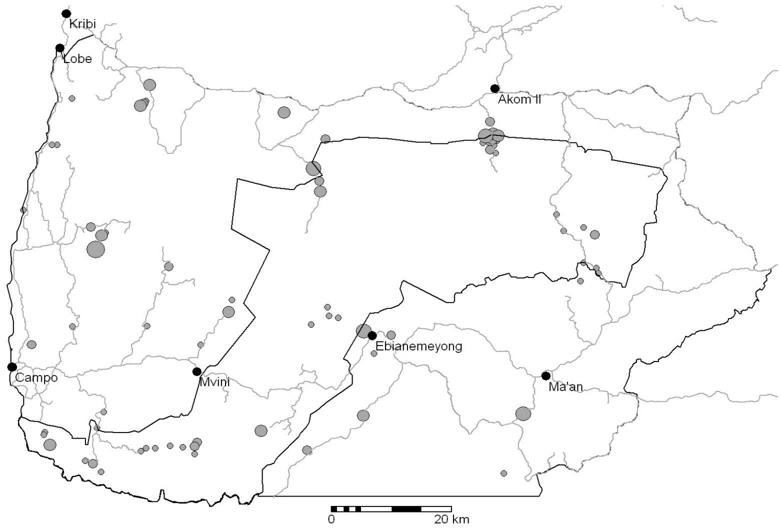

Figure 4.4 Distribution of 32 species of Caesalpinioideae that are either strictly endemic to the Campo-Ma'an and south-western Cameroon, endemic to Cameroon and Lower Guinea region, or that reach their northern limit of distribution in Campo-Ma'an. Note that the size of the circle is proportional to the number of different species that occur in a given locality.

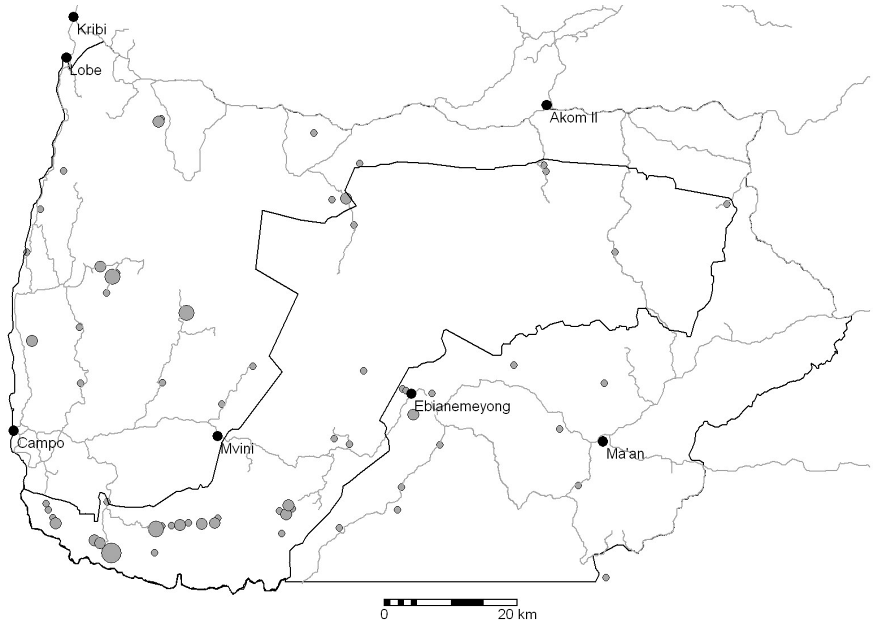

Figure 4.5 Distribution of 13 species of *Rinorea* that are either strictly endemic to the Campo-Ma'an and south-western Cameroon, endemic to Cameroon or the Lower Guinea region. The size of the circle is proportional to the number of different species that occur in a given locality.

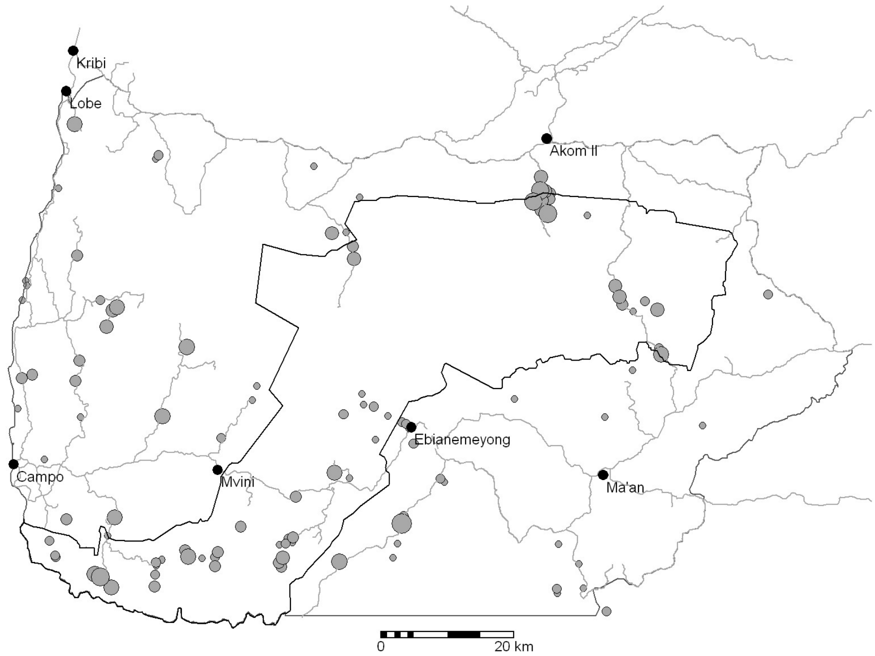

Figure 4.6 Distribution of 59 species of Rubiaceae which are either strictly endemic to the Campo-Ma'an and south-western Cameroon, endemic to Cameroon or the Lower Guinea region. Note that the size of the circle is proportional to the number of different species that occur in a given locality.

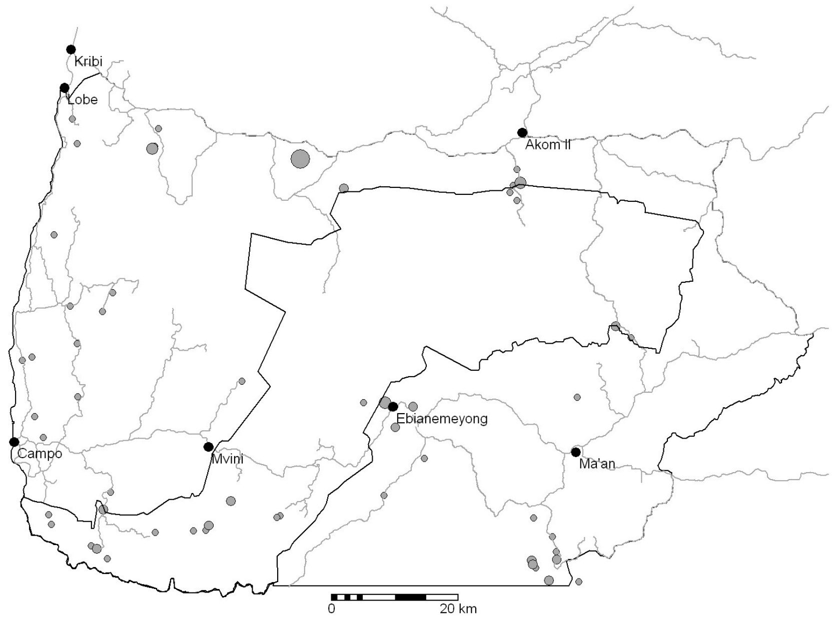

Figure 4.7 Distribution of 24 species that reach their northern limit of distribution in the Campo-Ma'an area. Note that the size of the circle is proportional to the number of different species that occur in a given locality.

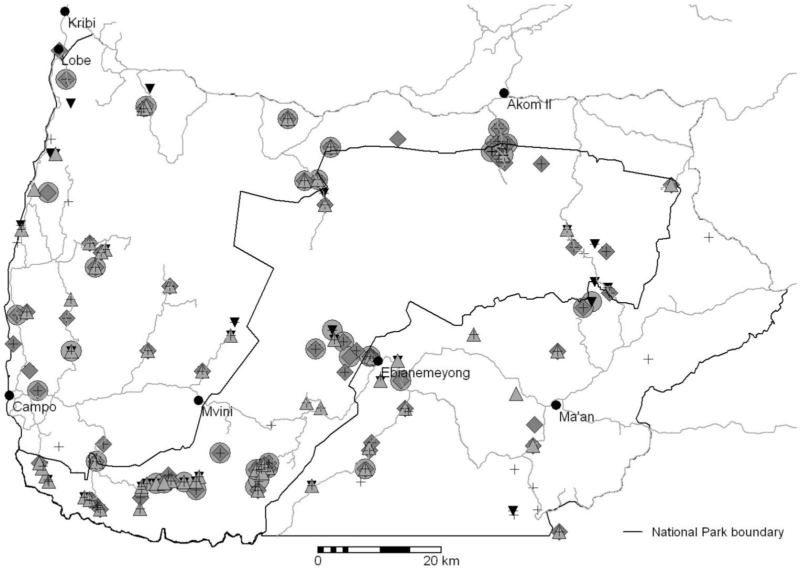

Figure 4.8 Distribution patterns of 178 selected bio-indicator taxa in the Campo-Ma'an area. Note that some species may overlap within localities. Where: □ (grey) = Strict and narrow endemics; ○ (grey) = *Begonia*; ▼= Caesalpinioideae; Δ (grey) = *Rinorea* and + = Rubiaceae species.

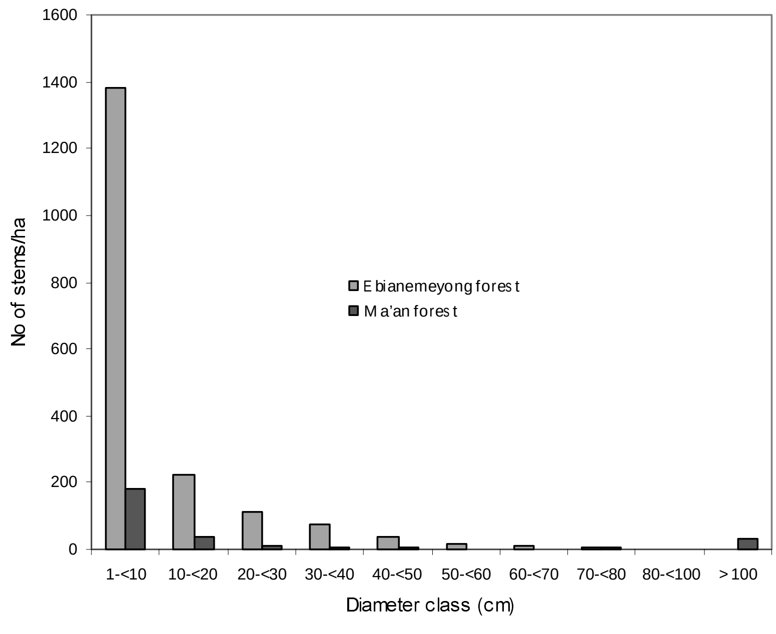

Figure 4.9 Diameter class distribution of the number of Okoumé stems/ha recorded in 2 plots of 0.1 ha each in the Ma'an forest and on exposed hill slopes around Ebianemeyong in the Campo-Ma'an National Park.

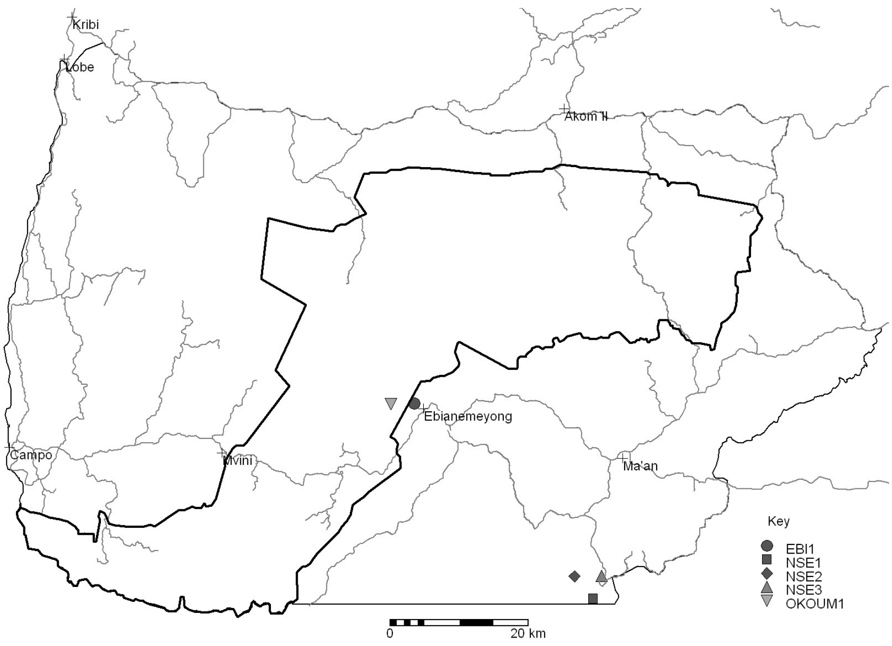

Figure 4.10 Distribution of *Aucoumea klaineana* (Okoumé) in the Campo-Ma'an area. Where EBI1 and OKOUM1 represent their locations on exposed hill slopes around Ebinanemeyong in the National Park and NSE1 to 3, in Nsengou near the border with Equatorial Guinea

4.4. DISCUSSION

Evidence for a late Pleistocene refuge in the Campo-Ma'an rain forest

The Campo-Ma'an rain forest is characterized by a rich and diverse flora with more than 2297 species of vascular plants, ferns and fern allies belonging to 851 genera and 155 families. It has about 114 strict and narrow endemic species, 29 of which are only known from the area, 29 only occur in southwestern Cameroon, and 56 are near endemics that also occur in other parts of Cameroon (Chapter, 5). The distribution of 178 bio-indicator taxa selected on the basis of their biology, endemism and growth forms, more or less fitted the glacial forest refuges as proposed or discussed by several authors (Hamilton, 1982; Maley, 1987, 1989, 1991, 1993 & 1996; Rietkerk *et al.*, 1996; Robbrecht, 1996; Sosef, 1994 & 1996; and Achoundong, 2000). Overall, there was a high concentration of bio-indicator species in the lowland evergreen forest rich in Caesalpinioideae and the submontane forests in the National Park and Kribi-Campo-Mvini area, and a relatively low concentration of these species in the Ma'an area (Figure 4.8). Similar patterns were observed for the distribution of strict and narrow endemic species, *Begonia*, Caesalpinioideae and Rubiaceae (Figures 4.2 to 4.7). Achoundong (1996 & 2000) mentioned that in terms of distribution, two groups of *Rinorea* species could be distinguished in Cameroon. A group that is limited to the coastal plain and another group which is mainly found inland. In the Campo-Ma'an area, the distribution of *Rinorea* species showed that *Rinorea microglossa* and *Rinorea sp. nov1.* were restricted to the coastal area between Kribi and Campo, while other species were mostly found in the lowland evergreen forest rich in Caesalpinioideae.

The Atlantic Biafran forest rich in Caesalpinoideae is often considered to represent the real climax forest vegetation while the Atlantic littoral forest type is regarded as the result of its degradation (Letouzey, 1983). In the Campo-Ma'an area, the distributions of Caesalps show a high concentration of bio-indicator species in the lowland evergreen forest rich in Caesalpinioideae, and in the submontane forest. There is a decrease in the number of species in the coastal forest rich in *Sacoglottis gabonensis,* and particularly in the mixed evergreen and semi-deciduous forest where semi-deciduous and secondary forest species became increasingly important. Furthermore, there was a high concentration of bio-indicator species in the park and in the Kribi-Campo-Mvini area on the higher slopes of the lowland forests and along riverbanks. This pattern supports the view of many authors who argued that during glacial times, patches of forests were restricted to higher altitude lowland forests, especially along the upper slopes of hills near the top (F.J. Breteler *pers. comm.*) or along riverbanks where there was enough humidity necessary for their survival. Therefore, we can hypothesize that past glacial forest expansion started in the Campo-Ma'an area from isolated patches of mid and higher elevation evergreen rain forest rich in Caesalpinioideae, located within the mountainous range that extents from Ebianemeyong to the Akom II. Moreover, the Campo-Ma'an area has a dense hydrographical pattern with many rivers and streams that may have played an important role during the dry-out periods, as they supplied humid conditions that may have allowed the survival of some forest types. This is illustrated today with the occurrence of indicator species such as *Aphanocalyx ledermannii, Begonia anisosepala, B. zenkeriana* and *Gilbertiodendron demonstrans,* which are often found in marshy places and along stream and river banks in the coastal forest and on Dipikar Island. At the same time it may be hypothesized that the persistence of Caesalpinioideae forests in this so-called western part of the south Cameroon forest refuge prevented *Aucoumea klaineana* to extend its distribution further northwards.

As discussed in Chapters 2 & 6, the lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis* is only known from the Campo area. This forest type, as well as the coastal forest and the mixed evergreen and semi-deciduous forest are characterised by a high number of fully grown and developed secondary forest species. Letouzey (1983) mentioned that *Alstonia boonei*, *Calpocalyx heitzii, Lophira alata, Pycnanthus angolensis, Sacoglottis gabonensis* and *Terminalia superba* are light demanding species with an invasive habit that frequently colonise forest gaps. He further argued that forest types rich in such species, will have difficulties to expand into the Caesalpinioideae forest, because their regeneration will be hampered since their seedlings and saplings will not survive in the understorey of such forest communities. The present mosaic pattern of some forest types, characterised by a mixture of evergreen, semi-deciduous and secondary forest species, is probably the consequence of long-term disturbances, which may have affected these areas since the glacial times, particularly the major disturbance which culminated about 2500 BP (Maley, 2002). However, it should be noted that recent and past human activities have also contributed to modify the balance of present-day ecological factors influencing the succession processes of these forests. We may therefore predict that if the current human perturbation is maintained the lowland rain forest rich in *Calpocalyx heitzii* and *Sacoglottis gabonensis* will further expand into the evergreen forest rich in Caesalpinioideae. But if the ongoing human pressure is controlled, we will rather expect a progressive expansion of the Caesalpinioideae forest towards the coast. In the drier Ma'an area, we will also expect to have more patches of evergreen Caesalpinioideae forest within the mixed evergreen and semi-deciduous forest. However, it should be mentioned that we expect a rather slow expansion of evergreen rain forest because it may not be able to cope with the relatively low precipitation recorded in the Ma'an area (below 1700 mm/year). Taking into consideration the fact that the Ma'an area is located within a transitional climatic zone with a relatively low annual rainfall, its vegetation represents a transition between the dry deciduous forest and the wet evergreen lowland forest rich in Caesalpinioideae.

The Campo-Ma'an rain forest, with its high concentration of endemic species and rich forest species diversity, is probably part of a late Pleistocene refuge as postulated in south-western Cameroon by several authors (Aubreville, 1962; White, 1979 & 1983, Maley, 1987, 1989 & 1990; Sosef, 1994). We assume that this refuge may probably extend further north-east along the mountainous range that goes up to the Bipindi area, because many narrow endemic species were also known to occur in the Akom II-Bipindi-Lolodorf areas. Overall, the distribution maps of the various bio-indicator species showed a low concentration of these species in the mixed evergreen and semi-deciduous forest located in the drier Nyabissan-Ma'an-Mekok area. A similar pattern was also observed from the distribution of strict and narrow endemic species. As shown in Table 4.2, only 15% of the total number of strict and narrow endemics and 46% of the selected bio-indicator species were recorded in this area. Furthermore, the drier Ma'an area is characterised by a semi-deciduous forest type with discontinuous canopy and the presence of many fully grown secondary forest species. This may suggest that the Ma'an area might have suffered from past human disturbance or that it may have been colonised by an open vegetation type during the dry-out periods. Therefore, it is probably undergoing a phase of forest recolonisation under the present climatic conditions. Taking into consideration the fact that the Ma'an vegetation shows a strong secondary character in terms of its species composition with many semi-deciduous elements, we can hypothesise that it was not part of the postulated forest refuge in south-western Cameroon under substantial drier atmospheric conditions than today.

It should be noted that these patterns in species richness are also the result of past and present biotic and abiotic structuring processes as has been clearly shown in Chapter 2. Taking into consideration the fact that paleo-evidence provides more information leading to the identification of the location and extent of Pleistocene rain forest refuges, the distribution patterns of bio-indicator species are often used to check the position of these forest refuges. Therefore, in the absence of paleo-evidence, it is almost impossible to unravel the role of the postulated rain forest refuges in the framework of other environmental processes that operated in the past without creating circular arguments. Furthermore, it is worth mentioning that past and present climatic changes, biological interaction, ecosystem dynamics, and regional and evolutionary processes must in varying degree be taken into consideration to explain the high level of endemism and diversity recorded in the area. Moreover, it is suggested that further research to date the origin of endemic and slow dispersal species using recent modern molecular and phylogenetic (cladistic) techniques should be encouraged for a better understanding of the evolutionary processes of tropical rain forest taxa.

Ecological aspects of *Aucoumea klaineana* (Okoumé) at its northern limit of distribution

Okoumé is the most important timber species exploited in Gabon and accounts for over 90% of all timber export (White & Abernethy, 1997). In Gabon, it is a large canopy tree with winged seeds that by strong wind can be dispersed as far as several hundreds of metres from the parent tree. It tends to grow gregariously in stands with several individuals quite close together. Their roots are often joined, which allow the exchange of nutrients between individuals. In the Campo-Ma'an area, these roots sometimes form a visible striking network on exposed rocks on hill slopes. Although its centre of frequency is found in Gabon, it reaches the northern limit of its distribution in the Campo-Ma'an area and its southern limit in western Congo. Okoumé is a light demanding species with very little or no regeneration capacity within the ecological environment presented by the lowland evergreen forest. Its frequent occurrence in Gabon is probably the result of savanna colonisation and forest disturbance in the past (White *et al.*, 2000; Maley, 2002).

Our study has demonstrated that there are two different types of Okoumé communities in the Campo-Ma'an area. A more mature community is found at the border with Equatorial Guinea, and a younger community exists on exposed rocks on hill slopes around Ebianemeyong and the Kom River in the National Park (Figure 4.10). As shown in Table 4.3, there was a significant difference between the number of Okoumé stems/ha recorded in the Ma'an (54 individuals in 0.2 ha) and Ebianemeyong forests (371 individuals in 0.2 ha). The Ebianemeyong community was characterised by an almost pure mono-dominant stand with many small and medium sized stems, and no stems above 80 cm DBH. The forest floor was open, completely covered by grasses, creeping *Selaginella*, terrestrial ferns, orchids and *Begonia* species. In the Ma'an community, there was a gradual reduction of stems within the various DBH classes with more than 30 large Okoumé trees recorded with a diameter above 100 cm (in 0.2 ha). It is worth mentioning that there are some 30-40-year-old Okoumé plantations near Kribi between Bidou and Akok in the Kienke Forest Reserve.

Is the distribution of Okoumé under the present climatic conditions in Cameroon expanding or contracting? Pollen obtained from lake Ossa near Edea in south Cameroon showed that between 7500 and 3000 BP (mid Holocene) the distribution of Okoumé extended further north towards the Sanaga River, reaching lake Ossa at about 170 km north of the present limit of distribution (Reynaud-Farrera *et al.*, 1996; Maley, 2002). It is hypothesised that the current distribution range of Okoumé is the result of the contraction of a wider spread population that existed during mid Holocene. During the severe arid period that occurred around 2500 BP, there was a considerable reduction of the forest that may have resulted in the reduction of the geographical range of Okoumé or in its fragmentation into small remnant patches

(Reynaud-Farrera *et al.*, 1996; Muloko-Ntoutoume *et al.*, 1998; Maley, 2002). In the same period, the rainfall suddenly became more seasonal, thus resulting into an abrupt expansion of savanna and open vegetation types that may have favoured the development of pioneer species. Therefore, when wetter conditions favourable to a new expansion of the forest returned, logically we expect Okoumé, which is a light demanding species with an excellent dispersal ability, to gain ground in the expansion process in preference to the lowland evergreen rain forest species. However, Okoumé has not been successful to expand further north towards lake Ossa because the lowland evergreen rain forest species formed a "barrier" against its expansion.

The climatic fluctuations that occurred in the Central Africa region may have contributed to slow down the expansion of Okoumé, as well as that of many species that reach their northern limit of distribution in the Campo-Ma'an area, to progress further north beyond the Sanaga River. In Gabon, there is an equatorial climate with a pronounced dry season that occurs from June/July to August or September. During this period, the sky is often clouded causing a limited evaporation and a low temperature (Reitsma, 1988). There is a climatic transition around 3°N and the Campo-Ma'an area falls within a transitional zone where the typical equatorial climate shifts from a maritime type with 4 seasons, to a "pseudo-tropical type", with only two seasons in the northern coastal region around Douala (Gartlan, 1992; Maley & Elenga 1993). Therefore, in order to explain the suggested past occurrence of Okoumé around lake Ossa, some authors argue that an equatorial climate must have reigned over south Cameroon during mid Holocene (Maley, 2002). However, in the Campo-Ma'an area, we have noticed that Okoumé is struggling to expand further north of its present range of distribution under the present climatic conditions. But this expansion is called to a halt because the species is unable to establish under the closed canopy of the Caesalpinioideae forest as it needs open habitats to regenerate. In our opinion, the unfavourable natural regeneration conditions are probably the main reason for the limited occurrence of Okoumé in Cameroon. So far, in Campo-Ma'an area, Okoumé is only found either in mixed evergreen and semi-deciduous forest with discontinuous canopy or in atypical habitats as on exposed hill slopes.

4.5. CONCLUSION

This study added some evidence in support to the view that the Campo-Ma'an area forms part of a series of postulated tropical rain forest refuges in Central Africa. The distributions of 178 bio-indicator taxa selected on the basis of their life strategy, endemism and/or growth forms show a pattern that roughly coincides with a glacial forest refuge in south-western Cameroon as proposed by several authors. Overall, there was a high concentration of narrow endemic and bio-indicator species in the National Park and in the Kribi-Campo-Mvini areas, and a relatively low concentration of these species in the Ma'an area. These bio-indicator species were mostly found in the lowland evergreen forest rich in Caesalpinioideae, on high altitude lowland rain forests (especially along the upper slopes of hills near the top) or along riverbanks. However, it should be noted that these patterns in species richness are also the result of past and present climatic changes, abiotic factors, biological interaction, ecosystem dynamics, and regional and evolutionary processes. Furthermore, human activities may also have contributed to modify the balance of present-day ecological conditions, resulting in shifts in the strength of contemporary ecological and evolutionary forces.

Table 4.1 List of 178 bio-indicator taxa consisting of 61 strict and narrow endemics, 59 species of Rubiaceae, 32 species of Caesalpinioideae, 13 species of *Begonia*, 13 species of *Rinorea* and 24 species that reach their northern limit of distribution in the Campo-Ma'an area. Note that some species may overlap within identified groups.

No	Family	Species	Guild	Habit	Chorology
1	Annonaceae	Monanthotaxis elegans (Engl. & Diels) Verdc.	sb	Sh	Sw-Cam
2	Annonaceae	Monodora zenkeri Engl. & Diels	sb	Sh	Sw-Cam
3	Apocynaceae	Petchia africana Leeuwenb.	sb	Sh	Sw-Cam
4	Apocynaceae	Tabernaemontana hallei (Boiteau) Leeuwenb.*	sb	Sh	Lg
5	Araceae	Culcasia bosii Ntepe-Nyame	sb	He	Sw-Cam
6	Balsaminaceae	Impatiens gongolana N.Hallé*	sb	Hb	Lg
7	Balsaminaceae	Impatiens hians Hook.f. var. bipindensis (Gilg) Grey-Wilson*	sb	Hb	Lg
8	Begoniaceae	Begonia anisosepala Hook.f. *	sb	Hb	Lg
9	Begoniaceae	Begonia cilio-bracteata Warb.	sb	Hb	Lg
10	Begoniaceae	Begonia clypeifolia Hook.f.*	sb	Hb	Lg
11	Begoniaceae	Begonia elaeagnifolia Hook. f.*	ep	Ep	Lg
12	Begoniaceae	Begonia heterochroma Sosef *	sb	Hb	Lg
13	Begoniaceae	Begonia letouzeyi Sosef	sb	Hb	Lg
14	Begoniaceae	Begonia mbangaensis Sosef	sb	Hb	Sw-Cam
15	Begoniaceae	Begonia microsperma Warb.	sb	Hb	Cam
16	Begoniaceae	Begonia montis-elephantis J.J.de Wilde	sb	Hb	Campo-Ma'an
17	Begoniaceae	Begonia potamophila Gilg	sb	Hb	Lg
18	Begoniaceae	Begonia sciaphila Gilg ex Engl.	sb	Hb	Lg
19	Begoniaceae	Begonia staudtii Gilg	sb	Hb	Lg
20	Begoniaceae	Begonia susaniae Sosef	sb	Hb	Lg
21	Begoniaceae	Begonia zenkeriana Smith & Wassh.	sb	Hb	Sw-Cam
22	Burseraceae	Aucoumea klaineana Pierre*	pi	Tr	Lg
23	Burseraceae	Dacryodes buettneri (Engl.) Lam*	np	Tr	Lg
24	Celastraceae	Pristimera luteoviridis (Exell) N.Hallé var. kribiana N.Hallé	np	Swcl	Campo-Ma'an
25	Chrysobalanaceae	Dactyladenia cinera (Engl. ex de Wild) Prance & F.White	sb	Tr	Sw-Cam
26	Cyperaceae	Hypolytrum sp. nov. ined.	sb	Hb	Campo-Ma'an
27	Dichapetalaceae	Dichapetalum altescandens Engl. *	np	Lwcl	Lg
28	Dichapetalaceae	Dichapetalum librevillense Pellegr. *	np	Lwcl	Lg
29	Dichapetalaceae	Dichapetalum oliganthum Breteler	np	Lwcl	Sw-Cam
30	Dichapetalaceae	Tapura tchoutoi Breteler	sb	Sh	Campo-Ma'an
31	Dryopteridaceae	Lastreopsis davalliaeformis (Tardieu) Tardieu*	sb	He	Lg
32	Ebenaceae	Diospyros alboflavescens (Gürke) F.White	sb	Tr	Sw-Cam
33	Ebenaceae	Diospyros soyauxii Gürke & K. Schum.*	sb	Tr	Lg
34	Euphorbiaceae	Afrotrewia kamerunica Pax & Hoffm.	sb	Sh	Campo-Ma'an
35	Gramineae	Guaduella mildbraedii Pilg.	sb	Hb	Campo-Ma'an
36	Gramineae	Hyparrhenia wombaliensis (Vanderyst ex Robyns) Clayton *	pi	Hb	Lg
37	Icacinaceae	Rhaphiostylis subsessilifolia Engl.	sb	Swcl	Campo-Ma'an
38	Ixonanthaceae	Ochthocosmus calothyrsus (Mildbr.) Hutch. & Dalziel*	np	Tr	Lg
39	Lauraceae	Beilschmiedia cuspida (Krause) Robyns & Wilczek	sb	Tr	Campo-Ma'an
40	Lauraceae	Beilschmiedia dinklagei (Engl.) Robyns & Wilczek	sb	Tr	Campo-Ma'an
41	Lauraceae	Beilschmiedia klainei Robyns & Wilczek	sb	Tr	Sw-Cam
42	Lauraceae	Beilschmiedia papyracea (Stapf) Robyns & R.Wilczek	sb	Tr	Sw-Cam
43	Lauraceae	Beilschmiedia wilczekii Fouilloy	sb	Tr	Sw-Cam
44	Leguminosae-Caes.**	Amphimas ferrugineus Pierre ex Pellegr.*	np	Tr	Lg

No	Family	Species	Guild	Habit	Chorology
45	Leguminosae-Caes.**	Anthonotha isopetala (Harms) J.Léonard	sb	Tr	Lg
46	Leguminosae-Caes.**	Anthonotha leptorrhachis (Harms) J.Léonard	sb	Tr	Cam
47	Leguminosae-Caes.**	Aphanocalyx hedinii (A.Chev.) Wieringa	np	Tr	Cam
48	Leguminosae-Caes.**	Aphanocalyx ledermannii (Harms) Wieringa*	sw	Tr	Lg
49	Leguminosae-Caes.**	Berlinia auriculata Benth.	ri	Tr	Lg
50	Leguminosae-Caes.**	Berlinia craibiana Baker f.	ri	Tr	Lg
51	Leguminosae-Caes.**	Bikinia le-testui (Pellegr.) Wieringa ssp. le-testui	np	Tr	Lg
52	Leguminosae-Caes.**	Brachystegia cynometroides Harms	np	Tr	Lg
53	Leguminosae-Caes.**	Brachystegia mildbraedii Harms	np	Tr	Lg
54	Leguminosae-Caes.**	Copaifera religiosa J.Léonard*	np	Tr	Lg
55	Leguminosae-Caes.**	Daniellia klainei A.Chev.*	ri	Tr	Lg
56	Leguminosae-Caes.**	Detarium macrocarpum Harms	sb	Tr	Lg
57	Leguminosae-Caes.**	Dialium zenkeri Harms	sb	Tr	Sw-Cam
58	Leguminosae-Caes.**	Didelotia africana Baill.	sb	Tr	Lg
59	Leguminosae-Caes.**	Didelotia unifoliolata J.Léonard	sb	Tr	Lg
60	Leguminosae-Caes.**	Gilbertiodendron brachystegioides (Harms) J.Léonard	np	Tr	Lg
61	Leguminosae-Caes.**	Gilbertiodendron demonstrans (Baill.) J.Léonard	np	Tr	Lg
62	Leguminosae-Caes.**	Gilbertiodendron klainei (Pierre ex Pelligr.) J.Léonard	np	Tr	Lg
63	Leguminosae-Caes.**	Gilbertiodendron ogoouense (Pellegr.) J.Léonard	np	Tr	Lg
64	Leguminosae-Caes.**	Gilbertiodendron pachyanthum (Harms) J.Léonard	np	Tr	Sw-Cam
65	Leguminosae-Caes.**	Griffonia tessmannii (De Wild.) Campère	np	Lwcl	Lg
66	Leguminosae-Caes.**	Guibourtia tessmannii (Harms) J.Léonard	np	Tr	Lg
67	Leguminosae-Caes.**	Leonardoxa africana (Baill.) Aubrév.	sb	Tr	Lg
68	Leguminosae-Caes.**	Loesenera talbotii Baker f.	sb	Tr	Lg
69	Leguminosae-Caes.**	Oddoniodendron micranthum (Harms) Baker f.	np	Tr	Lg
70	Leguminosae-Caes.**	Paraberlinia bifoliolata Pellegr.	np	Tr	Lg
71	Leguminosae-Caes.**	Plagiosiphon longitubus (Harms) J.Léonard	sb	Tr	Sw-Cam
72	Leguminosae-Caes.**	Plagiosiphon multijugus (Harms) J.Léonard	sb	Tr	Cam
73	Leguminosae-Caes.**	Prioria joveri (Normand ex Aubrev.) Breteler	np	Tr	Lg
74	Leguminosae-Caes.**	Tetraberlinia moreliana Aubrév. *	sb	Tr	Lg
75	Leguminosae-Caes.**	Zenkerella citrina Taub.	sb	Tr	Lg
76	Loganiaceae	Mostuea neurocarpa Gilg*	sb	Sh	Lg
77	Loganiaceae	Strychnos canthioides Leeuwenb.	np	Lwcl	Campo-Ma'an
78	Melastomataceae	Amphiblemma letouzeyi Jacq.-Fél.	sb	Hb	Sw-Cam
79	Melastomataceae	Calvoa calliantha Jacq.-Fél.	sb	Hb	Sw-Cam
80	Melastomataceae	Calvoa stenophylla Jacques-Félix	sb	Hb	Campo-Ma'an
81	Melastomataceae	Guyonia tenella Naud.*	sb	Hb	Lg
82	Menispermaceae	Albertisia glabra (Diels & Troupin) Forman	sb	Swcl	Sw-Cam
83	Moraceae	Dorstenia dorstenioides (Engl.) Hijman & C.C.Berg	sb	Hb	Campo-Ma'an
84	Moraceae	Dorstenia involuta M.Hijman	sb	Hb	Campo-Ma'an
85	Ochnaceae	Testulea gabonensis Pellegr.*	np	Tr	Lg
86	Orchidaceae	Bulbophyllum alinae Szlachetko	ep	Ep	Campo-Ma'an
87	Orchidaceae	Podandriella batesii (la Croix) Szlachetko & Olszewski	sb	Hb	Campo-Ma'an
88	Orchidaceae	Polystachya letouzeyana Szlachetko & Olszewski	ep	Ep	Campo-Ma'an
89	Orchidaceae	Vanilla africana Lindley subsp. cucullata (Kraenzlin & K. Shum.) Szlachetko & Olszewski	np	Hcl	Sw-Cam
90	Podostemaceae	Ledermanniella annithomae C. Cusset	rh	Hb	Campo-Ma'an
91	Podostemaceae	Ledermanniella batangensis (Engl.) C. Cusset	rh	Hb	Campo-Ma'an
92	Podostemaceae	Ledermanniella bosii C.Cusset	rh	Hb	Campo-Ma'an

No	Family	Species	Guild	Habit	Chorology
93	Podostemaceae	Ledermanniella kamerunensis (Engl.) C. Cusset	rh	Hb	Campo-Ma'an
94	Rubiaceae	Bertiera bicarpellata (K.Schum.) N.Hallé	sb	Sh	Lg
95	Rubiaceae	Bertiera laxa Benth.	sb	Sh	Lg
96	Rubiaceae	Bertiera laxissima K.Schum.	sb	Sh	Lg
97	Rubiaceae	Bertiera retrofracta K.Schum.	sb	Sh	Lg
98	Rubiaceae	Bertiera subsessilis Hiern	sb	Sh	Lg
99	Rubiaceae	Chassalia ischnophylla (K.Schum.) Hepper	sb	Sh	Lg
100	Rubiaceae	Chassalia zenkeri K.Schum. & K.Krause	sb	Sh	Lg
101	Rubiaceae	Chazaliella insidens (Hiern) Petit & Verdc. subsp. insidens	sb	Sh	Lg
102	Rubiaceae	Chazaliella sciadephora (Hiern) Petit & Verdc. var. condensata Verdc.	sb	Sh	Cam
103	Rubiaceae	Ecpoma apocynaceum K.Schum.	pi	Sh	Sw-Cam
104	Rubiaceae	Ecpoma gigantostipulum (K.Schum.) N.Hallé	pi	Sh	Lg
105	Rubiaceae	Hymenocoleus glaber Robbrecht	sb	Hb	Cam
106	Rubiaceae	Hymenocoleus nervopilosus Robbrecht orientalis Robbrecht	sb	Hb	Lg
107	Rubiaceae	Ixora aneimenodesma K.Schum. aneimenodesma	sb	Sh	Cam
108	Rubiaceae	Ixora euosmia K.Schum.	ri	Sh	Lg
109	Rubiaceae	Ixora hippoperifera Bremek.	sb	Sh	Lg
110	Rubiaceae	Ixora macilenta De Block	pi	Sh	Lg
111	Rubiaceae	Ixora nematopoda K.Schum.	sb	Sh	Lg
112	Rubiaceae	Ixora synactica De Block	sb	Sh	Sw-Cam
113	Rubiaceae	Oxyanthus laxiflorus K.Schum. ex Hutch. & Dalziel	sb	Sh	Lg
114	Rubiaceae	Oxyanthus oliganthus K.Schum.	sb	Sh	Cam
115	Rubiaceae	Pavetta camerounensis S.Manning subsp. camerounensis	sb	Sh	Cam
116	Rubiaceae	Pavetta gabonica Bremek.	sb	Sh	Lg
117	Rubiaceae	Pavetta gracilipes Hiern	sb	Sh	Lg
118	Rubiaceae	Pavetta kribiensis S.Manning	sb	Sh	Sw-Cam
119	Rubiaceae	Pavetta mpomii S.Manning	sb	Sh	Sw-Cam
120	Rubiaceae	Pavetta staudtii Hutch. & Dalziel	sb	Sh	Cam
121	Rubiaceae	Pseudosabicea medusula (K.Schum.) N.Hallé	np	Hb	Cam
122	Rubiaceae	Pseudosabicea proselyta N.Hallé	pi	Hb	Lg
123	Rubiaceae	Pseudosabicea segregata (Hiern) N.Hallé	pi	Hb	Lg
124	Rubiaceae	Psychotria aemulans K. Schum.	sb	Sh	Campo-Ma'an
125	Rubiaceae	Psychotria avakubiensis De Wild.	sb	Sh	Lg
126	Rubiaceae	Psychotria batangana K. Schum.	sb	Sh	Campo-Ma'an
127	Rubiaceae	Psychotria bifaria Hiern var. bifaria	sb	Sh	Lg
128	Rubiaceae	Psychotria calceata Petit	sb	Sh	Lg
129	Rubiaceae	Psychotria camerunensis Petit	sb	Sh	Cam
130	Rubiaceae	Psychotria camptopus Verdc.	sb	Sh	Lg
131	Rubiaceae	Psychotria dimorphophylla K. Schum.	ri	Sh	Campo-Ma'an
132	Rubiaceae	Psychotria ebensis K.Schum.	sb	Sh	Lg
133	Rubiaceae	Psychotria globosa Hiern var. ciliata (Hiern) Petit	sb	Hb	Lg
134	Rubiaceae	Psychotria humilis Hiern var. humilis	pi	Hb	Lg
135	Rubiaceae	Psychotria ingentifolia Petit	sb	Sh	Lg
136	Rubiaceae	Psychotria lanceifolia K.Schum.	sb	Sh	Sw-Cam
137	Rubiaceae	Psychotria latistipula Benth.	sb	Sh	Lg
138	Rubiaceae	Psychotria letouzeyi Petit	sb	Sh	Lg
139	Rubiaceae	Psychotria oligocarpa K.Schum.	sb	Sh	Sw-Cam
140	Rubiaceae	Psychotria sadebeckiana K.Schum. var. elongata Petit	sb	Sh	Cam

No	Family	Species	Guild	Habit	Chorology
141	Rubiaceae	Psychotria sadebeckiana K.Schum. var. sadebeckiana	sb	Sh	Cam
142	Rubiaceae	Sericanthe auriculata (Keay) Robbrecht	sb	Sh	Lg
143	Rubiaceae	Sericanthe jacfelicis (N.Hallé) Robbrecht	sb	Sh	Lg
144	Rubiaceae	Tricalysia amplexicaulis Robbrecht	sb	Sh	Cam
145	Rubiaceae	Tricalysia lasiodelphys (K.Schum. & K.Krause) A.Chev. subsp. lasiodelphys	sb	Sh	Lg
146	Rubiaceae	Tricalysia obstetrix N.Hallé	sb	Sh	Lg
147	Rubiaceae	Tricalysia pedunculosa (N.Hallé) Robbrecht var. pedunculosa	sb	Sh	Lg
148	Rubiaceae	Tricalysia soyauxii K.Schum.	sb	Sh	Lg
149	Rubiaceae	Tricalysia sylvae Robbrecht	sb	Sh	Lg
150	Rubiaceae	Tricalysia talbotii (Wernham) Keay	sb	Sh	Cam
151	Rubiaceae	Tricalysia vadensis Robbrecht	sb	Sh	Lg
152	Rubiaceae	Vangueriella laxiflora (K.Schum.) Verdc.	sb	Swcl	Cam
153	Sapindaceae	Deinbollia macroura Gilg ex Radlkofer	sb	Sh	Campo-Ma'an
154	Sapindaceae	Deinbollia mezilii D.W.Thomas & D.J.Harris	sb	Sh	Campo-Ma'an
155	Sapindaceae	Deinbollia pycnophylla Gilg ex Radlk.*	sb	Sh	Lg
156	Scytopetalaceae	Rhaptopetalum sessilifolium Engl	sb	Sh	Sw-Cam
157	Sterculiaceae	Cola fibrillosa Engl. & Krause	sb	Tr	Sw-Cam
158	Sterculiaceae	Cola subglaucescens Engl.	sb	Tr	Sw-Cam
159	Sterculiaceae	Cola sulcata Engl.	sb	Tr	Sw-Cam
160	Sterculiaceae	Scaphopetalum acuminatum Engl. & K. Krause	sb	Sh	Campo-Ma'an
161	Sterculiaceae	Scaphopetalum brunneo-purpureum Engl. & K. Krause	sb	Sh	Campo-Ma'an
162	Sterculiaceae	Scaphopetalum paxii H. Winkler	sb	Sh	Sw-Cam
163	Sterculiaceae	Scaphopetalum zenkeri K.Schum.	sb	Sh	Sw-Cam
164	Violaceae	Rinorea albidiflora Engl.	sb	Sh	Lg
165	Violaceae	Rinorea campoensis M. Brandt ex Engl.	sb	Sh	Campo-Ma'an
166	Violaceae	Rinorea dentata P.Beauv.	sb	Sh	Lg
167	Violaceae	Rinorea exappendiculata Engl. ex Brandt	sb	Sh	Lg
168	Violaceae	Rinorea gabunensis Engl.	sb	Sh	Lg
169	Violaceae	Rinorea kamerunensis Engl.	sb	Sh	Lg
170	Violaceae	Rinorea ledermannii Engl.	sb	Sh	Lg
171	Violaceae	Rinorea longisepala Engl.	sb	Sh	Lg
172	Violaceae	Rinorea microglossa Engl.	sb	Sh	Sw-Cam
173	Violaceae	Rinorea sp. nov1. ined.	sb	Sh	Cam
174	Violaceae	Rinorea sp. nov2. ined.	sb	Sh	Cam
175	Violaceae	Rinorea verrucosa Chipp	sb	Sh	Lg
176	Violaceae	Rinorea woermaniana (Buttn.) Engl.	sb	Sh	Lg
177	Zingiberaceae	Aulotandra kamerunensis Loes.	sb	Hb	Sw-Cam
178	Zingiberaceae	Renealmia densispica Koechlin	sb	Hb	Sw-Cam

* for species that reach their northern of distribution in the Campo-Ma'an area
** Leguminosae-Caes. = Leguminosae-Caesalpinioideae
Guild: ep = epiphyte, np = non pioneer light demanding, pi = pioneer, rh = rheophyte, ri = riverine, sb = shade-bearer and sw = swamp.
Habit: Ep = epiphyte, Hb = herb, Hcl = herbaceous climber, He = hemi-epiphyte, Lwcl = large woody climber, Swcl = small woody climber, Sh = shrub, and Tr = tree.
Chorology: Campo-Ma'an = species that are strictly endemic to Campo-Ma'an, Sw-Cam = endemic to southwestern part of Cameroon (Kribi-Akom II-Bipindi-Lolodorf areas), Cam = endemic to Cameroon, Lg = Lower Guinea endemic plant species.

Chapter 5

BIODIVERSITY HOTSPOTS AND CONSERVATION PRIORITIES IN CENTRAL AFRICAN RAIN FORESTS

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5.1. INTRODUCTION

Until recently, patterns of species richness and endemism were based on an intuitive interpretation of distribution maps with very limited numerical analyses (White, 1979 & 1983). Such maps based solely on taxonomic collections tend to concentrate on collecting efforts more than biodiversity hotspots, since often the highest diversity is found in well-collected areas (ter Steege, 2000; Linder, 2001). During the last decades, there has been an overwhelming concern about the loss of tropical forest biological diversity, and an emphasis on the identification of biodiversity hotspots in an attempt to optimise conservation strategies (Beentje, 1996). Furthermore, the concept of sites of high diversity, or hotspots, has attracted the attention of conservationists as a tool for conservation priority settings (Davis *et al.*, 1994; Heywood & Watson, 1995; Stork *et al.*, 1997). With the development of GIS tools, geostatistics, phytosociological and multivariate analysis software packages, more rigorous numerical analyses of distributional and inventory data can be used for assessing conservation priorities.

Central African rain forests are among the top conservation priority areas in the world (Davis *et al.*, 1994; Heywood & Watson, 1995; Myers *et al.*, 2000). Taking into consideration the rich and diverse flora of the Campo-Ma'an rain forest, as well as its high level of endemism, it has been identified as one of the key conservation sites in Cameroon (Gartlan, 1989). The Campo-Ma'an area is a Technical Operational Unit (TOU) that comprises a National Park, five forest management units, two agro-industrial plantations, and a multi-uses zone (Chapter 1). Despite the low population density, there are many stakeholders and different types of land use. Activities such as logging and industrial and shifting agriculture exsert varying ecological impact on the forest ecosystem. This has led to deforestation, habitat fragmentation and alteration of the coastal forests. With the increasing destruction of natural ecosystems, it is important to identify biodiversity hotspots and conservation priorities in order to enable an effective management. To achieve this, we need to study the species composition and species distribution, so that we can target conservation resources and efforts to rich and diverse areas with a high number of endemic species. Endemism is commonly regarded as an important criterion for assessing the conservation value of a given area. In this Chapter, forest inventory data and taxonomic collections will be used to examine the distribution and convergence patterns of strict and narrow endemic species. We will use new quantitative conservation indices such as GHI (Genetic Heat Index) and Pioneer Index (PI) to analyse trends in endemic and rare species in the various forest types. Finally, geostatistic analysis and techniques will help to evaluate and identify potential areas of high conservation priority.

5.2. METHODS

Botanical assessment
Sampling was carried out in small plots of 0.1 ha in representative and homogeneous vegetation types (Chapter 1). In total 147 plots covering 14.7 ha were established and in each 0.1 ha plot, all trees, shrubs, herbs and lianas with DBH $\geq$ 1 cm were measured, recorded and identified. Furthermore, in each representative vegetation type, a provisional plant species checklist was made in the field with information on their growth form, guild and frequency. For unknown species, a voucher specimen

was collected. The study also involved the collection of fertile specimens encountered in plots, vegetation types and specific habitats such as exposed rocks and riverbanks.

Criteria for taxa inclusion

A plant species checklist was generated from the inventory data, from the plant collections made during the study, and from specimens previously collected in the area by other scientists, stored in the Cameroon and Wageningen herbaria. Furthermore, a taxonomic search of potential taxa of high conservation priority such as endemic, rare, new and threatened species was carried using existing floras and monographs (Keay & Hepper, 1954-1972; Aubréville & Leroy, 1961-1992; Aubréville & Leroy, 1963-2000; Lebrun & Stork, 2003; Satabié & Leroy, 1980-1985; Satabié & Morat, 1986-2001), the IUCN (2002) red list categories, and the WCMC (1998) world list of threatened trees. On the basis of this information, a list of 141 species of high conservation values was produced with information on their habit, guild, star category (Table 5.1) and chorology. In this list, priority was given to taxa that are strictly endemic to the Campo-Ma'an area. Followed by species that are endemic to southwestern Cameroon (also occurring in Bipindi and Lolodorf areas) or Cameroon and Lower Guinea endemics (especially if they reach their northern or southern limit of distribution in Campo-Ma'an).

Taking into consideration the fact that strict and narrow endemic species are highly vulnerable to human disturbance and other forms of environmental changes, they are often indicators of rich biodiversity, and their distribution is frequently used for the identification of biodiversity hotspots (Myers, 1988; Williams, 1993; Heywood & Watson, 1995). Based on their spatial distribution, endemic plant species may include broad endemics which have a large range of distribution such as Lower Guinea (Lg), Upper Guinea (Ug), Guinea (Gu = Lg + Ug) and Guineo-Congolian (Gc) endemics as defined by White (1979). Narrow endemics are restricted to a political area (e.g. endemic to Cameroon) or site (e.g. endemic to Campo-Ma'an area). Furthermore, species that reach their northern or southern limit of distribution in the Campo-Ma'an area were also included in the list.

Star rating of species and measurement of forest conservation value

A star rating system, based on the work of Hawthorne and Abu-Juam (1995) and Hawthorne (1996) in Ghana, Cable & Cheek (1998) and Tchouto *et al.* (1998) in Cameroon, was used to define the conservation status of each species recorded (Table 5.1). The factors considered when categorising species into star categories are their distribution, ecology, local abundance, taxonomy, life history, interaction with ecosystem parameters and economic importance (Hawthorne, 1996). Therefore, species that are endemic, rare, threatened, or likely to represent a scarce genetic resource, are more valuable than others are. Hence, forests richer in such species receive a higher score than others.

The Genetic Heat Index (GHI) concept was developed by Hawthorne (1995 & 1996) to express the conservation value of a given forest, and the Pioneer Index (PI) concept to express the level of disturbance in a given forest. GHI is an attempt to provide a scale, on which to measure the genetic 'temperature' or value of the forest. A plot/forest with an average GHI > 150 will be considered warm or hot. In general, for species with completed monographs, black stars occupy about 1-3 filled degree squares on a standard distribution map, gold stars 4-14, blue stars 15-30, and green star more than 30 degree squares.

Hawthorne (1996) defined the guild as a flexible concept used to circumscribe a group of plant species with a similar ecology and way of life. All the species were grouped into guild classes as defined in Table 5.2 and a PI score was calculated as an expression of the relative contribution contribution of pioneers. Five classes of human disturbance were used to evaluate the forest quality and condition as defined in Table 5.3. These classes were mainly based on the field observation of the level of human disturbance and the state of forest degradation.

The GHI and PI values of each sample were calculated using the TREMA database as follows:

$$GHI = \frac{(BK \times BK\ weight) + (GD \times GD\ weight) + (BU \times BU\ weight) + (RD \times RD\ weight)}{BK + GD + BU + GN + RD} \times 100$$

Where: GHI = Genetic Heat Index; BK = number of black star species; GD = number of gold star species; BU = number of blue star species; GN = number of green star species; and RD = number of red, scarlet and pink star species.

$$\text{Pioneer Index (PI)} = \frac{(Pioneer \times PI\ weight) + (NP \times NP\ weight)}{\text{Total number of species}} \times 100$$

Where: PI = number of pioneer species and NP = number of non-pioneer light demanding species.

Geostatistical analysis

Conservation indices such GHI and PI are likely to vary throughout a region. Geostatistics (Isaaks & Srivastava, 1989; Webster & Oliver, 2001) were applied to quantify the spatial distribution of GHI within the Campo-Ma'an forest. Geographic analyses were done using ILWIS software (ILWIS, 2001) and GSTAT package (Pebesma & Wesseling, 1998) of R software (R Development Core Team, 2002). The semivariance was calculated for GHI data on a minimum lag distance of 1250 m and each lag distance class contained at least 105 pairs of points. The semivariogram parameters (nugget, sill and range) were computed using the GSTAT fit variogram function. During the study of GHI spatial variability, the main objective was to obtain a map from point observations. Since this also required the estimation of a value at un-visited locations, the technique commonly used is known as kriging (Isaaks & Srivastava, 1989). The semivariogram function was then used to extrapolate the GHI values in the Campo-Ma'an forest at 100 m x 100 m grid, using Ordinary Kriging. The output map was reclassified into five classes of conservation value (Hawthorne, 1996).

Table 5.1 Star categories and GHI weight classes as defined for Cameroon. Adapted from Hawthorne and Abu-Juam (1995), Hawthorne (1996) and Tchouto *et al.* (1998).

Star category	Weight for GHI	Comment
Black (BK)	27	Species which are only found in the Campo-Ma'an area (strictly endemic) or near endemics (species which also occur in some localities around Campo-Ma'an such as Bipindi, Edea-Kribi, Lolodorf or southern part of Cameroon). Urgent attention to conservation of population is needed.
Gold (GD)	9	Cameroon endemics, rare and threatened Lower Guinea endemics. Cameroon has definitely responsibility for preserving these species.
Blue (BU)	3	Lower Guinea and Guineo-Congolian endemics which are widespread internationally but rare in Cameroon, or *vice versa*.
Scarlet (SC)	1	Common but under serious pressure from heavy exploitation. Exploitation needs to be curtailed if usage is to be sustainable. Protection of all scales vital.
Red (RD)	1	Common but under pressure from exploitation
Pink (PK)	1	Common and moderately exploited
Green (GN)	-	Widespread Guineo-Congolian, pantropical and tropical African species that are not under pressure. No particular conservation concern.

Table 5.2 Guild and weight classes. Adapted from Hawthorne and Abu-Juam (1995), Hawthorne (1996) and Cable & Cheek (1998)

Guild	Weight for PI	Comment
Pioneer (PI)	2	Regenerating only in forest gaps and therefore indicating disturbed forest (e.g. *Ceiba , Musanga, Harungana, Macaranga*)
Non-Pioneer light demanding (NP)	1	Although some juveniles are also found in the understorey of undisturbed forest, they require gaps to develop to full maturity. Generally, non-pioneer light demanding are abundant in matured disturbed forest (e.g. *Albizia, Entandrophragma, Piptadeniastrum, Pycnanthus*)
Shade-bearers (SB)	-	Understorey herbs, shrubs and trees which grow, flower and fruit in undisturbed forest (e.g. *Cola, Diospyros, Psychotria, Rinorea*)

Table 5.3 Forest condition classes showing the degree of human disturbance on the natural forest cover.

Forest condition	Classes	Comment
Excellent	Virtually undisturbed	Virtually Undisturbed forest, with good canopy and few signs of human disturbance except for hunting and NTFPs collection.
Good	Less than 25% disturbed	Small patches of recent disturbance (<25%) with good canopy cover.
Slightly degraded	25-50% disturbed	Obviously disturbed with significant patches (25-50%) of recent degradation but with good predominant forest and broken upper canopy.
Mostly degraded	More than 50% disturbed	Considerable area (>50%) of recent degradation. Patchy with heavily disrupted canopy.
Very poor	Farm land	No significant forest left (<2% good forest). Massive land conversion for plantation or farm.

5.3. RESULTS

Species richness and endemism

A plant species checklist (Annex 3) made of 2297 species of vascular plants, ferns and fern allies was generated from inventory data and from 2348 herbarium specimens and 4789 ecological specimens collected in the various plots. They belonged to 851 genera and 155 families. More than 67% of the specimens were identified at species level, 28% at generic level, 4% at family level and 1% remained unidentified. The 20 most important families and genera are shown in Tables 5.4 and 5.5. In terms of growth form, tree species contributed for 26% to the total number of 2297 species recorded, followed by herbs (24%), shrubs (23%) and climbers (17%) respectively. About 72% of the total number of species recorded was also found in the Campo-Ma'an National Park.

In addition to a list of 92 threatened species (Table 5.7) recorded in IUCN (2002) and WCMC (1998), a list with 141 plant species of high conservation priorities was produced, with information on their growth forms, guild, chorology and star categories (Table 5.6). Only species that are endemic to Cameroon and species that reach their northern or southern limit of distribution are included in this list. The Campo-Ma'an area has about 114 endemic species, 29 of which are only known from the area, 29 only occur in the southwestern part of Cameroon, and 56 near endemics that also occur in other parts of Cameroon (Table 5.6 & Figure 5.1).

Table 5.4 Most important families recorded in the Campo-Ma'an area.

No	Family	No of species	Predominant growth forms
1	Rubiaceae	279	Trees, shrubs, herbs and climbers
2	Euphorbiaceae	117	Trees, shrubs, herbs and climbers
3	Leguminosae-Caesalpinioideae	96	Trees and shrubs
4	Apocynaceae	80	Trees, shrubs, herbs and climbers
5	Annonaceae	69	Trees, shrubs and climbers
6	Acanthaceae	68	Herbs
7	Leguminosae-Papilionoideae	65	Trees, herbs and climbers
8	Sterculiaceae	62	Shrubs and trees
9	Gramineae	54	Herbs
10	Orchidaceae	54	Terrestrial and epiphytic herbs
11	Melastomataceae	46	Shrubs and herbs
12	Moraceae	40	Trees, shrubs and herbs
13	Celastraceae	39	Climbers
14	Cyperaceae	39	Herbs
15	Dichapetalaceae	39	Climbers
16	Sapindaceae	36	Trees and shrubs
17	Araceae	34	Herbs and hemi-epiphytes
18	Loganiaceae	33	Shrubs and climbers
19	Sapotaceae	30	Trees and shrubs
20	Begoniaceae	29	Terrestrial and epiphytic herbs
	Others (135 families)	988	Trees, shrubs, climbers and herbs

Table 5.5 Most important genera recorded in the Campo-Ma'an area.

No	Genus	No of species	Predominant growth forms
1	*Dichapetalum* (Dichapetalaceae)	37	Climbers
2	*Psychotria* (Rubiaceae)	35	Shrubs
3	*Cola* (Sterculiaceae)	32	Trees and shrubs
4	*Begonia* (Begoniaceae)	29	Terrestrial and epiphytic herbs
5	*Diospyros* (Ebenaceae)	27	Trees and shrubs
6	*Salacia* (Celastraceae)	27	Climbers
7	*Strychnos* (Loganiaceae)	24	Climbers
8	*Rinorea* (Violaceae)	23	Trees and shrubs
9	*Drypetes* (Euphorbiaceae)	21	Trees and shrubs
10	*Combretum* (Combretaceae)	18	Climbers
11	*Dorstenia* (Moraceae)	18	Herbs
12	*Campylospermum* (Ochnaceae)	17	Shrubs
13	*Bulbophyllum* (Orchidaceae)	16	Terrestrial and epiphytic herbs
14	*Ficus* (Moraceae)	16	Trees and stranglers
15	*Garcinia* (Guttiferae)	16	Trees and shrubs
16	*Asplenium* (Aspleniaceae)	15	Epiphytic herbs
17	*Culcasia* (Araceae)	15	Herbs and hemi-epiphytes
18	*Landolphia* (Apocynaceae)	15	Climbers
19	*Tricalysia* (Rubiaceae)	15	Trees and shrubs
20	*Bertiera* (Rubiaceae)	14	Shrubs
	Others (831 genera)	1867	Trees, shrubs, climbers and herbs

Shrubs contributed for 38% of the 114 endemic species (Table 5.6), herbs (29%), trees (20%) and climbers (11%). Moreover, 540 species (23% of the total number of species) recorded are endemic to the Lower Guinea Centre of Endemism, 1123 species (49%) are Guineo-Congolian endemics and 105 species (5%) are Guinea endemics as described by White (1979). Overall, there was a high concentration of strict and narrow endemic species in the lowland evergreen forest rich in Caesalpinioideae, coastal and submontane forests located in the western and northern parts of Ma'an and a relatively low concentration of these species in Ma'an area (Figure 5.1). Although more than 70% of the total endemic species recorded were also found in the National Park, 17 of the 29 strict endemic species were not recorded in the park (Table 5.6). The distribution patterns of these 17 taxa showed a high concentration of species around Campo, Lobe, Massif des Mamelles, Mont d'Eléphant and Zingui and a very poor representation in the Ma'an area (Figure 5.2).

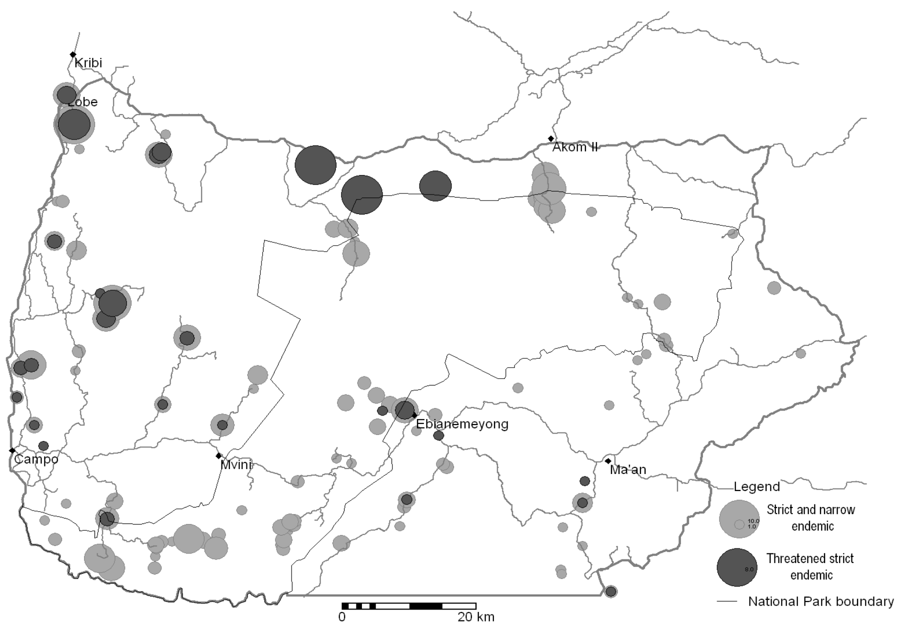

Figure 5.1Distribution of 114 strict and narrow endemic plant species recorded in the Campo-Ma'an area (grey circle). Black circle represents the distribution of threatened strict endemics that are not found in the National Park. The size of the circle represents the relative density of endemics at a given point.

Genetic Heat Index and measurement of forest conservation value

More than 57% of the plots have a high Genetic Heat Index (GHI) score with the highest score recorded in the submontane forest (GHI = 294.4) and the lowest score in mangrove (GHI = 3.1). As shown in Figure 5.3, the submontane forest had the highest average GHI score of 214.7, followed by the lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis* (GHI = 194.1). The mangrove and the coastal forest on sandy shorelines had the lowest average GHI score (GHI = 3 and 120.2 respectively). The average pioneer index (PI) was very high in the mangrove forest (PI = 125), coastal forest on sandy shorelines (PI = 66.9) and in the forest rich in *Aucoumea klaineana* (PI = 60). Generally, there was a significant decrease in average GHI with increasing average PI (Figure 5.3). As shown in Figure 5.4, there was a very strong significant negative correlation between the average GHI scores and the PI scores recorded in the various vegetation types ($F_{1\text{-}10} = 111.71$, $R^2 = 0.918$, $P < 0.0001$). However, the correlation was rather weak with a low explanatory factor when the analysis was carried out using all plots as individual data points ($F_{1\text{-}145} = 94.00$, $R^2 = 0.393$, $P < 0.0001$). Most of the forest types within the National Park were virtually undisturbed or less than 25% disturbed (Figure 5.5). The coastal forest between Campo and Kribi, as well as the forests around Massif des Mamelles, Mont d'Elephant, agro-industrial plantations, logging concessions and settlements were much more affected by human activities (Figure 5.5). These forests were often more than 25% disturbed and were characterised by a high PI scores (Figures 5.3 & 5.5).

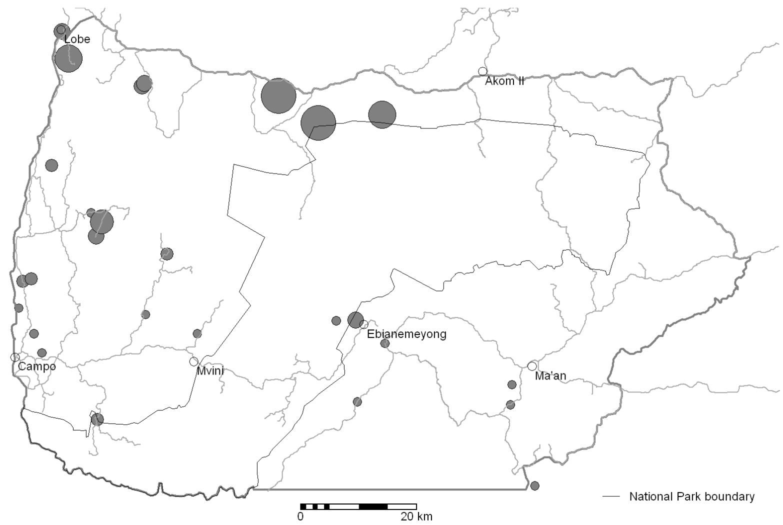

Figure 5.2 Distribution of 17 strict endemic plant species that are not found in the National Park. The size of the circle represents the relative density of endemics at a given point.

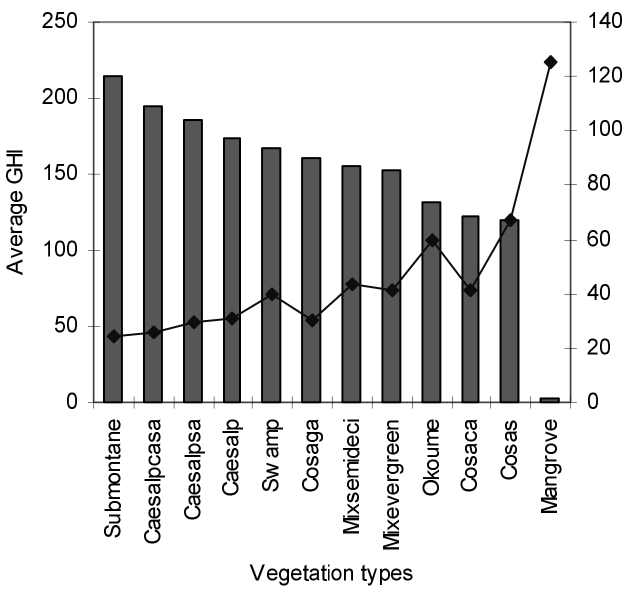

Figure 5.3 The average Genetic Heat Index (GHI = bars) and average Pioneer Index (PI = line) for the various vegetation types. Submontane: Submontane forest; Caesalpcasa: Lowland evergreen forest rich in Caesalpinioideae, *Calpocalyx heitzii* and *Sacoglottis gabonensis*; Caesalpsa: Lowland evergreen forest rich in Caesalpinioideae and *Sacoglottis gabonensis*; Caesalp: Lowland evergreen forest rich in Caesalpinioideae; Cosaga: Coastal forest with *Sacoglottis gabonensis*; Mixsemideci: Mixed evergreen and semi-deciduous forest with semi-deciduous elements predominant; Mixevergreen: Mixed evergreen and semi-deciduous forest with elements of evergreen forest predominant; Okoumé: forest rich in *Aucoumea klaineana*; Cosaca: Coastal forest with *Sacoglottis gabonensis* and *Calpocalyx heitzii*; and Cosas: Coastal forest on sandy shorelines.

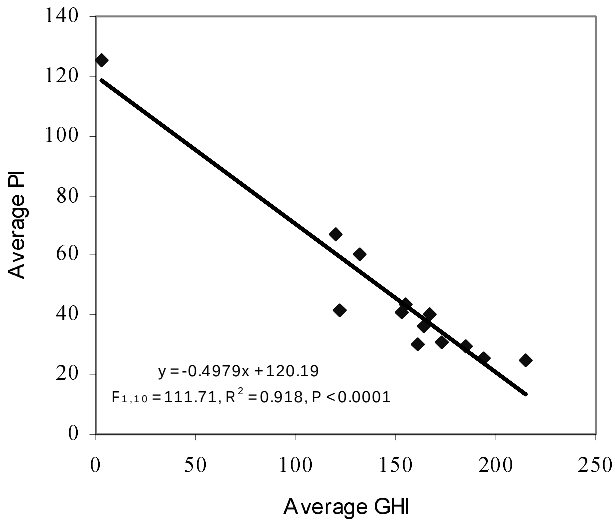

Figure 5.4 Correlation between the average GHI scores and the average PI scores for the various vegetation types.

Geostatistical results

The analysis of the spatial structure of the dataset did not show any preferential spatial trend. Therefore, an omni-directional analysis of the semivariance (best described by a spherical model) was applied. Figure 5.6 shows the semivariogram and its characteristics. The GHI variable showed a strong spatial dependence within a range of 10500 m. The nugget (645) was low compared to the total variance or sill (3700). This suggests that more than 82% (100*(Sill-Nugget)/Sill) of the semivariance of GHI could be modelled by the variogram over a range of 10 km. The output map of the ordinary kriging (Figure 5.7) was reclassified into five GHI classes, partitioning the conservation value of the Campo-Ma'an forest. This partition showed that 1% of the area was characterised by a very high conservation value, 45% by a high conservation value, 30% by an average conservation value, 15 % by a low conservation value and 9% by a very low conservation value. A considerable portion of the National Park and the forests around Massif des Mamelles and Mont d'Eléphant was characterised by a high conservation value, with highest values found in Dipikar Island, Massif des Mamelles, Mont d'Elephant and in the submontane forest on hilltops. The forests in the Ma'an area, around Campo and agro-industrial plantations, near villages and along the roads had a low conservation value. Similar patterns were observed for the distribution of strict and narrow endemic species (Figure 5.1).

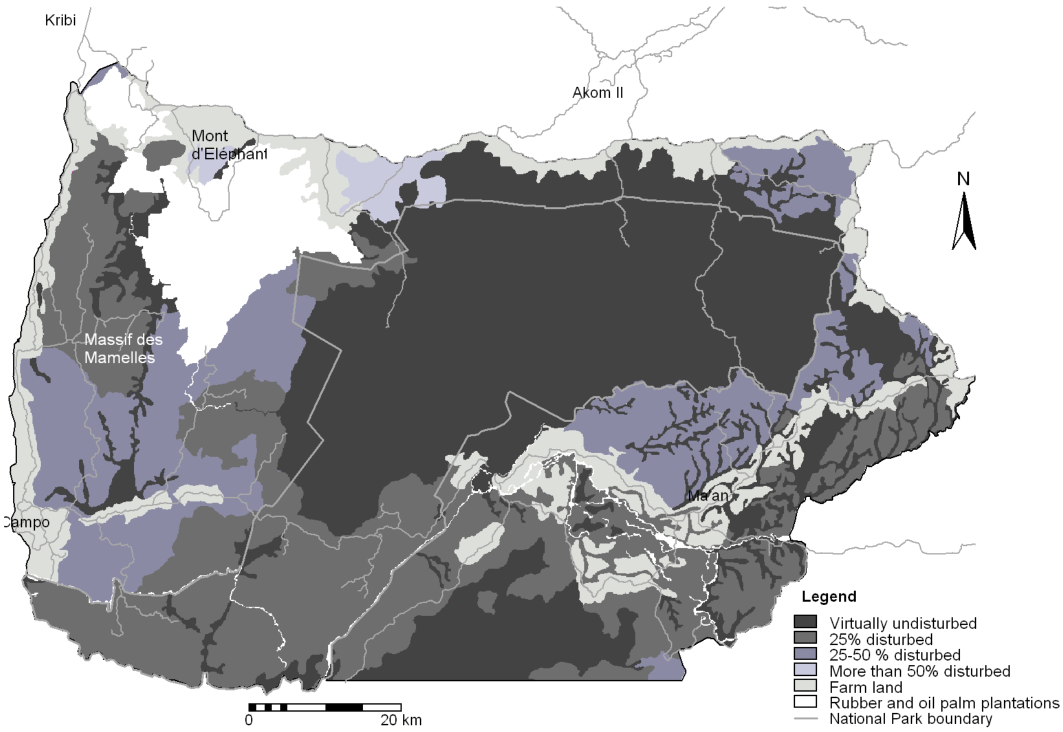

Figure 5.5 Impact of human disturbance on the Campo-Ma'an rain forest.

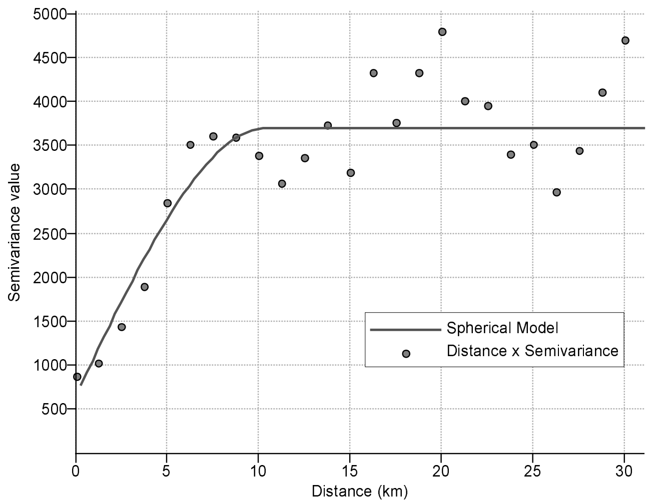

Figure 5.6 Spherical variogram model for GHI in the Campo-Ma'an rain forest (estimated from 147 points of 0.1 ha each).

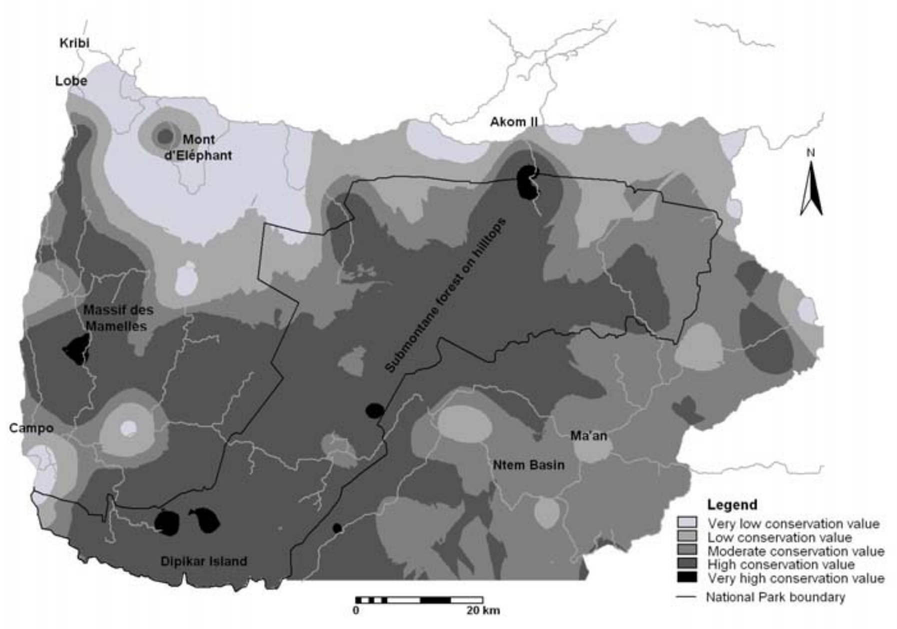

Figure 5.7 Ordinary kriging map showing the distribution of GHI scores and conservation hotspots within the Campo-Ma'an rain forest. The following GHI values are defined for the various conservation classes (Hawthorne, 1996): Very high conservation value for GHI > 200; High conservation value (150 ≤ GHI < 200); Moderate conservation value (100 ≤ GHI < 150); Low conservation value (50 ≤ GHI < 100) and very low conservation value (GHI < 50).

5.4. DISCUSSION

Species richness and endemism

The Campo-Ma'an area is characterised by a rich and diverse flora with more than 2297 species of vascular plants, ferns and fern allies (Annex 3). The site has about 114 endemic plant species, 29 of which are restricted to the area, 29 also occur in the southwestern part of Cameroon (Kribi-Akom II-Bipindi and Lolodorf areas) and 56 others that also occur in other parts of Cameroon. Furthermore, 540 species recorded are Lower Guinea endemics, 1123 species are Guineo-Congolian endemics and 105 species are Guinea endemics. Most diverse genera were understorey small trees, shrubs and herbs. The number of endemic plant species is relatively high considering the size of the area, and more than 75% of the current forest cover was characterised either by very high, high or average GHI values (Figure 5.7). Furthermore, the distribution patterns of strict and narrow endemic species showed a high concentation of these species in the submontane forest between Ebianemeyong and Akom II, in Dipikar Island, and in the forests around Massif des Mamelles, Lobe, Mont d'Eléphant and Zingui. Surprisingly, the mixed evergreen and semi-deciduous forest in the Ma'an area showed a relatively low concentration of these species (Figure 5.1). One of the explanations for the high occurrence of endemics might stem partly from the fact that the area falls within a series of postulated rain forest refugia in Central

Africa (Hamilton, 1982; White, 1983; Maley, 1987, 1989 & 1990; Sosef, 1994 & 1996). In such refugia, the unique combination of climatic and geological histories, contemporary ecological factors, and inherent biological properties of taxa and their combinations, may have contributed to survival and/or speciation (Barbault & Sastrapradja, 1995; Hawksworth & Kalin-Arroyo, 1995). Furthermore, the Campo-Ma'an area forms part of the Guineo-Congolian Regional Centre of Endemism (White, 1983). All families endemic to this biogeographic region are found in the area (White, 1983). They include Hoplestigmataceae, Huaceae, Lepidobotryaceae, Medusandraceae, Pandaceae, Pentadiplandraceae and Scytopetalaceae. Moreover, 82% of endemic genera cited by White (1983) also occur in the area. They are *Afrobrunnichia, Amphimas, Anthonotha, Aneulophus, Antrocaryon, Aphanocalyx, Aubrevillea, Aucoumea, Anopyxis, Baillonella, Brenania, Buchholzia, Calpocalyx, Coelocaryon, Coula, Crotonogyne, Cylicodiscus, Desbordesia, Didelotia, Discoglypremna, Distemonanthus, Duboscia, Endodesmia, Erismadelphus, Grossera, Heckeldora, Hylodendron, Hymenostegia, Hypodaphnis, Gilbertiodendron, Gossweilerodendron, Loesenera, Monopetalanthus (*now synonym of *Bikinia), Ophiobotrys, Pachyelasma, Poga, Tessmannia, Tetraberlinia, Turraeanthus* and *Tieghemella*.

Forest richness and biodiversity hotspots

The study has demonstrated that the submontane forest, the lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis*, and the lowland evergreen forest rich in Caesalpinioideae are richer in species of high conservation priorities compared to the other forest types. This is confirmed by the high average GHI scores recorded in these forest types (Figure 5.3). More than 57% of the plots recorded have a high average GHI score (GHI > 150). However, the coastal forest on sandy shorelines and forest rich in *Aucoumea klaineana* had lower GHI scores than others. There was a strong significant negative correlation between the average GHI scores and the average PI scores recorded in the various vegetation types. Most of the National Park and the coastal forests around Massif des Mamelles and Mont d'Eléphant was characterised by a high conservation value with small patches of forest with very high conservation value located in the submontane forest on hilltops, in Dipikar Island, on Massif des Mamelles, and Mont d'Elephant. More often, these forests were virtually undisturbed or less than 25% disturbed (Figure 5.5). This implies that the Massif des Mamelles and the Mont d'Elephant areas represent other biodiversity hotspots, located outside of the Park (Figure 5.7). In the contrary, the forests around Campo, agro-industrial plantations, logging concessions, near villages and along the roads had a low conservation value with low GHI scores, high PI scores and high levels of disturbance. This confirmed that disturbed forests are rich in pioneer species but poor in plant species with high conservation priority. It is worth reiterating that a considerable portion of the Campo-Ma'an area has been selectively logged at least twice during the past 30 years. Although logging damages were moderate and had low effect on the total forest biodiversity, it has created forest gaps that allowed the development of many pioneer species. This might have contributed to the high average PI scores registered in the coastal forest types.

Threatened species

During the selection of species of high conservation priority, taxa were chosen on a global rather than a Cameroonian or a Campo-Ma'an perspective of conservation importance, since we feel that the plants of Campo-Ma'an are of global importance. In total, 141 species of high conservation priority and 92 threatened species listed in the IUCN (2002) and WCMC (1998) were identified for the Campo-Ma'an area (Tables 5.6 & 5.7). Of the 29 strict endemic species that are only known from the Campo-Ma'an area, 17 were not recorded in the National Park illustrating the need for conservation activities outside the park. Their distribution patterns showed a high concentration of species around Campo, Lobe, Massif des Mamelles, Mont d'Eléphant and Zingui and a very poor representation in the Ma'an area (Figure 5.2). Although these 17 strict endemics are not immediately threatened with extinction, the most threatened are probably those occurring in the coastal zone and in areas located at the vicinity of large agro-industrial plantations, since these areas are heavily exploited. As shown in Figure 5.5, their habitats are fragmented and degraded because these areas are surrounded by farms and heavily disturbed forests.

Taking into consideration the fact that extinct species are taxa that are no longer known to exist in the world after repeated search in their type localities (WCMC, 1998; IUCN, 2002), we can not yet talk about extinction because no attempt has been made to search for these species. Furthermore, only 67% of the total amount of specimens collected were identified at species level. However, with the ongoing speed of forest degradation noticed in the coastal area, 8 of these strict endemics (*Beilschmiedia dinklagei*, *Deinbollia macroura*, *Ledermanniella batangensis, Psychotria aemulans*, *P. batangana*, *P. dimorphophylla*, *P. oligocarpa*, and *Strychnos canthioides*) that are only known from the coastal zone can be categorised as endangered species. While the 9 others that are located inland around Efoulan, Fenda, Massif des Mamelles, Mont d'Eléphant and Zingui can be categorised as vulnerable. They are *Afrotrewia kamerunica, Bulbophyllum alinae*, *Begonia montis-elephantis*, *Calvoa stenophylla, Dorstenia dorstenioides*, *Guaduella mildbraedii*, *Hypolytrum sp. nov*., *Scaphopetalum acuminatum* and *S. brunneo-purpureum*. Some of them so far are only known from type specimens or from a few collections made in the type locality before the 60s. Others such as *Afrotrewia kamerunica, Begonia montis-elephantis* and *Hypolytrum sp. nov*. have a restricted range with a small and restricted population. Furthermore, habitat fragmentation may convert a previously more continuous population structure to a metapopulation structure, with local populations becoming so small that they may have a substantial risk of extinction (Hawksworth & Kalin-Arroyo, 1995).

Implications for biodiversity conservation

The Campo-Ma'an National Park

The National Park is the core conservation area of the Campo-Ma'an Technical Operational Unit. It is surrounded by areas under several land uses that have varying ecological impact on the park and the surrounding forests. The park is of high conservation priority with about 72% of the 2297 species of vascular plants, ferns and fern allies recorded so far in the Campo-Ma'an area. More than 70% of the total endemic species recorded were also found in the National Park, and most of the forest types with high GHI scores, low PI scores and high conservation priority species were also found in the park (Figures 5.3 & 5.7). The most important one is the endemic lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis,* a vegetation type that only occurs in the Campo area

(Letouzey, 1985; Gartlan, 1989; Thomas & Thomas, 1993). Other forest types such as the submontane forest on hilltops, the lowland evergreen forest rich in Caesalpinioideae and the mixed evergreen and semi-deciduous forests are also well represented. So far the National Park is the only area with a legal conservation status. It is a permanent state forest that is protected by law and solely used for forest and wildlife conservation. However, its boundaries have not been marked, the management plan has not yet been produced and protection is weak. Therefore, it is of urgent need to demarcate the boundary of the park, reinforce its protection, complete and implement its management plan as soon as possible.

Massif des Mamelles and Mont d'Eléphant

This study has demonstrated that other hotspots for biodiversity conservation, such as Mont d'Eléphant and Massif des Mamelles, are located outside the National Park (Figure 5.7). These areas are non-permanent forest estates that can be allocated for human activities such as logging, agro-industry, agriculture, agro-forestry, community forest, communal forest or private forest. Moreover, hunting, fishing, mineral exploitation or any other form of economic activities is allowed if done in accordance to the 1994 forest law. Unfortunately, these areas do not have any conservation status and a number of ongoing human activities have negative impacts on the forest ecosystem (Chapter 1). In addition to the construction of the Tchad-Cameroon oil pipeline terminal at Grand Batanga and the rock exploitation on Mont d'Eléphant, there exists a plan to exploit the iron ore deposits of the Massif des Mamelles. All these activities, if realized, would affect the vegetation and thus impact the biodiversity. As shown in Figure 5.5, these fragmented forest patches with high conservation priorities are more exposed to forest degradation and habitat loss since they are surrounded by disturbed and degraded forests. Furthermore, they are the type localities for some rare endemic species such as *Afrotrewia kamerunica*, *Begonia montis-elephantis* and *Bulbophyllum alinae* that are so far only known from the type specimens or from few collections made in these areas. Pressure on these fragmented hotspots will increase in the future with the growing human population density, the few local employment opportunities and the poverty of the local people, for whom the forest is a major resource. In order to ensure the protection of these areas, it is suggested that local community be encouraged to create community forests with several management zones. Each community forest should have the identified biodiversity hotspot as the core conservation area, surrounded by a buffer zone stimulating the sustainable management of non-timber forest products and hunting practices.

The coastal zone, Ntem basin, Lobe and Memve'ele waterfalls

The coastal zone is a narrow strip (65 km long) along the Atlantic Ocean from the Lobe waterfalls to the Ntem estuary in the Dipikar Island that extends about 2-3 km inland. It has suffered and continues to suffer from intense human pressure that has led to the destruction of most of its natural vegetation (Figure 5.5). However, it worth mentioning that some rare endemic species such as *Deinbollia macroura*, *Psychotria batangana*, *P. dimorphophylla*, *P. oligocarpa*, and *Strychnos canthioides* are so far only known from this zone. Furthermore, there is an impressive network of rivers and streams in the Campo-Ma'an area that presents a number of very specialized riparian habitats. Our study confirmed that the Lobe, Bongola, Memve'ele waterfalls and Ntem basin (Boucle du Ntem) support a rich riparian flora with many endemic and rare rheophyte species (Cusset, 1987; Thomas & Thomas, 1993). Most of the endemic rheophytes are of the genus *Ledermanniella* in the Podostemaceae family. These rheophytes which are found on exposed rocks in streambeds, are seasonally submerged by fast-flowing water, and normally reproduce in drier periods when the water level recedes. The Ntem basin is also reported to constitute an important refuge for wildlife and fish fauna because of the presence of many rare species of freshwater fishes (Vivien, 1991; Matthews & Matthews, 2000; Djama, 2001). Therefore, it is suggested a separate management strategy be developed in order to protect these coastal and riparian habitats.

5.5. CONCLUSION

The Campo-Ma'an area is characterised by a rich and diverse flora with more than 2297 species of vascular plants, ferns and fern allies belonging to 851 genera and 155 families. The site has about 114 endemic plant species, 29 of that are restricted to the area, 29 also occur in the southwestern part of Cameroon and 56 others that also occur in other parts of Cameroon. Furthermore, 540 species recorded are Lower Guinea endemics, 1123 species are Guineo-Congolian endemics and 105 species are Guinea endemics. All endemic families of the Guineo-Congolian Regional Centre of Endemism and 82% of endemic genera cited by White (1983) are also found in the Campo-Ma'an area. The study has demonstrated that the submontane forest, the lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis*, and the lowland evergreen forest rich in Caesalpinioideae showed a high conservation value with high GHI scores, high concentration of endemic species, low PI scores and low level of disturbance. Most of the forest types with plant species of high concentration of strict and narrow endemic species appeared to occur in the Campo-Ma'an National Park. The most important one is the endemic lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis* a vegetation type that only occurs in the Campo area.

Moreover, the study also demonstrated that there are other biodiversity hotspots in the coastal zone and areas such as Mont d'Eléphant and Massif des Mamelles that are located outside the National Park. These areas support 17 strict endemic species that are not found in the park. Unfortunately, these strict endemics are the most threatened since their habitats are fragmented and degraded as a result of past and present land conversion to subsistence and industrial plantations. Furthermore, these hotspots are the type localities for some rare endemic species that are so far only known from type specimens or from few collections made in these areas. Contrary to the National Park, these hotspots do not yet have any conservation status *per se.* However, although the park is a permanent state forest which is protected by law and should be solely used for forest and wildlife conservation, its boundaries have not been marked, the management plan has not yet been produced and protection is weak. It is, therefore of urgent need to demarcate its boundary, reinforce its protection, and complete and implement its management plan as soon as possible. Furthermore, taking into consideration the fact that pressure on these fragmented hotspots would increase in the future with the growing human population density, it is suggested that a separate management strategy be developed to ensure the protection of these biodiversity hotspots and their endemic species.

Table 5.6 List of 141 plant species that are either strictly endemic to the Campo-Ma'an area (only found in Campo-Ma'an) or near endemic (also occur in the western parts of south Cameroon or other parts of Cameroon). Those species that reach their northern or southern limit of distribution in the Campo-Ma'an area are also included in the list.

No	Family	Species	Guild	Star	Habit	Chorology	Notes
1	Acanthaceae	*Stenandrium thomense* (Milne-Redh.) Vollesen	sb	GD	Hb	Cam	Akom II, Dipikar Island, Western and South Cameroon
2	Annonaceae	*Monanthotaxis elegans* (Engl. and Diels) Verdc.	sb	GD	Sh	Sw-Cam	Akom II, Dipikar Island, Massif des Mamelles, Bipindi and Lolodorf
3	Annonaceae	*Monodora zenkeri* Engl. and Diels*	sb	GD	Sh	Cam	Massif des Mamelles, Bipindi and Lolodorf
4	Apocynaceae	*Callichilia monopodialis* (K.Schum.) Stapf*	sb	GD	Sh	Cam	Ma'an, South, Centre and East Cameroon
5	Apocynaceae	*Landolphia flavidiflora* (K.Schum.) Persoon*	np	GD	Lwcl	Cam	Efoulan, Bipindi, Makak and Mt. Cameroon
6	Apocynaceae	*Petchia africana* Leeuwenb.*	sb	BK	Sh	Sw-Cam	Campo, Bipindi and Lolodorf
7	Apocynaceae	*Tabernaemontana hallei* (Boiteau) Leeuwenb.	sb	GD	Sh	Lg	Northern limit of distribution , from Gabon to Akom II, Onoyong and Ma'an
8	Araceae	*Culcasia bosii* Ntepe-Nyame	sb	BK	He	Sw-Cam	Massif des Mamelles, Dipikar Island, Ma'an and Bipindi
9	Araceae	*Culcasia panduriformis* Engl. and Krause	sb	GD	Hb	Cam	Bifa, Zingui, Akom II, Dipikar Island, Bipindi, Mt Cameroon and Eseka
10	Aristolochiaceae	*Pararistolochia preussii* (Engl.) Hutch. And Dalziel	np	GD	Swcl	Cam	Dipikar Island, Ebolowa and Mt. Cameroon
11	Balsaminaceae	*Impatiens hians* Hook.f. var. *bipindensis* (Gilg) Grey-Wilson	sb	bu	Hb	Lg	Northern limit of distribution, from Gabon to Bipindi, Zingui
12	Balsaminaceae	*Impatiens gongolana* N.Hallé	sb	bu	Hb	Lg	Northern limit of distribution, from Gabon to Ebianemeyong
13	Begoniaceae	*Begonia anisosepala* Hook.f.	sb	bu	Hb	Lg	Northern limit of distribution, from Gabon to Bipindi, Zingui and Grand Batanga
14	Begoniaceae	*Begonia clypeifolia* Hook.f.	sb	bu	Hb	Lg	Northern limit of distribution, from Congo, Gabon to Mvini and Efoulan
15	Begoniaceae	*Begonia elaeagnifolia* Hook. f.	ep	bu	Ep	Lg	Northern limit of distribution, from Gabon to Mvini, Efoulan and around Kom River
16	Begoniaceae	*Begonia heterochroma* Sosef	sb	bu	Hb	Lg	Northern limit of distribution, from Gabon to Lolabe and around Kribi
17	Begoniaceae	*Begonia mbangaensis* Sosef	sb	BK	Hb	Sw-Cam	Akom II, Efoulan, Bipindi and Lolodorf
18	Begoniaceae	*Begonia microsperma* Warb.	sb	GD	Hb	Cam	Ebianemeyong, Ma'an, South-west and South Cameroon
19	Begoniaceae	*Begonia montis-elephantis* J.J.de Wilde*	sb	BK	Hb	Campo-Ma'an	Rare species, only known from a small population on Mt d'Eléphant
20	Begoniaceae	*Begonia zenkeriana* Smith and Wassh.	sb	BK	Hb	Sw-Cam	Campo, Massif des Mamelles, Dipikar Island, Bipindi and Lolodorf
21	Burseraceae	*Aucoumea klaineana* Pierre	pi	bu	Tr	Lg	Northern limit of distribution, from Gabon to Ma'an and Ebianemeyong
22	Burseraceae	*Dacryodes buettneri* (Engl.) Lam.	np	bu	Tr	Lg	Northern limit of distribution, from Gabon to Ma'an and Ebianemeyong
23	Capparaceae	*Ritchiea simplicifolia* Oliv. Caloneura (Gilg) Kers	sb	BK	Sh	Cam	Lobe, Campo, Kienke, Dipikar Island, Bipindi, Lolodorf and Ebolowa

No	Family	Species	Guild	Star	Habit	Chorology	Notes
24	Celastraceae	*Pristimera luteoviridis* (Exell) N.Hallé var. *kribiana* N.Hallé	np	BK	Swcl	Campo-Ma'an	Rare species, only known from few collections on Mt d'Eléphant and Dipikar Island
25	Chrysobalanaceae	*Dactyladenia cinera* (Engl. Ex de Wild) Prance and F.White**	sb	BK	Tr	Sw-Cam	Rare species, only known from type specimens (Bipindi) and a record from Grand Batanga
26	Chrysobalanaceae	*Dactyladenia icondere* (Baill.) Prance and F.White	sb	bu	Sh	Lg	Northern limit of distribution, from Congo, Gabon to Grand Batanga , Campo and Dipikar Island
27	Combretaceae	*Combretum cinnabarinum* Engl. and Diels	np	bu	Lwcl	Lg	Northern limit of distribution, from Gabon to Bipindi and Dipikar Island
28	Cyperaceae	*Hypolytrum* sp. nov. ined.*	sb	BK	Hb	Campo-Ma'an	New species only known from Mont d'Eléphant
29	Dichapetalaceae	*Dichapetalum altescandens* Engl. *	np	bu	Lwcl	Lg	Northern limit of distribution, from Gabon to Efoulan and Zingui
30	Dichapetalaceae	*Dichapetalum cymulosum* (Oliv.) Engl.*	np	GD	Lwcl	Cam	Grand Batanga, Campo, Bipindi , Lolodorf and Douala
31	Dichapetalaceae	*Dichapetalum librevillense* Pellegr.*	np	bu	Lwcl	Lg	Northern limit of distribution, from Gabon to Mt d'Eléphant and Campo
32	Dichapetalaceae	*Dichapetalum oliganthum* Breteler *	np	BK	Lwcl	Sw-Cam	Grand Batanga, Campo, Mt d'Eléphant, Kribi, Longi and Lolodorf.
33	Dichapetalaceae	*Tapura tchoutoi* Breteler	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections around Bifa and Dipikar Island
34	Dryopteridaceae	*Lastreopsis davalliaeformis* (Tardieu) Tardieu*	sb	bu	He	Lg	Northern limit of distribution, from Gabon to Bipindi and Zingui
35	Ebenaceae	*Diospyros alboflavescens* (Gürke) F.White	sb	BK	Tr	Sw-Cam	Rare species, only known from few collections from Bifa, Zingui and Bipindi
36	Ebenaceae	*Diospyros soyauxii* Gürke and K. Schum.	Sb	Bu	Tr	Lg	Northern limit of distribution, from Gabon to Campo and Zingui
37	Euphorbiaceae	*Afrotrewia kamerunica* Pax and Hoffm.*	sb	BK	Sh	Campo-Ma'an	Rare species, only known from Massif des Mamelles
38	Gnetaceae	*Gnetum buchholzianum* Engl.	np	GD	Hcl	Cam	Dipikar Island, Onoyong, Ma'an, Littoral, South-west and South provinces of Cameroon
39	Gramineae	*Guaduella mildbraedii* Pilg.*	sb	BK	Hb	Campo-Ma'an	Rare species, only known from few collections in the Campo area
40	Gramineae	*Hyparrhenia wombaliensis* (Vanderyst ex Robyns) Clayton*	pi	bu	Hb	Lg	Northern limit of distribution, from Congo to Campo
41	Guttiferae	*Garcinia conrauana* Engl.	sb	GD	Tr	Cam	Akom II, South-west and South Cameroon
42	Guttiferae	*Garcinia densivenia* Engl.	ri	GD	Tr	Cam	Dipikar Island, Ebianemeyong, Mvini, Littoral and South Cameroon
43	Icacinaceae	*Alsodeiopsis zenkeri* Engl.	rh	GD	Sh	Cam	Frequent along the Bongola and Ntem rivers, and other rivers in Littoral, East and South Cameroon
44	Icacinaceae	*Iodes kamerunensis* Engl.	sb	GD	Swcl	Cam	Akom II, Dipikar Island, Bipindi, Bertoua and Nanga Eboko
45	Icacinaceae	*Rhaphiostylis ovalifolia* Engl. ex Sleumer*	sb	GD	Swcl	Cam	Coastal forest around Kribi, Grand Batanga, Lolabe, Elabi Massif des Mamelles, Littoral and South Cameroon
46	Icacinaceae	*Rhaphiostylis subsessilifolia* Engl.	sb	BK	Swcl	Campo-Ma'an	Rare species, only known from Grand Batanga, Ebianemeyong and Mt d'Eléphant
47	Ixonanthaceae	*Ochthocosmus calothyrsus* (Mildbr.) Hutch. and Dalziel	np	bu	Tr	Lg	Northern limit of distribution, from Gabon to Cameroon (frequent in the Campo-Ma'an area)
48	Lauraceae	*Beilschmiedia cuspida* (Krause) Robyns and Wilczek	sb	BK	Tr	Campo-Ma'an	Rare species, only known from Fenda and Akom II

No	Family	Species	Guild	Star	Habit	Chorology	Notes
49	Lauraceae	*Beilschmiedia dinklagei* (Engl.) Robyns and Wilczek*	sb	BK	Tr	Campo-Ma'an	Rare species, only known from few records around Grand Batanga
50	Lauraceae	*Beilschmiedia klainei* Robyns and Wilczek	sb	BK	Tr	Sw-Cam	Rare species, only known from few records from Akom II, Ebianemeyong and Bipindi
51	Lauraceae	*Beilschmiedia papyracea* (Stapf) Robyns and R.Wilczek	sb	BK	Tr	Sw-Cam	Rare species, only known from Ebianemeyong, Akom II, Fenda and Bipindi
52	Lauraceae	*Beilschmiedia welczekii* Fouilloy	sb	BK	Tr	Sw-Cam	Akom II, Mvini, Nkoelon, Dipikar Island, Ebianemeyong, Ma'an, Bipindi and Lolodorf
53	Leguminosae-Caesalpinioideae	*Amphimas ferrugineus* Pierre ex Pellegr.	np	bu	Tr	Lg	Northern limit of distribution, from Gabon to Dipikar Island, Ma'an, Onoyong and Akom II
54	Leguminosae-Caesalpinioideae	*Anthonotha leptorrhachis* (Harms) J.Léonard	sb	GD	Tr	Cam	Bifa, Campo, Dipikar Island, Lobe, Massif des Mamelles, Mt d'Eléphant, Bipindi, Lolodorf and Mt Cameroon
55	Leguminosae-Caesalpinioideae	*Aphanocalyx hedinii* (A.Chev.) Wieringa	np	GD	Tr	Cam	Akom II, Ebianemeyong, Kom, Ma'an, Bipindi and Eseka
56	Leguminosae-Caesalpinioideae	*Aphanocalyx ledermannii* (Harms) Wieringa	sw	bu	Tr	Lg	Northern limit of distribution, occurs along rivers from Gabon, Equatorial Guinea to the Dipikar Island
57	Leguminosae-Caesalpinioideae	*Copaifera religiosa* J.Léonard	np	bu	Tr	Lg	Northern limit of distribution, from Congo to Akom II and Efoulan
58	Leguminosae-Caesalpinioideae	*Daniellia klainei* A.Chev.	ri	bu	Tr	Lg	Northern limit of distribution, from Congo to Akom II, Eoulan and Ma'an
59	Leguminosae-Caesalpinioideae	*Dialium zenkeri* Harms	sb	BK	Tr	Sw-Cam	Campo, Dipikar Island, Onoyong, Bipindi and Lolodorf
60	Leguminosae-Caesalpinioideae	*Gilbertiodendron pachyanthum* (Harms) J.Léonard	np	BK	Tr	Sw-Cam	Ebianemeyong, Kom, Massif des Mamelles, Bipindi and Lolodorf
61	Leguminosae-Caesalpinioideae	*Plagiosiphon longitubus* (Harms) J.Léonard	sb	BK	Tr	Sw-Cam	Akom II, Efoulan, Ma'an, Bipindi, and Lolodorf
62	Leguminosae-Caesalpinioideae	*Plagiosiphon multijugus* (Harms) J.Léonard	sb	GD	Tr	Cam	Akom II, Dipikar Island, Ma'an, Bipindi and Kribi-Edea areas
63	Leguminosae-Caesalpinioideae	*Tetraberlinia moreliana* Aubrév. *	sb	bu	Tr	Lg	Northern limit of distribution, from Gabon, Bidou and Mt. d'Eléphant
64	Liliaceae	*Chlorophytum petrophyllum* K.Krause	sb	GD	Hb	Cam	Bifa, Dipikar Island, Mvini, Littoral and South Cameroon
65	Loganiaceae	*Mostuea neurocarpa* Gilg	sb	bu	Sh	Lg	Northern limit of distribution, from Gabon to Bifa, Campo and Dipikar Island
66	Loganiaceae	*Strychnos canthioides* Leeuwenb. *	np	BK	Lwcl	Campo-Ma'an	Rare species, only known from few collections around Grand Batanga and Lolabe
67	Loganiaceae	*Strychnos elaeocarpa* Gilg ex Leeuwenb.	ri	GD	Tr	Cam	Akom II, Dipikar Island, Ebianemeyong, Onoyong, Bipindi, Lolodorf, Kribi-Edea and South-west Cameroon
68	Loganiaceae	*Strychnos mimfiensis* Gilg ex Leeuwenb.	np	GD	Lwcl	Cam	Dipikar Island, Mvini, Ma'an, Bipindi, Masok, Douala-Edea-Kribi areas.
69	Loranthaceae	*Tapinanthus preussii* (Engl.) Tiegh.	pa	GD	Pa	Cam	Grand Batanga, Bongola, Bipindi, Eseka, Barombi and along the Lokoundje and Nyong rivers.
70	Marantaceae	*Hypselodelphys zenkeriana* (K.Schum.) Milne-Redh.	pi	GD	Hb	Cam	Ma'an, Onoyong and South Cameroon
71	Melastomataceae	*Amphiblemma letouzeyi* Jacq.-Fél.*	sb	BK	Hb	Sw-Cam	Rare species, only known from few collections recorded on hills around Akom II, Efoulan and Bipindi
72	Melastomataceae	*Calvoa calliantha* Jacq.-Fél.	sb	BK	Hb	Sw-Cam	Rare species, only known from Ebianemeyong, Akom II and Bipindi
73	Melastomataceae	*Calvoa stenophylla* Jacques-Félix*	sb	BK	Hb	Campo-Ma'an	Rare species, only known from type specimens collected in Zingui

No	Family	Species	Guild	Star	Habit	Chorology	Notes
74	Melastomataceae	*Guyonia tenella* Naud.	sb	bu	Hb	Lg	Northern limit of distribution, from Equatorial Guinea to Lobe and Bongola
75	Melastomataceae	*Memecylon arcuato-marginatum* Gilg ex Engl. var. *arcuato-marginatum*	sb	BK	Sh	Cam	Akom II, Dipikar Island, Kom, Mt. d'Eléphant, Kienke, Longi and Kribi-Edea
76	Menispermaceae	*Albertisia glabra* (Diels and Troupin) Forman	sb	BK	Swcl	Sw-Cam	Rare species, only known from Dipikar Island and Bipindi
77	Menispermaceae	*Penianthus camerounensis* A.Dekker	sb	GD	Sh	Cam	Afan, Akom II, Dipikar Island, Ebianemeyong, Mekok, Littoral, South and South-west Cameroon
78	Moraceae	*Dorstenia dorstenioides* (Engl.) Hijman and C.C.Berg*	sb	BK	Hb	Campo-Ma'an	Rare species, only known from few collection around Kienke and Fenda
79	Moraceae	*Dorstenia involuta* M.Hijman	sb	BK	Hb	Campo-Ma'an	Rare species, only known from Dipikar Island and Ma'an
80	Myrsinaceae	*Ardisia dolichocalyx* Taton	sb	GD	Hb	Cam	Bifa, Campo, Dipikar Island, Onoyong, Littoral, South and South-west Cameroon
81	Myrtaceae	*Eugenia kameruniana* Engl.*	sb	BK	Sh	Cam	Rare species, only known from Ebianemeyong, Ma'an, Nyabissan
82	Ochnaceae	*Campylospermum letouzeyi* Farron	sb	GD	Sh	Cam	Dipikar Island and South Cameroon
83	Ochnaceae	*Campylospermum zenkeri* (Engl. ex Tiegh.) Farron	sb	GD	Sh	Cam	Campo, Massif des Mamelles, Kribi-Edea and South Cameroon
84	Ochnaceae	*Testulea gabonensis* Pellegr.	np	bu	Tr	Lg	Northern limit of distribution, from Gabon to Dipikar Island, Ma'an and Onoyong
85	Olacaceae	*Octoknema dinklagei* Engl.	sb	GD	Tr	Cam	Akok, Grand Batanga, Lolabe, South and South-west Cameroon
86	Orchidaceae	*Bulbophyllum alinae* Szlachetko *	ep	BK	Ep	Campo-Ma'an	Rare species, only known from few collections on Mt d'Eléphant
87	Orchidaceae	*Corymborkis minima* P.J.Cribb*	sb	GD	Hb	Cam	Rare species, only known from few collections around Campo, Lolabe and Korup National Park
88	Orchidaceae	*Podandriella batesii* (la Croix) Szlachetko and Olszewski*	sb	BK	Hb	Campo-Ma'an	Rare species, only known from Akom II, Efoulan and Ebianemeyong
89	Orchidaceae	*Polystachya letouzeyana* Szlachetko and Olszewski*	ep	BK	Ep	Campo-Ma'an	Rare species, only known from Efoulan
90	Orchidaceae	*Vanilla africana* Lindley subsp. *cucullata* (Kraenzlin and K. Shum.) Szlachetko and Olszewski *	np	BK	Hcl	Sw-Cam	Campo, Massif des Mamelles, Mt d'Eléphant and Bipindi
91	Podostemaceae	*Ledermanniella annithomae* C. Cusset*	rh	BK	Hb	Campo-Ma'an	Rare species, only known from Memve'ele water falls
92	Podostemaceae	*Ledermanniella batangensis* (Engl.) C. Cusset*	rh	BK	Hb	Campo-Ma'an	Rare species, only known from Lobe water falls
93	Podostemaceae	*Ledermanniella bosii* C.Cusset	rh	BK	Hb	Campo-Ma'an	Rare species, only known from the Ntem Basin, Bongola, Lobe and Memve'ele waterfalls
94	Podostemaceae	*Ledermanniella boumiensis* C. Cusset	rh	bu	Hb	Lg	Northern limit of distribution, from Gabon to the Bongola and Memve'ele water falls
95	Podostemaceae	*Ledermanniella kamerunensis* (Engl.) C. Cusset	rh	BK	Hb	Campo-Ma'an	Rare species, only known from the Bongola water falls in Dipikar Island
96	Podostemaceae	*Ledermanniella linearifolia* Engl.	rh	GD	Hb	Cam	Lobe and Bongola falls in the Campo-Ma'an area, and in the Nkam river in Yabassi
97	Podostemaceae	*Ledermanniella variabilis* (G.Taylor) C.Cusset	rh	GD	Hb	Cam	Bongola and Lobe water falls, and in Mamfe river in South-west Cameroon
98	Rhizophoraceae	*Cassipourea kamerunensis* (Engl.) Alston	sb	GD	Sh	Cam	Akom II, Littoral and South Cameroon

No	Family	Species	Guild	Star	Habit	Chorology	Notes
99	Rhizophoraceae	*Cassipourea zenkeri* (Engl.) Alston	sb	GD	Sh	Cam	Akom II, Bifa, Ebianemeyong, Eboundja, Lobe, Ma'an, Bipindi, Lolodorf and South Cameroon
100	Rubiaceae	*Chazaliella sciadephora* (Hiern) Petit and Verdc. var. *condensata* Verdc.	sb	GD	Sh	Cam	Mvini, Onoyong, Ma'an, Littoral and South Cameroon
101	Rubiaceae	*Ecpoma apocynaceum* K.Schum.	pi	BK	Sh	Sw-Cam	Rare species, only known from Bifa , Zingui and Bipindi
102	Rubiaceae	*Hymenocoleus* glaber Robbr.	sb	GD	Hb	Cam	Akom II, Dipikar Island, Massif des Mamelles, Mvini, Littoral, South and South-west Cameroon
103	Rubiaceae	*Ixora aneimenodesma* K.Schum. subsp. *aneimenodesma*	sb	GD	Sh	Cam	Akom II, Dipikar Island, Bipindi and Lolodorf
104	Rubiaceae	*Ixora synactica* De Block*	sb	BK	Sh	Sw-Cam	Rare species, only known from Efoulan, Zingui and Bipindi
105	Rubiaceae	*Oxyanthus oliganthus* K.Schum.	sb	GD	Sh	Cam	Akom II, Ma'an and South Cameroon
106	Rubiaceae	*Pavetta camerounensis* S.Manning subsp. *camerounensis*	sb	GD	Sh	Cam	Akom II, Bifa, Campo, Dipikar Island, Massif des Mamelles, Mt d'Eléphant, Littoral and South Cameroon
107	Rubiaceae	*Pavetta kribiensis* J.Manning	sb	BK	Sh	Sw-Cam	Rare species, only known from Mvini, Bipindi and Lolodorf
108	Rubiaceae	*Pavetta mpomii* S.Manning	sb	BK	Sh	Sw-Cam	Mt d'Eléphant, Mvini, Nkoelon, Ebianemeyong, Bipindi and Lolodorf
109	Rubiaceae	*Pavetta staudtii* Hutch. and Dalziel	sb	GD	Sh	Cam	Dipikar Island, Mvini, Nkoelon and South Cameroon
110	Rubiaceae	*Pseudosabicea medusula* (K.Schum.) N.Hallé	np	GD	Hb	Cam	Ebianemeyong, Nyabissan, Ma'an, Centre and South Cameroon
111	Rubiaceae	*Psychotria aemulans* K. Schum.**	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections around Grand Batanga
112	Rubiaceae	*Psychotria batangana* K. Schum.*	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections around Grand Batanga
113	Rubiaceae	*Psychotria camerunensis* Petit	sb	GD	Sh	Cam	Akom II, Bifa, Ma'an, Bipindi, Lolodorf , Centre and South Cameroon
114	Rubiaceae	*Psychotria dimorphophylla* K. Schum.*	ri	BK	Sh	Campo-Ma'an	Rare species, only known from few collections from Grand Batanga and Lobe
115	Rubiaceae	*Psychotria lanceifolia* K.Schum.	sb	BK	Sh	Sw-Cam	Rare species, only known from Akom II, Onoyong, Bipindi and Lolodorf
116	Rubiaceae	*Psychotria oligocarpa* K.Schum.*	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections around Grand Batanga
117	Rubiaceae	*Psychotria sadebeckiana* K.Schum. var. *elongata* Petit	sb	GD	Sh	Cam	Akok, Bifa, Campo, Dipikar Island, Kom, Mvini and South Cameroon
118	Rubiaceae	*Psychotria sadebeckiana* K.Schum. var. *sadebeckiana*	sb	GD	Sh	Cam	Akom II, Dipikar Island, Massif des Mamelles, Mvini, and South Cameroon
119	Rubiaceae	*Tricalysia amplexicaulis* Robbr.	sb	GD	Sh	Cam	Dipikar Island, Massif des Mamelles, Centre and South Cameroon
120	Rubiaceae	*Tricalysia talbotii* (Wernham) Keay	sb	GD	Sh	Cam	Ebianemeyong, Mvini, Centre and South Cameroon
121	Rubiaceae	*Vangueriella laxiflora* (K.Schum.) Verdc.	sb	GD	Swcl	Cam	Mvini, Nkoelon, Centre and South Cameroon
122	Sapindaceae	*Deinbollia macroura* Gilg ex Radlkofer*	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections around Campo
123	Sapindaceae	*Deinbollia mezilii* D.W.Thomas and D.J.Harris	sb	BK	Sh	Campo-Ma'an	Rare species, only known from Bifa, Massif des Mamelles and Dipikar Island

No	Family	Species	Guild	Star	Habit	Chorology	Notes
124	Sapindaceae	*Deinbollia pycnophylla* Gilg ex Radlk.	sb	bu	Sh	Lg	Northern limit of distribution, from Gabon to Dipikar Island
125	Scytopetalaceae	*Pierrina zenkeri* Engl.	sb	GD	Sh	Cam	Bifa, Campo, Ebianemeyong, Ma'an, Nyabissan, Littoral and South Cameroon
126	Scytopetalaceae	*Rhaptopetalum sessilifolium* Engl*	sb	BK	Sh	Sw-Cam	Rare species, only known from few collections around Efoulan and Bipindi
127	Sterculiaceae	*Cola fibrillosa* Engl. and Krause	sb	BK	Tr	Sw-Cam	Rare species, only known from few collections around Dipikar Island and Bipindi
128	Sterculiaceae	*Cola letouzeyana* Nkongm.	sb	GD	Sh	Cam	Akom II, Dipikar Island, Ebianemeyong, Onoyong, Centre and South Cameroon
129	Sterculiaceae	*Cola praeacuta* Brenan and Keay	sb	GD	Sh	Cam	Bifa, Dipikar Island, Massif des Mamelles, South and South-west Cameroon
130	Sterculiaceae	*Scaphopetalum acuminatum* Engl. and K. Krause*	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections from Efoulan and Fenda
131	Sterculiaceae	*Scaphopetalum brunneo-purpureum* Engl. and K. Krause**	sb	BK	Sh	Campo-Ma'an	Rare species, only known from few collections from Fenda and Zingui
132	Sterculiaceae	*Scaphopetalum zenkeri* K.Schum.	sb	BK	Sh	Sw-Cam	Akom II, Dipikar Island, Ebianemeyong, Bipindi and Lolodorf
133	Thymelaeaceae	*Dicranolepis glandulosa* H.H.W.Pearson	sb	GD	Sh	Cam	Akom II, Dipikar Island, Grand Batanga, Campo, Littoral, South, and South-west Cameroon
134	Urticaceae	*Urera gravenreuthi* Engl.	pi	GD	Hcl	Cam	Dipikar Island, Ma'an, Littoral, South and South-west Cameroon
135	Violaceae	*Allexis zygomorpha* Achoundong and Onana*	sb	BK	Sh	Cam	Coastal forest between Edea and Campo, Bidou, Akok, Longi, Bipindi and Lolodorf
136	Violaceae	*Rinorea campoensis* M. Brandt ex Engl.	sb	BK	Sh	Campo-Ma'an	Rare species, only known from Campo, Dipikar Island, Lobe and Massif des Mamelles
137	Violaceae	*Rinorea microglossa* Engl. *	sb	BK	Sh	Sw-Cam	Efoulan, Bipindi, Lolodorf, Centre and South Cameroon
138	Violaceae	*Rinorea sp. nov. 1* ined.*	sb	GD	Sh	Cam	Coastal forest between Kribi and Campo, Dipikar Island, and Douala-Edea-Kribi regions
139	Violaceae	*Rinorea sp. nov. 2* ined.*	sb	GD	Sh	Cam	Kienke, Massif des Mamelles, Dipikar Island, Kribi, Kribi-Edea, Douala-Yaounde, and Eseka regions
140	Zingiberaceae	*Aulotandra kamerunensis* Loes.	sb	BK	Hb	Sw-Cam	Rare species, only known from few collections from Ebianemeyong, Nyabissan and Bipindi
141	Zingiberaceae	*Renealmia densispica* Koechlin	sb	BK	Hb	Sw-Cam	Rare species, only known from few collections from Dipikar Island, Ebianemeyong and Ambam

* Species strictly endemic to the Campo-Ma'an area that were not recorded in the National Park
** Species for which the status or range needs more investigation
Guild: ep = epiphyte, np = non pioneer light demanding, pi = pioneer, rh = rheophyte, ri = riverine, sb = shade-bearer and sw = swamp.
Star: as defined in Table 5.1
Habit: Ep = epiphyte, Hb = herb, Hcl = herbaceous climber, He = hemi-epiphyte, Lwcl = large woody climber, Swcl = small woody climber, Pa = parasite, Sh = shrub, and Tr = tree.
Chorology: Campo-Ma'an = strict endemic to Campo-Ma'an, Sw-Cam = endemic to southwestern part of Cameroon, Cam = endemic to Cameroon, Lg = Lower Guinea endemic (especially those species that reach either their northern or southern limit of distribution in the Campo-Ma'an area).

Table 5.7 IUCN (1994) threat categories for 92 plant species recorded in the Campo-Ma'an area that are listed in The IUCN (2002) Red List of Threatened Species and The World List of Threatened Trees (WCMC, 1998).

No	Family	Species	Guild	Habit	Chorology	IUCN/WCMC
1	Acanthaceae	Afrofittonia silvestris Lindau	sb	Hb	Lg	VU A1c+2c
2	Acanthaceae	Sclerochiton preussii (Lindau) C.B.Clarke	sb	Hb	Lg	EN B1+2e
3	Anacardiaceae	Antrocaryon micraster A. Chev. & Guillaum.	pi	Tr	Lg	VU A1cd
4	Anacardiaceae	Trichoscypha bijuga Engl.	sb	Tr	Lg	CR A1c+2abc
5	Anacardiaceae	Trichoscypha mannii Hook. f.	sb	Tr	Lg	VU A1c, B1+2c
6	Annonaceae	Boutiquea platypetala Le Thomas	sb	Sh	Lg	EN A1c+2c
7	Annonaceae	Pachypodanthium barteri (Benth.) Hutch. & Dalziel	sw	Tr	Lg	VU A1c
8	Annonaceae	Uvariastrum zenkeri Engl. & Diels	sb	Sh	Lg	VU A1c, B1+2c
9	Annonaceae	Uvariodendron connivens (Benth.) R.E.Fr.	sb	Tr	Lg	LR/nt
10	Asclepiadaceae	Tylophora cameroonica N.E.Br.	pi	Swcl	Lg	LR/nt
11	Boraginaceae	Cordia platythyrsa Baker	pi	Tr	Gc	VU A1d
12	Burseraceae	Aucoumea klaineana Pierre	pi	Tr	Lg	VU A1cd
13	Burseraceae	Dacryodes igaganga Aubrev. & Pellegr.	np	Tr	Lg	VU A1cd+2cd
14	Celastraceae	Salacia lehmbachii Loes. var. pes-ranulae N.Hallé	np	Swcl	Lg	VU B1+2c
15	Chrysobalanaceae	Dactyladenia cinera (Engl. ex de Wild) Prance & F.White	sb	Tr	Sw-Cam	CR B1+2c
16	Combretaceae	Terminalia ivorensis A.Chev.	np	Tr	Gu	VU A1cd
17	Connaraceae	Hemandradenia mannii Stapf	sb	Tr	Lg	LR/nt
18	Ebenaceae	Diospyros barteri Hiern	sb	Tr	Gu	VU A1c
19	Ebenaceae	Diospyros crassiflora Hiern	sb	Tr	Gc	EN A1d
20	Euphorbiaceae	Amanoa strobilacea Müll.Arg.	sb	Sh	Gu	VU A1c, B1+2c
21	Euphorbiaceae	Crotonogyne manniana Müll.Arg.	sb	Sh	Lg	LR/nt
22	Euphorbiaceae	Drypetes preussii (Pax) Hutch.	sb	Tr	Lg	VU B1+2c
23	Euphorbiaceae	Drypetes tessmanniana (Pax) Pax & K.Hoffm.	sb	Sh	Lg	CR A1c+2c
24	Euphorbiaceae	Neoboutonia mannii Benth.	pi	Tr	Gu	LR/nt
25	Euphorbiaceae	Pseudagrostistachys africana (Müll.Arg.) Pax & K.Hoffm.	sb	Tr	Lg	VU A1c, B1+2c
26	Guttiferae	Garcinia brevipedicellata (Baker f.) Hutch. & Dalziel	sb	Tr	Lg	VU A1c, B1+2c
27	Guttiferae	Garcinia kola Heckel	sb	Tr	Gc	VU A1cd
28	Guttiferae	Garcinia staudtii Engl.	sb	Tr	Lg	VU A1c, B1+2c
29	Hoplestigmataceae	Hoplestigma pierreanum Gilg	np	Tr	Lg	CR A1c+2c
30	Huaceae	Afrostyrax kamerunensis Perkins & Gilg	sb	Tr	Lg	VU A1c, B1+2c
31	Huaceae	Afrostyrax lepidophyllus Mildbr.	sb	Tr	Lg	VU A1c, B1+2c
32	Irvingiaceae	Irvingia excelsa Mildbr.	np	Tr	Gc	LR/nt
33	Irvingiaceae	Irvingia gabonensis (Aubry-Lecomte ex O'Rorke) Baill.	np	Tr	Gc	LR/nt
34	Leguminosae-Caesalpinioideae	Afzelia bipindensis Harms	np	Tr	Gc	VU A1cd
35	Leguminosae-Caesalpinioideae	Afzelia pachyloba Harms	np	Tr	Gc	VU A1d
36	Leguminosae-Caesalpinioideae	Anthonotha leptorrhachis (Harms) J.Léonard	sb	Tr	Cam	CR A1c+2c
37	Leguminosae-Caesalpinioideae	Aphanocalyx hedinii (A.Chev.) Wieringa	np	Tr	Cam	CR B1+2abcd, C1+2ab
38	Leguminosae-Caesalpinioideae	Daniellia klainei A.Chev.	ri	Tr	Lg	LR/nt
39	Leguminosae-Caesalpinioideae	Daniellia oblonga Oliv.	np	Tr	Lg	VU A1c
40	Leguminosae-Caesalpinioideae	Dialium bipindense Harms	np	Tr	Lg	LR/nt
41	Leguminosae-Caesalpinioideae	Dialium tessmannii Harms	sb	Tr	Lg	LR/nt
42	Leguminosae-Caesalpinioideae	Didelotia unifoliolata J.Léonard	sb	Tr	Lg	LR/nt
43	Leguminosae-Caesalpinioideae	Gilbertiodendron pachyanthum (Harms) J.Léonard	np	Tr	Sw-Cam	VU D2
44	Leguminosae-Caesalpinioideae	Guibourtia ehie (A. Chev.) J. Léonard	np	Tr	Gc	VU A1c
45	Leguminosae-Caesalpinioideae	Loesenera talbotii Baker f.	sb	Tr	Lg	VU A1c, B1+2c
46	Leguminosae-Caesalpinioideae	Pellegriniodendron diphyllum (Harms) J.Léonard	sb	Tr	Gu	LR/nt
47	Leguminosae-Caesalpinioideae	Plagiosiphon longitubus (Harms) J.Léonard	sb	Tr	Sw-Cam	CR A1+2c
48	Leguminosae-Caesalpinioideae	Swartzia fistuloides Harms	sb	Tr	Gc	EN A1cd
49	Leguminosae-Mimosoideae	Calpocalyx heitzii Pellegr.	np	Tr	Lg	VU A1c, B1+2c
50	Leguminosae-Mimosoideae	Calpocalyx le-testui Pellegr.	sb	Tr	Gc	VU D2
51	Leguminosae-Mimosoideae	Calpocalyx ngouniensis Pellegr.	sb	Tr	Gc	VU A1c
52	Leguminosae-Papilionoideae	Craibia atlantica Dunn	sb	Tr	Gc	VU A1c
53	Leguminosae-Papilionoideae	Millettia laurentii De Wild.	np	Tr	Gc	EN A1cd
54	Leguminosae-Papilionoideae	Millettia macrophylla Benth.	pi	Tr	Lg	VU A1c, B1+2c
55	Leguminosae-Papilionoideae	Ormocarpum klainei Tisser.	sb	Sh	Lg	CR A1c
56	Liliaceae	Chlorophytum petrophyllum K.Krause	sb	Hb	Cam	CR A1c+2c
57	Melastomataceae	Memecylon candidum Gilg	sb	Sh	Lg	VU B1+2c
58	Melastomataceae	Memecylon dasyanthum Gilg ex Lederman & Engl.	sb	Tr	Lg	VU B1+2c
59	Melastomataceae	Warneckea wildeana Jacq.-Fél.	sb	Sh	Lg	VU D2

No	Family	Species	Guild	Habit	Chorology	IUCN/WCMC
60	Meliaceae	Entandrophragma angolense (Welw.) C.DC.	np	Tr	Tra	VU A1cd
61	Meliaceae	Entandrophragma candollei Harms	np	Tr	Gc	VU A1cd
62	Meliaceae	Entandrophragma cylindricum (Sprague) Sprague	np	Tr	Gc	VU A1cd
63	Meliaceae	Entandrophragma utile (Dawe & Sprague) Sprague	np	Tr	Gc	VU A1cd
64	Meliaceae	Guarea cedrata (A.Chev.) Pellegr.	np	Tr	Gc	VU A1c
65	Meliaceae	Guarea thompsonii Sprague & Hutch.	np	Tr	Gc	VU A1c
66	Meliaceae	Khaya anthotheca (Welw.) C.DC.	np	Tr	Gc	VU A1cd
67	Meliaceae	Khaya ivorensis A.Chev.	np	Tr	Gc	VU A1cd
68	Meliaceae	Lovoa trichilioides Harms	np	Tr	Gc	VU A1cd
69	Meliaceae	Turraeanthus africanus (Welw. ex C.DC.) Pellegr.	sb	Tr	Gc	VU A1cd
70	Moraceae	Milicia excelsa (Welw.) C.C.Berg	pi	Tr	Tra	LR/nt
71	Myrtaceae	Eugenia kameruniana Engl.	sb	Sh	Cam	CR A1c
72	Ochnaceae	Lophira alata Banks ex Gaertn.f.	pi	Tr	Gc	VU A1cd
73	Ochnaceae	Testulea gabonensis Pellegr.	np	Tr	Lg	EN A1cd
74	Rhizophoraceae	Anopyxis klaineana (Pierre) Engl.	np	Tr	Gc	VU A1cd
75	Rubiaceae	Hallea stipulosa (DC.) Leroy	sw	Tr	Gc	VU A1cd
76	Rubiaceae	Nauclea diderrichii (De Wild. & T.Durand) Merrill	pi	Tr	Gc	VU A1cd
77	Rutaceae	Vepris heterophylla Letouzey	sb	Sh	Gc	EN A1c, B1+2c
78	Sapotaceae	Autranella congolensis (De Wild.) A.Chev.	np	Tr	Gc	CR A1cd
79	Sapotaceae	Baillonella toxisperma Pierre	np	Tr	Lg	VU A1cd
80	Sapotaceae	Gluema ivorensis Aubrév. & Pellegr.	np	Tr	Gc	VU B1+2c
81	Sapotaceae	Tieghemella africana Pierre	np	Tr	Lg	EN A1cd
82	Simaroubaceae	Nothospondias staudtii Engl.	np	Tr	Gc	VU B1+2c
83	Sterculiaceae	Cola hypochrysea K.Schum.	sw	Tr	Lg	VU A1c
84	Sterculiaceae	Cola philipi-jonesii Brenan & Keay	sb	Sh	Lg	EN B1+2c
85	Sterculiaceae	Cola praeacuta Brenan & Keay	sb	Sh	Cam	CR A1c+2c
86	Sterculiaceae	Cola semecarpophylla K.Schum.	sb	Sh	Lg	LR/cd
87	Sterculiaceae	Mansonia altissima (A.Chev.) A.Chev. var. kamerunica Jacq.-Fél.	np	Tr	Gu	EN A1cd
88	Sterculiaceae	Pterygota bequaertii De Wild.	np	Tr	Gc	VU A1cd
89	Sterculiaceae	Pterygota macrocarpa K.Schum.	np	Tr	Gc	VU A1cd
90	Sterculiaceae	Sterculia oblonga Mast.	pi	Tr	Gc	VU A1cd
91	Violaceae	Allexis cauliflora (Oliv.) Pierre	sb	Sh	Lg	VU A1c, B1+2c
92	Violaceae	Allexis obanensis (Baker f.) Melchior	sb	Sh	Lg	VU B1+2c

NB: Guild, habit and chorology categories as defined in Table 5.6

Photo: Understorey palm species (*Podococcus barteri* G. Mann & Wendl.) frequently found throughout the Campo-Ma'an rain forest (Tchouto, M.G.P.)

Chapter 6

GENERAL CONCLUSIONS AND IMPLICATIONS FOR BIODIVERSITY CONSERVATION

Gildas Peguy Tchouto Mbatchou

6.1. INTRODUCTION

The Campo-Ma'an rain forest is recognised to be an important site within the Guineo-Congolian Regional Centre of Endemism (White, 1979 & 1983). Its conservation value is high at local, national, regional and global levels (Gartlan, 1989 & 1992; Foahom & Jonkers, 1992; Thomas & Thomas, 1993; Davis *et al.*, 1994; de Kam *et al.*, 2002). However, despite its great biological importance, the Campo-Ma'an forest has suffered and continues to suffer from intense human pressure that has led to the degradation of most of the forest along the coast and the lowland forest around settlements. It is largely in order to ensure the conservation of biodiversity and the sustainable management of its natural resources that a Technical Operational Unit (TOU) was created in the Campo-Ma'an area. The main components of the TOU are a National Park, five forestry management units, two agro-industrial plantations and several agro-forestry zones (Chapter 1). So far, the National Park exists only on paper since in reality it has not yet been gazetted, and it has no boundary and management plan. Taking into consideration the fact that there was limited baseline biological information, essential for the elaboration of the Campo-Ma'an strategic and management plans, it was of vital importance to carry out sound taxonomic and ecological research in order to identify conservation priorities and hotspots for biodiversity conservation.

During this study, a vegetation map of the Campo-Ma'an area was produced and the various vegetation types were described with information on their structure and composition (Chapter 2). A plant species checklist (Annex 3) made of 2297 species of vascular plants, ferns and fern allies was generated from inventory data and from 2348 herbarium specimens and 4789 ecological specimens. They belonged to 851 genera and 155 families. Furthermore, a list of 92 threatened species recorded in IUCN (2002) and WCMC (1998), and a list of 141 plant species of high conservation priorities were produced, with information on their growth forms, guild, chorology and conservation status (Chapter 5). The distribution maps of species of high conservation priority such as endemic, rare, threatened, and bio-indicator taxa, were produced and used to identify and locate potential hotspots for biodiversity conservation, and to confirm the existence of a postulated Pleistocene rain forest refuge in the Campo-Ma'an area (Chapters 4 & 5).

6.2. GENERAL CONCLUSION

The most important phytogeographic studies of Africa are those of White (1979 & 1983) who divided Africa into floristic units (phytochoria) based on chorological criteria such as shape, surface and geographic position of species distributions and on the occurrence of endemics. This led him to distinguished Regional Centres of Endemism defined as phytochoria that show a total of more than 1000 endemic species and to which more than half of the total number of its species is confined. The southern part of Cameroon falls under the Guineo-Congolian Regional Centre of Endemism that is reported to be species-rich with high levels of endemism (White, 1983; Davis *et al.*, 1994). The Guineo-Congolian region comprises three sub-divisions, Upper Guinea, Lower Guinea and Congolia. The Lower Guinea sub-region comprises the Atlantic Biafran forest zone that extends from Southeast Nigeria to Gabon and the Mayombe area in Congo (Letouzey, 1985). The Campo-

Ma'an rain forest lies in the middle of this forest belt which stresses its importance in terms of conservation priorities. In Cameroon, this Biafran forest zone covers about 70,000 km² with three main protected areas that include the Campo-Ma'an National Park, Korup National Park and the Douala-Edea Faunal Reserve. This study, as well as other research (Aubréville, 1968; Letouzey, 1968 & 1985; Reitsma, 1988; Tchouto, 1995; Newbery & Gartlan, 1996; White, 1996; Cable & Cheek, 1998), carried out in this forest zone have shown that in terms of relative abundance, the Caesalpinioideae represent the most important taxon of tree species in the Lower Guinea sub-region, sometimes forming distinctive near mono-dominant stands. However, in the Campo-Ma'an area, several species are co-dominant and many of them are gregarious. Many canopy and emergent trees of the family Leguminosae as well as other tree species such as *Desbordesia glaucescens* and *Terminalia superba* have large buttresses and diameters that contributed to the high basal area and forest biomass recorded in the area (Table 6.1).

The vegetation in the Campo-Ma'an area is determined by climate especially rainfall, altitude, soils, proximity to the sea and human disturbance (Chapter 1). The structure and composition of the forest, as well as its physiognomy changes progressively as one moves from sea level to 1100 m on hilltops. The vegetation evolves from the mangrove or coastal forest on sandy shorelines through the endemic lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis*, to the submontane forest on hilltops and the mixed evergreen and semi-deciduous forest in the drier Ma'an area. Other vegetation types/sub-types include swamps, seasonally flooded forests, riverine and secondary forests. The forest in the Ma'an area is described as transitional between the coastal evergreen forest and the semi-deciduous forest of the interior. It has a distinct Gabonese affinity with small patches of *Aucoumea klaineana* (Okoumé) populations that reach their northern limit of distribution around Ebianemeyong on exposed steep hills and Nsengou near to the border with Equatorial Guinea. The strong relation between human disturbance and the vegetation has implications for the floristic composition and species richness of the various forest types. Coastal forests appeared to be more disturbed, including many secondary species, being less species-rich and less diverse than other forest types.

Table 6.1 Number of species, number of stems/ha, mean basal area/ha and Shannon diversity index (H') for all vascular plant species with DBH ≥ 10 cm recorded in some forest areas within the Guineo-Congolian region.

Inventory site	No of species	Stems/ha	Mean basal area/ha	Shannon diversity index (H')	Notes	Authors
Cameroon						
Campo-Ma'an (14.7 ha)*	1116	5312	76.71	5.54		Present study
Campo-Ma'an (14.7 ha)	532	545	72.9	5.26	2297 species of vascular plants recorded including 30 strictly endemic taxa.	Present study
Dja Wildlife Reserve (26.14 ha)	372	512	32.6	5.46		Sonke (1998)
Korup National Park	410	471	27.8	-		Newbery & Gartlan (1996)
Korup National Park (50 ha)	307	492	26.7	1.73		Thomas *et al.*, 2003
Korup National Park (50 ha)*	494	6581	32.2	1.93	1100 species	Thomas *et al.*, 2003
Mount Cameroon (7.25 ha)	161	444	33.9	3.99	2433 species including 49 strictly endemic taxa.	Tchouto (1995); Cable & Cheek (1998)
Gabon						
Doussala (1 ha)	109	425	35.7	-		Reitsma (1988)
Lope (12.5 ha)	312	389	34.5	-		White (1996)
Minkébé (3 ha)	202	385	-	-		van Valkenburg *et al.*, 1998
Oveng (1 ha)	131	497	36.4	-		Reitsma (1988)
Central African Republic						
Ngotto forest (2.5 ha)	147	549	34.4	5.3		Lejoly (1995b)
Congo						
Odzala National Park	120	347	21.1	-		Lejoly (1995a)
Democratic Republic of Congo						
Cuvette Centrale	206	346	32.3	-		Wolter (1993)

* for all vascular plant species with DBH ≥ 1 cm

Generally, patterns of species richness and endemism are used for the identification of biodiversity hotspots. During our study, inventory data and taxonomic collections were used to assess the distribution patterns of strict and narrow endemic species. Conservation indices such as Genetic Heat Index (GHI) and Pioneer Index (PI) were used to analyse the trends in endemic and rare species recorded and geostatistic techniques helped to evaluate and identify potential areas of high conservation priority. The results showed that the Campo-Ma'an area is characterised by a rich and diverse flora with more than 2297 species of vascular plants, ferns and fern allies belonging to 851 genera and 155 families. The area has about 114 endemic plant species, 29 of that are restricted to the area, 29 also occur in south-western Cameroon and 56 others that also occur in other parts of Cameroon. Furthermore, 540 species recorded are Lower Guinean endemics, 105 species are Guinean endemics and 1123 species are Guineo-Congolian endemics. An explanation for this high incidence of endemism, richness and structured pattern of the vegetation might stem partly from the fact that the area falls within a series of postulated rain forest refuges in Central Africa (Hamilton, 1982; White, 1983; Maley, 1987 &1989; Sosef, 1994 & 1996). In such forest refuges, the unique combination of climatic and geological histories, contemporary ecological variables and inherent biological properties of taxa, may have contributed to speciation (Hawksworth & Kalin-Arroyo, 1995). The distribution patterns of high conservation priority species showed a high concentration of these species in the National Park between Dipikar Island and Ebianemeyong-Akom II area, and on Massif des Mamelles and Mont d"Eléphant. Most of the submontane forest and the lowland evergreen forest rich in

Caesalpinioideae were characterised by high GHI scores, low PI scores and low level of disturbance. Other areas of high concentration of strict and narrow endemic species were located outside the park in the coastal zone and in areas such as Mont d'Eléphant and Massif des Mamelles. Unfortunately, these areas that support 17 strict endemic species that are not found in the park were much more affected by human activities. Most forests located at their closed vicinity were characterised by high PI scores with more than 25% of the forest cover affected by recent human disturbance. Overall, the Ma'an forest and the coastal forest on sandy shorelines showed a low concentration of endemic species.

Despite the rich biological and scientific importance of the area, the Campo-Ma'an rain forest is seriously affected by human activities such as urbanisation, agriculture and timber exploitation. Cameroon has a population of about 15 millions with a high growth rate of 3.2% (Gartlan, 1992). Furthermore, she is experiencing an economic crisis that has significantly reduced the national budget and employment opportunities, and increased the poverty level of the people. So far, most Cameroonians rely heavily on agriculture and forest resources for subsistence. Therefore, with the growing human population rate, local pressure on these fragile ecosystems will increase in the future. Deforestation for agricultural purposes is the biggest threat to the tropical rain forest since shifting agriculture and permanent plantations increase by about 75,000 to 95,000 ha per year in Cameroon (Gartlan, 1992). In the Campo-Ma'an area, agro-industrial plantation and land clearance for subsistence agriculture have destroyed more than 15% of the natural forest cover.

Long before these recent human activities in the Campo-Ma'an rain forests, man has had a marked influence on the coastal vegetation. This has brought several authors to argue that the coastal forests and the mixed evergreen and semi-deciduous forests in the Ma'an area may have undergone a great change in the past that is probably caused by man (Reynaud & Maley, 1994; Oslisly *et al.*, 2001; Maley & Brenac, 1998; Maley, 2001 & 2002). A strong indication of past human disturbance is the frequent occurrence of *Alstonia boonei, Ceiba pentandra, Lophira alata, Pycnanthus angolensis* and *Terminalia superba,* which are characteristic of mature secondary forests in some of the forest types recorded.

In a large and heterogeneous forest ecosystem such as the Campo-Ma'an rain forest, the selection of the most appropriate methods for the assessment of the forest is always a difficult matter since many questions need to be addressed in order to decide on the best approach to be taken. To be effective, a botanical assessment method that provided both quantitative and qualitative information was used during our study. The quantitative data came from the enumeration of all vascular plants with DBH $\geq$ 1 cm in small plots of 0.1 ha each that were established throughout the research area. The qualitative information was generated from herbarium specimen data collected in the various vegetation types and habitats encountered, and from several provisional plant species checklists made in the field in each of these vegetation types. This sampling approach led to the collection of information on all growth forms including trees, shrubs, climbers and herbaceous vascular plants that enable us to study the correlation between tree species diversity and the diversity of other growth forms. The results showed that only 22% of the diversity of shrubs and lianas could be explained by the diversity of large and medium sized trees, and less than 1% of herb diversity was explained by the tree diversity. The shrub layer was by far the most species rich in the different plots and vegetation types, and was significantly more diverse and species-rich than the tree and herbaceous layers. Moreover, shrubs contributed for 38% of the 114 strict and narrow endemic plant species recorded in the area, herbs (29%), trees (20%) and climbers (11%). These results indicated that in the context of African tropical rain forest, tree species diversity does not tell it all and therefore, it may not be a good indicator for the diversity of shrubs and herbaceous species. Furthermore, this suggests that biodiversity survey based solely on large and medium sized tree species (DBH ≥ 10 cm) is not an adequate method for the assessment of plant diversity because other growth form such as shrubs, climbers and herbs are under-represented. Inventory design based on small plots of 0.1 ha, in which all vascular plants with DBH ≥ 1 cm are recorded, is therefore, a more appropriate sampling method for biodiversity conservation purposes than assessments based solely on large and medium sized tree species.

6.3. IMPLICATIONS FOR BIODIVERSITY CONSERVATION

The Campo-Ma'an National Park

The study has demonstrated that the park is of great scientific and conservation importance containing about 72% of the 2297 species of vascular plants, ferns and fern allies recorded in the Campo-Ma'an area and more than 70% of the total endemic species. The site's conservation opportunities include a rich diversity of flora, fauna and habitats amongst which the most characteristic is the endemic lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis* that only occurs in the Campo area. So far the Park is the only land use type in the area with a legal conservation status. It is fully protected by law, and logging, hunting, fishing, mineral exploitation, pastoral industrial, agricultural and forestry activities are forbidden. However, its boundaries have not been marked in the field, the management plan has not yet been produced, protection is weak and the participation of stakeholders in the management process is not operational. Taking into consideration the fact that the park is surrounded by several land-uses, its management needs to be strengthened and coherent with that of other land-use types found in the area. Furthermore, it is of urgent need to demarcate the boundary of the park, reinforce its protection, complete and implement its management plan as soon as possible. Although the park is virtually free from human disturbance, present human influence is by no means negligible since illegal hunting is frequent. To allow effective control of poaching, several logging tracks and footpaths at the vicinity of the park need therefore to be closed, additional control posts should be established and more forest guards appointed.

With its tremendous living genetic resources and its conservation status, the park is an ideal place for scientific research. Further research is needed on the Dipikar Island and in areas east of Mvini's river and Nkoelon to study the forest dynamics in disturbed lowland forest. This study will help to access the rate of forest recovery after logging in terms of plant species richness, forest structure and composition. Such research is needed because a better knowledge of the effect of human disturbance on the forest ecosystem is important for the development of sustainable forest management systems. Furthermore, it has been shown that mammals are primary consumers of forest fruits and seeds in tropical rain forest (Mbelli, 2002). They contribute to seed dispersal and thus to forest regeneration. It is therefore suggested that future research work be focused on plant-animal relations with emphasis on the natural regeneration of timber species and important NTFPs. This will lead to a better understanding of the dispersal, germination, growth and mortality rates of plant species as well as their interactions with vertebrate fruit eaters such as elephants, apes, birds, ruminants, bats and rodents.

Massif des Mamelles and Mont d'Eléphant

The study has also demonstrated that there are biodiversity hotspots such as the Massif des Mamelles and Mont d'Eléphant that are not located in the National Park. Unfortunately, these areas of high conservation priority do not yet have any conservation status and are mostly found along the coast and near settlements where local human pressure is intense. As shown in Chapter 5, there are 17 plant species strictly endemic to the Campo-Ma'an area, which are not found in the park. These endemic species are the most threatened since their habitats are fragmented and degraded as a result of past and present land conversion to subsistence and industrial plantations. The rate of forest degradation is likely to accelerate in the near future, if the present trends in land-use and patterns of exploitation persist. Conservation needs are exceptionally urgent in such areas since they are of great scientific interest and under severe threat. There is an urgent need for the development of a separate management strategy in order to ensure the protection of these biodiversity hotspots and their endemic species. In Cameroon forest legislation, there are other forms of land-use such as community and communal forests that are compatible with the conservation of biodiversity. Therefore, it is suggested that local communities be encouraged to create community forests since its management does not only focus on nature conservation but also takes into consideration their interests. Each community forest could have the identified biodiversity hotspot as the core conservation area, surrounded by a buffer zone in which the sustainable management of non-timber forest products and hunting are developed. In the wake of today's forest loss, a careful sustainable land-use strategy in the buffer zones surrounding the National Park and other identified core biodiversity hotspots is necessary for their long-term survival and the protection of species of high conservation priority.

Forest management units

As shown in Chapter 1, logging concessions that are also called "Forestry management unit" (FMU) are the most important land-use type after the National Park. They represent about 31.4% of the Campo-Ma'an Technical Operational Unit. Some of them (09021, 09022 and 09025, Figure 1.1 in Chapter 1) have been selectively logged at least once during the past 30 years. Although logging damages are moderate and have less effect on the forest biodiversity, further logging activities should be avoided in areas that have been exploited already twice. Despite the effect of logging on these forests, there are still considerable patches of undisturbed forests that are characterised by a rich and diverse flora. It has become increasingly clear that National Parks cannot be protected without the establishment of a buffer zone. Therefore, FMU's can serve as the park's buffer zone since they are located in its close vicinity. The management plan of the logging concessions should be compatible with conservation initiatives and include a separate management strategy aimed at enhancing the sustainable management of natural resources. Taking into consideration the fact that the success of their conservation will largely depend on the ability to reconcile the objectives of conservation and together with the needs of the loggers and the local communities, the management strategy should be developed with the full participation of the local people.

The Ma'an area has been recently allocated for timber exploitation (FMU 09024). It supports small populations of Okoumé at the border with Equatorial Guinea with only few stems of exploitable size. This important commercial timber species is of scientific interest since it reaches the northern limit of its distribution in the Campo-Ma'an area. Therefore, it is strongly recommended that Okoumé should not be exploited and that conservation measures be taken during logging to ensure the protection of this species. Furthermore, special logging techniques should be applied in order to minimise logging damage such as breakage of Okoumé trees, saplings and residual stems, and to protect eventual seedlings from discarded crowns of felled trees.

Although selective logging techniques are used in the FMU, a number of irregularities were reported in the area, as far as the proper application of the techniques and the implementation of the forestry law that regulates logging activities in Cameroon are concerned. It is suggested that selective logging at low intensity, using techniques that minimizes impacts, be applied in all FMU. Furthermore, research should be carried out to assess the current logging techniques and the level of implementation of the forestry law. The results of this research should include recommendations for a sustainable timber harvesting, the use of adequate selective logging techniques, and control mechanisms to minimise bottlenecks that hinder the proper implementation of the forestry law. It was also noticed that the amount of waste products derived from logging and timber transformation activities was high. The waste products include abandoned logs and remains from sawmills. Although they were reported not to be economically profitable by the loggers, these abandoned logs are of great economic importance for the rural and urban economy. Therefore, further studies should be carried out to assess the demand, markets and trade of these products, and to identify an effective mechanism that will help to minimise this waste.

The Campo-Ma'an area has ca 249 NTFPs and 112 timber species of which only 60 species are being exploited (Tchouto *et al.*, 2002 unpublished). Although the TOU has many NTFP species with high economic value, few local people rely on it as source of income. Furthermore, many important forest products such as fruits, spices, vegetables and rattans that are popularly traded in Cameroon and the sub-region for their high commercial values, are poorly exploited in the area. This is partly due to the fact that many local people derive their income from agriculture, hunting and fishing, and that the commercialisation channels of these products are poorly known by the local communities. In order to reduce the current pressure on the Campo-Ma'an rain forest, alternate income generating activities should be identified for the local communities. The trade of NTFPs is one of such activities if an adequate strategy for its sustainable management, exploitation and commercialisation is developed. Therefore, a participatory ethnobotanical study should be carried out with the local communities in their villages and in logging concessions in order:

- To prepare a checklist of all timber and NTFP species used by the local people;
- To carry out a market survey to assess the demand and trade of these products;
- To study their biomass, densities, dynamics and the impact of their exploitation on the forest ecosystem.

Ecological monitoring
Tropical rain forests are fragile because of their complex dynamic ecosystems, their high number of species and their rich interacting structure. Although they are well adapted to persist in the environment in which they have evolved, they are much less resistant to human disturbances. Therefore, in the Campo-Ma'an area, it is of vital importance to monitor human activities and related changes in flora and fauna. This will enable the park management to act appropriately whenever undesired changes in the conservation status of its rich biodiversity occur. Remote sensing images and impact studies on human activities are required to monitor land cover changes, and the changes in vegetation, flora and fauna within and around the park.

This study has demonstrated that the Campo-Ma'an area harbours about 141 plant species of high conservation priority and 92 threatened species listed in the red data list of IUCN (2002) and WCMC (1998). Of the 29 strict endemic species that only occur in the Campo-Ma'an area, 17 are the most threatened since they are located outside the National Park and in areas such as the coastal zone, and at the vicinity of settlements and large agro-industrial plantations where human pressures are severe. Furthermore, their habitats are fragmented and degraded as a result of past and present land conversion to subsistence agriculture and industrial plantations. Research is urgently needed on the population biology and ecology of these threatened species. In order to avoid the extinction of these species, botanical monitoring should be carried out to assess their status. Measures to secure their conservation should include the strict protection of these fragmented type localities.

Ecological sustainable agriculture
Shifting agriculture is identified as among the most destructive uses of the forest since it involves large amount of land conversion from natural forest to farms and fallow. In order to prevent further encroachment into the remaining lowland and coastal forests, farmers need to intensify their agricultural production systems. Furthermore, crop production needs to be increased in the existing agricultural lands to feed a growing population. Farmers should be encouraged to form common initiative groups in which they can receive adequate training on nursing, planting, maintenance, harvesting, storage and marketing techniques from the local staff of the Ministry of Agriculture.

Conservation and environmental education
Biodiversity conservation is a concept that is not yet well understood by the local communities. As a result there is a permanent conflict between conservation initiatives and the needs of the local communities and other stakeholders such as

logging and agro-industrial enterprises. A stakeholder analysis carried out in the area (ERE Développement, 2002) showed that there is an overwhelming concern among stakeholders about the restrictions imposed with the creation of the National Park. The creation of the park has led to the reduction of the availability of bush meat within the TOU and the reduction of forestland for future agricultural expansion. Furthermore, the contribution of the park to the local economy is not yet evident. Despite the efforts made by the Campo-Ma'an Project to sensitize the local communities, a large majority is still very skeptical about the contribution of biodiversity conservation to their livelihoods. Therefore, environmental education programs should be reinforced in the area. This will help to create awareness among local people, to explain the purpose of conservation and the reasons for creating the National Park, and to educate them on the far-reaching implications of forest degradation. Local people need to learn about the importance of community forests and how to apply, create and manage a community forest. They also need to be informed on the existing laws on forestry, wildlife and fisheries. By doing so, the Campo-Ma'an Project will create a conducive working atmosphere that may help to secure their active and full participation in any conservation initiatives.

Environmental education should be carried out at all levels, with different target groups within the local communities (traditional leaders, elite, hunters, farmers, women, children, teachers, etc.), timber exploiters, agro-industrials, local administrative authorities and any other stakeholders involved in the conservation of biodiversity in the TOU. Simple and appropriate education tools should be used to offer the local communities something that is important, clear, easy to recall and above all, something that give them food for thought. Dissemination of information to stakeholders is necessary for their involvement in the decision-making process. Key findings of all studies carried out in the area should be published and made available to the local communities. Simple leaflets with the list of plant and wildlife species of high conservation values should be produced with their local names, conservation status and pictures, and distributed to all the stakeholders. Regular broadcasts on television through attractive programmes are vital for the presentation and dissemination of information gathered.

Photo: Natural forest gap rich in fern species (Tchouto, M.G.P.)

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Photo: Mangrove vegetation along the Ntem River (Tchouto, M.G.P.)

ANNEXES

Annex 1. Summary table showing the number of species/plot, number of stems/ha, mean basal area/ha, Shannon diversity index (H'), Genetic Heat Index (GHI) scores, Pioneer Index (PI) scores in 147 plots of 0.1 ha each with information on their location, altitude, slope, rainfall, vegetation type and geographic co-ordinates.

No	0.1 ha plot code	5 x 5m sub-plot	Qualitative Sample code	Locality	Altitude (m)	Slope	Rainfall (mm/year)	Vegetation code*	No of species	H'	GHI	PI	Latitude (N) d°.minsec	Longitude (E) d°.minsec
1	T21	T21		Bibabimvoto	40	Slope	2800	Caesalpcasa	139	4.09	155.9	33.3	2.13508	9.56015
2	T11	T11		Mabiogo	10	Flat	2800	Cosaca	106	3.81	165.8	42.6	2.16327	9.52233
3	MELE1	MELE1	MELEX1	Medjivini	400	Slope	1670	Mixevergreen	98	3.85	138.2	41.3	2.17562	10.20512
4	MELE2	MELE2	MELEX2	Medjivini	400	Flat	1670	Mixevergreen	109	3.96	127.1	43.6	2.18341	10.21016
5	MELE3	MELE3	MELEX3	Medjivini	360	Flat	1670	Mixevergreen	99	3.71	153.7	45.7	2.18084	10.20487
6	MELE4	MELE4	MELEX4	Aloum	360	Slope	1670	Mixevergreen	94	3.84	122.5	42	2.21197	10.24154
7	MELE5	MELE5	MELEX5	Engon	400	Slope	1670	Mixevergreen	90	3.60	113.6	43	2.21361	10.23575
8	EFOU1	EFOU1	EFOUX1	Efoulan	600	Slope	2000	Caesalp	108	4.32	257.1	36.5	2.44562	10.32279
9	EFOU2	EFOU2	EFOUX2	Efoulan	1000	Hill top	2000	Submontane	79	2.98	294.4	24.7	2.44435	10.31484
10	EFOU3	EFOU3	EFOUX3	Efoulan	800	Slope	2000	Submontane	118	4.16	205.6	27.1	2.44576	10.32035
11	EFOU4	EFOU4	EFOUX4	Efoulan	400	Slope	2000	Caesalp	109	4.11	151.7	25.5	2.46056	10.32093
12	T31	T31	T3X1	Bibabimvoto	60	Flat	2800	Caesalpcasa	100	3.94	179.2	26.3	2.12485	10.00516
13	T32	T32	T3X2	Bibabimvoto	40	Flat	2800	Caesalpcasa	95	4.06	180	28.6	2.13473	10.00539
14	T33	T33	T3X3	Bibabimvoto	40	Flat	2800	Caesalpcasa	104	4.03	192	26	2.14323	10.00586
15	T34	T34	T3X4	Bibabimvoto	40	Flat	2800	Caesalpcasa	105	4.11	233.3	26.3	2.15009	10.01259
16	T35	T35	T3X5	Bibabimvoto	40	Flat	2800	Caesalpcasa	95	3.89	209.2	30.1	2.14457	10.00582
17	EBI1	EBI1, EBI2	EBIX1	Ebianemeyong	660	Slope	1750	Okoume	52	2.91	97.3	53.3	2.26077	10.20562
18	EBI2	EBI3	EBIX2	Ebianemeyong	740	Slope	1750	Submontane	114	4.15	266.7	25	2.26090	10.20533
19	EBI3	EBI4	EBIX3	Ebianemeyong	500	Slope	1750	Caesalp	86	3.85	192.2	27.5	2.26012	10.21112
20	EBI4	EBI5	EBIX4	Ebianemeyong	460	Slope	1750	Caesalp	88	3.60	175.4	43.2	2.25412	10.21251
21	T51	T51	T5X1	Mvini	200	Flat	2800	Caesalpcasa	95	4.03	188.6	19.8	2.15112	10.11125
22	T52	T52	T5X2	Mvini	180	Flat	2800	Caesalp	95	4.11	158.6	23.9	2.14243	10.11081
23	T53	T53	T5X3	Mvini	180	Flat	2800	Caesalp	75	3.65	116.3	22.4	2.14448	10.10545
24	T54		T5X4	Mvini	200	Flat	2800	Caesalp	80	3.91	96.6	34.7	2.14555	10.11045
25	T55	T55	T5X5	Mvini	200	Slope	2800	Caesalp	93	3.51	117.4	24.1	2.15211	10.11117
26	T56			Mvini	260	Flat	2800	Caesalp	91	3.84	175.4	24.4	2.15573	10.11313
27	T22	T22	T2X2	Bibabimvoto, 1000m along T2	40	Slope	2800	Caesalpcasa	115	4.10	171.4	25	2.13367	9.56282
28	T23	T23	T2X3	Bibabimvoto, 1500m along T2	40	Flat	2800	Caesalpcasa	120	4.23	153.5	19.5	2.13328	9.56400
29	T24	T24	T2X4	Bibabimvoto, 2000m along T2	40	Slope	2800	Caesalpcasa	94	3.60	124.3	27.4	2.12548	9.57111
30	T25	T25	T2X5	Bibabimvoto, 4000m along T2	60	Flat	2800	Caesalpcasa	93	3.78	141.4	23.6	2.15513	9.57337
31	T26	T26	T2X6	Bibabimvoto, 2500m along T2	40	Flat	2800	Caesalpcasa	97	3.78	145.8	30.4	2.13052	9.57050
32	T41	T41	T4X1	Bibabimvoto, 2500m along T4	40	Flat	2800	Caesalpcasa	106	3.76	186.2	34.3	2.14281	10.05454
33	T42	T42	T4X2	Bibabimvoto, 1100m along T4	40	Flat	2800	Caesalpcasa	134	4.28	211.2	22.4	2.14512	10.15481
34	T43	T43	T4X3	Bibabimvoto, 3000m along base line from T4	80	Slope	2800	Caesalpcasa	102	3.47	220.6	23.9	2.15096	10.04413

No	0.1 ha plot code	5 x 5m sub-plot	Qualitative Sample code	Locality	Altitude (m)	Slope	Rainfall (mm/year)	Vegetation code*	No of species	H'	GHI	PI	Latitude (N) d°.minsec	Longitude (E) d°.minsec
35	T44	T45	T4X5	Bibabimvoto, along the Bongola river	10	Flat	2800	Swamp	26	2.12	183.3	55.6	2.15374	10.05588
36	T4FP1	T44	T4X4	Bibabimvoto, 500m along base line from T4	60	Slope	2800	Caesalpcasa	121	4.17	207.7	24.8	2.15129	10.05450
37	T81	T82	T8X2	Bibabimvoto, 2500m along T8	100	Slope	2800	Caesalpcasa	118	4.03	172.8	24.5	2.16156	10.03346
38	T82			Bibabimvoto, 1500m along T8	80	Slope	2800	Caesalpcasa	121	4.03	202.2	20.9	2.15472	10.03194
39	T83	T83	T8X3	Bibabimvoto, 1500m along base line from T8	60	Flat	2800	Caesalpcasa	107	4.07	209.3	17.8	2.15022	10.02144
40	T8FP1	T81	T8X1	Bibabimvoto, 100m along T8	80	Slope	2800	Caesalpcasa	103	3.79	164.6	26.5	2.15043	10.02562
41	T61	T61	T6X1	Mvini, 100m along T6	240	Slope	2800	Caesalp	95	3.89	186.4	38.6	2.16133	10.10585
42	T62		T6X3	Mvini, 2100m along T6	120	Flat	2800	Caesalp	103	3.66	125.7	41.7	2.16246	10.11598
43	T63	T64	T6X4	Mvini	220	Slope	2800	Caesalp	92	3.72	185.9	29.5	2.16486	10.12034
44	T64	T65	T6X5	Mvini	140	Flat	2800	Caesalp	89	3.70	176.7	31	2.16411	10.11418
45	T6FP1	T62	T6X2	Mvini, 1000m along T6	200	Slope	2800	Caesalp	114	3.96	162.7	30	2.16174	10.11266
46	T6FP2	T63		Mvini, 1600m along T6	160	Slope	2800	Caesalp	96	3.91	167.5	29.7	2.16174	10.11445
47	T12	T12	T1X2	Mabiogo, Dipikar Island, 500m along T1	20	Flat	2800	Cosaca	102	3.56	121.6	38.3	2.15124	9.52531
48	T13	T13	T1X3	Mabiogo, Dipikar Island, 800m along T1	10	Flat	2800	Swamp	84	3.71	120	49.4	2.15208	9.52504
49	T14	T14	T1X4	Mabiogo, Dipikar Island, 1300m along T1	40	Flat	2800	Cosaca	107	3.93	91.5	38.2	2.15418	9.52381
50	T15	T15	T1X5	Mabiogo, Dipikar Island, 2600m along T1	10	Flat	2800	Cosaca	89	3.77	78.5	54.9	2.16212	9.52167
51	T16		T1X6	Mabiogo, Dipikar Island, 3900m along T1	20	Flat	2800	Cosaca	95	3.59	113.6	38	2.17042	9.51547
52	T1FP1	T1FP1	T1FP1X	Mabiogo, Dipikar Island, 3500m along T1	10	Flat	2800	Cosaca	108	3.76	97.6	36.6	2.16499	9.52039
53	EGON1	EGON1	EGONX1	Efoulan, Egongo Hills	1000	Slope	2000	Submontane	135	4.12	166.3	25	2.44458	10.32528
54	EGON2	EGON2	EGONX2	Efoulan, Egongo Hills	900	Slope	2000	Submontane	122	3.94	211.8	23.4	2.4406	10.3134
55	EGON3	EGON3	EGONX3	Efoulan, Egongo Hills	820	Flat	2000	Submontane	139	4.50	176.1	31.3	2.4404	10.31306
56	EGON4	EGON4	EGONX4	Efoulan, Egongo Hills	900	Slope	2000	Submontane	146	4.18	161.5	24.6	2.4411	10.32111
57	EGON5	EGON5	EGONX5	Efoulan, Egongo Hills	760	Slope	2000	Submontane	133	4.43	159.8	27	2.44046	10.32167
58	EGON6	EGON6	EGONX6	Efoulan, Egongo Hills	740	Flat	2000	Submontane	148	4.30	180	30.5	2.43483	10.32328
59	EGON7	EGON7	EGONX7	Efoulan, Egongo Hills	940	Slope	2000	Submontane	135	4.11	153.5	16.7	2.44172	10.32483
60	EGON8	EGON8	EGONX8	Efoulan, Egongo Hills	900	Flat	2000	Submontane	128	4.10	226.7	23.7	2.43254	10.32099
61	EGON9	EGON9	EGONX9	Efoulan, Egongo Hills	780	Slope	2000	Submontane	134	4.20	218.8	21.6	2.43059	10.32402
62	EGON10	EGON10	EGONX10	Efoulan, Egongo Hills	700	Slope	2000	Submontane	147	4.51	205.3	21.1	2.44193	10.3224
63	NSE1	NSE1	NSEX1	Nsengou	440	Flat	1670	Okoume	96	3.53	104.3	60.9	2.10515	10.34489
64	NSE2	NSE2	NSEX2	Nsengou	420	Flat	1670	Okoume	105	4.00	114.8	62.6	2.12368	10.33223
65	NSE3	NSE3	NSEX3	Nsengou	460	Flat	1670	Okoume	107	3.59	125.9	46.5	2.12405	10.35297
66	NSE4	NSE4	NSEX4	Nsengou	420	Slope	1670	Mixsemideci	98	3.09	101.4	45.7	2.12152	10.33261
67	NSE5	NSE5	NSEX5	Nsengou	440	Flat	1670	Mixsemideci	86	3.12	93.4	50	2.1157	10.33421
68	NSE6	NSE6	NSEX6	Nsengou	400	Slope	1670	Mixsemideci	131	3.77	133.3	46.3	2.10559	10.35069
69	NSE7	NSE7	NSEX7	Nsengou	400	Slope	1670	Mixsemideci	91	3.34	164.5	55.8	2.10476	10.37229
70	NSE8	NSE8	NSEX8	Nsengou	480	Slope	1670	Mixsemideci	103	3.81	93.8	54.5	2.13193	10.35386
71	NSE9			Nsengou	500	Slope	1670	Mixsemideci	106	3.64	124.7	54.7	2.14378	10.35071
72	NSE10	NSE9	NSEX9	Aloum	480	Slope	1670	Mixsemideci	107	3.62	76	46	2.16144	10.33312

No	0.1 ha plot code	5 x 5m sub-plot	Qualitative Sample code	Locality	Altitude (m)	Slope	Rainfall (mm/year)	Vegetation code*	No of species	H'	GHI	PI	Latitude (N) d°.minsec	Longitude (E) d°.minsec
73	NSE11		NSEX10	Boucles du Ntem	460	Flat	1670	Swamp	107	3.71	117.4	45.3	2.18183	10.35079
74	ONO1	ONO1	ONOX1	Onoyong	500	Slope	1750	Mixevergreen	98	3.62	117.4	45.7	2.31392	10.41489
75	ONO2	ONO2	ONOX2	Onoyong	480	Flat	1750	Mixevergreen	96	3.79	189	31.8	2.32085	10.41393
76	ONO3	ONO3	ONOX3	Onoyong	480	Flat	1750	Mixevergreen	95	3.59	193.2	39.5	2.32393	10.40466
77	ONO4	ONO4	ONOX4	Onoyong	480	Slope	1750	Mixevergreen	92	3.58	203.2	33.3	2.35589	10.40309
78	ONO5	ONO5	ONOX5	Onoyong	500	Flat	1750	Mixevergreen	106	3.57	91.1	40.6	2.37138	10.38069
79	ONO6	ONO6	ONOX6	Onoyong	480	Flat	1750	Mixevergreen	102	3.87	156.3	37.9	2.36203	10.38288
80	ONO7	ONO7	ONOX7	-Onoyong	460	Flat	1750	Mixevergreen	82	3.20	155.2	37.3	2.35416	10.38432
81	ONO8	ONO8	ONOX8	Onoyong	480	Flat	1750	Mixevergreen	118	4.16	112.5	35.8	2.35086	10.39347
82	ONO9	ONO9	ONOX9	Bijap	460	Slope	1750	Mixevergreen	126	3.85	113.8	38.8	2.30537	10.40138
83	ONO10	ONO10	ONOX10	Bijap	500	Slope	1750	Mixevergreen	85	3.36	96.6	47.4	2.30227	10.39310
84	ONO11	ONO11	ONOX11	Bidem	480	Flat	1750	Mixevergreen	135	4.02	134.4	38.6	2.35184	10.41313
85	MM1	MM1	MMX1	Massif des Mamelles, 1400m along IRTIS1	40	Slope	2800	Caesalpcasa	118	3.51	203.6	28.4	2.26386	9.54513
86	MM2	MM2	MMX2	Massif des Mamelles, 800m along IR2T2	40	Slope	2800	Caesalpcasa	104	3.89	215.4	23.7	2.31119	9.54484
87	MM3	MM3	MMX3	Bibabimvoto, 500m along IR4T4	20	Flat	2800	Caesalpcasa	121	4.16	175.3	26.4	2.18279	9.5739
88	MM4	MM4	MMX4	Massif des Mamelles	280	Slope	2800	Caesalpsa	117	4.16	148.2	20.6	2.33571	9.56582
89	MM5	MM5	MMX5	Massif des Mamelles	220	Slope	2800	Caesalpsa	113	4.02	185.2	22.8	2.35171	9.5729
90	MM6	MM6	MMX6	Rocher du Loup	0	Slope	2800	Cos	45	3.09	164.5	40.5	2.37411	9.50287
91	MM7		MMX10	Rocher du Loup	10	Slope	2800	Cos	55	2.94	150	47.8	2.37392	9.50273
92	MM8	MM7	MMX7	Mvini, 500m along IRS9T9	100	Slope	2800	Caesalpcasa	114	4.06	195.3	26	2.24541	10.06173
93	MM9	MM8	MMX8	Nkoelon	80	Flat	2800	Caesalpcasa	123	4.02	163.3	24.8	2.26411	10.01308
94	BIFA1	BIFA1	BIFAX1	Bifa	80	Slope	2950	Caesalpsa	129	4.17	173.9	33.9	2.41375	10.16233
95	BIFA2	BIFA2	BIFAX2	Bifa	120	Flat	2950	Caesalpsa	119	3.48	210.7	26.4	2.3927	10.17001
96	BIFAFP3	BIFA3	BIFAX3	Bifa	60	Flat	2950	Caesalpsa	86	3.35	142.6	32.5	2.40281	10.16548
97	BIFA4	BIFA4	BIFAX4	Bifa	100	Slope	2950	Caesalpsa	126	4.08	172.4	41	2.41328	10.15133
98	ELE1	ELE1	ELEX1	Bidou, Mont d'Elephant	180	Slope	2950	Caesalpsa	138	4.26	175.5	31.8	2.47522	10.01120
99	ELEP2	ELE2	ELEX2	Bidou, Mont d'Elephant	100	Slope	2950	Caesalpsa	97	3.59	165.2	24.7	2.48064	10.01250
100	ELE3	ELE3	ELEX3	Bidou, Mont d'Elephant	60	Flat	2950	Caesalpsa	137	4.25	160.8	29	2.47366	10.00570
101	AKOK1	AKOK1	AKOKX1	Ebodje, around Akok	20	Flat	2800	Cosaga	102	3.61	152.1	24.2	2.39443	9.54372
102	AKOK2	AKOK2	AKOKX2	Ebodje, around Akok	40	Flat	2800	Cosaga	140	4.41	116.7	34.9	2.34243	9.54135
103	AKOK3	AKOK3	AKOKX3	Ebodje, around Akok	5	Flat	2800	Cosaga	94	3.60	156.5	29.3	2.43554	9.53301
104	AKOK4	AKOK4	AKOKX4	Ebodje, around Boussibliga	10	Slope	2800	Cosaga	96	3.56	158.6	22.6	2.43564	9.53021
105	AKOK5	AKOK5	AKOKX5	Ebodje, around Lolabe 2	5	Slope	2800	Cosaga	109	3.64	122.4	36.3	2.40464	9.51395
106	KOMFP1	KOM1	KOMX1	Nkoelone, around Kom river	100	Flat	2800	Caesalpsa	100	3.82	189	38	2.27586	10.08475
107	KOM2	KOM2	KOMX2	Nkoelone, around Kom river	80	Slope	2800	Caesalpsa	96	3.61	154.2	29.2	2.29089	10.09062
108	EBOU1	EBOU1	EBOUX1	Eboundja	10	Flat	2800	Cosaga	81	3.57	171.4	35.3	2.48199	9.54507
109	EBOU2	EBOU2	EBOUX2	Eboundja	20	Slope	2800	Cosaga	85	3.73	139.3	28.8	2.45116	9.53065
110	EBOU3	EBOU3	EBOUX3	Ypeyendje	0	Flat	2800	Cos	41	2.96	44.4	87.9	2.36083	9.50106

No	0.1 ha plot code	5 x 5m sub-plot	Qualitative Sample code	Locality	Altitude (m)	Slope	Rainfall (mm/year)	Vegetation code*	No of species	H'	GHI	PI	Latitude (N) d°.minsec	Longitude (E) d°.minsec
111	CAMPO1	CAMPO1	CAMPOX1	Bouandjo	45	Slope	2800	Cosaga	103	3.96	213.7	24.7	2.30031	9.50582
112	EBIA1	EBIA1	EBIAX1	Ebianemeyong, path to Memve'ele water falls	380	Flat	1750	Mixevergreen	116	3.74	136.4	46.7	2.24246	10.21487
113	EBIA2	EBIA2	EBIAX2	Ebianemeyong, near Memve'ele water falls	360	Slope	1750	Mixevergreen	91	3.54	132.8	40.2	2.24012	10.21483
114	EBIA3			Oveng, path to Chantier A	350	Slope	2800	Caesalp	93	3.81	125.4	34.1	2.21395	10.16383
115	CAMPO2	CAMPO2	CAMPOX2	Itonde Nigerian, Campo area	40	Slope	2800	Cosaca	92	3.74	131	33.3	2.27175	9.49940
116	CAMPO4	CAMPO4	CAMPOX4	Mintom Centre, Campo area	65	Flat	2800	Cosaca	78	3.31	113.1	38.9	2.23097	9.51566
117	CAMPO3	CAMPO3	CAMPOX3	Melaba, Campo area	40	Slope	2800	Cosaga	89	3.68	124.3	34.5	2.29479	9.50480
118	CAMPO5	CAMPO5	CAMPOX5	Nazaret, Campo area	60	Flat	2800	Cosaca	89	3.34	95.5	50.6	2.18571	9.53457
119	NGOAM2	NGOAM2	NGOAMX2	Ngoambang in the Ma'an area	330	Slope	1670	Mixevergreen	90	2.97	102.7	41.4	2.16480	10.20542
120	NGOAM1	NGOAM1	NGOAMX1	Ngoambang in the Ma'an area	430	Slope	1670	Mixevergreen	63	2.89	103.8	61.7	2.15095	10.20550
121	NGOMA7	NGOMA7	NGOMAX7	Ebianemeyong	500	Flat	1750	Caesalp	110	3.86	148.4	36.4	2.26467	10.19531
122	NGOMA1	NGOMA1	NGOMAX1	Ebianemeyong	480	Slope	1750	Caesalp	115	3.97	116.7	33.6	2.27370	10.17469
123	NGOMA2	NGOMA2	NGOMAX2	Ebianemeyong	600	Flat	1750	Caesalp	88	3.89	127.9	27.2	2.28280	10.18335
124	NGOMA3	NGOMA3	NGOMAX3	Ebianemeyong	640	Summit	1750	Caesalp	81	3.59	163.6	16.9	2.28125	10.18359
125	NGOMA4	NGOMA4	NGOMAX4	Ebianemeyong	380	Slope	1750	Caesalp	112	3.51	140.4	39	2.27240	10.16098
126	NGOMA5	NGOMA5	NGOMAX5	Ebianemeyong, around Nkolmekok	900	Slope	1750	Submontane	106	3.95	238.6	23.2	2.24460	10.18428
127	NGOMA6	NGOMA6	NGOMAX6	Ebianemeyong	480	Slope	1750	Caesalp	102	3.76	137.3	32.3	2.28449	10.17422
128	BONGO1	BONGO1	BONGOX1	Bibabimvoto, along the Bongola river	20	Flat	2800	Swamp	17	1.65	187.5	7.7	2.16581	9.57024
129	MAMA1	MAMA1	MAMAX1	Massif des Mamelles	60	Slope	2800	Caesalpsa	126	4.21	190.3	29.1	2.36062	9.56297
130	MAMA2	MAMA2	MAMAX2	Massif des Mamelles	230	Flat	2800	Caesalpsa	107	3.76	198.8	27	2.35327	9.57500
131	MABI1	MABI1	MABIX1	Mabiogo, Dipikar Island	0	Flat	2800	Mangrove	4	1.04	3.4	200	2.17356	9.51022
132	MABI2	MABI2	MABIX2	Mabiogo, Dipikar Island	0	Flat	2800	Mangrove	3	0.87	2.9	150	2.17498	9.50193
133	LOLA1	LOLA1	LOLAX1	Lolabe 3	0	Flat	2800	Cos	27	1.51	81.8	91.3	2.40214	9.50471
134	LOBE1	LOBE1	LOBEX1	Lobe toward V12, Hevecam area	60	Flat	2800	Caesalpsa	125	4.10	189.1	26.5	2.32189	10.0328
135	MIRA1	MIRA1	MIRAX1	Chantier A near the Mirador	300	Flat	2800	Caesalp	128	4.18	114.4	33.3	2.22055	10.15237
136	CORI1	CORI1	CORIX1	Mvini, Park corridor	140	Flat	2800	Swamp	96	3.94	177.5	41.4	2.20059	10.12176
137	OKOUM1	OKOUM1	OKOUMX1	Ebianemeyong, slopes on hills around Kom river	620	Slope	1750	Okoume	18	1.44	166.7	76.9	2.28066	10.19065
138	BIBOU1	BIBOU1	BIBOUX1	Biboulman, Akom II area	600	Flat	2000	Mixevergreen	91	3.54	104.2	32.6	2.42583	10.38511
139	BIN1	BIN1	BINX1	Bindem	540	Slope	2000	Mixsemideci	109	3.33	123.8	39.2	2.41072	10.47111
140	AFA1	AFA1	AFAx1	Afan	560	Flat	1670	Mixsemideci	132	4.17	153	54.4	2.36313	10.50285
141	MEKO1	MEKO1	MEKOX1	Mekok	580	Slope	1670	Mixsemideci	133	3.56	188.2	35.4	2.30557	10.52352
142	TYA1	TYA1	TYAX1	Tya'assono, Ma'an area	500	Flat	1670	Mixsemideci	131	3.74	136.1	38.7	2.25529	10.45101
143	MA1	MA1	MA1	Ma'an	500	Slope	1670	Mixsemideci	147	4.33	137.5	33.8	2.26342	10.37155
144	MA2	MA2	MAX2	Ma'an	500	Flat	1670	Mixsemideci	112	3.52	110	41.9	2.18283	10.41296
145	NSEB1	NSEB1	NSEBX1	Nsebito, Ma'an area	460	Slope	1670	Mixsemideci	110	3.50	205.3	23.5	2.28033	10.29569
146	NKON1	NKON1	NKONX1	Nkongmeyous, Ma'an area	500	Flat	1670	Mixsemideci	110	4.04	130.4	45.3	2.22508	10.33385
147	NYA1	NYA1	NYAX1	Nyabissan near Ma'an	420	Slope	1670	Mixsemideci	110	3.71	182.8	27.9	2.25469	10.23187

* Vegetation types as described in chapter 2 with the following codes: Caesalp: Lowland evergreen forest rich in Caesalpinioideae; Caesalpsa: Lowland evergreen forest rich in Caesalpinioideae and *Sacoglottis gabonensis*; Cosaca: Coastal forest with *Sacoglottis gabonensis* and *Calpocalyx heitzii*; Cosaga: Coastal forest with *Sacoglottis gabonensis*; Cosas: Coastal forest on sandy shorelines; Mangrove: Mangrove forest; Mixevergreen: Mixed evergreen and semi-deciduous forest with elements of evergreen forest predominant; Mixsemideci: Mixed evergreen and semi-deciduous forest with semi-deciduous elements predominant; Okoumé: Okoumé forest; and Submontane: Submontane forest on hill tops.

Annex 2. Soil characteristics including soil type, drainage, parent material, surface stone, topsoil texture (0-10 cm), pH (water) and electricity conductivity (EC, mS.cm^{-1}) taken at 0-10 cm, 10-20 cm, 30-20 cm and > 50 cm depths respectively in 72 representative samples.

No	Plot	Soil type	Drainage	Parent material	Surface stone	Topsoil texture	pH10	EC10	pH20	EC20	pH30	EC30	pH50	EC50
1	T21	Plinthic Ferrasols	Well drained	Gneiss	Gravels & stones	Sandy loam	3.92	237.6	4.10	38.6	4.12	29.8	4.40	24.9
2	EFOU1	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	Gravel, stones & boulders	Sandy clay loam	4.41	84.7	4.41	68.2	4.77	36.3	4.67	30.8
3	EFOU2	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	Stones & boulders	Sandy loam	4.38	102.3	4.49	90.2	4.82	52.8	4.75	40.7
4	EFOU3	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Sandy clay loam	3.89	190.3	4.22	110.0	4.33	60.5	4.50	41.8
5	EFOU4	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Sandy clay loam	4.24	58.3	4.47	53.9	4.70	37.4	4.57	37.4
6	T32	Plinthic Ferrasols	Well drained	Migmatite, quartzite	Gravels	Sandy loam	4.00	106.7	3.94	34.2	4.16	23.1	4.41	19.9
7	T34	Plinthic Ferrasols	Well drained	Migmatite, quartzite	Gravel & stones	Coarse sandy	4.16	88.0	3.96	41.9	3.95	33.1	4.34	21.5
8	T35	Plinthic Ferrasols	Well drained	Migmatite	Stones	Loam coarse sandy	3.97	61.6	3.82	32.0	3.46	29.8	4.10	20.2
9	T51	Plinthic Ferrasols	Well drained	Migmatite	Stones	Sandy clay loam	4.52	63.8	4.55	34.1	4.65	29.7	4.68	20.9
10	T53	Xanthic Ferrasols	Well drained	Migmatite	Gravels	Clay loam	4.88	122.1	4.22	58.3	4.32	47.3	4.52	33.0
11	T55	Xanthic Ferrasols	Moderately well drained	Migmatite	Gravels	Sandy clay loam	4.14	97.9	4.45	41.8	4.65	25.3	4.54	34.1
12	T22	Plinthic Ferrasols	Well drained	Gneiss	Gravels	Sandy clay loam	4.00	144.1	3.92	61.6	3.97	40.7	4.01	33.0
13	T25	Plinthic Ferrasols	Well drained	Gneiss	Gravels	Sandy clay loam	4.56	188.1	3.62	51.8	4.20	41.3	4.31	30.7
14	T41	Plinthic Ferrasols	Well drained	Migmatite	Stones	Loam coarse sandy	3.49	78.1	3.49	61.6	3.55	44.1	4.01	32.6
15	T43	Plinthic Ferrasols	Well drained	Migmatite	Boulders	Sandy clay loam	3.99	52.8	4.04	58.2	4.05	41.8	4.00	31.9
16	T4FP1	Plinthic Ferrasols	Well drained	Quartzite	Stones	Coarse sandy loam	4.03	62.7	4.16	62.7	3.48	45.1	4.04	35.2
17	T81	Plinthic Ferrasols	Well drained	Quartzite	Stones	Loam medium sand	3.45	86.9	4.14	42.9	4.09	29.8	4.10	19.6
18	T82	Plinthic Ferrasols	Well drained	Migmatite, quartzite	Stones	Sandy clay loam	5.17	106.7	4.88	55.0	4.98	23.1	4.89	20.0
19	T8FP1	Plinthic Ferrasols	Well drained	Migmatite	Gravel & stones	Loam medium sand	4.38	97.9	4.13	71.5	4.88	26.5	4.42	23.1
20	T61	Xanthic Ferrasols	Well drained	Migmatite	Boulders	Sandy clay loam	5.09	113.3	4.80	51.7	4.87	30.8	4.94	25.3
21	T62	Xanthic Ferrasols	Well drained	Migmatite	Stones	Clay loam	4.36	85.8	4.50	40.5	4.51	33.0	4.74	25.3
22	T63	Xanthic Ferrasols	Moderately well drained	Migmatite	Gravel, stones & boulders	Clay loam	4.91	77.0	4.92	31.9	4.85	25.3	4.98	24.2
23	T64	Xanthic Ferrasols	Well drained	Migmatite	Stones	Clay loam	4.10	105.6	4.38	55.0	4.53	37.4	4.72	23.1
24	T6FP1	Xanthic Ferrasols	Well drained	Migmatite	Stones	Sandy clay loam	4.52	82.5	4.64	37.4	4.83	34.1	4.76	26.4
25	T6FP2	Xanthic Ferrasols	Well drained	Migmatite	Gravels	Loamy sand	4.46	70.4	4.54	49.5	4.76	31.9	4.82	24.2
26	T1FP1	Plinthic Ferrasols	Well drained	Gneiss	No stones or gravels	Loamy sand	3.80	169.4	3.88	59.4	3.99	34.3	4.12	24.2
27	EGON1	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, gneiss	Stones	Loam medium sand	3.88	240.9	4.20	137.5	4.28	97.9	4.59	39.6
28	EGON3	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, gneiss	Gravel & boulders	Loamy sand	4.09	192.5	4.31	81.4	4.53	53.9	4.64	50.6
29	EGON5	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Sandy clay loam	3.87	145.2	4.00	102.3	4.06	91.3	4.32	69.3
30	EGON6	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Loam medium sand	4.00	181.5	4.28	132.0	4.41	63.8	4.62	44.0
31	EGON7	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	Gravel & stones	Loam coarse sandy	4.11	184.8	4.20	139.7	4.34	83.6	5.06	37.4
32	EGON8	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Loamy sand	3.71	222.2	3.94	172.7	4.33	84.7	4.33	68.2
33	EGON9	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Sandy clay loam	3.67	213.4	3.98	143.3	4.26	56.1	4.37	46.2
34	EGON10	Acri-Xanthic Ferrasols & Xanthic Ferrasols	Well drained	Migmatite, granite	No stones or gravels	Coarse sand	4.22	97.9	4.46	58.3	4.56	41.8	4.88	34.1
35	NSE1	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Loam medium sand	3.45	83.6	3.58	59.4	3.54	40.7	3.67	31.8

No	Plot	Soil type	Drainage	Parent material	Surface stone	Topsoil texture	pH10	EC10	pH20	EC20	pH30	EC30	pH50	EC50
36	NSE2	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Sandy clay loam	3.48	124.3	3.57	84.7	3.71	48.4	3.83	36.7
37	NSE3	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Sandy clay loam	3.61	211.2	3.57	67.1	3.50	48.4	3.91	34.8
38	NSE7	Xanthic Ferrasols	Well drained	Migmatite	Few gravel & stones	Loam medium sand	3.54	145.2	3.51	55.0	3.60	37.4	3.81	29.3
39	NSE8	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Sandy clay loam	3.75	107.8	3.69	55.0	3.60	36.3	4.01	28.2
40	NSE11	Dystric Fluviosols (hydric soil)	Poorly drained	Migmatite	No stones or gravels	Clay loam	3.78	171.1	3.69	51.8	3.73	35.7	4.21	26.4
41	ONO1	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Sandy clay loam	3.55	130.9	3.60	74.8	3.47	60.5	3.79	48.6
42	ONO3	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Sandy clay loam	3.46	181.5	3.46	69.3	3.55	35.2	3.62	23.9
43	ONO5	Xanthic Ferrasols	Moderately well drained	Migmatite	No stones or gravels	Sandy clay loam	3.77	150.7	3.79	49.6	3.68	39.6	4.02	35.2
44	ONO7	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Sandy clay loam	3.80	103.4	3.61	48.4	3.70	36.4	4.30	25.8
45	ONO9	Xanthic Ferrasols	Well drained	Migmatite	Boulders	Sandy clay loam	3.53	100.3	3.66	85.8	3.62	61.6	3.63	50.6
46	ONO11	Xanthic Ferrasols	Well drained	Migmatite	No stones or gravels	Loamy sand	3.58	171.6	3.59	59.4	3.65	31.6	4.01	20.9
47	MM3	Plinthic Ferrasols	Moderately well drained	Gneiss		Clay loam	3.96	180.4	4.00	107.8	4.45	38.5	4.59	25.3
48	MM4	Ferralic Cambisols & Ferric Acrisols	Well drained	Pynoxenite with quartzite	Gravels	Sandy clay loam	3.69	207.9	4.03	111.1	4.25	68.2	4.33	41.8
49	MM5	Ferralic Cambisols & Ferric Acrisols	well drained	Pynoxenite with quartzite		Clay loam	3.69	202.4	3.76	123.2	4.13	71.5	4.21	58.3
50	MM6	Sandy Dystric Fluviosols	Moderately well drained	Gneiss	Boulders	Clay loam	4.27	121.0	4.59	86.9	4.72	80.3	4.62	48.4
51	MM8	Plinthic Ferrasols	Well drained	Gneiss	Gravel, stones & boulders	Sandy clay loam	4.34	139.7	4.46	50.6	4.44	42.9	4.46	44.0
52	MM9	Plinthic Ferrasols	Well drained	Migmatite, quartzite	Gravel, stones & boulders	Loam coarse sandy	3.66	171.6	3.71	140.8	3.93	79.2	4.29	57.2
53	BIFA1	Plinthic Ferrasols	Well drained	Migmatite	Stones	Sandy clay loam	4.89	74.8	4.73	41.8	4.62	68.2	5.08	19.8
54	BIFA2	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	3.93	110.0	4.52	53.9	4.67	27.5	4.90	19.6
55	BIFAFP3	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	3.96	171.6	4.40	74.8	4.45	39.6	4.62	28.6
56	BIFA4	Plinthic Ferrasols	Well drained	Migmatite	Stones	Sandy loam	4.48	102.3	4.67	49.5	4.69	38.5	4.76	27.5
57	ELE1	Plinthic Ferrasols	Well drained	Migmatite	Boulders	Clay loam	4.07	135.3	4.44	66.0	4.47	47.3	4.50	35.2
58	ELEP2	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy loam	3.82	143.0	4.05	81.4	4.42	47.3	4.42	38.5
59	ELE3	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	3.89	114.4	4.35	42.9	4.49	31.9	4.69	18.7
60	AKOK1	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Loamy sand	3.93	81.4	4.43	33.0	4.67	24.2	4.81	17.6
61	AKOK2	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	5.32	47.3	4.82	26.4	4.78	23.1	5.00	17.6
62	AKOK4	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Loamy sand	3.90	66.0	4.21	46.2	4.52	25.3	4.66	19.8
63	AKOK5	Plinthic Ferrasols	Moderately well drained	Migmatite	Gravels	Loamy sand	3.70	95.7	3.98	58.3	4.10	51.7	4.24	38.5
64	EBOU1	Plinthic Ferrasols	Imperfectly drained	Migmatite	Gravels	Sandy loam	4.16	91.3	4.73	30.8	4.87	28.6	4.69	28.6
65	EBOU2	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy loam	4.29	79.2	4.20	39.6	4.44	29.7	4.56	24.2
66	EBOU3	Sandy Dystric Fluviosols	Moderately well drained	Granite	Gravels	Coarse	3.85	80.3	5.61	30.8	6.06	16.5	6.25	13.2
67	CAMPO1	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy coarse	4.12	84.7	4.60	40.7	4.79	25.3	4.97	19.8
68	EBIA3	Xanthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	4.22	64.9	4.36	40.7	4.66	39.6	4.61	24.2
69	CAMPO2	Plinthic Ferrasols	Imperfectly drained	Migmatite	Gravels	Sandy clay loam	4.19	89.1	4.62	102.3	4.75	26.4	4.70	19.8
70	CAMPO4	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	4.12	165.0	4.66	33.0	4.50	41.8	5.03	16.5
71	CAMPO3	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Clay loam	3.60	138.6	4.38	36.3	4.45	35.2	4.45	33.0
72	CAMPO5	Plinthic Ferrasols	Well drained	Migmatite	Gravels	Sandy clay loam	4.16	91.3	4.49	45.1	4.75	35.2	4.85	23.1

Where pH10 and EC10 mean pH and electricity conductivity at 0-10 cm, then pH20 and EC20 for pH and electricity conductivity at 10-20 cm, and so on.

Annex 3. Plant species checklist of the Campo-Ma'an area with information on their guild, star category, habit, chorology, IUCN and WCMC threat categories.

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1	Acanthaceae	Acanthus montanus (Nees) T.Anderson	pi	gn	Hb	Gc	Re	
2	Acanthaceae	Adhatoda buchholzii (Lindau) S.Moore	pi	bu	Hb	Lg	Co	
3	Acanthaceae	Adhatoda maculata (T.Anderson) C.B.Clarke	pi	gn	Hcl	Gc	Hl	
4	Acanthaceae	Adhatoda tristis Nees	pi	gn	Hb	Gc	Hl	
5	Acanthaceae	Afrofittonia silvestris Lindau	sb	bu	Hb	Lg	Co	VU A1c+2c
6	Acanthaceae	Ascotheca paucinervia (T.Anderson ex C.B.Clarke) Heine	pi	bu	Hb	Lg	Hl	
7	Acanthaceae	Asystasia decipiens Heine	pi	bu	Hb	Lg	Hl	
8	Acanthaceae	Asystasia gangetica Lindau	pi	gn	Hb	Gc	Co	
9	Acanthaceae	Asystasia macrophylla (T.Anderson) Lindau	sb	bu	Hb	Lg	Co	
10	Acanthaceae	Asystasia vogeliana Benth.	pi	gn	Hb	Gc	Co	
11	Acanthaceae	Brachystephanus jaundensis Lindau	pi	bu	Hb	Lg	Hl	
12	Acanthaceae	Brillantaisia debilis Burkill	pi	gn	Hb	Gc	Co	
13	Acanthaceae	Brillantaisia lamium (Nees) Benth.	pi	gn	Hb	Gc	Hl	
14	Acanthaceae	Brillantaisia owariensis P. Beauv.	pi	gn	Hb	Gc	Co	
15	Acanthaceae	Brillantaisia soyauxii Lindau	pi	bu	Hb	Lg	Hl	
16	Acanthaceae	Brillantaisia vogeliana (Nees) Benth.	pi	gn	Hb	Gc	Co	
17	Acanthaceae	Chlamydocardia buettneri Lindau	sb	gn	Hb	Gu	Co	
18	Acanthaceae	Dicliptera elliotii C.B.Clarke	pi	gn	Hb	Tra	Hl	
19	Acanthaceae	Dicliptera laxispica Lindau	pi	gn	Hb	Gc	Hl	
20	Acanthaceae	Dicliptera obanensis S.Moore	pi	gn	Hb	Gc	Hl	
21	Acanthaceae	Dischistocalyx grandifolius C.B.Clarke	ep	bu	Hb	Lg	Hl	
22	Acanthaceae	Dischistocalyx hirsutus C.B.Clarke	ep	gn	Hb	Lg	Co	
23	Acanthaceae	Dischistocalyx strobilinus C.B.Clarke	ep	bu	Hb	Lg	Co	
24	Acanthaceae	Elytraria marginata Vahl	pi	gn	Hb	Gc	Co	
25	Acanthaceae	Eremomastax polysperma (Benth.) Dandy	pi	gn	Hb	Tra	Re	
26	Acanthaceae	Eremomastax speciosa (Hochst.) Cufod.	pi	gn	Hb	Tra	Re	
27	Acanthaceae	Filetia africana Lindau	pi	gn	Hb	Gc	Hl	
28	Acanthaceae	Hypoestes aristata (Vahl) Soland. ex Roem. & Schult.	pi	gn	Hb	Gc	Hl	
29	Acanthaceae	Hypoestes triflora (Forssk.) Roem. & Schult.	pi	gn	Hb	Tra	Hl	
30	Acanthaceae	Justicia biokoensis V.A.W. Graham	pi	bu	Hb	Lg	Co	
31	Acanthaceae	Justicia extensa T.Anderson	pi	gn	Hb	Gc	Co	
32	Acanthaceae	Justicia insularis T.Anderson	pi	gn	Hb	Tra	Co	
33	Acanthaceae	Justicia laxa T.Anderson	pi	gn	Hb	Gc	Co	
34	Acanthaceae	Justicia tenella (Nees) T.Anderson	pi	gn	Hb	Tra	Hl	
35	Acanthaceae	Justicia tristis T.Anderson	pi	gn	Hb	Gc	Co	
36	Acanthaceae	Lankesteria brevior C.B.Clarke	pi	gn	Hb	Gc	Co	
37	Acanthaceae	Lankesteria elegans (P.Beauv.) T.Anderson	sb	gn	Hb	Gc	Co	
38	Acanthaceae	Mendoncia gilgiana (Lindau) Benoist	np	bu	Hb	Lg	Co	
39	Acanthaceae	Mendoncia iodioides (s.Moore) Heine	np	gn	Swcl	Gc	Hl	
40	Acanthaceae	Mendoncia lindaviana (Gilg) Benoist	np	bu	Swcl	Lg	Co	
41	Acanthaceae	Mendoncia phytocrenoides (Gilg) Benoist	np	gn	Swcl	Gc	Co	
42	Acanthaceae	Nelsonia canescens (Lam.) Spreng.	pi	gn	Hb	Tra	Co	
43	Acanthaceae	Nelsonia smithii Oersted	sb	gn	Hb	Tra	Hl	
44	Acanthaceae	Phaulopsis angolana S.Moore	pi	gn	Hb	Gc	Co	
45	Acanthaceae	Phaulopsis ciliata (Willd.) Hepper	pi	gn	Hb	Gc	Co	
46	Acanthaceae	Phaulopsis silvestris (Lindau) Lindau	pi	gn	Hb	Gc	Hl	
47	Acanthaceae	Physacanthus batanganus (G.Braun & K.Schum.) Lindau	sb	gn	Hb	Gc	Co	
48	Acanthaceae	Physacanthus nematosiphon (Lindau) Rendle & Britten	sb	gn	Hb	Gc	Co	
49	Acanthaceae	Pseuderanthemum ludovicianum (Büttner) Lindau	pi	gn	Hb	Tra	Co	
50	Acanthaceae	Pseuderanthemum tunicatum (Afzel.) Milne-Redh.	pi	gn	Hb	Tra	Co	
51	Acanthaceae	Rhinacanthus virens (Nees) Milne-Redh. var. obtusifolius Heine	sb	gn	Hb	Gc	Co	
52	Acanthaceae	Rhinacanthus virens (Nees) Milne-Redh. var. virens	sb	gn	Hb	Tra	Co	
53	Acanthaceae	Ruellia primuloides (T.Anderson ex Benth.) Heine	sw	gn	Hb	Gc	Co	
54	Acanthaceae	Rungia buettneri Lindau	sb	gn	Hb	Gc	Co	
55	Acanthaceae	Rungia congoensis C.B.Clarke	pi	gn	Hb	Gc	Co	
56	Acanthaceae	Schaueria populifolia C.B.Clarke	sb	bu	Hb	Lg	Co	
57	Acanthaceae	Sclerochiton preussii (Lindau) C.B.Clarke	sb	bu	Hb	Lg	Co	EN B1+2c
58	Acanthaceae	Staurogyne bicolor (Mildbr.) Champl.	sb	bu	Hb	Lg	Co	
59	Acanthaceae	Staurogyne kamerunensis (Engl.) Benoist	sb	gn	Hb	Gc	Co	
60	Acanthaceae	Stenandrium guineense (Nees) Vollesen	sb	gn	Hb	Gc	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
61	Acanthaceae	Stenandrium talbotii (S.Moore) Vollesen	sb	gn	Hb	Lg	Co	
62	Acanthaceae	Stenandrium thomense (Milne-Redh.) Vollesen	sb	GD	Hb	Cam	Co	
63	Acanthaceae	Thomandersia congolana De Wild. & T.Durand	sb	gn	Sh	Gc	Co	
64	Acanthaceae	Thomandersia hensii De Wild. & T.Durand	sb	gn	Sh	Gc	Co	
65	Acanthaceae	Thomandersia laurifolia (Benth.) Baill.	sb	bu	Sh	Lg	Co	
66	Acanthaceae	Thunbergia vogeliana Benth.	pi	gn	Hcl	Gc	Co	
67	Acanthaceae	Whitfieldia elongata (P.Beauv.) De Wild. & T.Durand	pi	gn	Hcl	Gc	Hl	
68	Acanthaceae	Whitfieldia preussii (Lindau) C.B.Clarke	pi	gn	Hcl	Tra	Hl	
69	Adiantaceae	Adiantum poiretii Wikstr. var. poiretii	ep	gn	Ep	Tra	Hl	
70	Adiantaceae	Adiantum vogelii Mett. ex Keyserl.	ep	gn	Ep	Gc	Hl	
71	Adiantaceae	Afropteris repens (C.Chr.) Alston	sb	gn	Hb	Gc	Co	
72	Adiantaceae	Cheilanthes farinosa (Forssk.) Kaulf.	pi	gn	Hb	Pa	Co	
73	Adiantaceae	Pellaea doniana J.Sm. ex Hook.	sb	gn	Ep	Gc	Co	
74	Adiantaceae	Pityrogramma calomelanos (L.) Link var. calomelanos	pi	gn	Hb	Tra	Co	
75	Adiantaceae	Pteris pteridioides (Hook.) Ballard	sb	gn	Hb	Gc	Co	
76	Alismataceae	Limnophyton fluitans Graebn.	rh	bu	Hb	Lg	Co	
77	Amaranthaceae	Achyranthes aspera L. var. aspera	pi	gn	Hb	Pa	Hl	
78	Amaranthaceae	Achyranthes aspera L. var. pubescens (Moq.) C.C.Towns.	pi	gn	Hb	Pa	Hl	
79	Amaranthaceae	Achyranthes aspera L. var. sicula L.	pi	gn	Hb	Pa	Hl	
80	Amaranthaceae	Achyranthes bidentata Blume	pi	gn	Hb	Pa	Co	
81	Amaranthaceae	Aerva lanata (L.) Juss. ex Schult.	pi	gn	Hb	Pa	Re	
82	Amaranthaceae	Alternanthera littoralis P.Beauv. var. maritima (Mart.) Pedersen	pi	gn	Hb	Pa	Hl	
83	Amaranthaceae	Alternanthera maritima (Mart.) St.-Hil.	pi	gn	Hb	Pa	Hl	
84	Amaranthaceae	Alternanthera sessilis (L.) R.Br.	pi	gn	Hb	Pa	Hl	
85	Amaranthaceae	Amaranthus hybridus L. subsp. cruentus (L.) Thell.	pi	gn	Hb	Pa	Hl	
86	Amaranthaceae	Amaranthus spinosus L.	pi	gn	Hb	Pa	Re	
87	Amaranthaceae	Celosia globosa Schinz	pi	gn	Hb	Pa	Co	
88	Amaranthaceae	Celosia isertii C.C.Towns.	pi	gn	Hb	Gc	Hl	
89	Amaranthaceae	Celosia laxa Schum. & Thonn.	pi	gn	Hb	Gc	Hl	
90	Amaranthaceae	Celosia leptostachya Benth.	pi	gn	Hb	Gc	Co	
91	Amaranthaceae	Cyathula achyranthoides (Kunth.) Moq.	pi	gn	Hb	Pa	Hl	
92	Amaranthaceae	Cyathula prostrata (L.) Blume var. pedicellata (C.B.Clarke) Cavaco	pi	gn	Hb	Gc	Re	
93	Amaranthaceae	Cyathula prostrata (L.) Blume var. prostrata	pi	gn	Hb	Gc	Re	
94	Amaryllidaceae	Crinum jagus (Thomps.) Dandy	rh	gn	Hb	Gc	Hl	
95	Amaryllidaceae	Crinum natans Baker	rh	gn	Hb	Gc	Co	
96	Amaryllidaceae	Crinum purpurascens Herb.	rh	gn	Hb	Gc	Co	
97	Amaryllidaceae	Scadoxus cinnabarinus (Decne.) Friis & Nordal	sb	gn	Hb	Gc	Co	
98	Amaryllidaceae	Scadoxus pseudocaulus (Bjornst. & Friis) Friis & Nordal	sb	bu	Hb	Lg	Hl	
99	Anacardiaceae	Anacardium occidentale L.	pi	gn	Tr	In	Re	
100	Anacardiaceae	Antrocaryon klaineanum Pierre	pi	bu	Tr	Lg	Re	
101	Anacardiaceae	Antrocaryon micraster A. Chev. & Guillaum.	pi	bu	Tr	Lg	Re	VU A1cd
102	Anacardiaceae	Lannea nigritana (Scott-Elliot) Keay var. pubescens Keay	pi	gn	Tr	Gc	Co	
103	Anacardiaceae	Lannea welwitschii (Hiern) Engl.	pi	gn	Tr	Gc	Co	
104	Anacardiaceae	Mangifera indica L.	pi	gn	Tr	In	Re	
105	Anacardiaceae	Pseudospondias microcarpa (A.Rich.) Engl. var. microcarpa	sw	gn	Tr	Tra	Co	
106	Anacardiaceae	Sorindeia africana (Engl.) v. d. Veken	sb	gn	Tr/Sh	Gc	Co	
107	Anacardiaceae	Sorindeia grandifolia Engl.	sb	gn	Tr/Sh	Gc	Re	
108	Anacardiaceae	Sorindeia juglandifolia (A. Rich.) Planch. ex Oliv.	sb	gn	Tr/Sh	Gc	Co	
109	Anacardiaceae	Sorindeia winkleri Engl.	sb	gn	Tr/Sh	Gc	Co	
110	Anacardiaceae	Spondias mombin L.	pi	gn	Tr	Tra	Re	
111	Anacardiaceae	Trichoscypha acuminata Engl.	sb	gn	Tr	Gc	Co	
112	Anacardiaceae	Trichoscypha arborea (A.Chev.) A.Chev.	sb	bu	Tr	Lg	Co	
113	Anacardiaceae	Trichoscypha bijuga Engl.	sb	bu	Tr/Sh	Lg	Co	CR A1c+2abc
114	Anacardiaceae	Trichoscypha hallei Breteler sp. nov.	sb	bu	Tr/Sh	Lg	Co	
115	Anacardiaceae	Trichoscypha laxiflora Engl.	sb	bu	Sh	Lg	Co	
116	Anacardiaceae	Trichoscypha lucens Oliv.	sb	gn	Sh	Gc	Co	
117	Anacardiaceae	Trichoscypha mannii Hook. f.	sb	bu	Tr/Sh	Lg	Co	VU A1c, B1+2c
118	Anacardiaceae	Trichoscypha oddonii De Wild.	sb	gn	Tr/Sh	Gc	Co	
119	Anacardiaceae	Trichoscypha oliveri Engl.	sb	bu	Tr/Sh	Lg	Co	
120	Anacardiaceae	Trichoscypha patens (Oliv.) Engl.	sb	bu	Tr/Sh	Lg	Co	
121	Anacardiaceae	Trichoscypha reygaertii De Wild.	sb	bu	Tr/Sh	Lg	Co	
122	Anacardiaceae	Trichoscypha rubicunda Lecomte	sb	bu	Tr/Sh	Lg	Co	

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123	Ancistrocladaceae	Ancistrocladus guineensis Oliv.	np	bu	Swcl	Lg	Co	
124	Anisophylleaceae	Anisophyllea polyneura Floret	sb	gn	Tr	Gc	Co	
125	Anisophylleaceae	Anisophyllea purpurascens Hutch. & Dalziel	sb	bu	Tr	Lg	Co	
126	Anisophylleaceae	Poga oleosa Pierre	sb	bu	Tr	Lg	Re	
127	Annonaceae	Annickia chlorantha (Oliv.) Setten & P.J.Maas	sb	pk	Tr	Gc	Co	
128	Annonaceae	Annona muricata L.	pi	gn	Tr	Gc	Re	
129	Annonaceae	Anonidium mannii (Oliv.) Engl. & Diels	sb	bu	Tr	Lg	Co	
130	Annonaceae	Artabotrys insignis Engl. & Diels	np	gn	Lwcl	Gc	Hl	
131	Annonaceae	Artabotrys macrophyllus Hook.f.	np	gn	Lwcl	Gc	Hl	
132	Annonaceae	Artabotrys rufus De Wild.	np	gn	Lwcl	Gc	Co	
133	Annonaceae	Artabotrys stenopetalus Engl. & Diels	np	gn	Lwcl	Gc	Hl	
134	Annonaceae	Artabotrys thomsonii Oliv.	np	gn	Lwcl	Gc	Hl	
135	Annonaceae	Boutiquea platypetala Le Thomas	sb	GD	Sh	Lg	Co	EN A1c+2c
136	Annonaceae	Cleistopholis glauca Pierre ex Engl. & Diels	pi	gn	Tr	Gc	R	
137	Annonaceae	Cleistopholis patens (Benth.) Engl. & Diels	pi	gn	Tr	Gc	Re	
138	Annonaceae	Friesodielsia enghiana (Diels) Verdc.	sb	gn	Lwcl	Gc	Co	
139	Annonaceae	Friesodielsia gracilipes (Benth.) Steenis	np	bu	Lwcl	Lg	Co	
140	Annonaceae	Friesodielsia gracilis (Hook.f.) Steenis	sb	bu	Lwcl	Lg	Co	
141	Annonaceae	Greenwayodendron suaveolens (Engl. & Diels) Verdc.	sb	gn	Tr	Gc	Co	
142	Annonaceae	Hexalobus crispiflorus A.Rich.	sb	gn	Tr	Gc	Co	
143	Annonaceae	Hexalobus salicifolius Engl.	sb	gn	Tr	Gc	Hl	
144	Annonaceae	Isolona campanulata Engl. & Diels	sb	gn	Tr	Gu	Co	
145	Annonaceae	Isolona congolana (De Wild. & T.Durand) Engl. & Diels	sb	gn	Tr	Gc	Hl	
146	Annonaceae	Isolona hexaloba (Pierre) Engl. & Diels	sb	gn	Tr	Gc	Co	
147	Annonaceae	Isolona zenkeri Engl.	sb	bu	Sh	Lg	Co	
148	Annonaceae	Meiocarpidium lepidotum (Oliv.) Engl. & Diels	sb	bu	Tr	Lg	Co	
149	Annonaceae	Mischogyne elliotianum (Engl. & Diels) R.E.Fr.	sb	gn	Sh	Gc	Hl	
150	Annonaceae	Monanthotaxis barteri (Baill.) Verdc.	sb	gn	Sh	Gc	Hl	
151	Annonaceae	Monanthotaxis cauliflora (Chipp) Verdc.	sb	gn	Swcl	Gc	Co	
152	Annonaceae	Monanthotaxis congoensis Baill.	sb	gn	Swcl	Gc	Co	
153	Annonaceae	Monanthotaxis diclina (Sprague) Verdc.	sb	gn	Swcl	Gc	Co	
154	Annonaceae	Monanthotaxis elegans (Engl. & Diels) Verdc.	sb	GD	Sh	Sw-Cam	Co	
155	Annonaceae	Monanthotaxis letouzeyi (Le Thomas) Verdc.	np	gn	Lwcl	Gc	Co	
156	Annonaceae	Monanthotaxis pellegrinii Verdc.	np	gn	Swcl	Gc	Hl	
157	Annonaceae	Monodora brevipes Benth.	sb	gn	Tr	Gc	Re	
158	Annonaceae	Monodora crispata Engl. & Diels	pi	gn	Tr	Gu	Hl	
159	Annonaceae	Monodora myristica (Gaertn.) Dunal	pi	gn	Tr	Gu	Re	
160	Annonaceae	Monodora tenuifolia Benth.	pi	gn	Tr	Gc	Re	
161	Annonaceae	Monodora zenkeri Engl. & Diels	sb	GD	Sh	Sw-Cam	Hl	
162	Annonaceae	Neostenanthera myristicifolia (Oliv.) Exell.	sw	gn	Sh	Gc	Co	
163	Annonaceae	Pachypodanthium barteri (Benth.) Hutch. & Dalziel	sw	GD	Tr	Lg	Co	VU A1c
164	Annonaceae	Pachypodanthium staudtii Engl. & Diels	np	gn	Tr	Gc	Co	
165	Annonaceae	Piptostigma calophyllum Mildbr. & Diels	sb	bu	Tr	Lg	Hl	
166	Annonaceae	Piptostigma fasciculatum (De Wild.) Boutique	sb	gn	Tr	Gc	Co	
167	Annonaceae	Piptostigma glabrescens Oliv.	sb	bu	Tr	Lg	Hl	
168	Annonaceae	Piptostigma multinervium Engl. & Diels	sb	bu	Tr	Lg	Co	
169	Annonaceae	Piptostigma pilosum Oliv.	sb	bu	Tr	Lg	Co	
170	Annonaceae	Polyceratocarpus parviflorus (Baker f.) Ghesq.	sb	gn	Tr	Gc	Co	
171	Annonaceae	Uvaria angolensis Welw. ex Oliv.	np	gn	Swcl	Gc	Hl	
172	Annonaceae	Uvaria anonoides Bak. f.	np	gn	Swcl	Gc	Hl	
173	Annonaceae	Uvaria baumannii Engl. & Diels	np	gn	Swcl	Gc	Hl	
174	Annonaceae	Uvaria bipindensis Engl.	np	GD	Lwcl	Lg	Hl	
175	Annonaceae	Uvaria obanensis Baker f.	np	bu	Swcl	Lg	Hl	
176	Annonaceae	Uvaria scabrida Oliv.	np	bu	Swcl	Lg	Co	
177	Annonaceae	Uvariastrum insculptum (Engl. & Diels) Sprague	sb	gn	Tr	Gc	Hl	
178	Annonaceae	Uvariastrum pierreanum Engl.	sb	bu	Sh	Lg	Co	
179	Annonaceae	Uvariastrum zenkeri Engl. & Diels	sb	bu	Sh	Lg	Co	VU A1c, B1+2c
180	Annonaceae	Uvariodendron calophyllum R.E.Fr.	sb	bu	Tr	Lg	Hl	
181	Annonaceae	Uvariodendron connivens (Benth.) R.E.Fr.	sb	bu	Tr	Lg	Co	LR/nt
182	Annonaceae	Uvariodendron giganteum (Engl.) R.E.Fr.	sb	bu	Tr	Lg	Co	
183	Annonaceae	Uvariodendron molundense (Engl. & Diels) R.E.Fr.	sb	bu	Tr	Lg	Hl	
184	Annonaceae	Uvariopsis bakeriana (Hutch. & Diels) Robyns & Ghesq.	sb	bu	Sh	Lg	Hl	
185	Annonaceae	Uvariopsis congolana (De Wild.) R.E.Fr.	sb	bu	Sh	Lg	Co	
186	Annonaceae	Uvariopsis dioica (Diels) Robyns & Ghesq.	sb	bu	Sh	Lg	Co	
187	Annonaceae	Uvariopsis zenkeri Engl.	sb	bu	Sh	Lg	Co	

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188	Annonaceae	Xylopia acutiflora (Dunal) A.Rich.	np	gn	Tr	Gc	Co	
189	Annonaceae	Xylopia aethiopica (Dunal) A.Rich.	ri	gn	Tr	Gc	Co	
190	Annonaceae	Xylopia hypolampra Mildbr.	np	gn	Tr	Gc	Re	
191	Annonaceae	Xylopia parviflora (A.Rich.) Benth.	sb	gn	Tr	Gc	Re	
192	Annonaceae	Xylopia quintasii Engl. & Diels	sb	gn	Tr	Gu	Re	
193	Annonaceae	Xylopia rubescens Oliv.	ri	gn	Tr	Gc	Re	
194	Annonaceae	Xylopia staudtii Engl. & Diels	sb	gn	Tr	Gc	Re	
195	Annonaceae	Xylopia villosa Chipp	sb	gn	Tr	Gc	Co	
196	Apocynaceae	Alafia barteri Oliv.	np	gn	Lwcl	Gc	Co	
197	Apocynaceae	Alafia lucida Stapf	np	gn	Lwcl	Gc	Hl	
198	Apocynaceae	Alafia multiflora (Stapf) Stapf	np	gn	Lwcl	Gc	Hl	
199	Apocynaceae	Alstonia boonei De Wild.	pi	gn	Tr	Tra	Re	
200	Apocynaceae	Ancylobotrys robusta Pierre	np	gn	Lwcl	Gc	Co	
201	Apocynaceae	Baissea axillaris (Benth.) Hua	np	bu	Swcl	Lg	Co	
202	Apocynaceae	Baissea baillonii Hua	np	gn	Swcl	Gc	Co	
203	Apocynaceae	Baissea gracillima (K.Schum.) Hua	np	gn	Swcl	Gc	Co	
204	Apocynaceae	Baissea leonensis Benth.	np	bu	Swcl	Lg	Co	
205	Apocynaceae	Baissea multiflora A.DC.	np	gn	Swcl	Gc	Hl	
206	Apocynaceae	Baissea odorata K.Schum.	np	gn	Swcl	Gc	Hl	
207	Apocynaceae	Baissea subrufa Stapf	np	gn	Swcl	Gc	Co	
208	Apocynaceae	Callichilia bequaertii De Wild.	sb	gn	Sh	Gc	Co	
209	Apocynaceae	Callichilia inaequalis Stapf	np	bu	Swcl	Lg	Co	
210	Apocynaceae	Callichilia monopodialis (K.Schum.) Stapf	sb	GD	Sh	Cam	Co	
211	Apocynaceae	Catharanthus roseus (L.) G.Don	pi	gn	Sh	In	Re	
212	Apocynaceae	Clitandra cymulosa Benth.	pi	gn	Swcl	Gc	Hl	
213	Apocynaceae	Cyclocotyla congolensis Stapf	ri	gn	Lwcl	Gc	Hl	
214	Apocynaceae	Cylindropsis parvifolia Pierre	np	bu	Lwcl	Lg	Hl	
215	Apocynaceae	Dictyophleba leonensis (Stapf) Pichon	np	gn	Lwcl	Gc	Co	
216	Apocynaceae	Dictyophleba ochracea (K.Schum. ex Hallier f.) Pichon	np	gn	Lwcl	Gc	Co	
217	Apocynaceae	Dictyophleba setosa de Hoogh	np	gn	Lwcl	Gc	Co	
218	Apocynaceae	Dictyophleba stipulosa (S.Moore ex Wermham) Pichon	np	gn	Lwcl	Gc	Co	
219	Apocynaceae	Funtumia elastica (Preuss) Stapf	np	pk	Tr	Tra	Co	
220	Apocynaceae	Hunteria ballayi Hua	sb	bu	Sh	Lg	Hl	
221	Apocynaceae	Hunteria camerunensis K.Schum. ex Hallier f.	sb	bu	Sh	Lg	Co	
222	Apocynaceae	Hunteria umbellata (K.Schum.) Hallier f.	sb	gn	Tr	Gc	Co	
223	Apocynaceae	Landolphia bruneelii (De Wild.) Pichon	ri	bu	Lwcl	Lg	Co	
224	Apocynaceae	Landolphia congolensis (Stapf) Pichon	np	gn	Lwcl	Gc	Co	
225	Apocynaceae	Landolphia dulcis (Sabine) Pichon	pi	gn	Lwcl	Gu	Co	
226	Apocynaceae	Landolphia flavidiflora (K.Schum.) Persoon	np	GD	Lwcl	Cam	Hl	
227	Apocynaceae	Landolphia foretiana (Pierre ex Jumelle) Pichon	np	gn	Lwcl	Gc	Co	
228	Apocynaceae	Landolphia glabra (Pierre ex Jumelle) Pichon	np	gn	Lwcl	Gc	Hl	
229	Apocynaceae	Landolphia incerta (K.Schum.) Persoon	np	gn	Lwcl	Gc	Co	
230	Apocynaceae	Landolphia jumellei (Pierre ex Jumelle) Pichon	np	bu	Lwcl	Lg	Hl	
231	Apocynaceae	Landolphia landolphioides (Hallier f.) A.Chev.	np	gn	Lwcl	Gc	Co	
232	Apocynaceae	Landolphia leptantha (K.Schum.) Persoon	np	bu	Lwcl	Lg	Co	
233	Apocynaceae	Landolphia ligustrifolia (Stapf) Pichon	np	gn	Lwcl	Gc	Co	
234	Apocynaceae	Landolphia maxima (K.Schum. ex Hallier f.) Pichon	np	bu	Lwcl	Lg	Hl	
235	Apocynaceae	Landolphia owariensis P.Beauv.	np	gn	Lwcl	Tra	Co	
236	Apocynaceae	Landolphia robustior (K.Schum.) Persoon	np	gn	Lwcl	Gc	Co	
237	Apocynaceae	Landolphia stenogyna Pichon	np	gn	Lwcl	Gc	Hl	
238	Apocynaceae	Malouetia barbata van der Ploeg	sb	gn	Sh	Gc	Co	
239	Apocynaceae	Motandra guineensis (Thonn.) A.DC.	np	gn	Lwcl	Tra	Hl	
240	Apocynaceae	Motandra poecilophylla Wernham	np	bu	Swcl	Lg	Hl	
241	Apocynaceae	Oncinotis glabrata (Baill.) Stapf ex Hiern	np	gn	Swcl	Tra	Hl	
242	Apocynaceae	Orthopichonia barteri (Stapf) H.Huber	np	gn	Lwcl	Gc	Hl	
243	Apocynaceae	Orthopichonia cirrhosa (Radlk.) H.Huber	np	bu	Lwcl	Lg	Hl	
244	Apocynaceae	Orthopichonia indeniensis (A.Chev.) H.Huber	np	gn	Lwcl	Gu	Hl	
245	Apocynaceae	Orthopichonia seretii (De Wild.) Vonk	np	gn	Lwcl	Gc	Co	
246	Apocynaceae	Orthopichonia visciflua (K.Schum. ex Hallier f.) Vonk	np	bu	Lwcl	Lg	Co	
247	Apocynaceae	Petchia africana Leeuwenb.	sb	BK	Sh	Sw-Cam	Hl	
248	Apocynaceae	Picralima nitida (Stapf) T.Durand & H.Durand	pi	gn	Tr	Gc	Co	
249	Apocynaceae	Pleiocarpa bicarpellata Stapf	sb	gn	Sh	Gc	Co	
250	Apocynaceae	Pleiocarpa mutica Benth.	sb	gn	Sh	Gu	Co	
251	Apocynaceae	Pleiocarpa rostrata Benth.	sb	bu	Sh	Lg	Co	
252	Apocynaceae	Pleioceras zenkeri Stapf	pi	bu	Sh	Lg	Hl	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
253	Apocynaceae	Rauvolfia caffra Sond.	pi	gn	Tr	Tra	Co	
254	Apocynaceae	Rauvolfia mannii Stapf	sb	gn	Sh	Gc	Co	
255	Apocynaceae	Rauvolfia vomitoria Afzel.	pi	gn	Sh	Tra	Co	
256	Apocynaceae	Strophanthus bullenianus Mast.	np	gn	Lwcl	Gc	Hl	
257	Apocynaceae	Strophanthus congensis Franch.	np	gn	Lwcl	Gc	Hl	
258	Apocynaceae	Strophanthus gratus (Wall. & Hook.) Baill.	np	pk	Lwcl	Gc	Hl	
259	Apocynaceae	Strophanthus hispidus DC.	np	pk	Swcl	Tra	Hl	
260	Apocynaceae	Strophanthus preussii Engl. & Pax	np	gn	Swcl	Gc	Hl	
261	Apocynaceae	Strophanthus sarmentosus DC. var. sarmentosus	np	gn	Swcl	Gc	Hl	
262	Apocynaceae	Strophanthus thollonii Franch.	ri	gn	Lwcl	Tra	Co	
263	Apocynaceae	Tabernaemontana brachyantha Stapf	np	gn	Tr	Gc	Hl	
264	Apocynaceae	Tabernaemontana contorta Stapf	np	bu	Tr	Lg	Re	
265	Apocynaceae	Tabernaemontana crassa Benth.	sb	gn	Tr	Gc	Co	
266	Apocynaceae	Tabernaemontana eglandulosa Stapf	np	gn	Lwcl	Gc	Co	
267	Apocynaceae	Tabernaemontana glandulosa (Stapf) Pichon	sb	gn	Lwcl	Gc	Co	
268	Apocynaceae	Tabernaemontana hallei (Boiteau) Leeuwenb.	sb	GD	Sh	Lg	Co	
269	Apocynaceae	Tabernaemontana inconspicua Stapf	sb	gn	Tr	Gc	Co	
270	Apocynaceae	Tabernaemontana penduliflora K. Schum.	np	gn	Tr	Gc	Co	
271	Apocynaceae	Tabernaemontana psorocarpa (Pierre ex Stapf) Pichon	sb	GD	Tr	Lg	Co	
272	Apocynaceae	Tabernanthe iboga Baill.	sb	pk	Sh	Tra	Co	
273	Apocynaceae	Voacanga africana Stapf	pi	gn	Sh	Tra	Co	
274	Apocynaceae	Voacanga bracteata Stapf	sb	gn	Sh	Gc	Co	
275	Apocynaceae	Voacanga psilocalyx Pierre ex Stapf	sb	bu	Sh	Lg	Co	
276	Araceae	Anchomanes difformis (Blume) Engl.	ri/sw	gn	Hb	Tra	Co	
277	Araceae	Anubias barteri Schott caladiifolia Engl.	ri/sw	bu	Hb	Lg	Co	
278	Araceae	Anubias barteri Schott var. barteri	ri/sw	bu	Hb	Lg	Co	
279	Araceae	Anubias barteri Schott var. glabra N.E.Br.	ri/sw	gn	Hb	Gc	Co	
280	Araceae	Anubias gilletii De Wild. & T.Durand	ri/sw	gn	Hb	Gc	Co	
281	Araceae	Anubias hastifolia Engl.	ri/sw	gn	Hb	Gc	Co	
282	Araceae	Cercestis camerunensis (Ntepe-Nyame) Bogner	sb	bu	Hcl	Lg	Co	
283	Araceae	Cercestis dinklagei Engl.	sb	gn	He	Gc	Co	
284	Araceae	Cercestis ivorensis A.Chev.	sb	gn	He	Gu	Co	
285	Araceae	Cercestis kamerunianus (Engl.) N.E.Br.	sb	bu	He	Lg	Co	
286	Araceae	Cercestis mirabilis (N.E.Br.) Bogner	sb	gn	Hcl	Gc	Co	
287	Araceae	Colocasia esculenta (L.) Schott	pi	gn	Hb	In	Re	
288	Araceae	Culcasia annetii Ntepe-Nyame	sb	gn	He	Gc	Co	
289	Araceae	Culcasia barombensis N.E.Br.	sb	gn	He	Gc	Co	
290	Araceae	Culcasia bosii Ntepe-Nyame	sb	BK	He	Sw-Cam	Co	
291	Araceae	Culcasia dinklagei Engl.	sb	bu	Hb	Lg	Co	
292	Araceae	Culcasia ekongoloi Ntepe-Nyame	sb	gn	He	Gc	Co	
293	Araceae	Culcasia lanceolata Engl.	sb	bu	He	Lg	Co	
294	Araceae	Culcasia loukandensis Pell.	sb	gn	He	Gc	Co	
295	Araceae	Culcasia mannii (Hook.f.) Engl.	sb	bu	Hb	Lg	Co	
296	Araceae	Culcasia obliquifolia Engl.	sb	bu	He	Lg	Co	
297	Araceae	Culcasia panduriformis Engl. & Krause	sb	GD	Hb	Cam	Co	
298	Araceae	Culcasia parviflora N.E.Br.	sb	gn	He	Gc	Co	
299	Araceae	Culcasia sapinii De Wild.	sb	gn	He	Gc	Co	
300	Araceae	Culcasia simiarum Ntepe-Nyame	sb	gn	He	Gc	Co	
301	Araceae	Culcasia striolata Engl.	sb	bu	Hb	Lg	Co	
302	Araceae	Culcasia tenuifolia Engl.	sb	gn	He	Gc	Co	
303	Araceae	Lasiomorpha senegalensis Schott	sw	gn	Hb	Gc	Re	
304	Araceae	Nephthytis gravenreuthii (Engl.) Engl.	sb	bu	Hb	Lg	Hl	
305	Araceae	Nephthytis poissonii (Engl.) N.E.Br. var. constricta (N.E.Br.) Ntepe-Nyame	sb	bu	Hb	Lg	Hl	
306	Araceae	Nephthytis poissonii (Engl.) N.E.Br. var. poissonii	sb	gn	Hb	Gc	Co	
307	Araceae	Pistia stratiotes L.	rh	gn	Hb	Pa	Re	
308	Araceae	Rhaphidophora africana N.E.Br.	sb	gn	Hcl	Gc	Co	
309	Araceae	Stylochaeton zenkeri Engl.	sb	gn	Hb	Gc	Co	
310	Araliaceae	Schefflera barteri (Seem.) Harms	ep	gn	Str	Gc	Co	
311	Aristolochiaceae	Pararistolochia macrocarpa (Duch.) Poncy	np	gn	Swcl	Gc	Co	
312	Aristolochiaceae	Pararistolochia preussii (Engl.) Hutch. & Dalziel	np	GD	Swcl	Cam	Hl	
313	Aristolochiaceae	Pararistolochia promissa (Mast.) Keay	np	gn	Swcl	Gc	Hl	
314	Aristolochiaceae	Pararistolochia triactina (Hook.f.) Hutch. & Dalziel	np	gn	Swcl	Gc	Hl	
315	Aristolochiaceae	Pararistolochia zenkeri (Engl.) Hutch. & Dalziel	np	gn	Swcl	Gc	Hl	
316	Asclepiadaceae	Anisopus efulensis (N.E.Br.) Goyder	pi	gn	Swcl	Gc	Hl	
317	Asclepiadaceae	Anisopus mannii N.E.Br.	pi	gn	Swcl	Gc	Hl	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
318	Asclepiadaceae	Cryptolepis sanguinolenta (Lindl.) Schltr.	pi	gn	Swcl	Gc	Hl	
319	Asclepiadaceae	Cynanchum adalinae (K.Schum.) K.Schum. subsp. adalinae	pi	gn	Swcl	Gc	Co	
320	Asclepiadaceae	Epistemma rupestre H.Huber	sb	gn	Swcl	Gc	Co	
321	Asclepiadaceae	Toxocarpus brevipes (Benth.) N.E.Br.	pi	gn	Swcl	Gc	Co	
322	Asclepiadaceae	Toxocarpus racemosa (Benth.) N.E.Br.	pi	gn	Swcl	Gc	Hl	
323	Asclepiadaceae	Tylophora cameroonica N.E.Br.	pi	bu	Swcl	Lg	Co	LR/nt
324	Asclepiadaceae	Tylophora oculata N.E.Br.	pi	gn	Swcl	Gc	Hl	
325	Asclepiadaceae	Tylophora sylvatica Decne.	pi	gn	Swcl	Gc	Hl	
326	Aspleniaceae	Asplenium africanum Desv.	ep	gn	Ep	Gc	Co	
327	Aspleniaceae	Asplenium barteri Hook.	ep	gn	Ep	Gc	Co	
328	Aspleniaceae	Asplenium brausei Hieron.	ep	GD	Ep	Lg	Hl	
329	Aspleniaceae	Asplenium currori Hook.	ep	gn	Ep	Gc	Co	
330	Aspleniaceae	Asplenium dregeanum Kunze	ep	gn	Ep	Tra	Co	
331	Aspleniaceae	Asplenium emarginatum P.Beauv.	ep	gn	Ep	Gc	Co	
332	Aspleniaceae	Asplenium gemmascens Alston	ep	gn	Ep	Gc	Co	
333	Aspleniaceae	Asplenium gemmiferum Schrad.	sb	gn	Hb	Gc	Hl	
334	Aspleniaceae	Asplenium geppii Carruth.	ep	bu	Ep	Lg	Hl	
335	Aspleniaceae	Asplenium laurentii Bommer ex Christ	ep	gn	Ep	Gc	Co	
336	Aspleniaceae	Asplenium macrophlebium Baker	ep	gn	Ep	Tra	Hl	
337	Aspleniaceae	Asplenium sandersonii Hook.	ep	gn	Ep	Gc	Hl	
338	Aspleniaceae	Asplenium unilaterale Lam.	sb	gn	Hb	Pal	Co	
339	Aspleniaceae	Asplenium variabile Hook. var. paucijugum (Ballard) Alston	ep	gn	Ep	Tra	Co	
340	Aspleniaceae	Asplenium variabile Hook. var. variabile	ep	gn	Ep	Gc	Co	
341	Avicenniaceae	Avicennia germinans (L.) L.	sw	gn	Tr	Gc	Co	
342	Balanophoraceae	Thonningia sanguinea Vahl	sa	gn	Pa	Tra	Co	
343	Balsaminaceae	Impatiens columbaria J.J.Bos	sb	gn	Hb	Gc	Co	
344	Balsaminaceae	Impatiens filicornu Hook.f.	sb	bu	Hb	Lg	Co	
345	Balsaminaceae	Impatiens gongolana N.Hallé	sb	bu	Hb	Lg	Co	
346	Balsaminaceae	Impatiens hians Hook.f. var. bipindensis (Gilg) Grey-Wilson	sb	bu	Hb	Lg	Co	
347	Balsaminaceae	Impatiens hians Hook.f. var. hians	sb	gn	Hb	Gc	Co	
348	Balsaminaceae	Impatiens mackeyana Hook. f. subsp. mackeyana	sb	gn	Hb	Gc	Co	
349	Balsaminaceae	Impatiens mackeyana Hook.f. subsp. zenkeri (Warb.) Grey-Wilson	sb	bu	Hb	Lg	Co	
350	Balsaminaceae	Impatiens macroptera Hook.f.	sb	bu	Hb	Lg	Co	
351	Balsaminaceae	Impatiens mannii Hook.f.	sb	gn	Hb	Gc	Co	
352	Balsaminaceae	Impatiens niamniamensis Gilg	sb	gn	Hb	Gc	Co	
353	Balsaminaceae	Impatiens palpebrata Hook.f.	sb	bu	Hb	Lg	Co	
354	Begoniaceae	Begonia ampla Hook.f.	ep	gn	Ep	Gc	Co	
355	Begoniaceae	Begonia anisosepala Hook.f.	sb	bu	Hb	Lg	Hl	
356	Begoniaceae	Begonia bonus-henricus J.J.de Wilde	ep	bu	Ep	Lg	Hl	
357	Begoniaceae	Begonia capillipes Gilg	ep	bu	Ep	Lg	Co	
358	Begoniaceae	Begonia cilio-bracteata Warb.	sb	bu	Hb	Lg	Co	
359	Begoniaceae	Begonia clypeifolia Hook.f.	sb	bu	Hb	Lg	Co	
360	Begoniaceae	Begonia elaeagnifolia Hook. f.	ep	bu	Ep	Lg	Co	
361	Begoniaceae	Begonia elatostemmoides Hook.f.	sb	gn	Hb	Gc	Co	
362	Begoniaceae	Begonia eminii Warb.	sb	gn	Hb	Tra	Co	
363	Begoniaceae	Begonia fusialata Warb.	sb	gn	Hb	Gc	Co	
364	Begoniaceae	Begonia heterochroma Sosef	sb	bu	Hb	Lg	Co	
365	Begoniaceae	Begonia hirsutula Hook.f.	sb	gn	Hb	Gc	Co	
366	Begoniaceae	Begonia letouzeyi Sosef	sb	bu	Hb	Lg	Co	
367	Begoniaceae	Begonia longipetiolata Gilg	ep	gn	Ep	Gc	Co	
368	Begoniaceae	Begonia macrocarpa Warb.	sb	gn	Hb	Gc	Co	
369	Begoniaceae	Begonia mannii Hook.	ep	gn	Hb	Gu	Co	
370	Begoniaceae	Begonia mbangaensis Sosef	sb	BK	Hb	Sw-Cam	Co	
371	Begoniaceae	Begonia microsperma Warb.	sb	GD	Hb	Cam	Co	
372	Begoniaceae	Begonia montis-elephantis J.J.de Wilde	sb	BK	Hb	Campo-Ma'an	Co	
373	Begoniaceae	Begonia poculifera Hook.f. var. teusziana (J.Braun & K.Schum.) J.J. de Wilde	ep	bu	Ep	Lg	Hl	
374	Begoniaceae	Begonia potamophila Gilg	sb	bu	Hb	Lg	Co	
375	Begoniaceae	Begonia quadrialata Warb. subsp. quadrialata	sb	gn	Hb	Gc	Co	
376	Begoniaceae	Begonia sciaphila Gilg ex Engl.	sb	bu	Hb	Lg	Co	
377	Begoniaceae	Begonia scutifolia Hook.f.	ep	bu	Hb	Lg	Hl	
378	Begoniaceae	Begonia sessilifolia Hook.f.	sb	GD	Hb	Lg	Co	

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379	Begoniaceae	Begonia staudtii Gilg	sb	bu	Hb	Lg	Co	
380	Begoniaceae	Begonia subscutata De Wild.	ep	gn	Ep	Gc	Co	
381	Begoniaceae	Begonia susaniae Sosef	sb	bu	Hb	Lg	Hl	
382	Begoniaceae	Begonia zenkeriana Smith & Wassh.	sb	BK	Hb	Sw-Cam	Co	
383	Bignoniaceae	Markhamia lutea (Benth.) K.Schum.	pi	gn	Tr	Gc	Re	
384	Bignoniaceae	Markhamia tomemtosa (Benth.) K.Schum.	pi	gn	Tr	Gc	Hl	
385	Bignoniaceae	Newbouldia laevis (P.Beauv.) Seeman ex Bureau	pi	gn	Tr	Gc	Co	
386	Bignoniaceae	Spathodea campanulata P.Beauv.	pi	gn	Tr	Gc	Co	
387	Bombacaceae	Bombax brevicuspe Sprague	pi	gn	Tr	Gc	Re	
388	Bombacaceae	Bombax buonopozense P.Beauv.	pi	gn	Tr	Tra	Re	
389	Bombacaceae	Ceiba pentandra (L.) Gaertn.	pi	gn	Tr	Pa	Re	
390	Boraginaceae	Cordia aurantiaca Baker	pi	bu	Tr	Lg	Co	
391	Boraginaceae	Cordia platythyrsa Baker	pi	pk	Tr	Gc	Co	VU A1d
392	Burmanniaceae	Burmannia congesta (Wright) Jonker	sa	bu	Sa	Lg	Hl	
393	Burmanniaceae	Gymnosiphon longistylus (Benth.) Hutch.	sa	bu	Sa	Lg	Co	
394	Burseraceae	Aucoumea klaineana Pierre	pi	bu	Tr	Lg	Co	VU A1cd
395	Burseraceae	Canarium schweinfurthii Engl.	np	rd	Tr	Tra	Co	
396	Burseraceae	Dacryodes buettneri (Engl.) Lam	np	bu	Tr	Lg	Co	
397	Burseraceae	Dacryodes edulis (G.Don) H.J.Lam	pi	pk	Tr	Gc	Co	
398	Burseraceae	Dacryodes igaganga Aubrev. & Pellegr.	np	bu	Tr	Lg	Re	VU A1cd+2cd
399	Burseraceae	Dacryodes klaineana (Pierre) H.J.Lam	sb	gn	Tr	Gc	Co	
400	Burseraceae	Dacryodes ledermannii (Engl.) H.J.Lam	sb	bu	Tr	Lg	Hl	
401	Burseraceae	Dacryodes macrophylla (Oliv.) H.J.Lam	sb	bu	Tr	Lg	Re	
402	Burseraceae	Santiria trimera (Oliv.) Aubrév.	np	gn	Tr	Gc	Re	
403	Cactaceae	Rhipsalis baccifera (J.Miller) Stearn	ep	gn	Ep	Tra	Co	
404	Capparaceae	Buchholzia coriacea Engl.	sb	gn	Tr	Gc	Co	
405	Capparaceae	Cleome rutidosperma DC.	pi	gn	Hb	Gc	Co	
406	Capparaceae	Cleome spinosa Jacq.	pi	gn	Hb	In	Hl	
407	Capparaceae	Ritchiea capparoides (And.) Britten	sb	gn	Sh	Gc	Co	
408	Capparaceae	Ritchiea erecta Hook.f.	sb	bu	Sh	Lg	Co	
409	Capparaceae	Ritchiea simplicifolia Oliv. caloneura (Gilg) Kers	sb	BK	Sh	Cam	Co	
410	Caryophyllaceae	Drymaria cordata (L.) Willd.	pi	gn	Hb	Pa	Co	
411	Cecropiaceae	Musanga cecropioides R.Br. ex Tedlie	pi	gn	Tr	Gc	Re	
412	Cecropiaceae	Myrianthus arboreus P.Beauv.	pi	gn	Tr	Tra	Co	
413	Cecropiaceae	Myrianthus preussii Engl. subsp. preussii	pi	bu	Tr	Lg	Co	
414	Cecropiaceae	Myrianthus serratus (Trécul) Benth. & Hook.	sb	gn	Sh	Gu	Co	
415	Celastraceae	Apodostigma pallens (Planch. ex Oliv.) R.Wilczek	np	gn	Swcl	Gc	Hl	
416	Celastraceae	Campylostemon angolense Welw. ex Oliv.	np	gn	Swcl	Gc	Hl	
417	Celastraceae	Cuervea macrophylla (Vahl) R.Wilczek ex N.Hallé	np	gn	Swcl	Gc	Hl	
418	Celastraceae	Loeseneriella apocynoides (Welw. ex Oliv.) N.Hallé ex J.	pi	gn	Swcl	Gc	Hl	
419	Celastraceae	Loeseneriella clematoides (Loes.) R.Wilczek ex N.Hallé	pi	gn	Swcl	Gc	Hl	
420	Celastraceae	Loeseneriella iotricha (Loes.) N.Hallé var. iotricha	pi	gn	Swcl	Gc	Hl	
421	Celastraceae	Loeseneriella rowlandii (Loes.) N.Hallé	np	gn	Swcl	Gc	Co	
422	Celastraceae	Pristimera luteoviridis (Exell) N.Hallé var. kribiana N.Hallé	np	BK	Swcl	Campo-Ma'an	Hl	
423	Celastraceae	Pristimera preussii (Loes.) N.Hallé	np	bu	Swcl	Lg	Co	
424	Celastraceae	Salacia alata De Wild. var. alata	np	bu	Swcl	Lg	Co	
425	Celastraceae	Salacia alata De Wild. var. superba N.Hallé	np	bu	Swcl	Lg	Co	
426	Celastraceae	Salacia cornifolia Hook.f.	np	gn	Swcl	Gc	Co	
427	Celastraceae	Salacia debilis (G.Don) Walp.	np	gn	Swcl	Gc	Co	
428	Celastraceae	Salacia dimidia N.Hallé	sb	bu	Sh	Lg	Co	
429	Celastraceae	Salacia dusenii Loes.	np	gn	Swcl	Gc	Co	
430	Celastraceae	Salacia erecta (G.Don) Walp. var. erecta	np	gn	Swcl	Tra	Co	
431	Celastraceae	Salacia gabunensis Loes.	np	bu	Swcl	Lg	Co	
432	Celastraceae	Salacia lehmbachii Loes. var. lehmbachii	np	gn	Swcl	Gc	Co	
433	Celastraceae	Salacia lehmbachii Loes. var. pes-ranulae N.Hallé	np	bu	Swcl	Lg	Co	VU B1+2c
434	Celastraceae	Salacia letouzeyana N.Hallé	np	bu	Swcl	Lg	Co	
435	Celastraceae	Salacia loloensis Loes. marmorata Loes.	np	gn	Swcl	Gc	Co	
436	Celastraceae	Salacia loloensis Loes. var. loloensis	np	gn	Swcl	Gc	Co	
437	Celastraceae	Salacia loloensis Loes. var. sibangana N.Hallé	np	GD	Swcl	Lg	Co	
438	Celastraceae	Salacia longipes (Oliv.) N.Hallé var. camerunensis (Loes.) N.Hallé	np	gn	Swcl	Gc	Co	
439	Celastraceae	Salacia longipes (Oliv.) N.Hallé var. longipes	np	gn	Swcl	Gc	Co	
440	Celastraceae	Salacia lucida Oliv.	np	GD	Swcl	Lg	Co	
441	Celastraceae	Salacia mannii Oliv.	np	gn	Swcl	Gc	Co	

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442	Celastraceae	Salacia nitida (Benth.) N.E.Br.	np	gn	Swcl	Gc	Co	
443	Celastraceae	Salacia pallescens Oliv.	np	gn	Swcl	Gc	Co	
444	Celastraceae	Salacia preussii Loes. var. preussii	np	bu	Swcl	Lg	Co	
445	Celastraceae	Salacia regeliana J.Braun & K.Schum.	np	gn	Swcl	Gc	Co	
446	Celastraceae	Salacia staudtiana Loes. var. leonensis Loes.	np	gn	Swcl	Gc	Co	
447	Celastraceae	Salacia staudtiana Loes. var. staudtiana	np	bu	Swcl	Lg	Co	
448	Celastraceae	Salacia whytei Loes. var. wermoeseniana (Wilczek) Hallé	np	gn	Swcl	Gc	Hl	
449	Celastraceae	Salacia whytei Loes. var. whytei	np	gn	Swcl	Gc	Hl	
450	Celastraceae	Salacia zenkeri Loes.	np	gn	Swcl	Gc	Hl	
451	Celastraceae	Salacighia letestuana (Pellegr.) Blakelock	np	gn	Swcl	Gc	Hl	
452	Celastraceae	Thyrsosalacia nematobrachion Loes.	np	bu	Swcl	Lg	Hl	
453	Celastraceae	Tristemonanthus mildbraedianus Loes.	np	gn	Swcl	Gc	Hl	
454	Chrysobalanaceae	Afrolicania elaeosperma Mildbr.	ri	gn	Sh	Gu	Hl	
455	Chrysobalanaceae	Chrysobalanus icaco L. subsp. icaco	ri	gn	Tr	Pa	Co	
456	Chrysobalanaceae	Dactyladenia barteri (Hook.f. ex Oliv.) Prance & F.White	sb	gn	Tr	Gc	Co	
457	Chrysobalanaceae	Dactyladenia campestris (Engl.) Prance & F.White	pi	gn	Tr	Gc	Co	
458	Chrysobalanaceae	Dactyladenia cinera (Engl. ex de Wild) Prance & F.White	sb	BK	Tr	Sw-Cam	Hl	CR B1+2c
459	Chrysobalanaceae	Dactyladenia floribunda Welw.	ri	gn	Tr	Gc	Hl	
460	Chrysobalanaceae	Dactyladenia icondere (Baill.) Prance & F.White	sb	bu	Sh	Lg	Co	
461	Chrysobalanaceae	Dactyladenia pallescens (Baill.) Prance & F.White	sb	gn	Tr	Gc	Co	
462	Chrysobalanaceae	Magnistipula glaberrima Engl.	sb	bu	Tr	Lg	Co	
463	Chrysobalanaceae	Magnistipula tessmannii (Engl.) Prance	sb	gn	Tr	Gc	Hl	
464	Chrysobalanaceae	Magnistipula zenkeri Engl.	ri	gn	Tr	Gu	Hl	
465	Chrysobalanaceae	Maranthes chrysophylla (Oliv.) Prance	sb	gn	Tr	Gc	Co	
466	Chrysobalanaceae	Maranthes gabunensis (Engl.) Prance	sb	gn	Tr	Gc	Hl	
467	Chrysobalanaceae	Maranthes glabra (Oliv.) Prance	sb	gn	Tr	Gc	Co	
468	Chrysobalanaceae	Parinari excelsa Sabine	np	gn	Tr	Gc	Re	
469	Chrysobalanaceae	Parinari hypochrysea Mildbr. ex Letouzey & F.White	np	bu	Tr	Lg	Re	
470	Colchicaceae	Gloriosa superba L.	pi	gn	Hb	Pal	Co	
471	Combretaceae	Combretum auriculatum Engl. & Diels	ri	gn	Lwcl	Gc	Co	
472	Combretaceae	Combretum bipindense Engl. & Diels	np	gn	Lwcl	Gc	Co	
473	Combretaceae	Combretum bracteatum (Laws.) Engl. & Diels	pi	gn	Lwcl	Gc	Co	
474	Combretaceae	Combretum cinnabarinum Engl. & Diels	np	bu	Lwcl	Lg	Hl	
475	Combretaceae	Combretum comosum G. Don	pi	gn	Lwcl	Gc	Hl	
476	Combretaceae	Combretum conchipetalum Engl. & Diels	ri	gn	Lwcl	Gc	Hl	
477	Combretaceae	Combretum confertum (Benth.) Laws.	pi	gn	Lwcl	Gc	Hl	
478	Combretaceae	Combretum cuspidatum Planch. ex Benth.	ri	gn	Lwcl	Gc	Hl	
479	Combretaceae	Combretum demeusi De Wild.	ri	gn	Lwcl	Gc	Hl	
480	Combretaceae	Combretum lacianiatum Engl. ex Engl. & Diels	pi	gn	Lwcl	Gc	Hl	
481	Combretaceae	Combretum mannii Laws. ex Engl. & Diels	pi	gn	Lwcl	Gc	Co	
482	Combretaceae	Combretum mucronatum Thonn. ex Schum.	pi	gn	Lwcl	Gc	Hl	
483	Combretaceae	Combretum oyemense Exell	np	gn	Lwcl	Gu	Hl	
484	Combretaceae	Combretum paniculatum Vent.	pi	gn	Lwcl	Tra	Co	
485	Combretaceae	Combretum platypterum (Welw.) Hutch. & Dalziel	pi	gn	Lwcl	Gc	Co	
486	Combretaceae	Combretum racemosum P.Beauv.	pi	gn	Lwcl	Gc	Co	
487	Combretaceae	Combretum sordidum Exell	pi	gn	Lwcl	Gc	Hl	
488	Combretaceae	Combretum zenkeri Engl. & Diels	pi	gn	Lwcl	Gu	Hl	
489	Combretaceae	Conocarpus erectus L.	ri	gn	Swcl	Tra	Co	
490	Combretaceae	Laguncularia racemosa (L.) Gaertn.f.	sw	gn	Swcl	Tra	Hl	
491	Combretaceae	Pteleopsis hylodendron Mildbr.	pi	gn	Tr	Gc	Co	
492	Combretaceae	Strephonema mannii Hook.f.	sb	bu	Tr	Lg	Co	
493	Combretaceae	Strephonema sericeum Hook. f.	sb	bu	Tr	Lg	Co	
494	Combretaceae	Terminalia catappa L.	pi	gn	Tr	In	Re	
495	Combretaceae	Terminalia ivorensis A.Chev.	np	sc	Tr	Gu	Re	VU A1cd
496	Combretaceae	Terminalia superba Engl. & Diels	pi	pk	Tr	Gc	Re	
497	Commelinaceae	Amischotolype tenuis (C.B.Clarke) R.S.Rao	sb	gn	Hb	Gc	Co	
498	Commelinaceae	Aneilema beniniense (P.Beauv.) Kunth	pi	gn	Hb	Tra	Co	
499	Commelinaceae	Aneilema umbrosum (Vahl) Kunth subsp. ovato-oblongum (P.Beauv.) J.K.Morton	sb	gn	Hb	Gc	Co	
500	Commelinaceae	Aneilema umbrosum (Vahl) Kunth subsp. umbrosum	sb	gn	Hb	Gc	Co	
501	Commelinaceae	Buforrestia mannii C.B.Clarke	sb	bu	Hb	Lg	Co	
502	Commelinaceae	Commelina africana L. var. africana	pi	gn	Hb	Gc	Co	
503	Commelinaceae	Commelina benghalensis L.	pi	gn	Hb	Gc	Co	
504	Commelinaceae	Commelina cameroonensis J.K.Morton	pi	bu	Hb	Lg	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
505	Commelinaceae	Commelina capitata Benth.	pi	gn	Hb	Gc	Co	
506	Commelinaceae	Commelina diffusa Burm.f.	pi	gn	Hb	Pa	Co	
507	Commelinaceae	Commelina longicapsa C.B.Clarke	sb	gn	Hb	Gc	Co	
508	Commelinaceae	Floscopa africana (P.Beauv.) C.B.Clarke subsp. africana	sw	gn	Hb	Gc	Co	
509	Commelinaceae	Floscopa mannii C.B.Clarke	sw	bu	Hb	Lg	Co	
510	Commelinaceae	Palisota ambigua (P.Beauv.) C.B.Clarke	np	gn	Sh	Gc	Co	
511	Commelinaceae	Palisota barteri Hook.	sb	gn	Hb	Gc	Co	
512	Commelinaceae	Palisota bracteosa C.B.Clarke	sb	gn	Hb	Gc	Co	
513	Commelinaceae	Palisota hirsuta (Thunb.) K.Schum.	pi	gn	Sh	Gc	Co	
514	Commelinaceae	Palisota lagopus Mildbr.	sb	GD	Hb	Lg	Co	
515	Commelinaceae	Palisota mannii C.B.Clarke	sb	gn	Hb	Gc	Co	
516	Commelinaceae	Palisota satabiei Brenan	sb	GD	Hb	Lg	Co	
517	Commelinaceae	Palisota thollonii Hua	sb	gn	Hb	Gc	Co	
518	Commelinaceae	Pollia condensata C.B.Clarke	pi	gn	Hb	Tra	Co	
519	Commelinaceae	Polyspatha paniculata Benth.	sb	gn	Hb	Gc	Co	
520	Commelinaceae	Stanfieldiella imperforata (C.B.Clarke) Brenan	pi	gn	Hb	Tra	Co	
521	Commelinaceae	Stanfieldiella oligantha (Mildbr.) Brenan	pi	gn	Hb	Gc	Co	
522	Compositae	Adenostemma perrottetii DC.	pi	gn	Hb	Gc	Hl	
523	Compositae	Ageratum conyzoides L.	pi	gn	Hb	Gc	Re	
524	Compositae	Aspilia africana (Pers.) C.D.Adams subsp. africana	pi	gn	Hb	Gc	Re	
525	Compositae	Conyza sumatrensis (Retz.) E.Walker	pi	gn	Hb	Gc	Hl	
526	Compositae	Crassocephalum crepidioides (Benth.) S.Moore	pi	gn	Hb	Pal	Hl	
527	Compositae	Elephantopus mollis Kunth	pi	gn	Hb	In	Co	
528	Compositae	Eleutheranthera ruderalis (Sw.) Sch.Bip.	pi	gn	Hb	Pa	Hl	
529	Compositae	Emilia coccinea (Sims) G.Don	pi	gn	Hb	Tra	Co	
530	Compositae	Eupatorium odoratum L.	pi	gn	Hb	Pa	Re	
531	Compositae	Melanthera scandens (Schumach. & Thonn.) Roberty	pi	gn	Hb	Tra	Co	
532	Compositae	Microglossa pyrifolia (Lam.) Kuntze	pi	gn	Hb	Pal	Hl	
533	Compositae	Mikania cordata (Burm.f.) B.L.Robinson var. cordata	pi	gn	Hb	Pal	Co	
534	Compositae	Mikaniopsis paniculata Milne-Redh.	pi	gn	Hb	Gc	Hl	
535	Compositae	Spilanthes filicualis (Schum. & Thonn.) C.D.Adams	pi	gn	Hb	Gc	Re	
536	Compositae	Struchium sparganophora (L.) Kuntze	pi	gn	Hb	Pa	Hl	
537	Compositae	Vernonia conferta Benth.	pi	gn	Sh	Gc	Re	
538	Compositae	Vernonia hymenolepis A.Rich.	pi	gn	Hb	Tra	Hl	
539	Compositae	Vernonia stellulifera (Benth.) C.Jeffrey	pi	gn	Hb	Gc	Co	
540	Connaraceae	Agelaea paradoxa Gilg	np	gn	Lwcl	Gc	Re	
541	Connaraceae	Agelaea pentagyna (Lam.) Baill.	np	gn	Lwcl	Tra	Re	
542	Connaraceae	Agelaea poggeana Gilg	np	gn	Lwcl	Gc	Co	
543	Connaraceae	Cnestis corniculata Lam.	np	gn	Swcl	Tra	Co	
544	Connaraceae	Cnestis ferruginea Vahl ex DC.	pi	gn	Swcl	Gc	Co	
545	Connaraceae	Connarus africanus Lam.	pi	gn	Lwcl	Gc	Hl	
546	Connaraceae	Connarus congolanus Schellenb.	np	gn	Lwcl	Gc	Co	
547	Connaraceae	Connarus griffonianus Baill.	np	gn	Lwcl	Gc	Co	
548	Connaraceae	Connarus staudtii Gilg	np	gn	Lwcl	Gc	Co	
549	Connaraceae	Hemandradenia mannii Stapf	sb	bu	Tr	Lg	Co	LR/nt
550	Connaraceae	Jollydora duparquetiana (Baill.) Pierre	sb	gn	Sh	Gc	Co	
551	Connaraceae	Manotes expansa Sol. ex Planch.	pi	gn	Lwcl	Gc	Hl	
552	Connaraceae	Manotes griffoniana Baill.	pi	gn	Lwcl	Gc	Hl	
553	Connaraceae	Rourea coccinea (Thonn. ex Schum.) Benth. subsp. coccinea	pi	gn	Lwcl	Gc	Co	
554	Connaraceae	Rourea minor (Gaertn.) Alston	pi	gn	Lwcl	Pal	Co	
555	Connaraceae	Rourea myriantha Baill.	pi	gn	Lwcl	Gc	Hl	
556	Connaraceae	Rourea obliquifoliolata Gilg	pi	gn	Lwcl	Gc	Co	
557	Connaraceae	Rourea solanderi Baker	pi	gn	Lwcl	Gc	Hl	
558	Connaraceae	Rourea thomsonii (Baker) Jongkind	pi	gn	Lwcl	Tra	Co	
559	Convolvulaceae	Calycobolus africanus (G.Don) Heine	pi	gn	Lwcl	Gc	Co	
560	Convolvulaceae	Ipomoea cairica (L.) Sweet	pi	gn	Hb	Pa	Co	
561	Convolvulaceae	Ipomoea involucrata P.Beauv.	pi	gn	Hb	Tra	Co	
562	Convolvulaceae	Ipomoea mauritiana Jacq.	pi	gn	Hb	Pa	Co	
563	Convolvulaceae	Ipomoea pes-caprae (L.) Sweet subsp. Brasiliensis Choisy	pi	gn	Hb	Pa	Co	
564	Convolvulaceae	Ipomoea stolonifera (Cyrill.) J.F.Gmel.	pi	gn	Hb	Tra	Hl	
565	Convolvulaceae	Neuropeltis acuminata (P.Beauv.) Benth.	np	gn	Lwcl	Gc	Co	
566	Convolvulaceae	Neuropeltis incompta Good	np	gn	Lwcl	Gc	Co	
567	Convolvulaceae	Neuropeltis pseudovelutina Lejoly & Lisowski	np	gn	Lwcl	Gc	Co	
568	Convolvulaceae	Neuropeltis velutina Hallier f.	np	gn	Lwcl	Gc	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
569	Costaceae	Costus afer Ker Gawl.	pi	bu	Hb	Lg	Co	
570	Costaceae	Costus dewevrei De Wild. & T.Durand	pi	gn	Hb	Gc	Hl	
571	Costaceae	Costus dinklagei K.Schum.	sb	gn	Hb	Gc	Co	
572	Costaceae	Costus dubius (Afzel.) K.Schum.	pi	gn	Hb	Tra	Co	
573	Costaceae	Costus englerianus K.Schum.	sb	gn	Hb	Gc	Co	
574	Costaceae	Costus lateriflorus Baker	pi	gn	Hb	Gc	Co	
575	Costaceae	Costus letestui Pellegr.	sb	bu	Hb	Lg	Co	
576	Costaceae	Costus ligularis Baker	sb	bu	Hb	Lg	Co	
577	Costaceae	Costus lucanusianus J.Braun & K.Schum.	pi	gn	Hb	Gc	Co	
578	Costaceae	Costus phaeotrichus Loes.	pi	gn	Hb	Gc	Co	
579	Costaceae	Costus smithiana (Baker) Planch.	pi	gn	Hb	Gc	Hl	
580	Costaceae	Costus tappenbeckianus J.Braun & K.Schum.	sb	bu	Hb	Lg	Co	
581	Crassulaceae	Kalanchoe pinnata (Lam.) Pers.	pi	gn	Hb	Pa	Re	
582	Cucurbitaceae	Bambekea racemosa Cogn.	pi	gn	Hcl	Gc	Co	
583	Cucurbitaceae	Coccinia barteri (Hook.f.) Keay	pi	gn	Hcl	Tra	Co	
584	Cucurbitaceae	Cogniauxia podolaena Baill.	pi	gn	Hcl	Gc	Co	
585	Cucurbitaceae	Cucumeropsis mannii Naud.	ri	gn	Hcl	Tra	Re	
586	Cucurbitaceae	Lagenaria breviflora Benth.	pi	gn	Hcl	Tra	Hl	
587	Cucurbitaceae	Momordica cabraei (Cogn.) C.Jeffrey	pi	gn	Hcl	Tra	Co	
588	Cucurbitaceae	Momordica charantia L.	pi	gn	Hcl	Pa	Co	
589	Cucurbitaceae	Momordica cissoides Planch. ex Benth.	pi	gn	Hcl	Tra	Co	
590	Cucurbitaceae	Momordica foetida Schum. & Thonn.	pi	gn	Hcl	Tra	Co	
591	Cucurbitaceae	Momordica multiflora Hook.f.	pi	gn	Hcl	Tra	Co	
592	Cucurbitaceae	Raphidiocystis jeffreyana R. & A. Fern	pi	gn	Hcl	Gc	Co	
593	Cucurbitaceae	Ruthalicia longipes (Hook.f.) C.Jeffrey	pi	gn	Hcl	Gu	Co	
594	Cucurbitaceae	Zehneria capillacea (Shumach) C. Jeffrey	pi	gn	Hcl	Gc	Hl	
595	Cucurbitaceae	Zehneria keayana R. & A.Fern.	pi	gn	Hcl	Gc	Hl	
596	Cyanastraceae	Cyanastrum cordifolium Oliv.	sb	bu	Hb	Lg	Co	
597	Cyatheaceae	Alsophila camerooniana (Hook.) R.M.Tryon	sb	gn	Sh	Gc	Re	
598	Cyperaceae	Afrotrilepis pilosa (Boeck.) J.Raynal	pi	gn	Hb	Gc	Hl	
599	Cyperaceae	Bulbostylis hensii (C.B.Clarke) Haines	pi	gn	Hb	Tra	Hl	
600	Cyperaceae	Cyperus cuspidatus Kunth	pi	gn	Hb	Gc	Hl	
601	Cyperaceae	Cyperus cyperoides (L.) Kuntze	pi	gn	Hb	Gc	Co	
602	Cyperaceae	Cyperus distans L.f.	pi	gn	Hb	Gc	Co	
603	Cyperaceae	Cyperus fertilis Boeck.	pi	gn	Hb	Gc	Co	
604	Cyperaceae	Cyperus laxus Lam. subsp. buchholzii (Boeck.) Lye	pi	gn	Hb	Tra	Co	
605	Cyperaceae	Cyperus ligularis L.	pi	gn	Hb	Tra	Hl	
606	Cyperaceae	Cyperus tenuiculmis Boeck.	pi	gn	Hb	Tra	Hl	
607	Cyperaceae	Cyperus tenuis Sw.	pi	gn	Hb	Tra	Co	
608	Cyperaceae	Eleocharis geniculata (L.) Roem. & Schult.	pi	gn	Hb	Tra	Hl	
609	Cyperaceae	Fimbristylis bisumbellata (Forssk.) Bubani	pi	gn	Hb	Pa	Hl	
610	Cyperaceae	Fimbristylis cymosa R.Br.	pi	gn	Hb	Pa	Hl	
611	Cyperaceae	Fimbristylis dichotoma (L.) Vahl	pi	gn	Hb	Pa	Hl	
612	Cyperaceae	Fimbristylis ferruginea (L.) Vahl	pi	gn	Hb	Pa	Hl	
613	Cyperaceae	Fimbristylis hispidula (Vahl) Kunth	pi	gn	Hb	Pa	Hl	
614	Cyperaceae	Fimbristylis squarrosa Vahl	pi	gn	Hb	Pa	Hl	
615	Cyperaceae	Fuirena umbellata Rottb.	pi	gn	Hb	Pa	Hl	
616	Cyperaceae	Hypolytrum heteromorphum Nelmes	sb	gn	Hb	Gc	Co	
617	Cyperaceae	Hypolytrum lancifolium C.B.Clarke	sb	gn	Hb	Gc	Co	
618	Cyperaceae	Hypolytrum purpuracens Cherm.	sb	gn	Hb	Gc	Co	
619	Cyperaceae	Hypolytrum sp. nov. ined.	sb	BK	Hb	Campo-Ma'an	Co	
620	Cyperaceae	Kyllinga nemoralis (Forst.) Dandy ex Hutch.	pi	gn	Hb	Tra	Co	
621	Cyperaceae	Kyllinga peruviana Lam.	pi	gn	Hb	Tra	Hl	
622	Cyperaceae	Kyllinga tenuifolia Steud.	pi	gn	Hb	Tra	Hl	
623	Cyperaceae	Mapania africana Boeck.	sb	bu	Hb	Lg	Co	
624	Cyperaceae	Mapania amplivaginata K.Schum.	sb	gn	Hb	Gc	Co	
625	Cyperaceae	Mapania macrantha (Boeck) H.Pfeiffer	sb	bu	Hb	Lg	Co	
626	Cyperaceae	Mapania mannii C.B.Clarke subsp. mannii	sb	gn	Hb	Gc	Co	
627	Cyperaceae	Mapania pubisquama Cherm.	sb	gn	Hb	Gc	Co	
628	Cyperaceae	Mapania raynaliana D.A.Simpson	sb	bu	Hb	Lg	Co	
629	Cyperaceae	Mapania soyauxii (Boeck) K.Schum.	sb	gn	Hb	Gc	Co	
630	Cyperaceae	Pycreus cataractarum C.B.Clarke	pi	gn	Hb	Pa	Hl	
631	Cyperaceae	Pycreus smithianus (Ridley) C.B.Clarke	pi	gn	Hb	Pa	Hl	
632	Cyperaceae	Remirea maritima Aubl.	pi	gn	Hb	Pa	Hl	
633	Cyperaceae	Scleria boivinii Steud.	pi	gn	Hb	Gc	Co	

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634	Cyperaceae	Scleria catophylla C.B.Clarke	pi	gn	Hb	Gc	Hl	
635	Cyperaceae	Scleria naumanniana Boeck.	pi	gn	Hb	Gc	Hl	
636	Cyperaceae	Scleria racemosa Poir.	pi	gn	Hb	Gc	Co	
637	Davalliaceae	Davallia chaerophylloides (Poir.) Steud.	ep	gn	Hb	Tra	Hl	
638	Dennstaedtiaceae	Lonchitis currorii (Hook.) Mett. ex Kuhn	ep	gn	Hb	Tra	Co	
639	Dennstaedtiaceae	Microlepia speluncae (l.) T.Moore	ep	gn	Hb	Pa	Co	
640	Dichapetalaceae	Dichapetalum affine (Planch. ex Benth.) Breteler	np	bu	Lwcl	Lg	Co	
641	Dichapetalaceae	Dichapetalum altescandens Engl.	np	bu	Lwcl	Lg	Hl	
642	Dichapetalaceae	Dichapetalum angolense Chodat	np	gn	Lwcl	Gc	Co	
643	Dichapetalaceae	Dichapetalum arachnoideum Breteler	np	bu	Lwcl	Lg	Hl	
644	Dichapetalaceae	Dichapetalum bangii (Didr.) Engl.	np	gn	Lwcl	Gc	Hl	
645	Dichapetalaceae	Dichapetalum barbatum Breteler	np	bu	Lwcl	Lg	Hl	
646	Dichapetalaceae	Dichapetalum choristilum Engl.	np	gn	Lwcl	Gc	Co	
647	Dichapetalaceae	Dichapetalum crassifolium Chodat var. crassifolium	np	gn	Lwcl	Gc	Co	
648	Dichapetalaceae	Dichapetalum crassifolium Chodat var. integrum (Pierre) Breteler	np	bu	Lwcl	Lg	Co	
649	Dichapetalaceae	Dichapetalum cymulosum (Oliv.) Engl.	np	GD	Lwcl	Cam	Co	
650	Dichapetalaceae	Dichapetalum dewevrei De Wild. & T.Durand var. dewevrei	np	bu	Lwcl	Lg	Hl	
651	Dichapetalaceae	Dichapetalum gabonense Engl.	np	bu	Lwcl	Lg	Co	
652	Dichapetalaceae	Dichapetalum glomeratum Engl.	np	gn	Lwcl	Gc	Co	
653	Dichapetalaceae	Dichapetalum heudelotii (Planch. ex Oliv.) Baill. var. hispidum (Oliv.) Breteler	np	gn	Lwcl	Gc	Co	
654	Dichapetalaceae	Dichapetalum heudelotii (Planch. ex Oliv.) Baill. var. heudelotii	np	gn	Lwcl	Gc	Co	
655	Dichapetalaceae	Dichapetalum heudelotii (Planch. ex Oliv.) Baill. var. longitubulosum (Engl.) Breteler	np	bu	Lwcl	Lg	Co	
656	Dichapetalaceae	Dichapetalum heudelotii (Planch. ex Oliv.) Baill. var. ndongense (Engl.) Breteler	np	gn	Lwcl	Gc	Hl	
657	Dichapetalaceae	Dichapetalum insigne Engl.	sb	gn	Lwcl	Gc	Co	
658	Dichapetalaceae	Dichapetalum integripetalum Engl.	np	bu	Lwcl	Lg	Co	
659	Dichapetalaceae	Dichapetalum librevillense Pellegr.	np	bu	Lwcl	Lg	Hl	
660	Dichapetalaceae	Dichapetalum madagascariense Poir. var. madagascariense	np	gn	Lwcl	Tra	Co	
661	Dichapetalaceae	Dichapetalum melanocladum Breteler	np	bu	Lwcl	Lg	Co	
662	Dichapetalaceae	Dichapetalum minutiflorum Engl. & Ruhl.	np	bu	Lwcl	Lg	Co	
663	Dichapetalaceae	Dichapetalum mombuttense Engl.	np	gn	Lwcl	Gc	Co	
664	Dichapetalaceae	Dichapetalum mundense Engl.	np	gn	Lwcl	Gc	Co	
665	Dichapetalaceae	Dichapetalum oblongum (Hook. f. ex Benth.) Engl.	np	gn	Lwcl	Gu	Co	
666	Dichapetalaceae	Dichapetalum oliganthum Breteler	np	BK	Lwcl	Sw-Cam	Co	
667	Dichapetalaceae	Dichapetalum pallidum (Oliv.) Engl.	np	gn	Lwcl	Gc	Co	
668	Dichapetalaceae	Dichapetalum parvifolium Engl.	np	gn	Lwcl	Gc	Co	
669	Dichapetalaceae	Dichapetalum pulchrum Breteler	np	bu	Lwcl	Lg	Co	
670	Dichapetalaceae	Dichapetalum reticulatum Engl.	np	bu	Lwcl	Lg	Co	
671	Dichapetalaceae	Dichapetalum rudatisii Engl.	np	gn	Lwcl	Gc	Co	
672	Dichapetalaceae	Dichapetalum staudtii Engl.	np	gn	Lwcl	Gc	Co	
673	Dichapetalaceae	Dichapetalum tomentosum Engl.	np	gn	Lwcl	Gc	Co	
674	Dichapetalaceae	Dichapetalum unguiculatum Engl.	np	gn	Lwcl	Gc	Hl	
675	Dichapetalaceae	Dichapetalum witianum Breteler	np	bu	Lwcl	Lg	Hl	
676	Dichapetalaceae	Dichapetalum zenkeri Engl.	np	gn	Lwcl	Gc	Hl	
677	Dichapetalaceae	Tapura africana Oliv.	sb	bu	Tr	Lg	Co	
678	Dichapetalaceae	Tapura tchoutoi Breteler	sb	BK	Sh	Campo-Ma'an	Co	
679	Dilleniaceae	Tetracera alnifolia Willd. var. podotricha (Gilg) Staner	pi	gn	Lwcl	Gc	Co	
680	Dilleniaceae	Tetracera alnifolia Willd.var. alnifolia	pi	gn	Lwcl	Gc	Co	
681	Dilleniaceae	Tetracera eriantha (Oliv.) Hutch.	pi	gn	Lwcl	Gc	Hl	
682	Dioscoreaceae	Dioscorea alata L.	pi	gn	Swcl	Gc	Co	
683	Dioscoreaceae	Dioscorea bulbifera L.	pi	gn	Swcl	Gc	Co	
684	Dioscoreaceae	Dioscorea liebrechtsiana De Wild.	np	gn	Swcl	Gc	Hl	
685	Dioscoreaceae	Dioscorea mangenotiana J.Miege	pi	pk	Swcl	Gc	Hl	
686	Dioscoreaceae	Dioscorea minutiflora Engl.	np	gn	Swcl	Gc	Co	
687	Dioscoreaceae	Dioscorea smilacifolia De Wild.	np	gn	Swcl	Gc	Co	
688	Dracaenaceae	Dracaena arborea (Willd.) Link.	pi	gn	Tr	Tra	Co	
689	Dracaenaceae	Dracaena aubreyana Brongn. ex C.J.Morren	sb	gn	Sh	Gc	Co	
690	Dracaenaceae	Dracaena bicolor Hook.	sb	bu	Sh	Lg	Co	
691	Dracaenaceae	Dracaena braunii Engl.	sb	gn	Sh	Gc	Co	
692	Dracaenaceae	Dracaena camerooniana Baker	sb	gn	Sh	Tra	Co	
693	Dracaenaceae	Dracaena cerasifera Hua	sb	gn	Sh	Gu	Co	

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694	Dracaenaceae	Dracaena laxissima Engl.	sb	gn	Sh	Gc	Co	
695	Dracaenaceae	Dracaena phrynioides Hook.	sb	gn	Sh	Gc	Co	
696	Dracaenaceae	Dracaena poggei Engl.	sb	gn	Sh	Gc	Co	
697	Dracaenaceae	Dracaena surculosa Lindley	sb	gn	Sh	Gc	Co	
698	Dracaenaceae	Dracaena thalioides Mankoy ex C.Morr.	sb	bu	Sh	Lg	Co	
699	Dracaenaceae	Dracaena viridiflora Engl. & K.Krause	sb	bu	Sh	Lg	Co	
700	Dryopteridaceae	Dryopteris inaequalis agg. (Schltdl.) Kuntze	ep	gn	Hb	Tra	Hl	
701	Dryopteridaceae	Lastreopsis currori (Mett. ex Kuhn) Tindale	sb	gn	Hb	Gc	Co	
702	Dryopteridaceae	Lastreopsis davalliaeformis (Tardieu) Tardieu	sb	bu	He	Lg	Hl	
703	Dryopteridaceae	Lastreopsis efulensis (Baker) Tardieu	sb	gn	Hb	Gc	Hl	
704	Dryopteridaceae	Lastreopsis nigritiana (Baker) Tindale	sb	gn	Hb	Gc	Co	
705	Dryopteridaceae	Tectaria angelicifolia (Schum.) Copel.	ep	gn	Hb	Gc	Co	
706	Dryopteridaceae	Tectaria barteri (J.Sm.) C.Chr.	sb	bu	Hb	Lg	Co	
707	Dryopteridaceae	Tectaria camerooniana (Hook.) Alston	sb	gn	Hb	Gc	Co	
708	Dryopteridaceae	Tectaria fernandensis (Baker) C.Chr.	sb	bu	Hb	Lg	Co	
709	Dryopteridaceae	Tectaria varians (Moore) C.Chr.	sb	bu	Hb	Lg	Hl	
710	Dryopteridaceae	Triplophyllum buchholzii (Kuhn) Holttum	sb	gn	Hb	Gc	Co	
711	Dryopteridaceae	Triplophyllum gabonense Holttum	sb	gn	Hb	Gc	Co	
712	Dryopteridaceae	Triplophyllum jenseniae (C.Chr.) Holttum	sb	gn	Hb	Gc	Co	
713	Dryopteridaceae	Triplophyllum pilosissimum (T.Moore) Holttum	sb	gn	Hb	Gc	Co	
714	Dryopteridaceae	Triplophyllum protensum (Sw.) Holttum	sb	gn	Hb	Gc	Co	
715	Dryopteridaceae	Triplophyllum securidiforme (Hook.) Holttum var. securidiforme	sb	gn	Hb	Gc	Co	
716	Dryopteridaceae	Triplophyllum varians (T.Moore) Holttum	ep	gn	Hb	Gc	Co	
717	Ebenaceae	Diospyros alboflavescens (Gürke) F.White	sb	BK	Tr	Sw-Cam	Hl	
718	Ebenaceae	Diospyros barteri Hiern	sb	bu	Tr	Gu	Co	VU A1c
719	Ebenaceae	Diospyros bipindensis Gürke	sb	gn	Tr	Gc	Co	
720	Ebenaceae	Diospyros boala De Wild.	sb	gn	Tr	Gc	Co	
721	Ebenaceae	Diospyros canaliculata De Wild.	sb	gn	Tr	Gc	Co	
722	Ebenaceae	Diospyros cinnabarina (Gürke) F.White	sb	bu	Tr	Lg	Co	
723	Ebenaceae	Diospyros conocarpa Gürke & K.Schum.	sb	gn	Sh	Gc	Co	
724	Ebenaceae	Diospyros crassiflora Hiern	sb	sc	Tr	Gc	Re	EN A1d
725	Ebenaceae	Diospyros dendo Welw. ex Hiern	sb	gn	Tr	Gc	Co	
726	Ebenaceae	Diospyros fragrans Gürke	sb	bu	Tr	Lg	Co	
727	Ebenaceae	Diospyros gabunensis Gürke	sb	gn	Tr	Gc	Co	
728	Ebenaceae	Diospyros gracilescens Gürke	sb	bu	Tr	Lg	Co	
729	Ebenaceae	Diospyros hoyleana F.White subsp. hoyleana	sb	gn	Tr	Gc	Co	
730	Ebenaceae	Diospyros iturensis (Gürke) Letouzey & F.White	sb	gn	Tr	Gc	Co	
731	Ebenaceae	Diospyros kamerunensis Gürke	sb	gn	Tr	Gu	Co	
732	Ebenaceae	Diospyros longiflora Letouzey & F.White	sb	bu	Tr	Lg	Co	
733	Ebenaceae	Diospyros mannii Hiern	sb	gn	Tr	Gc	Co	
734	Ebenaceae	Diospyros melocarpa F.White	sb	gn	Sh	Gc	Co	
735	Ebenaceae	Diospyros obliquifolia (Hiern ex Gürke) F.White	sb	gn	Sh	Gc	Co	
736	Ebenaceae	Diospyros physocalycina Gürke	sb	bu	Tr	Lg	Co	
737	Ebenaceae	Diospyros piscatoria Gürke	sb	gn	Tr	Gc	Co	
738	Ebenaceae	Diospyros polystemon Gürke	sb	gn	Tr	Gc	Co	
739	Ebenaceae	Diospyros preussii Gürke	sw	gn	Sh	Gc	Co	
740	Ebenaceae	Diospyros sanza-minika A.Chev.	sb	bu	Tr	Lg	Co	
741	Ebenaceae	Diospyros soyauxii Gürke & K. Schum.	sb	bu	Tr	Lg	Co	
742	Ebenaceae	Diospyros suaveolens Gürke	sb	bu	Tr	Lg	Co	
743	Ebenaceae	Diospyros zenkeri (Gürke) F.White	sb	gn	Tr	Gc	Co	
744	Erythroxylaceae	Aneulophus africanus Benth.	sb	gn	Tr	Gc	Hl	
745	Erythroxylaceae	Erythroxylum emarginatum Thonn.	np	gn	Tr	Tra	Hl	
746	Erythroxylaceae	Erythroxylum mannii Oliv.	pi	gn	Tr	Gc	Co	
747	Euphorbiaceae	Acalypha brachystachya Hornem.	pi	gn	Hb	Pal	Hl	
748	Euphorbiaceae	Afrotrewia kamerunica Pax & Hoffm.	sb	BK	Sh	Campo-Ma'an	Co	
749	Euphorbiaceae	Alchornea cordifolia (Schum. & Thonn.) Müll.Arg.	pi	gn	Sh	Tra	Co	
750	Euphorbiaceae	Alchornea floribunda Müll.Arg.	sb	gn	Sh	Gc	Co	
751	Euphorbiaceae	Alchornea hirtella Benth.	pi	gn	Sh	Tra	Co	
752	Euphorbiaceae	Alchornea laxiflora (Benth.) Pax & K.Hoffm.	sb	gn	Sh	Tra	Co	
753	Euphorbiaceae	Amanoa strobilacea Müll.Arg.	sb	bu	Sh	Gu	Co	VU A1c, B1+2c
754	Euphorbiaceae	Antidesma laciniatum Müll.Arg. var. laciniatum	sb	gn	Tr	Gc	Co	
755	Euphorbiaceae	Antidesma laciniatum Müll.Arg. var. membranaceum Müll.Arg.	sb	gn	Tr	Gc	Co	
756	Euphorbiaceae	Antidesma membranaceum Müll.Arg.	pi	gn	Sh	Tra	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
757	Euphorbiaceae	Antidesma venosum Tul.	sb	gn	Tr	Tra	Co	
758	Euphorbiaceae	Antidesma vogelianum Müll.Arg.	sb	gn	Tr	Tra	Co	
759	Euphorbiaceae	Argomuellera macrophylla Pax	sb	gn	Sh	Tra	Co	
760	Euphorbiaceae	Bridelia grandis Pierre ex Hutch.	pi	gn	Tr	Gu	Re	
761	Euphorbiaceae	Bridelia micrantha (Hochst.) Baill.	pi	gn	Tr	Gc	Co	
762	Euphorbiaceae	Cleistanthus bipindensis Pax	sw	bu	Sh	Lg	Co	
763	Euphorbiaceae	Cleistanthus zenkeri Jabl.	sw	bu	Tr	Lg	Co	
764	Euphorbiaceae	Croton gratissimus Burch.	pi	gn	Sh	Tra	Co	
765	Euphorbiaceae	Crotonogyne impedita Prain	sb	bu	Sh	Lg	Co	
766	Euphorbiaceae	Crotonogyne manniana Müll.Arg.	sb	bu	Sh	Lg	Co	LR/nt
767	Euphorbiaceae	Crotonogyne poggei Pax	sb	gn	Sh	Gc	Co	
768	Euphorbiaceae	Crotonogyne preussii Pax	sb	bu	Sh	Lg	Co	
769	Euphorbiaceae	Crotonogyne strigosa Prain	sb	bu	Sh	Lg	Co	
770	Euphorbiaceae	Crotonogyne zenkeri Pax	sb	gn	Sh	Gc	Co	
771	Euphorbiaceae	Cyathogyne viridis Müll.Arg.	pi	gn	Hb	Gc	Co	
772	Euphorbiaceae	Cyrtogonone argentea (Pax) Prain	sb	bu	Tr	Lg	Re	
773	Euphorbiaceae	Cyttaranthus congolensis J.Léonard	sb	gn	Sh	Gc	Co	
774	Euphorbiaceae	Dalechampia ipomoeifolia Benth.	pi	gn	Hcl	Tra	Co	
775	Euphorbiaceae	Dichostemma glaucescens Pierre	sb	gn	Tr	Gc	Co	
776	Euphorbiaceae	Discoclaoxylon hexandrum (Müll.Arg.) Pax & K.Hoffm.	sb	gn	Tr	Gc	Co	
777	Euphorbiaceae	Discoglypremna caloneura (Pax) Prain	pi	gn	Tr	Gc	Re	
778	Euphorbiaceae	Drypetes aframensis Hutch.	sb	gn	Tr	Gu	Co	
779	Euphorbiaceae	Drypetes afzelii (Pax) Hutch.	sb	gn	Tr	Gu	Co	
780	Euphorbiaceae	Drypetes aylmeri Hutch. & Dalziel	sb	gn	Sh	Gc	Co	
781	Euphorbiaceae	Drypetes capillipes (Pax) Pax & K.Hoffm.	sb	gn	Sh	Gc	Co	
782	Euphorbiaceae	Drypetes chevalieri Beille	sb	gn	Sh	Gc	Co	
783	Euphorbiaceae	Drypetes floribunda (Müll.Arg.) Hutch.	sb	gn	Tr	Gc	Co	
784	Euphorbiaceae	Drypetes gabunensis (Pierre) Hutch.	sb	bu	Tr	Lg	Co	
785	Euphorbiaceae	Drypetes gilgiana (Pax) Pax & K.Hoffm.	sb	gn	Tr	Gu	Hl	
786	Euphorbiaceae	Drypetes gossweileri S.Moore	sb	gn	Tr	Gc	Co	
787	Euphorbiaceae	Drypetes inaequalis Hutch.	sb	gn	Sh	Gu	Co	
788	Euphorbiaceae	Drypetes klainei Pierre ex Pax	sb	gn	Tr	Gc	Co	
789	Euphorbiaceae	Drypetes leonensis Pax	sb	gn	Tr	Gc	Co	
790	Euphorbiaceae	Drypetes magnistipula (Pax) Hutch.	sb	bu	Sh	Lg	Co	
791	Euphorbiaceae	Drypetes molunduana Pax & K.Hoffm.	sb	bu	Sh	Lg	Co	
792	Euphorbiaceae	Drypetes obanensis S.Moore	sb	bu	Sh	Lg	Hl	
793	Euphorbiaceae	Drypetes paxii Hutch.	sb	bu	Tr	Lg	Co	
794	Euphorbiaceae	Drypetes preussii (Pax) Hutch.	sb	bu	Tr	Lg	Co	VU B1+2c
795	Euphorbiaceae	Drypetes principum (Müll.Arg.) Hutch.	sb	bu	Tr	Lg	Co	
796	Euphorbiaceae	Drypetes similis Hutch.	sb	bu	Tr	Lg	Co	
797	Euphorbiaceae	Drypetes staudtii (Pax) Hutch.	sb	bu	Tr	Lg	Co	
798	Euphorbiaceae	Drypetes tessmanniana (Pax) Pax & K.Hoffm.	sb	bu	Sh	Lg	Hl	CR A1c+2c
799	Euphorbiaceae	Duvigneaudia inopinata (Prain) J.Léonard	sb	gn	Sh	Gc	Co	
800	Euphorbiaceae	Erythrococca africana (Baill.) Prain	sb	gn	Sh	Gc	Co	
801	Euphorbiaceae	Erythrococca anomala (Juss. ex Poir.) Prain	sb	bu	Sh	Lg	Co	
802	Euphorbiaceae	Erythrococca hispida (Pax) Prain	sb	bu	Sh	Lg	Co	
803	Euphorbiaceae	Erythrococca membranacea (Müll.Arg.) Prain	sb	bu	Sh	Lg	Co	
804	Euphorbiaceae	Euphorbia glaucophylla Poir.	pi	gn	Hb	Pa	Hl	
805	Euphorbiaceae	Euphorbia heterophylla L.	pi	gn	Hb	Pa	Hl	
806	Euphorbiaceae	Euphorbia hirta L.	pi	gn	Hb	Pa	Co	
807	Euphorbiaceae	Euphorbia polycnemoides Hochst. ex Boiss	pi	gn	Hb	Pa	Co	
808	Euphorbiaceae	Euphorbia prostrata Ait.	pi	gn	Hb	Pa	Co	
809	Euphorbiaceae	Euphorbia thymifolia L.	pi	gn	Hb	Pa	Hl	
810	Euphorbiaceae	Excoecaria guineensis (Benth.) Müll.Arg.	pi	gn	Sh	Tra	Co	
811	Euphorbiaceae	Grossera paniculata Pax	sb	bu	Tr	Lg	Co	
812	Euphorbiaceae	Hamilcoa zenkeri (Pax) Prain	sb	bu	Sh	Lg	Co	
813	Euphorbiaceae	Hevea brasiliensis (A.Juss.) Müll.Arg.	pi	gn	Tr	In	Re	
814	Euphorbiaceae	Jatropha curcas L.	pi	gn	Sh	Pa	Hl	
815	Euphorbiaceae	Keayodendron bridelioides Leandri	sb	gn	Tr	Gu	Re	
816	Euphorbiaceae	Klaineanthus gaboniae Pierre ex Prain	sb	gn	Tr	Gc	Re	
817	Euphorbiaceae	Macaranga barteri Müll.Arg.	pi	gn	Tr	Gu	Co	
818	Euphorbiaceae	Macaranga monandra Müll.Arg.	pi	gn	Tr	Tra	Re	
819	Euphorbiaceae	Macaranga occidentalis (Müll.Arg.) Müll.Arg.	pi	bu	Tr	Lg	Re	
820	Euphorbiaceae	Macaranga schweinfurthii Pax	pi	gn	Tr	Gc	Hl	
821	Euphorbiaceae	Maesobotrya barteri (Baill.) Hutch. var. barteri	sb	gn	Sh	Gu	Hl	

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822	Euphorbiaceae	Maesobotrya bipindensis (Pax) Hutch.	sb	gn	Sh	Gc	Co	
823	Euphorbiaceae	Maesobotrya dusenii (Pax) Hutch.	sb	bu	Sh	Lg	Co	
824	Euphorbiaceae	Maesobotrya floribunda Benth.	sb	gn	Sh	Gc	Co	
825	Euphorbiaceae	Maesobotrya pauciflora Pax	sb	gn	Sh	Gc	Co	
826	Euphorbiaceae	Maesobotrya staudtii (Pax) Hutch.	sb	gn	Tr	Gc	Co	
827	Euphorbiaceae	Mallotus oppositifolius (Geiseler) Müll.Arg.	pi	gn	Sh	Tra	Re	
828	Euphorbiaceae	Manniophyton fulvum Müll.Arg.	np	gn	Lwcl	Gc	Co	
829	Euphorbiaceae	Maprounea membranacea Pax & K.Hoffm.	sb	gn	Tr	Gc	Co	
830	Euphorbiaceae	Mareya micrantha (Benth.) Müll.Arg.	sb	gn	Tr	Gc	Co	
831	Euphorbiaceae	Mareyopsis longifolia (Pax) Pax & K.Hoffm.	sb	gn	Tr	Gc	Co	
832	Euphorbiaceae	Margaritaria discoidea (Baill.) Webster	pi	gn	Tr	Pa	Co	
833	Euphorbiaceae	Necepsia afzelii Prain	sb	gn	Sh	Gu	Co	
834	Euphorbiaceae	Neoboutonia glabrescens Prain	pi	gn	Tr	Gu	Hl	
835	Euphorbiaceae	Neoboutonia mannii Benth.	pi	bu	Tr	Gu	Co	LR/nt
836	Euphorbiaceae	Phyllanthus amarus Schumach. & Thonn.	pi	gn	Swcl	Pa	Hl	
837	Euphorbiaceae	Phyllanthus mannianus Müll.Arg.	pi	bu	Swcl	Lg	Co	
838	Euphorbiaceae	Phyllanthus muellerianus (Kuntze) Exell	pi	gn	Swcl	Tra	Co	
839	Euphorbiaceae	Phyllanthus niruroides Müll.Arg.	pi	gn	Swcl	Gc	Co	
840	Euphorbiaceae	Plagiostyles africana (Müll.Arg.) Prain	sb	gn	Tr	Gu	Co	
841	Euphorbiaceae	Protomegabaria stapfiana (Beille) Hutch.	sb	gn	Tr	Gu	Co	
842	Euphorbiaceae	Pseudagrostistachys africana (Müll.Arg.) Pax & K.Hoffm.	sb	bu	Tr	Lg	Co	VU A1c, B1+2c
843	Euphorbiaceae	Pycnocoma macrophylla Benth.	sb	gn	Sh	Gc	Co	
844	Euphorbiaceae	Ricinodendron heudelotii (Baill.) Heckel	pi	pk	Tr	Tra	Re	
845	Euphorbiaceae	Ricinus communis L.	pi	gn	Sh	In	Re	
846	Euphorbiaceae	Sapium ellipticum (Krauss) Pax	pi	gn	Tr	Gc	Re	
847	Euphorbiaceae	Sibangea similis (Hutch.) Radcl.-Sm.	sb	bu	Tr	Lg	Re	
848	Euphorbiaceae	Spondianthus preussii Engl. var. preussii	sw	gn	Tr	Gu	Re	
849	Euphorbiaceae	Tetracarpidium conophorum (Müll.Arg.) Hutch. & Dalziel	pi	pk	Swcl	Gc	Co	
850	Euphorbiaceae	Tetrorchidium didymostemon (Baill.) Pax & K.Hoffm.	pi	gn	Tr	Gc	Co	
851	Euphorbiaceae	Thecacoris annobonae Pax & K.Hoffm.	sb	bu	Sh	Lg	Co	
852	Euphorbiaceae	Thecacoris batesii Hutch.	sb	bu	Sh	Lg	Co	
853	Euphorbiaceae	Thecacoris leptobotrya (Müll.Arg.) Brenan	sb	gn	Sh	Gc	Co	
854	Euphorbiaceae	Thecacoris stenopetala (Müll.Arg.) Müll.Arg.	sb	gn	Sh	Gu	Co	
855	Euphorbiaceae	Tragia benthami Baker	pi	gn	Hcl	Pa	Co	
856	Euphorbiaceae	Tragia preussii Pax	pi	gn	Hcl	Gc	Hl	
857	Euphorbiaceae	Tragia tenuifolia Benth.	pi	gn	Hcl	Gc	Co	
858	Euphorbiaceae	Uapaca acuminata (Hutch.) Pax & K.Hoffm.	np	bu	Tr	Lg	Co	
859	Euphorbiaceae	Uapaca guineensis Müll.Arg.	np	gn	Tr	Gc	Co	
860	Euphorbiaceae	Uapaca heudelotii Baill.	sw	bu	Tr	Lg	Co	
861	Euphorbiaceae	Uapaca paludosa Aubrév. & Léandri	sw	gn	Tr	Gc	Re	
862	Euphorbiaceae	Uapaca staudtii Pax	np	bu	Tr	Lg	Co	
863	Euphorbiaceae	Uapaca vanhouttei De Wild.	np	bu	Tr	Lg	Co	
864	Flacourtiaceae	Casearia barteri Mast.	sw	gn	Tr	Gc	Co	
865	Flacourtiaceae	Casearia stipitata Mast.	sw	gn	Tr	Gc	Co	
866	Flacourtiaceae	Dasylepis blackii (Oliv.) Chipp	sb	gn	Tr	Gc	Co	
867	Flacourtiaceae	Dovyalis zenkeri Gilg	pi	gn	Sh	Gc	Co	
868	Flacourtiaceae	Homalium africanum (Hook.f.) Benth.	sw	gn	Tr	Gc	Co	
869	Flacourtiaceae	Homalium dewevrei De Wild. & Th. Durand	sw	bu	Tr	Lg	Hl	
870	Flacourtiaceae	Homalium hypolosium Mildbr.	sb	bu	Tr	Lg	Hl	
871	Flacourtiaceae	Homalium letestui Pellegr.	np	gn	Tr	Gu	Co	
872	Flacourtiaceae	Homalium longistylum Mast.	np	gn	Tr	Tra	Co	
873	Flacourtiaceae	Homalium stipulaceum Welw. ex Mast.	sb	gn	Tr	Gc	Co	
874	Flacourtiaceae	Oncoba dentata Oliv.	pi	gn	Tr	Gc	Co	
875	Flacourtiaceae	Oncoba echinata Oliv.	sb	gn	Tr	Gc	Hl	
876	Flacourtiaceae	Oncoba flagelliflora (Mildbr.) Hul	sb	bu	Tr	Lg	Co	
877	Flacourtiaceae	Oncoba glauca (P.Beauv.) Planch.	np	gn	Tr	Gc	Co	
878	Flacourtiaceae	Oncoba mannii Oliv.	sb	gn	Tr	Gc	Co	
879	Flacourtiaceae	Oncoba welwitschii Oliv.	sb	gn	Tr	Gc	Hl	
880	Flacourtiaceae	Ophiobotrys zenkeri Gilg	np	gn	Tr	Gc	Hl	
881	Flacourtiaceae	Phyllobotryon spathulatum Müll.Arg.	sb	bu	Sh	Lg	Co	
882	Flacourtiaceae	Poggea alata Gürke	sb	gn	Sh	Gc	Co	
883	Flacourtiaceae	Scottellia coriacea A.Chev. ex Hutch. & Dalziel	sb	gn	Tr	Gc	Co	
884	Flacourtiaceae	Scottellia klaineana Pierre	sb	gn	Tr	Gc	Co	
885	Flacourtiaceae	Trichostephanus acuminatus Gilg	sb	bu	Sh	Lg	Hl	

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886	Flagellariaceae	Flagellaria guineensis Schumach.	pi	gn	Hb	Gc	Co	
887	Gesneriaceae	Acanthonema diandrum (Engl.) B.L. Burtt	ep	bu	Hb	Lg	Co	
888	Gesneriaceae	Acanthonema strigosum Hook.f.	ep	bu	Hb	Lg	Co	
889	Gesneriaceae	Epithema tenue C.B.Clarke	ep	gn	Hb	Gc	Co	
890	Gleicheniaceae	Dicranopteris linearis (Burm.f.) Underw. var. linearis	pi	gn	Hb	Pa	Co	
891	Gnetaceae	Gnetum africanum Welw.	np	bu	Hcl	Lg	Co	
892	Gnetaceae	Gnetum buchholzianum Engl.	np	GD	Hcl	Cam	Co	
893	Gramineae	Acroceras zizanioides (Kunth) Dandy	pi	gn	Hb	Pa	Hl	
894	Gramineae	Andropogon auriculatus Stapf	pi	gn	Hb	Pa	Hl	
895	Gramineae	Andropogon gayanus Kunth var. polycladus (Hack.) W.D.Clayton	pi	gn	Hb	Pa	Hl	
896	Gramineae	Antephora cristata (Doell) Hack.	pi	gn	Hb	Tra	Hl	
897	Gramineae	Axonopus compressus (Sw.) P.Beauv.	pi	gn	Hb	In	Hl	
898	Gramineae	Bambusa vulgaris H.Wendl.	pi	gn	Hb	In	Re	
899	Gramineae	Centotheca lappacea (L.) Desv.	pi	gn	Hb	Pal	Co	
900	Gramineae	Chloris pilosa Schumach.	pi	gn	Hb	Tra	Hl	
901	Gramineae	Coix lacryma-jobi L.	pi	gn	Hb	Pa	Hl	
902	Gramineae	Cyrtococcum chaetophoron (Roem. & Schult.) Dandy	pi	gn	Hb	Gc	Hl	
903	Gramineae	Digitaria fuscescens (Presl) Henr.	pi	gn	Hb	Pa	Hl	
904	Gramineae	Digitaria horizontalis Willd.	pi	gn	Hb	Tra	Hl	
905	Gramineae	Digitaria longiflora (Retzuis) Person	pi	gn	Hb	Tra	Hl	
906	Gramineae	Eleusine indica (L.) Gaertn.	pi	gn	Hb	Pa	Hl	
907	Gramineae	Eragrostis atrovirens (Desf.) Trin. ex Steud.	pi	gn	Hb	Pa	Hl	
908	Gramineae	Eragrostis ciliaris (L.) R.Br.	pi	gn	Hb	Pa	Hl	
909	Gramineae	Guaduella densiflora Pilg.	sb	bu	Hb	Lg	Co	
910	Gramineae	Guaduella humilis W.D.Clayton	sb	bu	Hb	Lg	Co	
911	Gramineae	Guaduella macrostachys (K.Schum.) Pilger	sb	gn	Hb	Gc	Co	
912	Gramineae	Guaduella marantifolia Franch.	sb	GD	Hb	Lg	Co	
913	Gramineae	Guaduella mildbraedii Pilg.	sb	BK	Hb	Campo-Ma'an	Hl	
914	Gramineae	Guaduella oblonga Hutch. ex W.D.Clayton	sb	gn	Hb	Gc	Co	
915	Gramineae	Hyparrhenia wombaliensis (Vanderyst ex Robyns) Clayton	pi	bu	Hb	Lg	Hl	
916	Gramineae	Ichnanthus pallens (Swartz.) Benth.	pi	gn	Hb	Pa	Hl	
917	Gramineae	Ichnanthus vicinus (Baill.) Merr.	pi	gn	Hb	Pa	Hl	
918	Gramineae	Imperata cylindrica (L.) Raeuschel	pi	gn	Hb	Tra	Hl	
919	Gramineae	Isachne buettneri Hack.	pi	gn	Hb	Gc	Hl	
920	Gramineae	Leptaspis zeylanica Nees	sb	gn	Hb	Tra	Co	
921	Gramineae	Megastachya mucronata (Poir.) P.Beauv.	pi	gn	Hb	Tra	Hl	
922	Gramineae	Microcalamus barbinodis Franch.	pi	gn	Hb	Gc	Co	
923	Gramineae	Olyra latifolia L.	pi	gn	Hb	Tra	Co	
924	Gramineae	Oplismenus hirtellus (L.) P.Beauv.	pi	gn	Hb	Pa	Co	
925	Gramineae	Oryza sativa L.	pi	gn	Hb	Pa	Hl	
926	Gramineae	Panicum brevifolium L.	pi	gn	Hb	Pal	Hl	
927	Gramineae	Panicum maximum Jacq.	pi	gn	Hb	Pal	Hl	
928	Gramineae	Panicum mueense Vanderyst	pi	gn	Hb	Pal	Hl	
929	Gramineae	Panicum repens L.	pi	gn	Hb	Pa	Hl	
930	Gramineae	Paspalum auriculatum sensu Clayton	pi	gn	Hb	Tra	Hl	
931	Gramineae	Paspalum conjugatum Berg	pi	gn	Hb	Pa	Hl	
932	Gramineae	Paspalum lamprocaryon K.Schum.	pi	gn	Hb	Tra	Hl	
933	Gramineae	Paspalum orbiculare G.Forst.	pi	gn	Hb	Pa	Hl	
934	Gramineae	Paspalum paniculatum L.	pi	gn	Hb	Pa	Hl	
935	Gramineae	Paspalum scrobiculatum L. ssp. bispicatum Hack.	pi	gn	Hb	Pal	Hl	
936	Gramineae	Paspalum vaginatum Sw.	pi	gn	Hb	Pa	Hl	
937	Gramineae	Pennisetum polystachion (L.) Schult. subsp. polystachion	pi	gn	Hb	Pa	Hl	
938	Gramineae	Pennisetum purpureum Schumach.	pi	gn	Hb	Tra	Hl	
939	Gramineae	Perotis indica (L.) Kuntze	pi	gn	Hb	In	Hl	
940	Gramineae	Puelia ciliata Franch.	sb	gn	Hb	Gc	Co	
941	Gramineae	Puelia schumanniana Pilg.	sb	GD	Hb	Lg	Co	
942	Gramineae	Setaria barbata (Lam.) Kunth	pi	gn	Hb	In	Co	
943	Gramineae	Setaria megaphylla (Steud.) T.Durand & Schinz	pi	gn	Hb	Tra	Co	
944	Gramineae	Sorghum arundinaceum (Desv.) Stapf	pi	gn	Hb	Tra	Co	
945	Gramineae	Sporobolus pyramidalis P.Beauv. var. pyramidalis	pi	GD	Hb	Tra	Co	
946	Gramineae	Stenotaphrum secundatum (Walt.) Kuntze	pi	gn	Hb	Pa	Hl	
947	Guttiferae	Allanblackia floribunda Oliv.	sb	gn	Tr	Gc	Co	
948	Guttiferae	Calophyllum inophyllum L.	pi	gn	Tr	Pa	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
949	Guttiferae	Endodesmia calophylloides Benth.	sb	gn	Tr	Gc	Co	
950	Guttiferae	Garcinia afzelii Engl.	sb	rd	Tr	Lg	Hl	
951	Guttiferae	Garcinia brevipedicellata (Baker f.) Hutch. & Dalziel	sb	GD	Tr	Lg	Co	VU A1c, B1+2c
952	Guttiferae	Garcinia chromocarpa Engl.	sb	gn	Tr	Gc	Co	
953	Guttiferae	Garcinia conrauana Engl.	sb	GD	Tr	Cam	Co	
954	Guttiferae	Garcinia densivenia Engl.	ri	GD	Tr	Cam	Co	
955	Guttiferae	Garcinia epunctata Stapf	sb	gn	Tr	Gc	Co	
956	Guttiferae	Garcinia gnetoides Hutch. & Dalziel	sb	gn	Tr	Gu	Co	
957	Guttiferae	Garcinia kola Heckel	sb	sc	Tr	Gc	Co	VU A1cd
958	Guttiferae	Garcinia lucida Vesque	sb	bu	Tr	Lg	Co	
959	Guttiferae	Garcinia mannii Oliv.	sb	sc	Tr	Lg	Co	
960	Guttiferae	Garcinia ovalifolia Oliv.	sb	gn	Tr	Gc	Co	
961	Guttiferae	Garcinia preussii Engl.	sb	bu	Sh	Lg	Co	
962	Guttiferae	Garcinia punctata Oliv.	sb	gn	Tr	Gc	Co	
963	Guttiferae	Garcinia smeathmannii (Planch. & Triana) Oliv.	sb	gn	Tr	Tra	Co	
964	Guttiferae	Garcinia staudtii Engl.	sb	bu	Tr	Lg	Co	VU A1c, B1+2c
965	Guttiferae	Garcinia zenkeri Engl.	sb	bu	Tr	Lg	Co	
966	Guttiferae	Harungana madagascariensis Lam. ex Poir.	pi	gn	Sh	Tra	Co	
967	Guttiferae	Mammea africana Sabine	sb	pk	Tr	Gc	Re	
968	Guttiferae	Pentadesma butyracea Sabine	sb	gn	Tr	Gu	Co	
969	Guttiferae	Psorospermum membranaceum C. H. Wright	sb	bu	Sh	Lg	Hl	
970	Guttiferae	Psorospermum staudtii Engl.	sb	gn	Sh	Gc	Co	
971	Guttiferae	Psorospermum tenuifolium Hook.f.	sb	gn	Sh	Tra	Co	
972	Guttiferae	Symphonia globulifera L.f.	sw	pk	Tr	Pa	Co	
973	Guttiferae	Vismia guineensis (L.) Choisy	pi	gn	Sh	Gc	Co	
974	Guttiferae	Vismia rubescens Oliv.	pi	gn	Sh	Gc	Co	
975	Hernandiaceae	Illigera pentaphylla Welw.	np	gn	Swcl	Gc	Co	
976	Hernandiaceae	Illigera vespertilo (Benth.) Baker f.	np	bu	Swcl	Lg	Co	
977	Hoplestigmataceae	Hoplestigma pierreanum Gilg	np	bu	Tr	Lg	Co	CR A1c+2c
978	Huaceae	Afrostyrax kamerunensis Perkins & Gilg	sb	bu	Tr	Lg	Co	VU A1c, B1+2c
979	Huaceae	Afrostyrax lepidophyllus Mildbr.	sb	bu	Tr	Lg	Co	VU A1c, B1+2c
980	Huaceae	Afrostyrax macranthus Mildbr.	sb	bu	Tr	Lg	Hl	
981	Humiriaceae	Sacoglottis gabonensis (Baill.) Urr.	np	gn	Tr	Gc	Re	
982	Hymenophyllaceae	Hymenophyllum triangulare Baker	ep	gn	He	Gc	Co	
983	Hymenophyllaceae	Trichomanes africanum Christ	ep	gn	He	Gc	Co	
984	Hymenophyllaceae	Trichomanes crispiforme Alston	ep	gn	He	Gc	Co	
985	Hymenophyllaceae	Trichomanes cupressoides Desv.	ep	bu	He	Lg	Co	
986	Hymenophyllaceae	Trichomanes erosum Willd. var. erosum	ep	gn	He	Tra	Co	
987	Hypoxidaceae	Hypoxis angustifolia Lam.	rh	gn	Hb	Gc	Co	
988	Icacinaceae	Alsodeiopsis mannii Oliv.	sb	bu	Sh	Lg	Co	
989	Icacinaceae	Alsodeiopsis rubra Engl.	sb	bu	Sh	Lg	Co	
990	Icacinaceae	Alsodeiopsis staudtii Engl.	sb	gn	Sh	Gu	Co	
991	Icacinaceae	Alsodeiopsis weissenborniana J.Braun & K.Schum.	sb	bu	Sh	Lg	Co	
992	Icacinaceae	Alsodeiopsis zenkeri Engl.	rh	GD	Sh	Cam	Co	
993	Icacinaceae	Chlamydocarya thomsoniana Baill.	sb	gn	Swcl	Gc	Hl	
994	Icacinaceae	Desmostachys brevipes (Engl.) Sleumer	sb	bu	Sh	Lg	Co	
995	Icacinaceae	Desmostachys tenuifolius Oliv. var. tenuifolius	sb	bu	Sh	Lg	Co	
996	Icacinaceae	Icacina mannii Oliv. var. mannii	ri	gn	Sh	Gc	Co	
997	Icacinaceae	Iodes africana Welw. ex Oliv.	np	gn	Swcl	Gc	Co	
998	Icacinaceae	Iodes kamerunensis Engl.	sb	GD	Swcl	Cam	Co	
999	Icacinaceae	Lasianthera africana P.Beauv.	sb	gn	Sh	Gc	Co	
1000	Icacinaceae	Lavigeria macrocarpa (Oliv.) Pierre	np	gn	Lwcl	Gc	Co	
1001	Icacinaceae	Leptaulus daphnoides Benth.	sb	gn	Tr	Gc	Re	
1002	Icacinaceae	Leptaulus grandifolius Engl.	sb	bu	Tr	Lg	Co	
1003	Icacinaceae	Leptaulus holstii (Engl.) Engl.	sb	gn	Sh	Gc	Co	
1004	Icacinaceae	Leptaulus zenkeri Engl.	sb	gn	Sh	Gc	Co	
1005	Icacinaceae	Pyrenacantha acuminata Engl.	sb	gn	Swcl	Gc	Co	
1006	Icacinaceae	Pyrenacantha glabrescens (Engl.) Engl.	sb	gn	Swcl	Gu	Hl	
1007	Icacinaceae	Pyrenacantha lebrunii Boutique	sb	gn	Swcl	Gc	Hl	
1008	Icacinaceae	Pyrenacantha staudtii (Engl.) Engl.	pi	gn	Swcl	Gc	Hl	
1009	Icacinaceae	Pyrenacantha sylvestris S. Moore	pi	gn	Swcl	Gc	Co	
1010	Icacinaceae	Pyrenacantha vogeliana Baill.	ri	gn	Swcl	Gc	Co	
1011	Icacinaceae	Rhaphiostylis beninensis (Hook.f. ex Planch.) Planch.	ri	gn	Swcl	Tra	Co	
1012	Icacinaceae	Rhaphiostylis ovalifolia Engl. ex Sleumer	sb	GD	Swcl	Cam	Hl	
1013	Icacinaceae	Rhaphiostylis preussii Engl.	sb	gn	Swcl	Gc	Co	

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1014	Icacinaceae	Rhaphiostylis subsessilifolia Engl.	sb	BK	Swcl	Campo-Ma'an	Co	
1015	Icacinaceae	Stachyanthus zenkeri Engl.	sb	gn	Swcl	Gc	Hl	
1016	Iridaceae	Gladiolus unguiculatus Baker	rh	gn	Hb	Gc	Co	
1017	Irvingiaceae	Desbordesia glaucescens (Engl.) Tiegh.	np	bu	Tr	Lg	Re	
1018	Irvingiaceae	Irvingia gabonensis (Aubry-Lecomte ex O'Rorke) Baill.	np	pk	Tr	Gc	Co	LR/nt
1019	Irvingiaceae	Irvingia grandifolia (Engl.) Engl.	np	pk	Tr	Gc	Co	
1020	Irvingiaceae	Klainedoxa gabonensis Pierre ex Engl.	np	gn	Tr	Gc	Re	
1021	Irvingiaceae	Klainedoxa trillessii Pierre ex Tiegh.	np	gn	Tr	Gc	Hl	
1022	Ixonanthaceae	Ochthocosmus africanus Hook.f.	np	gn	Tr	Gc	Hl	
1023	Ixonanthaceae	Ochthocosmus calothyrsus (Mildbr.) Hutch. & Dalziel	np	bu	Tr	Lg	Co	
1024	Ixonanthaceae	Ochthocosmus sessiliflorus (Oliv.) Baill.	ri	gn	Tr	Gu	Hl	
1025	Labiatae	Achyrospermum oblongifolium Baker	pi	gn	Hb	Gc	Co	
1026	Labiatae	Hoslundia opposita Vahl	pi	gn	Hb	Tra	Hl	
1027	Labiatae	Hyptis lanceolata Poir.	pi	gn	Hb	Pa	Hl	
1028	Labiatae	Platostoma africanum P.Beauv.	pi	gn	Hb	Pa	Hl	
1029	Labiatae	Plectranthus decurrens (Gürke) J.K.Morton	pi	bu	Hb	Lg	Co	
1030	Labiatae	Solenostemon mannii (Hook.f.) Baker	pi	gn	Hb	Gc	Hl	
1031	Labiatae	Solenostemon monostachyus (P.Beauv.) Briq. subsp. monostachyus	pi	gn	Hb	Tra	Co	
1032	Lauraceae	Beilschmiedia anacardioides (Engl. & K.Krause) Robyns & R.	sb	bu	Tr	Lg	Co	
1033	Lauraceae	Beilschmiedia cinnamomea (Stapf) Robyns & Wilczek	sb	GD	Tr	Lg	Co	
1034	Lauraceae	Beilschmiedia cuspida (Krause) Robyns & Wilczek	sb	BK	Tr	Campo-Ma'an	Hl	
1035	Lauraceae	Beilschmiedia dinklagei (Engl.) Robyns & Wilczek	sb	BK	Tr	Campo-Ma'an	Hl	
1036	Lauraceae	Beilschmiedia gaboonensis (Meisn.) Benth. & Hook.f.	sb	bu	Tr	Lg	Co	
1037	Lauraceae	Beilschmiedia klainei Robyns & Wilczek	sb	BK	Tr	Sw-Cam	Co	
1038	Lauraceae	Beilschmiedia myrciifolia (S.Moore) Robyns & R.Wilczek	sb	gn	Tr	Gc	Co	
1039	Lauraceae	Beilschmiedia obscura (Stapf) Engl. ex A.Chev.	sb	gn	Tr	Gc	Re	
1040	Lauraceae	Beilschmiedia papyracea (Stapf) Robyns & R.Wilczek	sb	BK	Tr	Sw-Cam	Hl	
1041	Lauraceae	Beilschmiedia staudtii Engl.	sb	bu	Tr	Lg	Hl	
1042	Lauraceae	Beilschmiedia wilczekii Fouilloy	sb	BK	Tr	Sw-Cam	Co	
1043	Lauraceae	Beilschmiedia zenkeri Engl.	sb	bu	Tr	Lg	Co	
1044	Lauraceae	Cassytha filiformis L.	ep	gn	Ep	Gc	Co	
1045	Lauraceae	Hypodaphnis zenkeri (Engl.) Stapf	sb	bu	Tr	Lg	Co	
1046	Lauraceae	Persea americana Miller	pi	gn	Tr	In	Re	
1047	Lecythidaceae	Napoleonaea imperialis P.Beauv.	sb	bu	Sh	Lg	Co	
1048	Lecythidaceae	Napoleonaea talbotii Baker f.	sb	bu	Sh	Lg	Co	
1049	Lecythidaceae	Napoleonaea vogelii Hook. & Planch.	sb	gn	Sh	Gc	Co	
1050	Lecythidaceae	Petersianthus macrocarpus (P.Beauv.) Liben	np	gn	Tr	Gc	Re	
1051	Leeaceae	Leea guineensis G.Don	pi	gn	Sh	Tra	Co	
1052	Leguminosae-Caes.*	Afzelia bella Harms var. bella	np	pk	Tr	Gc	Co	
1053	Leguminosae-Caes.*	Afzelia bipindensis Harms	np	sc	Tr	Gc	Re	VU A1cd
1054	Leguminosae-Caes.*	Afzelia pachyloba Harms	np	pk	Tr	Gc	Co	VU A1d
1055	Leguminosae-Caes.*	Anthonotha ferruginea (Harms) J.Léonard	np	bu	Tr	Lg	Co	
1056	Leguminosae-Caes.*	Anthonotha fragrans (Baker f.) Exell & Hillc.	np	gn	Tr	Gc	Co	
1057	Leguminosae-Caes. *	Anthonotha isopetala (Harms) J.Léonard	sb	bu	Tr	Lg	Co	
1058	Leguminosae-Caes. *	Anthonotha lamprophylla (Harms) J.Léonard	sb	gn	Tr	Gc	Co	
1059	Leguminosae-Caes. *	Anthonotha leptorrhachis (Harms) J.Léonard	sb	GD	Tr	Cam	Co	CR A1c+2c
1060	Leguminosae-Caes. *	Anthonotha macrophylla P.Beauv.	sb	gn	Tr	Gc	Co	
1061	Leguminosae-Caes. *	Aphanocalyx cynometroides Oliv.	np	gn	Tr	Gc	Co	
1062	Leguminosae-Caes. *	Aphanocalyx hedinii (A.Chev.) Wieringa	np	GD	Tr	Cam	Co	CR B1+2abcd, C1+2ab
1063	Leguminosae-Caes. *	Aphanocalyx ledermannii (Harms) Wieringa	sw	bu	Tr	Lg	Co	
1064	Leguminosae-Caes. *	Aphanocalyx margininervatus (J.Léonard) Wieringa	np	gn	Tr	Gu	Co	
1065	Leguminosae-Caes. *	Aphanocalyx microphyllus (Harms) Wieringa subsp. microphyllus	np	gn	Tr	Gc	Co	
1066	Leguminosae-Caes. *	Baikiaea insignis Benth.	sb	gn	Tr	Gc	Co	
1067	Leguminosae-Caes. *	Baikiaea robynsii Ghesq.	sb	gn	Tr	Gc	Co	
1068	Leguminosae-Caes. *	Berlinia auriculata Benth.	ri	bu	Tr	Lg	Co	
1069	Leguminosae-Caes. *	Berlinia bracteosa Benth.	ri	gn	Tr	Gc	Co	
1070	Leguminosae-Caes. *	Berlinia confusa Hoyle	ri	gn	Tr	Gu	Co	
1071	Leguminosae-Caes. *	Berlinia congolensis (Baker f.) Keay	ri	gn	Tr	Gc	Co	
1072	Leguminosae-Caes. *	Berlinia craibiana Baker f.	ri	bu	Tr	Lg	Hl	
1073	Leguminosae-Caes. *	Bikinia le-testui (Pellegr.) Wieringa ssp. le-testui	np	bu	Tr	Lg	Co	

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1074	Leguminosae-Caes. *	Brachystegia cynometroides Harms	np	bu	Tr	Lg	Re	
1075	Leguminosae-Caes. *	Brachystegia laurentii (De Wild.) Louis ex Hoyle	np	gn	Tr	Gc	Re	
1076	Leguminosae-Caes. *	Brachystegia mildbraedii Harms	np	bu	Tr	Lg	Re	
1077	Leguminosae-Caes. *	Chamaecrista kirkii (Oliv.) Standley	pi	gn	Sh	Tra	Co	
1078	Leguminosae-Caes. *	Copaifera mildbraedii Harms	np	gn	Tr	Gc	Re	
1079	Leguminosae-Caes. *	Copaifera religiosa J.Léonard	np	bu	Tr	Lg	Re	
1080	Leguminosae-Caes. *	Crudia gabonensis Pierre ex Harms	ri	gn	Tr	Gc	Re	
1081	Leguminosae-Caes. *	Crudia klainei Pierre ex De Wild.	sw	gn	Tr	Gc	Co	
1082	Leguminosae-Caes. *	Cynometra hankei Harms	sw	gn	Tr	Gc	Re	
1083	Leguminosae-Caes. *	Cynometra mannii Oliv.	sw	gn	Tr	Gc	Co	
1084	Leguminosae-Caes. *	Daniellia klainei A.Chev.	ri	bu	Tr	Lg	Re	LR/nt
1085	Leguminosae-Caes. *	Daniellia oblonga Oliv.	np	GD	Tr	Lg	Re	VU A1c
1086	Leguminosae-Caes. *	Daniellia ogea (Harms) Rolfe ex Holl.	pi	pk	Tr	Gu	Re	
1087	Leguminosae-Caes. *	Delonix regia (Boj. ex Hook.) Raf.	pi	gn	Tr	In	Re	
1088	Leguminosae-Caes. *	Detarium macrocarpum Harms	sb	bu	Tr	Lg	Re	
1089	Leguminosae-Caes. *	Dialium bipindense Harms	np	bu	Tr	Lg	Re	LR/nt
1090	Leguminosae-Caes. *	Dialium dinklagei Harms	ri	gn	Tr	Gc	Re	
1091	Leguminosae-Caes. *	Dialium guineense Willd.	np	BK	Tr	Sw-Cam	Re	
1092	Leguminosae-Caes. *	Dialium pachyphyllum Harms	sb	pk	Tr	Gc	Co	
1093	Leguminosae-Caes. *	Dialium tessmannii Harms	sb	bu	Tr	Lg	Hl	LR/nt
1094	Leguminosae-Caes. *	Dialium zenkeri Harms	sb	BK	Tr	Sw-Cam	Co	
1095	Leguminosae-Caes. *	Didelotia africana Baill.	sb	bu	Tr	Lg	Co	
1096	Leguminosae-Caes. *	Didelotia brevipaniculata J.Léonard	sb	bu	Tr	Lg	Hl	
1097	Leguminosae-Caes. *	Didelotia letouzeyi Pellegr.	sb	gn	Tr	Gc	Co	
1098	Leguminosae-Caes. *	Didelotia unifoliolata J.Léonard	sb	bu	Tr	Lg	Co	LR/nt
1099	Leguminosae-Caes. *	Distemonanthus benthamianus Baill.	pi	pk	Tr	Gu	Re	
1100	Leguminosae-Caes. *	Duparquetia orchidacea Baill.	pi	gn	Swcl	Gc	Co	
1101	Leguminosae-Caes. *	Erythrophleum ivorense A.Chev.	np	rd	Tr	Gu	Co	
1102	Leguminosae-Caes. *	Erythrophleum suaveolens (Guill. & Perr.) Brenan	np	gn	Tr	Tra	Re	
1103	Leguminosae-Caes. *	Gilbertiodendron brachystegioides (Harms) J.Léonard	np	bu	Tr	Lg	Hl	
1104	Leguminosae-Caes. *	Gilbertiodendron demonstrans (Baill.) J.Léonard	np	bu	Tr	Lg	Co	
1105	Leguminosae-Caes. *	Gilbertiodendron dewevrei (De Wild.) J.Léonard	sw	pk	Tr	Gc	Co	
1106	Leguminosae-Caes. *	Gilbertiodendron grandiflorum (De Wild.) J.Léonard	np	gn	Tr	Gc	Hl	
1107	Leguminosae-Caes. *	Gilbertiodendron klainei (Pierre ex Pelligr.) J.Léonard	np	bu	Tr	Lg	Hl	
1108	Leguminosae-Caes. *	Gilbertiodendron mayombense (Pellegr.) J.Léonard	sw	gn	Tr	Gc	Hl	
1109	Leguminosae-Caes. *	Gilbertiodendron ogoouense (Pellegr.) J.Léonard	np	bu	Tr	Lg	Hl	
1110	Leguminosae-Caes. *	Gilbertiodendron pachyanthum (Harms) J.Léonard	np	BK	Tr	Sw-Cam	Hl	VU D2
1111	Leguminosae-Caes. *	Gilletiodendron pierreanum (Harms) J.Léonard	np	gn	Tr	Lg	Co	
1112	Leguminosae-Caes. *	Griffonia physocarpa Baill.	sw	gn	Lwcl	Gc	Co	
1113	Leguminosae-Caes. *	Griffonia simplicifolia (Vahl ex DC.) Baill.	np	gn	Lwcl	Gu	Hl	
1114	Leguminosae-Caes. *	Griffonia tessmannii (De Wild.) Campère	np	bu	Lwcl	Lg	Hl	
1115	Leguminosae-Caes. *	Guibourtia demeusei (Harms) J.Léonard	sw	gn	Tr	Gc	Co	
1116	Leguminosae-Caes. *	Guibourtia ehie (A. Chev.) J. Léonard	np	pk	Tr	Gc	Co	VU A1c
1117	Leguminosae-Caes. *	Guibourtia pellegriniana J.Léonard	np	gn	Tr	Gc	Hl	
1118	Leguminosae-Caes. *	Guibourtia tessmannii (Harms) J.Léonard	np	pk	Tr	Lg	Co	
1119	Leguminosae-Caes. *	Hylodendron gabunense Taub.	pi	pk	Tr	Gc	Re	
1120	Leguminosae-Caes. *	Hymenostegia afzelii (Oliv.) Harms	sb	gn	Tr	Gu	Re	
1121	Leguminosae-Caes. *	Julbernardia letouzeyi Villiers	sb	gn	Tr	Gc	Hl	
1122	Leguminosae-Caes. *	Julbernardia pellegriniana Troupin	sb	gn	Tr	Gc	Hl	
1123	Leguminosae-Caes. *	Julbernardia seretii (De Wild.) Troupin	np	gn	Tr	Gc	Co	
1124	Leguminosae-Caes. *	Leonardendron gabunense (J.Léonard) Aubrév.	np	gn	Tr	Gc	Co	
1125	Leguminosae-Caes. *	Leonardoxa africana (Baill.) Aubrév.	sb	bu	Tr	Lg	Co	
1126	Leguminosae-Caes. *	Loesenera talbotii Baker f.	sb	bu	Tr	Lg	Co	VU A1c, B1+2c
1127	Leguminosae-Caes. *	Oddoniodendron micranthum (Harms) Baker f.	np	bu	Tr	Lg	Co	
1128	Leguminosae-Caes. *	Pachyelasma tessmannii (Harms) Harms	np	pk	Tr	Gc	Re	
1129	Leguminosae-Caes. *	Paraberlinia bifoliolata Pellegr.	np	bu	Tr	Lg	Co	
1130	Leguminosae-Caes. *	Pellegriniodendron diphyllum (Harms) J.Léonard	sb	bu	Tr	Gu	Re	LR/nt
1131	Leguminosae-Caes. *	Plagiosiphon emarginatus (Hutch. & Dalziel) J.Léonard	ri	gn	Tr	Gu	Co	
1132	Leguminosae-Caes. *	Plagiosiphon longitubus (Harms) J.Léonard	sb	BK	Tr	Sw-Cam	Co	CR A1+2c
1133	Leguminosae-Caes. *	Plagiosiphon multijugus (Harms) J.Léonard	sb	GD	Tr	Cam	Co	
1134	Leguminosae-Caes. *	Prioria balsamifera (Vermoesen) Breteler	np	rd	Tr	Gc	Hl	
1135	Leguminosae-Caes. *	Prioria joveri (Normand ex Aubrev.) Breteler	np	bu	Tr	Lg	Co	
1136	Leguminosae-Caes. *	Scorodophloeus zenkeri Harms	sb	pk	Tr	Gc	Co	
1137	Leguminosae-Caes. *	Senna alata (L.) Roxb.	pi	gn	Sh	Tra	Co	
1138	Leguminosae-Caes. *	Senna occidentalis (L.) Link	pi	gn	Sh	Tra	Co	

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1139	Leguminosae-Caes. *	Stachyothyrsus staudtii Harms	np	gn	Tr	Gc	Co	
1140	Leguminosae-Caes. *	Swartzia fistuloides Harms	sb	bu	Tr	Gc	Re	EN A1cd
1141	Leguminosae-Caes. *	Tessmannia africana Harms	sb	gn	Tr	Gc	Re	
1142	Leguminosae-Caes. *	Tetraberlinia bifoliolata (Harms) Hauman	np	gn	Tr	Gc	Co	
1143	Leguminosae-Caes. *	Tetraberlinia moreliana Aubrév.	sb	bu	Tr	Lg	Hl	
1144	Leguminosae-Caes. *	Toubaouate brevipaniculata (Léonard) Aubreville & Pellegr.	sb	gn	Tr	Gu	Co	
1145	Leguminosae-Caes. *	Zenkerella capparidacea (Taub.) J.Léonard	sb	gn	Tr	Gc	Hl	
1146	Leguminosae-Caes. *	Zenkerella citrina Taub.	sb	bu	Tr	Lg	Co	
1147	Leguminosae-Mim. **	Acacia pennata sensu Keay	pi	gn	Lwcl	Tra	Re	
1148	Leguminosae-Mim. **	Acacia pentagona (Schum.) Hook.f.	pi	gn	Lwcl	Tra	Co	
1149	Leguminosae-Mim. **	Albizia adianthifolia (Schum.) W.F.Wight	pi	gn	Tr	Gc	Co	
1150	Leguminosae-Mim. **	Albizia glaberrima (Schum. & Thonn.) Benth.	pi	gn	Tr	Gc	Co	
1151	Leguminosae-Mim. **	Albizia zygia (DC.) J.F.Macbr.	pi	pk	Tr	Tra	Re	
1152	Leguminosae-Mim. **	Aubrevillea kerstingii (Harms) Pellegr.	np	gn	Tr	Gc	Co	
1153	Leguminosae-Mim. **	Calliandra portoricensis (Jacq.) Benth.	pi	gn	Tr	In	Hl	
1154	Leguminosae-Mim. **	Calpocalyx dinklagei Harms	sb	bu	Tr	Lg	Co	
1155	Leguminosae-Mim. **	Calpocalyx heitzii Pellegr.	np	bu	Tr	Lg	Co	VU A1c, B1+2c
1156	Leguminosae-Mim. **	Calpocalyx le-testui Pellegr.	sb	bu	Tr	Gc	Co	VU D2
1157	Leguminosae-Mim. **	Calpocalyx ngouniensis Pellegr.	sb	bu	Tr	Gc	Hl	VU A1c
1158	Leguminosae-Mim. **	Cylicodiscus gabunensis Harms	np	gn	Tr	Gc	Re	
1159	Leguminosae-Mim. **	Entada gigas (L.) Fawcett & Rendle	sb	gn	Lwcl	Gc	Co	
1160	Leguminosae-Mim. **	Entada scelerata A.Chev.	sb	gn	Lwcl	Gc	Hl	
1161	Leguminosae-Mim. **	Fillaeopsis discophora Harms	sb	gn	Tr	Gc	Co	
1162	Leguminosae-Mim. **	Inga edulis Martius	pi	gn	Tr	Gc	Re	
1163	Leguminosae-Mim. **	Mimosa pudica L.	pi	gn	Swcl	Tra	Co	
1164	Leguminosae-Mim. **	Newtonia duparquetiana (Baill.) Keay	sb	gn	Tr	Gc	Co	
1165	Leguminosae-Mim. **	Newtonia grandifolia (Baill.) Villiers	np	bu	Tr	Lg	Co	
1166	Leguminosae-Mim. **	Newtonia griffoniana (Baill.) Baker f.	np	gn	Tr	Gc	Co	
1167	Leguminosae-Mim. **	Parkia bicolor A.Chev.	np	gn	Tr	Gc	Co	
1168	Leguminosae-Mim. **	Parkia filicoidea Oliv.	np	gn	Tr	Gc	Co	
1169	Leguminosae-Mim. **	Pentaclethra macrophylla Benth.	np	pk	Tr	Gc	Re	
1170	Leguminosae-Mim. **	Piptadeniastrum africanum (Hook.f.) Brenan	np	rd	Tr	Gc	Re	
1171	Leguminosae-Mim. **	Tetrapleura tetraptera (Schum. & Thonn.) Taub.	pi	pk	Tr	Tra	Re	
1172	Leguminosae-Pap. ***	Abrus precatorius L.	pi	gn	Hcl	Pa	Re	
1173	Leguminosae-Pap. ***	Amphimas ferrugineus Pierre ex Pellegr.	np	bu	Tr	Lg	Re	
1174	Leguminosae-Pap. ***	Amphimas pterocarpoides Harms	np	gn	Tr	Gc	Co	
1175	Leguminosae-Pap. ***	Andira inermis subsp. inermis (Wright) Dc	pi	gn	Hb	Tra	Re	
1176	Leguminosae-Pap. ***	Angylocalyx oligophyllus (Baker) Baker f.	sb	gn	Sh	Gc	Co	
1177	Leguminosae-Pap. ***	Angylocalyx talbotii Baker f.	sb	GD	Sh	Lg	Co	
1178	Leguminosae-Pap. ***	Angylocalyx zenkeri Harms	sb	gn	Sh	Gc	Co	
1179	Leguminosae-Pap. ***	Baphia capparidifolia Baker subsp. capparidifolia	sb	gn	Tr	Gc	Hl	
1180	Leguminosae-Pap. ***	Baphia capparidifolia Baker subsp. polygalacea Brummitt	sb	gn	Tr	Gc	Hl	
1181	Leguminosae-Pap. ***	Baphia laurifolia Baill.	sb	gn	Tr	Gc	Co	
1182	Leguminosae-Pap. ***	Baphia leptobotrys Harms	sb	bu	Tr	Lg	Co	
1183	Leguminosae-Pap. ***	Baphia leptostemma Baill. var. gracilipes (Harms) Soladoye	sb	bu	Tr	Lg	Hl	
1184	Leguminosae-Pap. ***	Baphia nitida Lodd.	sb	gn	Tr	Gu	Re	
1185	Leguminosae-Pap. ***	Baphiopsis parviflora Benth. ex Baker	sb	gn	Tr	Tra	Hl	
1186	Leguminosae-Pap. ***	Calopogonium muconoides Desv.	pi	gn	Hb	In	Co	
1187	Leguminosae-Pap. ***	Camoensia brevicalyx Benth.	pi	gn	Hb	Pa	Hl	
1188	Leguminosae-Pap. ***	Canavalia ensiformis (L.) DC.	pi	gn	Hb	Pa	Hl	
1189	Leguminosae-Pap. ***	Canavalia rosea (Sw.) DC.	pi	gn	Hb	Pa	Hl	
1190	Leguminosae-Pap. ***	Clitoria rubiginosa Juss. ex Pers.	pi	gn	Hb	In	Hl	
1191	Leguminosae-Pap. ***	Craibia atlantica Dunn	sb	bu	Tr	Gc	Re	VU A1c
1192	Leguminosae-Pap. ***	Crotalaria pallida Aiton	pi	gn	Hb	Pa	Co	
1193	Leguminosae-Pap. ***	Crotalaria retusa L.	pi	gn	Hb	Pa	Hl	
1194	Leguminosae-Pap. ***	Dalbergia afzeliana G.Don	np	gn	Swcl	Gc	Co	
1195	Leguminosae-Pap. ***	Dalbergia ecastaphyllum (L.) Taub.	pi	gn	Swcl	Gu	Co	
1196	Leguminosae-Pap. ***	Dalbergia hostilis Benth.	pi	gn	Swcl	Gc	Hl	
1197	Leguminosae-Pap. ***	Dalbergia pachycarpa (De Wild. & T.Durand) De Wild.	pi	gn	Swcl	Gc	Co	
1198	Leguminosae-Pap. ***	Dalbergia saxatilis Hook.f.	pi	gn	Swcl	Gc	Co	
1199	Leguminosae-Pap. ***	Dalhousiea africana M. Moore	pi	gn	Swcl	Gc	Co	
1200	Leguminosae-Pap. ***	Desmodium adscendens (Sw.) DC. var. adscendens	pi	gn	Hb	Tra	Re	
1201	Leguminosae-Pap. ***	Desmodium ramosissimum G.Don	pi	gn	Hb	Tra	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1202	Leguminosae-Pap. ***	Eriosema laurentii De Wild.	pi	gn	Hb	Tra	Co	
1203	Leguminosae-Pap. ***	Eriosema parviflorum E.Mey. subsp. parviflorum	pi	gn	Hb	Tra	Hl	
1204	Leguminosae-Pap. ***	Erythrina excelsa Baker	pi	gn	Tr	Gc	Re	
1205	Leguminosae-Pap. ***	Erythrina mildbraedii Harms	np	gn	Tr	Gc	Re	
1206	Leguminosae-Pap. ***	Indigofera hirsuta L.	pi	gn	Tr	In	Hl	
1207	Leguminosae-Pap. ***	Leptoderris aurantiaca Dunn	np	bu	Swcl	Lg	Hl	
1208	Leguminosae-Pap. ***	Leptoderris congolensis (De Wild.) Dunn	np	gn	Swcl	Gc	Hl	
1209	Leguminosae-Pap. ***	Leptoderris fasciculata (Benth.) Dunn	np	gn	Swcl	Gc	Hl	
1210	Leguminosae-Pap. ***	Leucomphalos capparideus Benth. ex Planch.	np	bu	Swcl	Lg	Co	
1211	Leguminosae-Pap. ***	Lonchocarpus griffonianus (Baill.) Dunn	ri	gn	Tr	Gc	Hl	
1212	Leguminosae-Pap. ***	Lonchocarpus sericeus (Poir.) Kunth	ri	gn	Tr	Pa	Hl	
1213	Leguminosae-Pap. ***	Machaerium lunatum (L.f.) Ducke	sb	gn	Sh	Pa	Hl	
1214	Leguminosae-Pap. ***	Millettia barteri (Benth.) Dunn	sw	gn	Lwcl	Gc	Co	
1215	Leguminosae-Pap. ***	Millettia bipindensis Harms	np	gn	Lwcl	Gc	Hl	
1216	Leguminosae-Pap. ***	Millettia dinklagei Harms	np	gn	Tr	Gu	Hl	
1217	Leguminosae-Pap. ***	Millettia griffoniana Baill.	sb	gn	Tr	Gc	Co	
1218	Leguminosae-Pap. ***	Millettia laurentii De Wild.	np	pk	Tr	Gc	Co	EN A1cd
1219	Leguminosae-Pap. ***	Millettia macrophylla Benth.	pi	bu	Tr	Lg	Co	VU A1c, B1+2c
1220	Leguminosae-Pap. ***	Millettia mannii Baker	sb	bu	Tr	Lg	Co	
1221	Leguminosae-Pap. ***	Millettia sanagana Harms	sb	gn	Tr	Gu	Hl	
1222	Leguminosae-Pap. ***	Mucuna flagellipes Hook.f.	ri	gn	Swcl	Gc	Co	
1223	Leguminosae-Pap. ***	Ormocarpum klainei Tisser.	sb	GD	Sh	Lg	Hl	CR A1c
1224	Leguminosae-Pap. ***	Ormocarpum megalophyllum Harms	pi	gn	Sh	Gu	Co	
1225	Leguminosae-Pap. ***	Ormocarpum sennoides (Willd.) DC. subsp. hispidum (Willd.) Brenan & J.Léonard	pi	gn	Sh	Tra	Co	
1226	Leguminosae-Pap. ***	Ormocarpum verrucosum P.Beauv.	sb	gn	Sh	Gc	Co	
1227	Leguminosae-Pap. ***	Ostryocarpus riparius Hook.f.	sw	gn	Swcl	Gu	Co	
1228	Leguminosae-Pap. ***	Pterocarpus mildbraedii Harms	np	pk	Tr	Gu	Co	
1229	Leguminosae-Pap. ***	Pterocarpus soyauxii Taub.	np	rd	Tr	Gc	Re	
1230	Leguminosae-Pap. ***	Rhynchosia mannii Baker	pi	gn	Hb	Gc	Co	
1231	Leguminosae-Pap. ***	Rhynchosia preussii (Harms) Taub. ex Harms	pi	gn	Hb	Gc	Hl	
1232	Leguminosae-Pap. ***	Stylosanthes erecta P. Beauv.	pi	gn	Hb	Tra	Re	
1233	Leguminosae-Pap. ***	Trifolium baccarinii Chiov.	pi	gn	Hb	Tra	Hl	
1234	Leguminosae-Pap. ***	Vigna gracilis (Guill. & Perr.) Hook.f.	pi	gn	Hcl	Gc	Hl	
1235	Leguminosae-Pap. ***	Vigna marina (Burm.) Merr.	pi	gn	Hcl	Pa	Hl	
1236	Lentibulariaceae	Utricularia andongensis Welw. ex Hiern	ep	gn	Hb	Gc	Hl	
1237	Lentibulariaceae	Utricularia mannii Oliv.	ep	bu	Ep	Lg	Hl	
1238	Lepidobotryaceae	Lepidobotrys staudtii Engl.	np	gn	Tr	Gc	Re	
1239	Liliaceae	Asparagus drepanophyllus Welw.	pi	gn	Swcl	Gc	Co	
1240	Liliaceae	Asparagus schweinfurthii Baker	pi	gn	Swcl	Gc	Co	
1241	Liliaceae	Chlorophytum alismifolium Baker	sb	bu	Hb	Lg	Co	
1242	Liliaceae	Chlorophytum macrophyllum (A.Rich.) Aschers.	sb	gn	Hb	Gc	Co	
1243	Liliaceae	Chlorophytum orchidastrum Lindl.	sb	gn	Hb	Gc	Co	
1244	Liliaceae	Chlorophytum petiolatum Baker	sb	gn	Hb	Gc	Co	
1245	Liliaceae	Chlorophytum petrophyllum K.Krause	sb	GD	Hb	Cam	Co	CR A1c+2c
1246	Liliaceae	Chlorophytum sparsiflorum Baker	sb	gn	Hb	Gc	Co	
1247	Linaceae	Hugonia macrophylla Oliv.	np	bu	Swcl	Lg	Co	
1248	Linaceae	Hugonia micans Engl.	np	bu	Swcl	Lg	Co	
1249	Linaceae	Hugonia obtusifolia C.H.Wright	np	gn	Swcl	Gc	Co	
1250	Linaceae	Hugonia planchonii Hook.f.	np	gn	Swcl	Gc	Co	
1251	Linaceae	Hugonia platysepala Welw. ex Oliv.	np	gn	Swcl	Gc	Co	
1252	Loganiaceae	Anthocleista liebrechtsiana De Wild.	sw	gn	Tr	Gc	Co	
1253	Loganiaceae	Anthocleista obanensis Wernham	pi	gn	Lwcl	Gc	Hl	
1254	Loganiaceae	Anthocleista schweinfurthii Gilg	pi	gn	Tr	Tra	Co	
1255	Loganiaceae	Anthocleista vogelii Planch.	sb	gn	Tr	Tra	Re	
1256	Loganiaceae	Mostuea batesii Baker	sb	gn	Sh	Gc	Co	
1257	Loganiaceae	Mostuea brunonis Didr. var. brunonis	sb	gn	Sh	Tra	Co	
1258	Loganiaceae	Mostuea hirsuta (T.Anderson ex Benth.) Baill.	pi	gn	Sh	Tra	Co	
1259	Loganiaceae	Mostuea neurocarpa Gilg	sb	bu	Sh	Lg	Co	
1260	Loganiaceae	Mostuea thomsonii (Oliv.) Benth.	sb	gn	Sh	Gc	Co	
1261	Loganiaceae	Strychnos aculeata Soler.	pi	gn	Lwcl	Tra	Co	
1262	Loganiaceae	Strychnos angolensis Gilg	ri	gn	Lwcl	Tra	Hl	
1263	Loganiaceae	Strychnos asterantha Leeuwenb.	pi	gn	Lwcl	Gu	Re	
1264	Loganiaceae	Strychnos boonei De Wild.	np	gn	Lwcl	Gc	Co	
1265	Loganiaceae	Strychnos camptoneura Gilg & Busse	np	gn	Lwcl	Gc	Hl	
1266	Loganiaceae	Strychnos canthioides Leeuwenb.	np	BK	Lwcl	Campo-	Hl	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
						Ma'an		
1267	Loganiaceae	Strychnos chrysophylla Gilg	ri	bu	Lwcl	Lg	Co	
1268	Loganiaceae	Strychnos dale De Wild.	np	gn	Lwcl	Gc	Co	
1269	Loganiaceae	Strychnos densiflora Baill.	ri	gn	Lwcl	Gc	Co	
1270	Loganiaceae	Strychnos dolichothyrsa Gilg ex Onochie & Hepper	np	gn	Lwcl	Gc	Co	
1271	Loganiaceae	Strychnos elaeocarpa Gilg ex Leeuwenb.	ri	GD	Tr	Cam	Co	
1272	Loganiaceae	Strychnos gnetifolia Gilg ex Onochie & Hepper	np	bu	Tr	Lg	Co	
1273	Loganiaceae	Strychnos icaja Baill.	np	gn	Lwcl	Gc	Co	
1274	Loganiaceae	Strychnos johnsonii Hutch. & M.B.Moss	np	gn	Lwcl	Gc	Hl	
1275	Loganiaceae	Strychnos longicaudata Gilg	np	gn	Lwcl	Gc	Co	
1276	Loganiaceae	Strychnos malacoclados C.H.Wright	np	gn	Lwcl	Gc	Co	
1277	Loganiaceae	Strychnos memecyloides S.Moore	np	gn	Lwcl	Gc	Co	
1278	Loganiaceae	Strychnos mimfiensis Gilg ex Leeuwenb.	np	GD	Lwcl	Cam	Co	
1279	Loganiaceae	Strychnos ngouniensis Pellegr.	ri	gn	Lwcl	Gc	Hl	
1280	Loganiaceae	Strychnos phaeotricha Gilg	np	gn	Lwcl	Gc	Co	
1281	Loganiaceae	Strychnos samba Duvign.	np	gn	Lwcl	Gc	Hl	
1282	Loganiaceae	Strychnos staudtii Gilg	sb	bu	Tr	Lg	Co	
1283	Loganiaceae	Strychnos tricalysioides Hutch. & M.B.Moss	np	gn	Lwcl	Gc	Co	
1284	Loganiaceae	Strychnos zenkeri Gilg ex Baker	np	bu	Tr	Lg	Hl	
1285	Lomariopsidaceae	Bolbitis acrostichoides (Afzel. ex Sw.) Ching	sb	gn	Hb	Tra	Co	
1286	Lomariopsidaceae	Bolbitis auriculata (Lam.) Alston	sb	gn	Hb	Tra	Co	
1287	Lomariopsidaceae	Bolbitis fluviatilis (Hook.) Ching	sw	gn	Hb	Gc	Co	
1288	Lomariopsidaceae	Bolbitis gaboonensis (Hook.) Alston	sb	gn	Hb	Gc	Co	
1289	Lomariopsidaceae	Bolbitis heudelotii (Bory ex Fée) Alston	sw	gn	Hb	Gc	Co	
1290	Lomariopsidaceae	Lomariopsis guineensis (underw.) Alston	sb	gn	He	Gc	Co	
1291	Lomariopsidaceae	Lomariopsis hederacea Alston	sb	gn	He	Gc	Co	
1292	Loranthaceae	Agelanthus brunneus (Engl.) Balle & N.Hallé	pa	gn	Pa	Gc	Co	
1293	Loranthaceae	Globimetula braunii (Engl.) Tiegh.	pa	gn	Pa	Gc	Co	
1294	Loranthaceae	Helixanthera mannii (Oliv.) Danser	pa	gn	Pa	Gc	Hl	
1295	Loranthaceae	Phragmanthera batangae (Engl.) Balle	pa	gn	Pa	Gc	Hl	
1296	Loranthaceae	Phragmanthera capitata (Spreng.) Balle	pa	gn	Pa	Gc	Hl	
1297	Loranthaceae	Phragmanthera longiflora (Balle) Polhill & Wiens	pa	bu	Pa	Lg	Hl	
1298	Loranthaceae	Phragmanthera polycrypta (F.Didr.) Balle	pa	gn	Pa	Gc	Hl	
1299	Loranthaceae	Phragmanthera talbotiora (Sprague) Balle	pa	bu	Pa	Lg	Hl	
1300	Loranthaceae	Tapinanthus preussii (Engl.) Tiegh.	pa	GD	Pa	Cam	Hl	
1301	Lycopodiaceae	Lycopodiella cernua (L.) Pic.Serm.	ep	gn	Hb	Pa	Co	
1302	Lycopodiaceae	Lycopodium warneckei (Herter) Alston	ep	gn	Hb	Pa	Hl	
1303	Malpighiaceae	Acridocarpus camerunensis Niedenzii	np	bu	Swcl	Lg	Co	
1304	Malpighiaceae	Acridocarpus longifolius (G.Don) Hook.f.	np	gn	Swcl	Gc	Co	
1305	Malpighiaceae	Acridocarpus macrocalyx Engl.	np	gn	Swcl	Gc	Co	
1306	Malpighiaceae	Acridocarpus smeathmannii (DC) Guil. & Perr.	ri	gn	Swcl	Gc	Hl	
1307	Malpighiaceae	Flabellaria paniculata Cav.	pi	gn	Lwcl	Tra	Co	
1308	Malpighiaceae	Heteropterys leona (Cav.) Exell	np	gn	Swcl	Gc	Co	
1309	Malvaceae	Hibiscus rostellatus Guill. & Perr.	pi	gn	Hb	Tra	Hl	
1310	Malvaceae	Hibiscus surattensis L.	pi	gn	Hb	Pal	Co	
1311	Malvaceae	Hibiscus tiliaceus L.	sw	gn	Hb	Pa	Co	
1312	Malvaceae	Sida acuta Burm.f.	pi	gn	Hb	Tra	Re	
1313	Malvaceae	Sida corymbosa R.E.Fr.	pi	gn	Hb	Tra	Re	
1314	Malvaceae	Sida rhombifolia L.	pi	gn	Hb	Pa	Re	
1315	Malvaceae	Urena lobata L.	pi	gn	Hb	Pa	Co	
1316	Marantaceae	Afrocalathea rhizantha (K.Schum.) K.Schum.	sb	bu	Hb	Lg	Co	
1317	Marantaceae	Ataenidia conferta (Benth.) Milne-Redh.	sb	gn	Hb	Gc	Co	
1318	Marantaceae	Halopegia azurea (K.Schum.) K.Schum.	sw	gn	Hb	Gc	Co	
1319	Marantaceae	Haumania danckelmaniana (J.Braun & K.Schum.) Milne-Redh.	np	gn	Hb	Gc	Co	
1320	Marantaceae	Hypselodelphys hirsuta (Loes.) J.Koech.	pi	bu	Hb	Lg	Hl	
1321	Marantaceae	Hypselodelphys poggeana (K.Schum.) Milne-Redh.	pi	gn	Hb	Gc	Co	
1322	Marantaceae	Hypselodelphys scandens Louis & Mullend.	pi	gn	Hb	Gc	Co	
1323	Marantaceae	Hypselodelphys violacea (Ridl.) Milne-Redh.	pi	gn	Hb	Gc	Co	
1324	Marantaceae	Hypselodelphys zenkeriana (K.Schum.) Milne-Redh.	pi	GD	Hb	Cam	Co	
1325	Marantaceae	Marantochloa congensis (K.Schum.) J.Léonard & Mullenders var. congensis	pi	gn	Hb	Gc	Co	
1326	Marantaceae	Marantochloa filipes (Benth.) Hutch.	pi	gn	Hb	Gc	Co	
1327	Marantaceae	Marantochloa leucantha (K.Schum.) Milne-Redh.	pi	gn	Hb	Tra	Co	
1328	Marantaceae	Marantochloa mannii (Benth.) Milne-Redh.	pi	gn	Hb	Tra	Co	
1329	Marantaceae	Marantochloa monophylla (K.Schum.) D'Orey	sb	gn	Hb	Gc	Co	

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1330	Marantaceae	Marantochloa purpurea (Ridl.) Milne-Redh.	sb	gn	Hb	Tra	Co	
1331	Marantaceae	Marantochloa ramosissima (Benth.) Hutch.	sb	bu	Hb	Lg	Co	
1332	Marantaceae	Megaphrynium macrostachyum (Benth.) Milne-Redh.	pi	gn	Hb	Gc	Co	
1333	Marantaceae	Megaphrynium tricogynum Koechlin	pi	bu	Hb	Lg	Hl	
1334	Marantaceae	Sarcophrynium brachystachys (Benth.) K.Schum.	sb	gn	Hb	Gc	Co	
1335	Marantaceae	Sarcophrynium prionogonium (K.Schum.) K.Schum. var. prionogonium	pi	gn	Hb	Gc	Co	
1336	Marantaceae	Sarcophrynium prionogonium (K.Schum.) K.Schum. var. puberulifolium Schnell	sb	gn	Hb	Gc	Co	
1337	Marantaceae	Sarcophrynium schweinfurthianum (Kuntze) Milne-Redh.	pi	gn	Hb	Gc	Co	
1338	Marantaceae	Sarcophrynium villosum (Benth.) K.Schum.	sb	gn	Hb	Gc	Co	
1339	Marantaceae	Thalia geniculata L.	pi	gn	Hb	Gc	Hl	
1340	Marantaceae	Thaumatococcus daniellii (Benn.) Benth.	pi	pk	Hb	Gc	Co	
1341	Marantaceae	Trachyphrynium braunianum (K.Schum.) Baker	pi	gn	Hb	Gc	Co	
1342	Marattiaceae	Marattia fraxinea J.Sm. var. fraxinea	ri	gn	Hb	Pal	Co	
1343	Medusandraceae	Soyauxia gabonensis Oliv.	sb	bu	Tr	Lg	Co	
1344	Medusandraceae	Soyauxia talbotii Baker f.	sb	gn	Tr	Gc	Co	
1345	Melastomataceae	Amphiblemma letouzeyi Jacq.-Fél.	sb	BK	Hb	Cam	Hl	
1346	Melastomataceae	Amphiblemma molle Hook.f.	sb	bu	Hb	Lg	Co	
1347	Melastomataceae	Calvoa calliantha Jacq.-Fél.	sb	BK	Hb	Cam	Co	
1348	Melastomataceae	Calvoa hirsuta Hook.f.	sb	gn	Hb	Gc	Hl	
1349	Melastomataceae	Calvoa monticola A.Chev. ex Hutch. & Dalziel	pi	gn	Hb	Gu	Co	
1350	Melastomataceae	Calvoa pulcherrima Gilg ex Engl.	pi	bu	Hb	Lg	Hl	
1351	Melastomataceae	Calvoa stenophylla Jacques-Félix	sb	BK	Hb	Campo-Ma'an	Hl	
1352	Melastomataceae	Dicellandra barteri Hook.f. var. erecta (Mildbr.) Jacq.-Fél.	sb	gn	Hb	Gc	Co	
1353	Melastomataceae	Dichaetanthera africana (Hook.f.) Jacq.-Fél.	pi	gn	Sh	Gu	Co	
1354	Melastomataceae	Dinophora spenneroides Benth.	pi	gn	Sh	Gc	Co	
1355	Melastomataceae	Dissotis decumbens (P.Beauv.) Triana	pi	gn	Hb	Tra	Hl	
1356	Melastomataceae	Dissotis multiflora (Sm.) Triana	pi	gn	Hb	Tra	Hl	
1357	Melastomataceae	Guyonia tenella Naud.	sb	bu	Hb	Lg	Co	
1358	Melastomataceae	Melastomastrum segregatum (Benth.) A. & R. Fern	ri	gn	Sh	Tra	Hl	
1359	Melastomataceae	Memecylon aequidianum Jacq.-Fél.	sb	bu	Sh	Lg	Hl	
1360	Melastomataceae	Memecylon afzelii G.Don	sb	gn	Tr	Gu	Co	
1361	Melastomataceae	Memecylon arcuato-marginatum Gilg ex Engl. var. arcuato-marginatum	sb	BK	Sh	Cam	Co	
1362	Melastomataceae	Memecylon calophyllum Gilg	sb	bu	Tr	Lg	Hl	
1363	Melastomataceae	Memecylon candidum Gilg	sb	bu	Sh	Lg	Co	VU B1+2c
1364	Melastomataceae	Memecylon dasyanthum Gilg ex Lederman & Engl.	sb	bu	Tr	Lg	Hl	VU B1+2c
1365	Melastomataceae	Memecylon englerianum Cogn.	sb	bu	Sh	Lg	Co	
1366	Melastomataceae	Memecylon macrodendron Gilg ex Engl.	sb	bu	Tr	Lg	Co	
1367	Melastomataceae	Memecylon nodosum (Engl.) Gilg ex Engl.	ri	bu	Sh	Lg	Co	
1368	Melastomataceae	Memecylon occultum Jacq.-Fél.	sb	bu	Tr	Gu	Hl	
1369	Melastomataceae	Memecylon virescens Hook.f.	sb	bu	Sh	Lg	Co	
1370	Melastomataceae	Memecylon viride Hook.f.	ri	gn	Sh	Gu	Co	
1371	Melastomataceae	Memecylon zenkeri Gilg	sb	bu	Sh	Lg	Co	
1372	Melastomataceae	Myrianthemum mirabile Gilg	pi	gn	Hcl	Gc	Hl	
1373	Melastomataceae	Ochthocharis dicellandroides (Gilg) C. Hansen & Wickens	ri	gn	Hb	Tra	Hl	
1374	Melastomataceae	Preussiella kamerunensis Gilg	ep	gn	Ep	Gu	Hl	
1375	Melastomataceae	Spathandra blakeiodes (G.Don) Jacq.-Fél.	pi	bu	Sh	Lg	Hl	
1376	Melastomataceae	Tristemma camerunense Jacq.-Fél.	pi	bu	Hb	Lg	Hl	
1377	Melastomataceae	Tristemma demeusei De Wild.	pi	gn	Hb	Gc	Hl	
1378	Melastomataceae	Tristemma hirtum P. Beauv.	pi	gn	Hb	Gu	Hl	
1379	Melastomataceae	Tristemma leiocalyx Cogn.	sw	gn	Hb	Gc	Hl	
1380	Melastomataceae	Tristemma littorale Benth. subsp. biafranum Jacq.-Fél.	pi	gn	Hb	Gu	Co	
1381	Melastomataceae	Tristemma littorale Benth. subsp. littorale Jacq.-Fél.	pi	gn	Hb	Gu	Co	
1382	Melastomataceae	Tristemma mauritianum J.F.Gmel.	pi	gn	Hb	Tra	Co	
1383	Melastomataceae	Tristemma oreophilum Gilg	pi	gn	Hb	Gc	Hl	
1384	Melastomataceae	Tristemma rosaceum (Gilg) Jacq.-Fél.	pi	gn	Hb	Gc	Hl	
1385	Melastomataceae	Warneckea bebaiensis (Gilg ex Engl.) Jacq.-Fél.	sb	bu	Sh	Lg	Co	
1386	Melastomataceae	Warneckea cinnamomoides (G.Don) Jacq.-Fél.	sb	gn	Sh	Gu	Co	
1387	Melastomataceae	Warneckea fascicularis (Planch. ex Benth.) Jacq.-Fél. var. mangrovensis Jacq.-Fél.	ri	gn	Sh	Gu	Hl	
1388	Melastomataceae	Warneckea membranifolia (Hook.f) Jacq.-Fél.	sb	gn	Sh	Gu	Co	
1389	Melastomataceae	Warneckea pulcherrima (Gilg) Jacq.-Fél.	sb	gn	Sh	Gc	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1390	Melastomataceae	Warneckea wildeana Jacq.-Fél.	sb	bu	Sh	Lg	Hl	VU D2
1391	Meliaceae	Carapa procera DC.	sb	gn	Tr	Gc	Co	
1392	Meliaceae	Entandrophragma angolense (Welw.) C.DC.	np	sc	Tr	Tra	Re	VU A1cd
1393	Meliaceae	Entandrophragma candollei Harms	np	sc	Tr	Gc	Co	VU A1cd
1394	Meliaceae	Entandrophragma cylindricum (Sprague) Sprague	np	sc	Tr	Gc	Re	VU A1cd
1395	Meliaceae	Entandrophragma utile (Dawe & Sprague) Sprague	np	sc	Tr	Gc	Re	VU A1cd
1396	Meliaceae	Guarea cedrata (A.Chev.) Pellegr.	np	pk	Tr	Gc	Re	VU A1c
1397	Meliaceae	Guarea glomerulata Harms	sb	gn	Tr	Gc	Co	
1398	Meliaceae	Guarea thompsonii Sprague & Hutch.	np	pk	Tr	Gc	Hl	VU A1c
1399	Meliaceae	Heckeldora staudtii (Harms) Staner	sb	gn	Sh	Gc	Co	
1400	Meliaceae	Heckeldora zenkeri (Harms) Staner	sb	bu	Sh	Lg	Co	
1401	Meliaceae	Khaya anthotheca (Welw.) C.DC.	np	sc	Tr	Gc	Co	VU A1cd
1402	Meliaceae	Khaya grandifolia C.DC.	np	sc	Tr	Tra	Re	
1403	Meliaceae	Khaya ivorensis A.Chev.	np	sc	Tr	Gc	Re	VU A1cd
1404	Meliaceae	Lovoa trichilioides Harms	np	rd	Tr	Gc	Re	VU A1cd
1405	Meliaceae	Trichilia dregeana Harv. & Sond.	np	gn	Tr	Tra	Co	
1406	Meliaceae	Trichilia gilgiana Harms	np	gn	Tr	Gc	Co	
1407	Meliaceae	Trichilia monadelpha (Thonn.) J.J.de Wilde	np	gn	Tr	Gc	Co	
1408	Meliaceae	Trichilia prieureana A.Juss. subsp. vermoesenii J.J.de Wilde	np	gn	Tr	Gc	Co	
1409	Meliaceae	Trichilia rubescens Oliv.	np	gn	Tr	Gc	Co	
1410	Meliaceae	Trichilia welwitschii C.DC.	np	gn	Tr	Gc	Co	
1411	Meliaceae	Turraea cabrae De Wild. & Th.Durand	pi	gn	Sh	Gc	Hl	
1412	Meliaceae	Turraea vogelii Hook.f. ex Benth.	pi	gn	Swcl	Gc	Hl	
1413	Meliaceae	Turraeanthus africanus (Welw. ex C.DC.) Pellegr.	sb	pk	Tr	Gc	Re	VU A1cd
1414	Meliaceae	Turraeanthus longipes Baill.	sb	bu	Sh	Lg	Co	
1415	Melianthaceae	Bersama abyssinica Fresen.	pi	gn	Tr	Tra	Co	
1416	Menispermaceae	Albertisia capituliflora (Diels) Forman	sb	bu	Swcl	Lg	Co	
1417	Menispermaceae	Albertisia cordifolia (Mangenot & Miege) Forman	sb	gn	Swcl	Gc	Hl	
1418	Menispermaceae	Albertisia glabra (Diels & Troupin) Forman	sb	BK	Swcl	Sw-Cam	Hl	
1419	Menispermaceae	Cissampelos owariensis P.Beauv. ex DC.	pi	gn	Hcl	Tra	Co	
1420	Menispermaceae	Dioscoreophyllum cumminsii (Stapf) Diels	pi	pk	Hcl	Gc	Hl	
1421	Menispermaceae	Jateorhiza macrantha (Hook.f.) Exell & Mendonça	pi	gn	Hcl	Gc	Co	
1422	Menispermaceae	Kolobopetalum auriculatum Engl.	sb	gn	Hcl	Gc	Co	
1423	Menispermaceae	Penianthus camerounensis A.Dekker	sb	GD	Sh	Cam	Co	
1424	Menispermaceae	Penianthus longifolius Miers	sb	gn	Sh	Gc	Co	
1425	Menispermaceae	Penianthus zenkeri (Engl.) Diels	sb	gn	Sh	Gc	Co	
1426	Menispermaceae	Rhigiocarya racemifera Miers	np	gn	Swcl	Gc	Co	
1427	Menispermaceae	Stephania abyssinica (Dill. & Rich.) Walp.	pi	gn	Hcl	Gc	Hl	
1428	Menispermaceae	Stephania dinklagei (Engl.) Diels	pi	gn	Hcl	Gc	Hl	
1429	Menispermaceae	Synclisia scabrida Miers	sb	gn	Swcl	Gc	Co	
1430	Menispermaceae	Syntriandrium preussii Engl.	sb	gn	Swcl	Gc	Hl	
1431	Menispermaceae	Syrrhonema fasciculatum Miers	pi	gn	Lwcl	Gc	Hl	
1432	Menispermaceae	Tiliacora odorata Engl.	np	bu	Swcl	Lg	Hl	
1433	Menispermaceae	Triclisia dictyophylla Diels	pi	gn	Lwcl	Gc	Co	
1434	Monimiaceae	Glossocalyx brevipes Benth.	sb	bu	Tr	Lg	Co	
1435	Monimiaceae	Glossocalyx longicuspis Benth.	sb	bu	Tr	Lg	Co	
1436	Moraceae	Dorstenia africana (Baill.) C.C.Berg	sb	bu	Sh	Lg	Co	
1437	Moraceae	Dorstenia barteri Bureau var. multiradiata (Engl.) Hijman & C.C.Berg	sb	bu	Hb	Lg	Co	
1438	Moraceae	Dorstenia dinklaglei Engl. var. dinklaigei	sw	gn	Hb	Gc	Hl	
1439	Moraceae	Dorstenia dorstenioides (Engl.) Hijman & C.C.Berg	sb	BK	Hb	Campo-Ma'an	Hl	
1440	Moraceae	Dorstenia elliptica Bureau	sb	gn	Hb	Gc	Co	
1441	Moraceae	Dorstenia involuta M.Hijman	sb	BK	Hb	Campo-Ma'an	Co	
1442	Moraceae	Dorstenia kameruniana Engl.	sb	gn	Sh	Tra	Co	
1443	Moraceae	Dorstenia lujae De Wild. var. lujae	sb	gn	Hb	Gc	Hl	
1444	Moraceae	Dorstenia mannii var. humilis (Hijman & C.C.Berg) Hijman	sb	bu	Hb	Lg	Co	
1445	Moraceae	Dorstenia mannii Hook.f. var. mannii	sb	bu	Hb	Lg	Co	
1446	Moraceae	Dorstenia mannii Hook.f. var. mungensis (Engl.) Hijman	sb	bu	Hb	Lg	Co	
1447	Moraceae	Dorstenia picta Bureau	sb	gn	Hb	Gc	Co	
1448	Moraceae	Dorstenia poinsettifolia Engl. var. angusta Hijman & C.C.Berg	sb	bu	Hb	Lg	Co	
1449	Moraceae	Dorstenia poinsettifolia Engl. var. poinsettifolia	sb	bu	Hb	Lg	Co	
1450	Moraceae	Dorstenia poinsettiifolia Engl. var. longicauda (Engl.) Hijman	sb	bu	Hb	Lg	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1451	Moraceae	Dorstenia preusii Engl.	sb	gn	Hb	Gc	Co	
1452	Moraceae	Dorstenia psilurus Welw.	sb	gn	Hb	Gc	Co	
1453	Moraceae	Dorstenia yambuyaensis De Wild.	sb	bu	Hb	Lg	Co	
1454	Moraceae	Ficus ardisioides Warb. subsp. camptoneura (Mildbr.) C.C.Berg	str	gn	Str	Gc	Co	
1455	Moraceae	Ficus asperifolia Miq.	pi	gn	Tr	Gc	Co	
1456	Moraceae	Ficus barteri Sprague	pi	gn	Tr	Gc	Hl	
1457	Moraceae	Ficus craterostoma Mildbr. & Burret	str	gn	Str	Gc	Co	
1458	Moraceae	Ficus cyathistipula Warb. subsp. cyathistipula	str	gn	Str	Pa	Co	
1459	Moraceae	Ficus exasperata Vahl	pi	gn	Tr	Tra	Co	
1460	Moraceae	Ficus leonensis Hutch.	str	gn	Tr	Gu	Hl	
1461	Moraceae	Ficus lutea Vahl	pi	gn	Tr	Tra	Hl	
1462	Moraceae	Ficus lyrata Warb.	str	gn	Str	Gc	Hl	
1463	Moraceae	Ficus mucuso Welw. ex Ficalho	pi	gn	Tr	Gc	Co	
1464	Moraceae	Ficus natalensis Hochst.	str	gn	Str	Tra	Co	
1465	Moraceae	Ficus ovata Vahl	str	gn	Str	Tra	Hl	
1466	Moraceae	Ficus pringsheimiana Braun ex K. Schum.	ep	gn	Tr	Gc	Hl	
1467	Moraceae	Ficus subsagittatifolia Mildbr. ex C.C. Berg	ep	bu	Tr	Lg	Hl	
1468	Moraceae	Ficus sur Forssk.	pi	gn	Tr	Pa	Co	
1469	Moraceae	Ficus vogeliana (Miq.) Miq.	sw	gn	Tr	Gc	Co	
1470	Moraceae	Milicia excelsa (Welw.) C.C.Berg	pi	sc	Tr	Tra	Re	LR/nt
1471	Moraceae	Scyphosyce manniana Baill.	sb	gn	Hb	Gc	Co	
1472	Moraceae	Treculia acuminata Baill.	sb	bu	Sh	Lg	Co	
1473	Moraceae	Treculia africana Decne.	np	gn	Tr	Tra	Re	
1474	Moraceae	Treculia obovoidea N.E.Br.	sb	gn	Tr	Gc	Co	
1475	Moraceae	Trilepisium madagascariense DC.	pi	gn	Tr	Tra	Co	
1476	Myristicaceae	Coelocaryon preussii Warb.	np	pk	Tr	Gc	Re	
1477	Myristicaceae	Pycnanthus angolensis (Welw.) Warb.	np	pk	Tr	Gc	Re	
1478	Myristicaceae	Scyphocephalium mannii (Benth.) Warb.	np	bu	Tr	Lg	Re	
1479	Myristicaceae	Staudtia kamerunensis Warb. var. gabonensis (Warb.) Fouilloy	np	pk	Tr	Gc	Re	
1480	Myristicaceae	Staudtia kamerunensis Warb. var. kamerunensis (Warb.) Fouilloy	np	pk	Tr	Gc	Re	
1481	Myrsinaceae	Ardisia batangaensis Taton	sb	gn	Hb	Gc	Co	
1482	Myrsinaceae	Ardisia buesgenii (Gilg & Schellenb.) Taton	sb	bu	Hb	Lg	Co	
1483	Myrsinaceae	Ardisia dewitiana Taton	sb	gn	Hb	Gc	Co	
1484	Myrsinaceae	Ardisia dolichocalyx Taton	sb	GD	Hb	Cam	Co	
1485	Myrsinaceae	Ardisia ebolowensis Taton	sb	bu	Hb	Lg	Co	
1486	Myrsinaceae	Ardisia leucantha Gilg & Schellenb	sb	gn	Hb	Gc	Co	
1487	Myrsinaceae	Ardisia staudtii Gilg	sb	gn	Hb	Gc	Co	
1488	Myrsinaceae	Ardisia zenkeri Gilg	sb	bu	Hb	Lg	Co	
1489	Myrtaceae	Eugenia kameruniana Engl.	sb	BK	Sh	Cam	Co	CR A1c
1490	Myrtaceae	Eugenia klaineana (Pierre) Engl.	sb	bu	Sh	Lg	Co	
1491	Myrtaceae	Eugenia talbotii Keay	sb	gn	Sh	Gc	Co	
1492	Myrtaceae	Eugenia whytei Sprague	sb	gn	Sh	Gc	Co	
1493	Myrtaceae	Eugenia zenkeri Engl.	sb	bu	Sh	Lg	Co	
1494	Myrtaceae	Psidium guineense Swartz	pi	gn	Sh	Pa	Re	
1495	Myrtaceae	Syzygium guineense (Willd.) DC. var. littorale Keay	sw	gn	Tr	Pa	Co	
1496	Myrtaceae	Syzygium staudtii (Engl.) Mildbr.	np	gn	Tr	Gu	Re	
1497	Nyctaginaceae	Boerhavia erecta L.	pi	gn	Hb	Tra	Co	
1498	Nymphaeaceae	Nymphaea heudelotii Planch.	rh	gn	Hb	Pa	Hl	
1499	Nymphaeaceae	Nymphaea lotus L.	rh	gn	Hb	Pa	Hl	
1500	Ochnaceae	Campylospermum calanthum (Gilg) Farron	sb	bu	Sh	Lg	Co	
1501	Ochnaceae	Campylospermum densiflora (De Wild. & Th. Durand) Farron	sb	gn	Sh	Gc	Co	
1502	Ochnaceae	Campylospermum duparquetiana (Baill.) Gilg	sb	gn	Sh	Gu	Co	
1503	Ochnaceae	Campylospermum dybowskii Tiegh.	sb	gn	Sh	Gc	Co	
1504	Ochnaceae	Campylospermum elongatum (Oliv.) Tiegh.	sb	bu	Sh	Lg	Co	
1505	Ochnaceae	Campylospermum excavatum	sb	bu	Sh	Lg	Co	
1506	Ochnaceae	Campylospermum flavum (Schum. & Thonn.) Farron	sb	gn	Sh	Gc	Co	
1507	Ochnaceae	Campylospermum glaberrimum (P.Beauv.) Farron	sb	gn	Sh	Gu	Co	
1508	Ochnaceae	Campylospermum glaucum (Tiegh.) Farron	sb	bu	Sh	Lg	Co	
1509	Ochnaceae	Campylospermum laxiflorum (De Wild. & T.Durand) Tiegh.	sb	gn	Sh	Gc	Co	
1510	Ochnaceae	Campylospermum letouzeyi Farron	sb	GD	Sh	Cam	Co	
1511	Ochnaceae	Campylospermum mannii (Oliv.) Tiegh.	sb	bu	Sh	Lg	Co	
1512	Ochnaceae	Campylospermum oliveri (Tiegh.) Farron	sb	gn	Sh	Gu	Co	

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1513	Ochnaceae	Campylospermum reticulatum (P.Beauv.) Farron var. reticulatum	sb	gn	Sh	Gc	Co	
1514	Ochnaceae	Campylospermum subcordatum (Stapf) Farron	sb	gn	Sh	Gu	Co	
1515	Ochnaceae	Campylospermum sulcatum (Tiegh.) Farron	sb	gn	Sh	Gu	Co	
1516	Ochnaceae	Campylospermum zenkeri (Engl. ex Tiegh.) Farron	sb	GD	Sh	Cam	Hl	
1517	Ochnaceae	Lophira alata Banks ex Gaertn.f.	pi	sc	Tr	Gc	Re	VU A1cd
1518	Ochnaceae	Ochna multiflora DC.	sb	gn	Sh	Gc	Hl	
1519	Ochnaceae	Rhabdophyllum affine (Hook.f.) Tiegh.	sb	gn	Tr	Gc	Co	
1520	Ochnaceae	Rhabdophyllum arnoldianum De Wild. & T. Durand	sb	gn	Tr	Gc	Co	
1521	Ochnaceae	Testulea gabonensis Pellegr.	np	bu	Tr	Lg	Co	EN A1cd
1522	Olacaceae	Aptandra zenkeri Engl.	sb	gn	Tr	Gc	Co	
1523	Olacaceae	Coula edulis Baill.	sb	gn	Tr	Gc	Re	
1524	Olacaceae	Diogoa zenkeri (Engl.) Exell & Mendonça	sb	gn	Tr	Gc	Re	
1525	Olacaceae	Engomegoma gordonii Breteler	np	bu	Tr	Lg	Re	
1526	Olacaceae	Heisteria parvifolia Sm.	sb	gn	Sh	Gc	Co	
1527	Olacaceae	Heisteria trillesiana Pierre	sb	bu	Sh	Lg	Co	
1528	Olacaceae	Heisteria zimmereri Engl.	ri	gn	Sh	Gc	Co	
1529	Olacaceae	Octoknema affinis Pierre	sb	bu	Tr	Lg	Co	
1530	Olacaceae	Octoknema dinklagei Engl.	sb	GD	Tr	Cam	Co	
1531	Olacaceae	Octoknema genovefae Villiers	sb	bu	Sh	Lg	Co	
1532	Olacaceae	Octoknema winkleri Engl.	sb	gn	Sh	Gc	Co	
1533	Olacaceae	Olax gambecola Baill.	sb	gn	Sh	Gc	Co	
1534	Olacaceae	Olax latifolia Engl.	sb	gn	Sh	Gc	Co	
1535	Olacaceae	Olax mannii Oliv.	ri	gn	Sh	Gc	Co	
1536	Olacaceae	Olax staudtii Engl.	sb	bu	Sh	Lg	Co	
1537	Olacaceae	Olax triplinerva Oliv.	ri	bu	Sh	Lg	Hl	
1538	Olacaceae	Ongokea gore (Hua) Pierre	np	gn	Tr	Gc	Co	
1539	Olacaceae	Ptychopetalum petiolatum Oliv.	sb	bu	Tr	Lg	Co	
1540	Olacaceae	Strombosia grandifolia Hook.f. ex Benth.	sb	gn	Tr	Gc	Co	
1541	Olacaceae	Strombosia pustulata Oliv.	sb	gn	Tr	Gc	Co	
1542	Olacaceae	Strombosia scheffleri Engl.	sb	gn	Tr	Gu	Co	
1543	Olacaceae	Strombosia zenkeri Engl.	sb	bu	Tr	Lg	Co	
1544	Olacaceae	Strombosiopsis tetrandra Engl.	sb	gn	Tr	Gc	Re	
1545	Olacaceae	Ximenia americana L.	sb	gn	Sh	Tra	Re	
1546	Oleaceae	Chionanthus mannii (Soler.) Stearn	sb	bu	Sh	Lg	Hl	
1547	Oleaceae	Jasminum preussii Engl. & Knobl.	pi	gn	Hcl	Gc	Co	
1548	Oleandraceae	Arthropteris monocarpa (Cordem.) C.Chr.	ep	gn	He	Tra	Co	
1549	Oleandraceae	Arthropteris palisoti (Desv.) Alston	ep	gn	He	Tra	Co	
1550	Oleandraceae	Nephrolepis biserrata (Sw.) Schott	ep	gn	Hb	Pa	Co	
1551	Onagraceae	Ludwigia abyssinica A. Rich.	sw	gn	Hb	Pa	Hl	
1552	Onagraceae	Ludwigia africana (Brenan) Hara	sw	gn	Hb	Pa	Hl	
1553	Onagraceae	Ludwigia erecta (L.) Hara	sw	gn	Hb	Tra	Co	
1554	Onagraceae	Ludwigia stenorraphe (Brenan) Hara	sw	gn	Hb	Tra	Hl	
1555	Ophioglossaceae	Ophioglossum reticulatum L.	ep	gn	Ep	Gc	Hl	
1556	Opiliaceae	Rhopalopilia pallens Pierre	sb	gn	Sh	Gc	Co	
1557	Opiliaceae	Urobotrya congolana (Baill.) Hiepko subsp. congolana	sb	gn	Sh	Gc	Co	
1558	Orchidaceae	Aerangis biloba (Lindl.) Schltr.	ep	gn	Ep	Gc	Co	
1559	Orchidaceae	Ancistrorhynchus capitatus (Lindl.) Summerh.	ep	bu	Ep	Lg	Hl	
1560	Orchidaceae	Ancistrorhynchus cephalotes (Rchb.f.) Summerh.	ep	bu	Ep	Lg	Hl	
1561	Orchidaceae	Angraecum birrimense Rolfe	ep	gn	Ep	Gc	Co	
1562	Orchidaceae	Angraecum distichum Lindl.	ep	gn	Ep	Gc	Co	
1563	Orchidaceae	Auxopus kamerunensis Schltr.	ep	gn	Ep	Gc	Hl	
1564	Orchidaceae	Bulbophyllum alinae Szlachetko	ep	BK	Ep	Campo-Ma'an	Hl	
1565	Orchidaceae	Bulbophyllum bufo (Lindl.) Rchb.f.	ep	gn	Ep	Gc	Hl	
1566	Orchidaceae	Bulbophyllum buntingii Rendle	ep	gn	Ep	Gc	Hl	
1567	Orchidaceae	Bulbophyllum calyptratum Kraenzl.	ep	gn	Ep	Gc	Hl	
1568	Orchidaceae	Bulbophyllum cochleatum Lindl.	ep	gn	Ep	Gc	Hl	
1569	Orchidaceae	Bulbophyllum colubrinum (Rchb.f.) Rchb.f.	ep	gn	Ep	Gc	Co	
1570	Orchidaceae	Bulbophyllum distans Lindl.	ep	gn	Ep	Gc	Hl	
1571	Orchidaceae	Bulbophyllum falcatum (Lindl.) Rchb.f.	ep	gn	Ep	Gc	Co	
1572	Orchidaceae	Bulbophyllum falcipetalum Lindl.	ep	gn	Ep	Gc	Hl	
1573	Orchidaceae	Bulbophyllum fuscum Lindl.	ep	gn	Ep	Gc	Co	
1574	Orchidaceae	Bulbophyllum imbricatum Lindl.	ep	gn	Ep	Gc	Hl	
1575	Orchidaceae	Bulbophyllum maximum (Lindl.) Rchb.f.	ep	gn	Ep	Tra	Hl	
1576	Orchidaceae	Bulbophyllum oreonastes Rchb.f.	ep	gn	Ep	Tra	Hl	

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1577	Orchidaceae	Bulbophyllum phaeopogon Schltr.	ep	gn	Ep	Gc	Co	
1578	Orchidaceae	Bulbophyllum sandersonii (Hook.f.) Rchb.f. subsp. sandersonii	ep	gn	Ep	Tra	Co	
1579	Orchidaceae	Bulbophyllum tentaculigerum Rchb.f.	ep	gn	Ep	Gc	Hl	
1580	Orchidaceae	Calyptrochilum emarginatum (Sw.) Schltr.	ep	gn	Ep	Gc	Co	
1581	Orchidaceae	Chamaeangis odoratissima (Rchb.f.) Schltr.	ep	gn	Ep	Tra	Hl	
1582	Orchidaceae	Corymborkis corymbosa Thouars	pi	gn	Hb	Tra	Co	
1583	Orchidaceae	Corymborkis minima P.J.Cribb	sb	GD	Hb	Cam	Hl	
1584	Orchidaceae	Cyrtorchis chailluana (Hook.f.) Schltr.	ep	gn	Ep	Gc	Co	
1585	Orchidaceae	Diaphananthe pellucida (Lindl.) Schltr.	ep	gn	Ep	Gc	Co	
1586	Orchidaceae	Eulophia alta (L.) Fawcett & Rendle	pi	gn	Hb	Tra	Co	
1587	Orchidaceae	Eulophia horsfallii (Batem.) Summerh.	pi	gn	Hb	Tra	Hl	
1588	Orchidaceae	Genyorchis pumila (Sw. ex Pers.) Schltr.	ep	gn	Ep	Gc	Co	
1589	Orchidaceae	Hetaeria mannii (Rchb.f.) T.Durand & Schinz	pi	gn	Hb	Gc	Hl	
1590	Orchidaceae	Liparis epiphytica Schltr.	pi	bu	Hb	Lg	Hl	
1591	Orchidaceae	Manniella gustavi Rchb.f.	pi	gn	Hb	Gc	Co	
1592	Orchidaceae	Podandriella batesii (la Croix) Szlachetko & Olszewski	sb	BK	Hb	Campo-Ma'an	Hl	
1593	Orchidaceae	Polystachya affinis Lindl.	ep	gn	Ep	Gc	Hl	
1594	Orchidaceae	Polystachya calluniflora Kraenzl.	ep	gn	Ep	Gc	Hl	
1595	Orchidaceae	Polystachya caloglossa Rchb.f.	ep	gn	Ep	Gc	Co	
1596	Orchidaceae	Polystachya fractiflexa Summerh.	ep	gn	Ep	Gc	Hl	
1597	Orchidaceae	Polystachya galeata (Sw.) Rchb.f.	ep	gn	Ep	Gc	Hl	
1598	Orchidaceae	Polystachya laxiflora Lindl.	ep	gn	Ep	Gc	Hl	
1599	Orchidaceae	Polystachya letouzeyana Szlachetko and Olszewski*	ep	BK	Ep	Campo-Ma'an	Hl	
1600	Orchidaceae	Polystachya polychaete Kraenzl.	ep	gn	Ep	Gc	Hl	
1601	Orchidaceae	Polystachya ramulosa Lindl.	ep	gn	Ep	Gc	Hl	
1602	Orchidaceae	Polystachya rhodoptera Rchb.f.	ep	gn	Ep	Gc	Hl	
1603	Orchidaceae	Rangaeris muscicola (Rchb.f.) Summerh.	ep	gn	Ep	Gc	Co	
1604	Orchidaceae	Solenangis scandens (Schltr.) Schltr.	ep	gn	Ep	Gc	Hl	
1605	Orchidaceae	Vanilla africana Lindl. subsp.africana	np	gn	Hcl	Gc	Co	
1606	Orchidaceae	Vanilla africana Lindley subsp. cucullata (Kraenzlin & K. Shum.) Szlachetko & Olszewski	np	BK	Hcl	Sw-Cam	Hl	
1607	Orchidaceae	Vanilla crenulata Rolfe	np	gn	Hcl	Gc	Hl	
1608	Orchidaceae	Vanilla grandifolia Kraenzl.	np	gn	Hcl	Gc	Hl	
1609	Orchidaceae	Zeuxine elongata Rolfe	pi	gn	Hb	Gc	Co	
1610	Orchidaceae	Zeuxine occidentalis (Summerh.) Geerinck	sb	gn	Hb	Gc	Co	
1611	Orchidaceae	Zeuxine stammleri Schltr.	sb	gn	Hb	Gc	Co	
1612	Oxalidaceae	Biophytum talbotii (Baker f.) Hutch. & Dalziel	pi	gn	Hb	Gc	Co	
1613	Oxalidaceae	Biophytum umbelatum Welw.	pi	gn	Hb	Pa	Hl	
1614	Oxalidaceae	Biophytum zenkeri Guillaumin	rh	gn	Hb	Gc	Co	
1615	Oxalidaceae	Oxalis corniculata L.	pi	gn	Hb	Pa	Co	
1616	Oxalidaceae	Oxalis corymbosa DC.	pi	gn	Hb	Pa	Co	
1617	Palmae	Calamus deërratus G.Mann & H.Wendl.	np	pk	Swcl	Gc	Co	
1618	Palmae	Cocos nucifera L.	pi	gn	Pal	Pa	Re	
1619	Palmae	Elaeis guineensis Jacq.	pi	pk	Pal	In	Re	
1620	Palmae	Eremospatha hookeri (G.Mann & H.Wendl.) H.Wendl.	np	pk	Swcl	Gc	Co	
1621	Palmae	Eremospatha laurentii De Wild.	np	pk	Swcl	Gc	Co	
1622	Palmae	Eremospatha macrocarpa (G.Mann & H.Wendl.) H.Wendl.	np	pk	Swcl	Gc	Co	
1623	Palmae	Eremospatha wenlandiana Dammer ex Becc.	np	pk	Swcl	Lg	Co	
1624	Palmae	Laccosperma opacum (G.Mann & H.Wendl.) Drude	np	pk	Swcl	Gc	Co	
1625	Palmae	Laccosperma secundiflorum (P.Beauv.) Kuntze	np	rd	Swcl	Gc	Co	
1626	Palmae	Nypa fruticans Wurmb.	sw	gn	Pa	Pal	Re	
1627	Palmae	Oncocalamus mannii (H.Wendl.) H.Wendl.	np	pk	Swcl	Gc	Co	
1628	Palmae	Phoenix reclinata L.	pi	gn	Pal	Pa	Co	
1629	Palmae	Podococcus barteri G. Mann & Wendl.	sb	bu	Pal	Lg	Co	
1630	Palmae	Raphia hookeri G.Mann & H.Wendl.	sw	pk	Pal	Gc	Co	
1631	Palmae	Raphia regalis Becc.	sw	pk	Pal	Gc	Co	
1632	Palmae	Raphia vinifera P.Beauv.	sw	pk	Pal	Gc	Re	
1633	Palmae	Sclerosperma mannii Wendl.	sw	gn	Pal	Gc	Co	
1634	Pandacea	Centroplacus glaucinus Pierre	np	gn	Tr	Gu	Co	
1635	Pandaceae	Microdesmis camerunensis J.Léonard	sb	bu	Sh	Lg	Co	
1636	Pandaceae	Microdesmis haumaniana J.Léonard	sb	gn	Sh	Gc	Co	
1637	Pandaceae	Microdesmis puberula Hook.f. ex Planch.	sb	gn	Sh	Gc	Co	
1638	Pandaceae	Microdesmis zenkeri Pax	sb	bu	Sh	Lg	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1639	Pandaceae	Panda oleosa Pierre	sb	gn	Tr	Gc	Co	
1640	Pandanaceae	Pandanus candelabrum P.Beauv.	sw	gn	Tr	Gc	Co	
1641	Pandanaceae	Pandanus satabiei Huynh	sw	bu	Tr	Lg	Co	
1642	Passifloraceae	Adenia cissampeloides (Planch. ex Benth.) Harms	pi	gn	Swcl	Tra	Co	
1643	Passifloraceae	Adenia gracilis Harms	pi	gn	Swcl	Gc	Co	
1644	Passifloraceae	Adenia letouzeyi W.J.de Wilde	pi	gn	Swcl	Gc	Co	
1645	Passifloraceae	Adenia lobata (Jacq.) Engl.	pi	gn	Swcl	Gc	Co	
1646	Passifloraceae	Adenia mannii (Mast.) Engl.	pi	gn	Swcl	Gc	Co	
1647	Passifloraceae	Adenia poggei (Engl.) Engl.	pi	gn	Swcl	Gc	Hl	
1648	Passifloraceae	Adenia staudtii Harms	pi	gn	Hcl	Gc	Hl	
1649	Passifloraceae	Barteria fistulosa Mast.	pi	gn	Tr	Gc	Co	
1650	Passifloraceae	Barteria nigritana Mast.	pi	bu	Tr	Lg	Co	
1651	Passifloraceae	Efulensia clematoides C.H.Wright	pi	gn	Swcl	Gc	Co	
1652	Passifloraceae	Paropsia grewioides Welw. ex Mast.	sb	bu	Sh	Lg	Hl	
1653	Passifloraceae	Passiflora foetida L.	pi	gn	Hcl	Pa	Co	
1654	Passifloraceae	Smeathmannia pubescens Soland. ex R.Br.	sb	gn	Tr	Gc	Hl	
1655	Pedaliaceae	Sesamum indicum L.	pi	gn	Hb	Pa	Hl	
1656	Pedaliaceae	Sesamum radiatum Schum. & Thonn.	pi	gn	Hb	Pa	Co	
1657	Pentadiplandraceae	Pentadiplandra brazzeana Baill.	pi	gn	Lwcl	Pa	Co	
1658	Phytolaccaceae	Hilleria latifolia (Lam.) H.Walt.	pi	gn	Hb	In	Hl	
1659	Phytolaccaceae	Phytolacca dodecandra L'Hér.	pi	gn	Hcl	Tra	Hl	
1660	Piperaceae	Peperomia molleri C.DC.	ep	gn	Ep	Tra	Co	
1661	Piperaceae	Peperomia pellucida (L.) H.B. & K.	ep	gn	Ep	Tra	Co	
1662	Piperaceae	Piper guineense Schum. & Thonn.	sb	gn	Hcl	Tra	Co	
1663	Piperaceae	Piper nigrum L.	pi	gn	Hb	Gc	Hl	
1664	Piperaceae	Piper umbellatum L.	pi	gn	Hb	Pa	Co	
1665	Podostemaceae	Dicraeanthus africanus Engl.	rh	bu	Hb	Lg	Co	
1666	Podostemaceae	Ledermanniella annithomae C. Cusset	rh	BK	Hb	Campo-Ma'an	Hl	
1667	Podostemaceae	Ledermanniella batangensis (Engl.) C. Cusset	rh	BK	Hb	Campo-Ma'an	Hl	
1668	Podostemaceae	Ledermanniella bifurcata (Engl.) C. Cusset	rh	bu	Hb	Lg	Hl	
1669	Podostemaceae	Ledermanniella bosii C.Cusset	rh	BK	Hb	Campo-Ma'an	Co	
1670	Podostemaceae	Ledermanniella boumiensis C. Cusset	rh	GD	Hb	Lg	Co	
1671	Podostemaceae	Ledermanniella cristat (Engl.) C. Cusset	rh	bu	Hb	Lg	Co	
1672	Podostemaceae	Ledermanniella fusilla (Warm.) C.Cusset	rh	bu	Hb	Lg	Co	
1673	Podostemaceae	Ledermanniella kamerunensis (Engl.) C. Cusset	rh	BK	Hb	Campo-Ma'an	Hl	
1674	Podostemaceae	Ledermanniella ledermannii (Engl.) C.Cusset	rh	gn	Hb	Gc	Co	
1675	Podostemaceae	Ledermanniella linearifolia Engl.	rh	GD	Hb	Cam	Co	
1676	Podostemaceae	Ledermanniella pusilla (Warm.) C.Cusset	rh	bu	Hb	Lg	Co	
1677	Podostemaceae	Ledermanniella variabilis (G.Taylor) C.Cusset	rh	GD	Hb	Cam	Hl	
1678	Podostemaceae	Tristicha trifaria (Bory) Spreng.	rh	gn	Hb	Pa	Co	
1679	Polygalaceae	Atroxima afzeliana (Oliv.) Stapf	sb	gn	Swcl	Gc	Hl	
1680	Polygalaceae	Atroxima liberica Stapf	sb	gn	Swcl	Gc	Co	
1681	Polygalaceae	Carpolobia alba G.Don	sb	gn	Sh	Gc	Co	
1682	Polygalaceae	Carpolobia gossweileri (Exell) Petit	sb	bu	Tr	Lg	Co	
1683	Polygalaceae	Carpolobia lutea G.Don	sb	gn	Sh	Gu	Co	
1684	Polygalaceae	Securidaca welwitschii Oliv.	pi	gn	Swcl	Gc	Hl	
1685	Polygonaceae	Afrobrunnichia erecta (Asch.) Hutch. & Dalziel	pi	gn	Swcl	Gc	Co	
1686	Polygonaceae	Polygonum salicifolium Brouss. ex Willd.	pi	gn	Hb	Pa	Co	
1687	Polypodiaceae	Drynaria laurentii (Christ ex De Wild. & Th.Durand) Hieron	ep	gn	Ep	Tra	Co	
1688	Polypodiaceae	Drynaria volkensii Hieron.	ep	gn	Ep	Tra	Hl	
1689	Polypodiaceae	Microgramma lycopodioides (L.) Copel.	ep	gn	Ep	Pal	Hl	
1690	Polypodiaceae	Phymatosorus scolopendria (Burm.f) Pic.Serm.	ep	gn	Ep	Pal	Co	
1691	Polypodiaceae	Platycerium stemaria (P.Beauv.) Desv.	ep	gn	Ep	Gc	Co	
1692	Portulacaceae	Portulaca oleracea L.	pi	gn	Hb	Pa	Hl	
1693	Portulacaceae	Talinum triangulare (Jacq.) Willd.	pi	gn	Hb	Tra	Hl	
1694	Pteridaceae	Acrostichum aureum L.	sw	gn	Hb	Pa	Co	
1695	Pteridaceae	Pteris atrovirens Willd.	sb	gn	Hb	Gc	Co	
1696	Pteridaceae	Pteris burtoni Baker	sb	gn	Hb	Gc	Co	
1697	Pteridaceae	Pteris linearis Poir.	sb	gn	Hb	Tra	Co	
1698	Pteridaceae	Pteris mildbraedii Hieron.	sb	gn	Hb	Tra	Co	
1699	Pteridaceae	Pteris togoensis Hieron.	sb	gn	Hb	Gc	Co	
1700	Ranunculaceae	Ranunculus multifidus Forssk.	pi	gn	Hb	Tra	Hl	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1701	Rhamnaceae	Gouania longipetala Hemsl.	pi	gn	Swcl	Gc	Co	
1702	Rhamnaceae	Lasiodiscus fasciculiflorus Engl.	sw	gn	Tr	Gc	Co	
1703	Rhamnaceae	Lasiodiscus mannii Hook.f.	sw	gn	Tr	Gc	Co	
1704	Rhamnaceae	Lasiodiscus marmoratus C.H.Wright	sw	gn	Tr	Gc	Co	
1705	Rhamnaceae	Maesopsis eminii Engl.	pi	gn	Tr	Tra	Co	
1706	Rhamnaceae	Ventilago africana Exell	np	gn	Swcl	Gc	Hl	
1707	Rhizophoraceae	Anopyxis klaineana (Pierre) Engl.	np	rd	Tr	Gc	Co	VU A1cd
1708	Rhizophoraceae	Cassipourea barteri (Hook.f.) N.E.Br.	ri	gn	Sh	Gu	Co	
1709	Rhizophoraceae	Cassipourea congoensis R.Br. ex DC.	sb	gn	Sh	Gc	Co	
1710	Rhizophoraceae	Cassipourea dinklagei (Engl.) Alst.	sb	bu	Sh	Lg	Hl	
1711	Rhizophoraceae	Cassipourea kamerunensis (Engl.) Alston	sb	GD	Sh	Cam	Co	
1712	Rhizophoraceae	Cassipourea sericea (Engl.) Alst.	sb	bu	Sh	Lg	Co	
1713	Rhizophoraceae	Cassipourea zenkeri (Engl.) Alston	sb	GD	Sh	Cam	Co	
1714	Rhizophoraceae	Rhizophora mangle L.	sw	gn	Tr	Pa	Co	
1715	Rhizophoraceae	Rhizophora racemosa G.F.W.Mey.	sw	gn	Tr	Pa	Co	
1716	Rubiaceae	Aidia genipiflora (DC.) Dandy	sb	gn	Tr	Gc	Co	
1717	Rubiaceae	Aidia micrantha (K.Schum.) White	sb	gn	Tr	Gc	Co	
1718	Rubiaceae	Aoranthe cladantha (K.Schum.) Somers	sw	gn	Tr	Gc	Co	
1719	Rubiaceae	Argocoffeopsis scandens (K.Schum.) Lebrun	sb	gn	Swcl	Gc	Co	
1720	Rubiaceae	Argocoffeopsis subcordata (Hiern) Lebrun	sb	gn	Swcl	Gc	Hl	
1721	Rubiaceae	Atractogyne bracteata (Wernham) Hutch. & Dalziel	pi	gn	Swcl	Gu	Co	
1722	Rubiaceae	Atractogyne gabonii Pierre	pi	gn	Swcl	Gc	Hl	
1723	Rubiaceae	Aulacocalyx caudata (Hiern) Keay	sb	bu	Tr	Lg	Co	
1724	Rubiaceae	Aulacocalyx jasminiflora Hook.f.	sb	gn	Tr	Gc	Co	
1725	Rubiaceae	Aulacocalyx talbotii (Wernham) Keay	sb	bu	Tr	Lg	Co	
1726	Rubiaceae	Belonophora coriacea Hoyle	sb	gn	Sh	Gc	Co	
1727	Rubiaceae	Belonophora talbotii (Wernham) Keay	sb	bu	Sh	Lg	Co	
1728	Rubiaceae	Belonophora wernhamii Hutch. & Dalziel	sb	bu	Sh	Lg	Co	
1729	Rubiaceae	Bertiera aethiopica Hiern	pi	gn	Sh	Gc	Co	
1730	Rubiaceae	Bertiera batesii Wernham	sb	gn	Sh	Gc	Co	
1731	Rubiaceae	Bertiera bicarpellata (K.Schum.) N.Hallé	sb	bu	Sh	Lg	Co	
1732	Rubiaceae	Bertiera bracteolata Hiern	pi	gn	Hcl	Gu	Co	
1733	Rubiaceae	Bertiera breviflora Hiern	sb	gn	Sh	Gc	Co	
1734	Rubiaceae	Bertiera elabensis K.Krause	ri	bu	Sh	Lg	Hl	
1735	Rubiaceae	Bertiera globiceps K.Schum.	sb	gn	Sh	Gc	Co	
1736	Rubiaceae	Bertiera iturensis K.Krause	sb	gn	Sh	Gc	Co	
1737	Rubiaceae	Bertiera laxa Benth.	sb	bu	Sh	Lg	Co	
1738	Rubiaceae	Bertiera laxissima K.Schum.	sb	GD	Sh	Lg	Co	
1739	Rubiaceae	Bertiera racemosa (G.Don) K.Schum. var. elephantina N.Hallé	sb	gn	Sh	Gc	Co	
1740	Rubiaceae	Bertiera racemosa (G.Don) K.Schum. var. racemosa (G.Don) K.Schum.	sb	gn	Sh	Gc	Co	
1741	Rubiaceae	Bertiera retrofracta K.Schum.	sb	bu	Sh	Lg	Co	
1742	Rubiaceae	Bertiera subsessilis Hiern	sb	bu	Sh	Lg	Co	
1743	Rubiaceae	Borreria latifolia (Aubl.) K.Schum.	pi	gn	Hb	Gc	Hl	
1744	Rubiaceae	Brenania brieyi (De Wild.) Petit	sb	gn	Tr	Gc	Re	
1745	Rubiaceae	Canthium ripae	np	gn	Swcl	Gc	Co	
1746	Rubiaceae	Chassalia afzelii (Hiern) K.Schum.	sb	gn	Sh	Gc	Co	
1747	Rubiaceae	Chassalia cristata (Hiern) Bremek.	sb	gn	Sh	Gc	Hl	
1748	Rubiaceae	Chassalia ischnophylla (K.Schum.) Hepper	sb	bu	Sh	Lg	Co	
1749	Rubiaceae	Chassalia kolly (Schumach.) Hepper	sb	gn	Sh	Gu	Co	
1750	Rubiaceae	Chassalia macrodiscus K.Schum.	pi	gn	Swcl	Gc	Hl	
1751	Rubiaceae	Chassalia simplex K.Krause	sb	gn	Sh	Gc	Co	
1752	Rubiaceae	Chassalia zenkeri K.Schum. & K.Krause	sb	bu	Sh	Lg	Co	
1753	Rubiaceae	Chazaliella coffeosperma (K.Schum.) Verdc.	sb	gn	Sh	Gc	Co	
1754	Rubiaceae	Chazaliella domatiicola (De Wild.) Petit & Verdc.	sb	gn	Sh	Gc	Co	
1755	Rubiaceae	Chazaliella insidens (Hiern) Petit & Verdc. subsp. insidens	sb	bu	Sh	Lg	Co	
1756	Rubiaceae	Chazaliella oddonii (De Wild.) Petit & Verdc.	sb	gn	Sh	Gc	Co	
1757	Rubiaceae	Chazaliella sciadephora (Hiern) Petit & Verdc. var. condensata Verdc.	sb	GD	Sh	Cam	Co	
1758	Rubiaceae	Chazaliella sciadephora (Hiern) Petit & Verdc. var. sciadephora	sb	gn	Sh	Gc	Co	
1759	Rubiaceae	Coffea brevipes Hiern	sb	gn	Sh	Gc	Co	
1760	Rubiaceae	Coffea congensis Froehn.	sb	gn	Sh	Gc	Hl	
1761	Rubiaceae	Coffea heterocalyx Stoffelen	sb	gn	Sh	Gc	Hl	
1762	Rubiaceae	Coffea liberica Bull. ex Hiern	pi	pk	Sh	Tra	Re	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1763	Rubiaceae	Coffea mayombensis A.Chev.	sb	gn	Sh	Gc	Co	
1764	Rubiaceae	Corynanthe pachyceras K.Schum.	sb	gn	Tr	Gc	Re	
1765	Rubiaceae	Craterispermum aristatum Wernham	sb	bu	Sh	Lg	Co	
1766	Rubiaceae	Craterispermum caudatum Hutch.	sb	gn	Sh	Gc	Co	
1767	Rubiaceae	Craterispermum cerinanthum Hiern	sb	gn	Sh	Gc	Co	
1768	Rubiaceae	Craterispermum laurinium (Poir.) Benth.	sb	gn	Sh	Gc	Co	
1769	Rubiaceae	Craterispermum ledermannii K.Krause	sb	gn	Sh	Gc	Co	
1770	Rubiaceae	Craterispermum scandens Engl. & Gilg	sb	gn	Sh	Gc	Hl	
1771	Rubiaceae	Cremaspora thomsonii Hiern	np	bu	Swcl	Lg	Hl	
1772	Rubiaceae	Cremaspora triflora (Thonn.) K.Schum.	np	gn	Swcl	Tra	Co	
1773	Rubiaceae	Cuviera acutiflora DC.	pi	gn	Tr	Gu	Co	
1774	Rubiaceae	Cuviera macroura K.Schum.	pi	gn	Tr	Gc	Hl	
1775	Rubiaceae	Cuviera talbotii (Wernham) Verdc.	pi	bu	Tr	Lg	Co	
1776	Rubiaceae	Cuviera truncata Benth.	pi	gn	Tr	Gc	Hl	
1777	Rubiaceae	Cuviera uncinula N.Hallé	sb	gn	Tr	Gc	Co	
1778	Rubiaceae	Didymosalpinx abbeokutae Hiern	sb	gn	Swcl	Gc	Co	
1779	Rubiaceae	Diodia sarmentosa Sw.	pi	gn	Hb	Pa	Co	
1780	Rubiaceae	Diodia scandens sensu Hepper	pi	gn	Hb	Tra	Co	
1781	Rubiaceae	Diodia serrulata (P.Beauv.) G.Taylor	pi	gn	Hb	Tra	Hl	
1782	Rubiaceae	Ecpoma apocynaceum K.Schum.	pi	BK	Sh	Sw-Cam	Co	
1783	Rubiaceae	Ecpoma gigantostipulum (K.Schum.) N.Hallé	pi	bu	Sh	Lg	Co	
1784	Rubiaceae	Euclinia longiflora Salisb.	sb	gn	Sh	Gc	Co	
1785	Rubiaceae	Gaertnera bieleri (De Wild.) Petit	sb	gn	Sh	Gc	Hl	
1786	Rubiaceae	Gaertnera dinklagei K.Schum.	sb	gn	Sh	Gc	Hl	
1787	Rubiaceae	Gaertnera fissistipula (K. Schum. & K. Krause) Petit	sb	bu	Sh	Lg	Co	
1788	Rubiaceae	Gaertnera trachystyla (Hiern) Petit	sb	gn	Sh	Gc	Co	
1789	Rubiaceae	Geophila afzelii Hiern	pi	gn	Hb	Gc	Co	
1790	Rubiaceae	Geophila lancistipula Hiern	pi	gn	Hb	Gc	Hl	
1791	Rubiaceae	Geophila obvallata (Schumach.) Didr.	pi	gn	Hb	Gc	Co	
1792	Rubiaceae	Geophila repens (L.) I.M.Johnston	pi	gn	Hb	Gc	Co	
1793	Rubiaceae	Geophila speciosa K. Schum.	pi	gn	Hb	Gc	Co	
1794	Rubiaceae	Hallea ciliata (Aubr. et Pell.) J.F. Leroy	sw	rd	Tr	Gc	Hl	
1795	Rubiaceae	Hallea stipulosa (DC.) Leroy	sw	rd	Tr	Gc	Co	VU A1cd
1796	Rubiaceae	Heinsia crinita (Afzel.) G.Taylor	pi	gn	Sh	Gc	Co	
1797	Rubiaceae	Hymenocoleus glaber Robbrecht	sb	GD	Hb	Cam	Co	
1798	Rubiaceae	Hymenocoleus hirsutus (Benth.) Robbrecht	sb	gn	Hb	Gc	Co	
1799	Rubiaceae	Hymenocoleus libericus (A.Chev. ex Hutch. & Dalziel) Robbrecht	sb	gn	Hb	Gc	Co	
1800	Rubiaceae	Hymenocoleus nervopilosus Robbrecht var. orientalis Robbrecht	sb	bu	Hb	Lg	Co	
1801	Rubiaceae	Hymenocoleus neurodictyon (K.Schum.) Robbr. var. neurodictyon	sb	gn	Hb	Gc	Co	
1802	Rubiaceae	Hymenocoleus rotundifolius (A.Chev. ex Hepper) Robbrecht	sb	gn	Hb	Gc	Co	
1803	Rubiaceae	Hymenocoleus scaphus (K.Schum.) Robbrecht	sb	gn	Hb	Gc	Co	
1804	Rubiaceae	Hymenocoleus subipecacuanha (K.Schum.) Robbrecht	sb	gn	Hb	Gc	Co	
1805	Rubiaceae	Hymenodictyon floribundum (Steud. & Hochst.) B.L.Rob.	sb	gn	Sh	Tra	Co	
1806	Rubiaceae	Ixora aneimenodesma K.Schum. subsp. aneimenodesma	sb	GD	Sh	Cam	Co	
1807	Rubiaceae	Ixora breviflora Hiern	sb	gn	Sh	Gc	Co	
1808	Rubiaceae	Ixora euosmia K.Schum.	ri	bu	Sh	Lg	Co	
1809	Rubiaceae	Ixora guineensis Benth.	sb	gn	Sh	Gu	Co	
1810	Rubiaceae	Ixora hippoperifera Bremek.	sb	bu	Sh	Lg	Co	
1811	Rubiaceae	Ixora macilenta De Block	pi	bu	Sh	Lg	Co	
1812	Rubiaceae	Ixora minutiflora Hiern subsp. chasalliensis De Block	sb	bu	Sh	Lg	Hl	
1813	Rubiaceae	Ixora minutiflora Hiern subsp. Minutiflora	sb	bu	Sh	Lg	Hl	
1814	Rubiaceae	Ixora nematopoda K.Schum.	sb	bu	Sh	Lg	Co	
1815	Rubiaceae	Ixora synactica De Block	sb	BK	Sh	Sw-Cam	Hl	
1816	Rubiaceae	Ixora talbotii Wernham	sb	gn	Sh	Gc	Hl	
1817	Rubiaceae	Keetia acuminata (De Wild.) Bridson	pi	gn	Sh	Gc	Co	
1818	Rubiaceae	Keetia hispida (Benth.) Bridson	pi	gn	Swcl	Gc	Co	
1819	Rubiaceae	Keetia mannii (Hiern) Bridson	pi	gn	Swcl	Gc	Co	
1820	Rubiaceae	Lasianthus batangensis K.Schum.	sb	gn	Sh	Gc	Co	
1821	Rubiaceae	Lasianthus repens Hepper	sb	gn	Hb	Gc	Co	
1822	Rubiaceae	Leptactina arnoldiana De Wild.	np	gn	Sh	Gc	Co	
1823	Rubiaceae	Leptactina involucrata Hook.f.	sb	gn	Sh	Gc	Hl	
1824	Rubiaceae	Leptactina latifolia K.Schum.	sb	bu	Sh	Lg	Hl	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1825	Rubiaceae	Leptactina mannii Hook.f.	ri	gn	Sh	Gc	Co	
1826	Rubiaceae	Massularia acuminata (G.Don) Bullock ex Hoyle	sb	gn	Sh	Gc	Co	
1827	Rubiaceae	Morelia senegalensis A.Rich. ex DC.	ri	gn	Swcl	Gc	Co	
1828	Rubiaceae	Morinda confusa Hutch.	np	gn	Tr	Gc	Hl	
1829	Rubiaceae	Morinda longiflora G.Don	np	gn	Tr	Gc	Hl	
1830	Rubiaceae	Morinda lucida Benth.	pi	gn	Tr	Gc	Hl	
1831	Rubiaceae	Morinda morindoides (Baker) Milne-Redh.	np	gn	Swcl	Gc	Co	
1832	Rubiaceae	Mussaenda arcuata Lam. ex Poir.	pi	gn	Swcl	Tra	Co	
1833	Rubiaceae	Mussaenda chippii Wernham	pi	gn	Swcl	Gc	Co	
1834	Rubiaceae	Mussaenda elegans Schum. & Thonn.	pi	gn	Swcl	Gc	Co	
1835	Rubiaceae	Mussaenda isertiana DC.	pi	bu	Swcl	Lg	Hl	
1836	Rubiaceae	Mussaenda polita Hiern	pi	bu	Swcl	Lg	Co	
1837	Rubiaceae	Mussaenda tenuiflora Benth.	pi	gn	Swcl	Gc	Co	
1838	Rubiaceae	Nauclea diderrichii (De Wild. & T.Durand) Merrill	pi	sc	Tr	Gc	Re	VU A1cd
1839	Rubiaceae	Nauclea pobeguinii (Pobeguin ex Pellegr.) Petit	sw	gn	Tr	Gc	Re	
1840	Rubiaceae	Nauclea vanderguchtii (De Wild.) Petit	pi	gn	Tr	Gc	Hl	
1841	Rubiaceae	Nichallea soyauxii (Hiern) Bridson	np	gn	Sh	Gc	Hl	
1842	Rubiaceae	Oldenlandia affinis (Roem. & Schult.) DC.	pi	gn	Hb	Gc	Hl	
1843	Rubiaceae	Oldenlandia corymbosa L.	pi	gn	Hb	Pa	Hl	
1844	Rubiaceae	Oldenlandia lancifolia (Schumach.) DC.	sw	gn	Hb	Pa	Co	
1845	Rubiaceae	Otomeria guineensis Benth.	pi	gn	Hb	Gc	Co	
1846	Rubiaceae	Otomeria micrantha K.Schum.	pi	gn	Hb	Gc	Co	
1847	Rubiaceae	Otomeria volubilis (K.Schum.) Verdc.	pi	gn	Hcl	Gc	Co	
1848	Rubiaceae	Oxyanthus brevicaulis K.Krause	sb	gn	Sh	Gc	Co	
1849	Rubiaceae	Oxyanthus formosus Hook.f. ex Planch.	sb	gn	Sh	Gc	Co	
1850	Rubiaceae	Oxyanthus gracilis Hiern	sb	gn	Sh	Gc	Co	
1851	Rubiaceae	Oxyanthus laxiflorus K.Schum. ex Hutch. & Dalziel	sb	bu	Sh	Lg	Co	
1852	Rubiaceae	Oxyanthus oliganthus K.Schum.	sb	GD	Sh	Cam	Co	
1853	Rubiaceae	Oxyanthus setosus Keay	sb	gn	Sh	Gu	Co	
1854	Rubiaceae	Oxyanthus speciosus DC. subsp. speciosus	sb	gn	Sh	Gc	Co	
1855	Rubiaceae	Oxyanthus subpunctatus (Hiern) Keay	sw	gn	Sh	Gc	Hl	
1856	Rubiaceae	Oxyanthus unilocularis Hiern	ri	gn	Sh	Gc	Co	
1857	Rubiaceae	Parapentas setigera (Hiern) Verdc.	ri	gn	Hb	Gc	Co	
1858	Rubiaceae	Pauridiantha canthiiflora Hook.f.	sb	bu	Sh	Lg	Co	
1859	Rubiaceae	Pauridiantha dewevrei (De Wild. & Th.Durand) Bremek.	sb	gn	Sh	Gc	Co	
1860	Rubiaceae	Pauridiantha divaricata (K.Schum.) Bremek.	sb	bu	Sh	Lg	Co	
1861	Rubiaceae	Pauridiantha floribunda (K.Schum. & K.Krause) Bremek.	sb	bu	Sh	Lg	Co	
1862	Rubiaceae	Pauridiantha hirtella (Benth.) Bremek.	pi	gn	Sh	Gu	Hl	
1863	Rubiaceae	Pauridiantha multiflora K.Schum.	sb	gn	Sh	Gc	Hl	
1864	Rubiaceae	Pauridiantha venusta N.Hallé	sb	bu	Sh	Lg	Co	
1865	Rubiaceae	Pausinystalia johimbe (K. Schum.) Pierre ex Beille	sb	pk	Tr	Lg	Co	
1866	Rubiaceae	Pausinystalia macroceras (K.Schum.) Pierre ex Beille	sb	gn	Tr	Gc	Co	
1867	Rubiaceae	Pavetta bidentata Hiern var. bidentata	sb	bu	Sh	Lg	Co	
1868	Rubiaceae	Pavetta camerounensis S.Manning subsp. camerounensis	sb	GD	Sh	Cam	Co	
1869	Rubiaceae	Pavetta gabonica Bremek.	sb	bu	Sh	Lg	Co	
1870	Rubiaceae	Pavetta gracilipes Hiern	sb	bu	Sh	Lg	Hl	
1871	Rubiaceae	Pavetta kribiensis S.Manning	sb	BK	Sh	Sw-Cam	Co	
1872	Rubiaceae	Pavetta macrostemon K.Schum.	sb	gn	Sh	Gc	Hl	
1873	Rubiaceae	Pavetta mpomii S.Manning	sb	BK	Sh	Sw-Cam	Co	
1874	Rubiaceae	Pavetta puberula Hiern	sb	gn	Sh	Gc	Co	
1875	Rubiaceae	Pavetta rigida Hiern	sb	gn	Sh	Gc	Co	
1876	Rubiaceae	Pavetta staudtii Hutch. & Dalziel	sb	GD	Sh	Cam	Co	
1877	Rubiaceae	Pavetta tetramera (Hiern) Bremek.	sb	gn	Sh	Gc	Co	
1878	Rubiaceae	Pavetta urophylla Bremek.	sb	gn	Sh	Gc	Co	
1879	Rubiaceae	Pentodon pentandrus (Schum. & Thonn.) Vatke	pi	gn	Hb	Tra	Co	
1880	Rubiaceae	Petitiocodon parviflorum (Keay) Robbrecht	sb	bu	Sh	Lg	Co	
1881	Rubiaceae	Pleiocoryne fernandense (Hiern) S.Rauschert	np	gn	Swcl	Gc	Co	
1882	Rubiaceae	Poecilocalyx schumannii Bremek.	sb	bu	Sh	Lg	Co	
1883	Rubiaceae	Poecilocalyx setiflorus (R.Good) Bremek.	ri	gn	Sh	Gc	Co	
1884	Rubiaceae	Poecilocalyx stipulosa (Hutch. & Dalziel) N.Hallé	sb	gn	Sh	Gc	Co	
1885	Rubiaceae	Polysphaeria macrophylla K.Schum.	sb	gn	Sh	Gc	Co	
1886	Rubiaceae	Pseudosabicea floribunda (K.Schum.) N.Hallé	pi	gn	Hb	Gc	Co	
1887	Rubiaceae	Pseudosabicea medusula (K.Schum.) N.Hallé	np	GD	Hb	Cam	Co	
1888	Rubiaceae	Pseudosabicea proselyta N.Hallé	pi	bu	Hb	Lg	Co	
1889	Rubiaceae	Pseudosabicea segregata (Hiern) N.Hallé	pi	bu	Hb	Lg	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1890	Rubiaceae	Psilanthus mannii Hook.f.	sb	gn	Sh	Gc	Co	
1891	Rubiaceae	Psychotria aemulans K. Schum.	sb	BK	Sh	Campo-Ma'an	Hl	
1892	Rubiaceae	Psychotria avakubiensis De Wild.	sb	bu	Sh	Lg	Co	
1893	Rubiaceae	Psychotria batangana K. Schum.	sb	BK	Sh	Campo-Ma'an	Hl	
1894	Rubiaceae	Psychotria bifaria Hiern var. bifaria	sb	bu	Sh	Lg	Co	
1895	Rubiaceae	Psychotria calceata Petit	sb	bu	Sh	Lg	Co	
1896	Rubiaceae	Psychotria calva Hiern	sb	gn	Sh	Gc	Co	
1897	Rubiaceae	Psychotria camerunensis Petit	sb	GD	Sh	Cam	Co	
1898	Rubiaceae	Psychotria camptopus Verdc.	sb	bu	Sh	Lg	Co	
1899	Rubiaceae	Psychotria densinervia (K.Krause) Verdc.	sb	gn	Sh	Gc	Hl	
1900	Rubiaceae	Psychotria dimorphophylla K. Schum.	ri	BK	Sh	Campo-Ma'an	Hl	
1901	Rubiaceae	Psychotria djumaensis De Wild.	sb	gn	Sh	Gc	Co	
1902	Rubiaceae	Psychotria ebensis K.Schum.	sb	bu	Sh	Lg	Co	
1903	Rubiaceae	Psychotria fimbriatifolia R.D.Good	sb	gn	Sh	Gc	Co	
1904	Rubiaceae	Psychotria gabonica Hiern	sb	gn	Sh	Gc	Co	
1905	Rubiaceae	Psychotria globiceps K.Schum.	sb	gn	Sh	Gu	Co	
1906	Rubiaceae	Psychotria globosa Hiern var. ciliata (Hiern) Petit	sb	bu	Hb	Lg	Co	
1907	Rubiaceae	Psychotria globosa Hiern var. globosa	sb	gn	Hb	Gc	Co	
1908	Rubiaceae	Psychotria guineensis Petit	sb	gn	Sh	Gu	Co	
1909	Rubiaceae	Psychotria humilis Hiern var. humilis	pi	bu	Hb	Lg	Co	
1910	Rubiaceae	Psychotria ingentifolia Petit	sb	bu	Sh	Lg	Co	
1911	Rubiaceae	Psychotria lanceifolia K.Schum.	sb	BK	Sh	Sw-Cam	Co	
1912	Rubiaceae	Psychotria latistipula Benth.	sb	bu	Sh	Lg	Co	
1913	Rubiaceae	Psychotria leptophylla Hiern	sb	gn	Sh	Gc	Co	
1914	Rubiaceae	Psychotria letouzeyi Petit	sb	bu	Sh	Lg	Co	
1915	Rubiaceae	Psychotria mannii (Hook.f.) Hiern	sb	gn	Sh	Gc	Co	
1916	Rubiaceae	Psychotria oligocarpa K.Schum.	sb	BK	Sh	Campo-Ma'an	Co	
1917	Rubiaceae	Psychotria peduncularis (Salisb.) Steyerm. var. suaveolens (Hiern) Verdc.	sb	gn	Sh	Gc	Co	
1918	Rubiaceae	Psychotria peduncularis (Salisb.) Steyerm. var. peduncularis	sb	gn	Sh	Gc	Co	
1919	Rubiaceae	Psychotria psychotrioides (DC.) Roberty	sb	gn	Sh	Gc	Hl	
1920	Rubiaceae	Psychotria sadebeckiana K.Schum. var. elongata Petit	sb	GD	Sh	Cam	Co	
1921	Rubiaceae	Psychotria sadebeckiana K.Schum. var. sadebeckiana	sb	GD	Sh	Cam	Co	
1922	Rubiaceae	Psychotria subobliqua Hiern	sb	gn	Sh	Gc	Co	
1923	Rubiaceae	Psychotria subpunctata Hiern	sb	bu	Sh	Lg	Co	
1924	Rubiaceae	Psychotria venosa (Hiern) Petit	sb	gn	Tr	Gc	Co	
1925	Rubiaceae	Psychotria vogeliana Benth.	sb	gn	Sh	Gc	Co	
1926	Rubiaceae	Psydrax acutiflora (Hiern) Bridson	pi	gn	Tr	Gc	Co	
1927	Rubiaceae	Psydrax arnoldiana (De Wild. & T.Durand) Bridson	pi	gn	Tr	Gc	Hl	
1928	Rubiaceae	Psydrax dunlapii (Hutch. & Dalziel) Bridson	pi	bu	Tr	Lg	Co	
1929	Rubiaceae	Psydrax palma (K.Schum.) Bridson	pi	bu	Tr	Lg	Co	
1930	Rubiaceae	Psydrax subcordata (DC.) Bridson	pi	gn	Tr	Gc	Co	
1931	Rubiaceae	Rothmannia hispida (K.Schum.) Fagerlind	sb	gn	Sh	Gc	Co	
1932	Rubiaceae	Rothmannia longiflora Salisb.	pi	gn	Sh	Tra	Co	
1933	Rubiaceae	Rothmannia lujae (De Wild.) Keay	sb	gn	Sh	Gc	Co	
1934	Rubiaceae	Rothmannia macrocarpa (Hiern) Keay	sb	gn	Sh	Gc	Co	
1935	Rubiaceae	Rothmannia mayumbensis (Good) Keay	sb	gn	Sh	Gc	Co	
1936	Rubiaceae	Rothmannia octomera (Hook.f.) Fagerlind	np	gn	Sh	Gc	Hl	
1937	Rubiaceae	Rothmannia talbotii (Wernham) Keay	sb	gn	Sh	Gc	Co	
1938	Rubiaceae	Rothmannia urcelliformis (Hiern) Bullock ex Robyns	sb	gn	Sh	Tra	Co	
1939	Rubiaceae	Rothmannia whitfieldii (Lindl.) Dandy	sb	gn	Sh	Tra	Co	
1940	Rubiaceae	Rutidea decorticata Hiern	sb	gn	Swcl	Gc	Hl	
1941	Rubiaceae	Rutidea glabra Hiern	sb	gn	Swcl	Gc	Co	
1942	Rubiaceae	Rutidea hispida Hiern	pi	bu	Swcl	Lg	Co	
1943	Rubiaceae	Rutidea membranacea Hiern	sb	gn	Swcl	Gc	Hl	
1944	Rubiaceae	Rutidea nigerica Bridson	pi	gn	Swcl	Gc	Hl	
1945	Rubiaceae	Rutidea olenotricha Hiern	pi	gn	Swcl	Gc	Hl	
1946	Rubiaceae	Rutidea smithii Hiern subsp. smithii	pi	gn	Swcl	Gc	Hl	
1947	Rubiaceae	Rytigynia membranacea (Hiern) Robyns	pi	gn	Swcl	Gc	Hl	
1948	Rubiaceae	Rytigynia rubra Robyns	pi	gn	Swcl	Gc	Co	
1949	Rubiaceae	Sabicea calycina Benth.	pi	gn	Hcl	Gc	Co	
1950	Rubiaceae	Sabicea capitellata Benth.	pi	bu	Hcl	Lg	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
1951	Rubiaceae	Sabicea dinklagei K.Schum.	pi	gn	Hcl	Gc	Hl	
1952	Rubiaceae	Sabicea gabonica (Hiern) Hepper	pi	gn	Hcl	Gc	Co	
1953	Rubiaceae	Sabicea pilosa Hiern	pi	bu	Hcl	Lg	Co	
1954	Rubiaceae	Sabicea speciosa K.Schum.	pi	gn	Hcl	Gu	Co	
1955	Rubiaceae	Sacosperma paniculatum (Benth.) G.Taylor	ri	gn	Swcl	Tra	Co	
1956	Rubiaceae	Schumanniophyton magnificum (K.Schum.) Harms	sb	gn	Sh	Gc	Co	
1957	Rubiaceae	Sericanthe auriculata (Keay) Robbrecht	sb	bu	Sh	Lg	Co	
1958	Rubiaceae	Sericanthe jacfelicis (N.Hallé) Robbrecht	sb	bu	Sh	Lg	Co	
1959	Rubiaceae	Sherbournia ailarama N.Hallé	sb	gn	Swcl	Gc	Re	
1960	Rubiaceae	Sherbournia zenkeri Hua	np	bu	Swcl	Lg	Co	
1961	Rubiaceae	Stipularia africana P.Beauv.	pi	gn	Sh	Gc	Co	
1962	Rubiaceae	Tarenna asteriscus (K.Schum.) Bremek.	sb	gn	Swcl	Gc	Co	
1963	Rubiaceae	Tarenna bipindensis (K.Schum.) Bremek.	sb	gn	Swcl	Gu	Hl	
1964	Rubiaceae	Tarenna conferta (Benth.) Hiern	sb	gn	Sh	Gc	Hl	
1965	Rubiaceae	Tarenna eketensis Werham	sb	gn	Sh	Gc	Co	
1966	Rubiaceae	Tarenna grandiflora Hiern	sb	bu	Tr	Lg	Co	
1967	Rubiaceae	Tarenna lasiorachis (K.Schum. & K.Krause) Bremek.	sb	bu	Sh	Lg	Co	
1968	Rubiaceae	Tarenna thomasii Hutch. & Dalziel	sb	gn	Sh	Gc	Co	
1969	Rubiaceae	Tarenna vignei Hutch. & Dalziel var. subglabra Keay	sb	gn	Sh	Gc	Co	
1970	Rubiaceae	Tricalysia amplexicaulis Robbrecht	sb	GD	Sh	Cam	Co	
1971	Rubiaceae	Tricalysia biafrana Hiern	sb	gn	Tr	Gc	Hl	
1972	Rubiaceae	Tricalysia coriacea (Benth.) Hiern subsp. Coriacea	sb	gn	Sh	Tra	Co	
1973	Rubiaceae	Tricalysia gossweileri S.Moore	sb	gn	Sh	Gc	Co	
1974	Rubiaceae	Tricalysia lasiodelphys (K.Schum. & K.Krause) A.Chev. subsp. lasiodelphys	sb	bu	Sh	Lg	Co	
1975	Rubiaceae	Tricalysia macrophylla K.Schum.	np	gn	Tr	Gu	Co	
1976	Rubiaceae	Tricalysia obstetrix N.Hallé	sb	bu	Sh	Lg	Co	
1977	Rubiaceae	Tricalysia oligoneura K.Schum.	sb	gn	Sh	Gc	Co	
1978	Rubiaceae	Tricalysia pallens Hiern	sb	gn	Sh	Tra	Hl	
1979	Rubiaceae	Tricalysia pedunculosa (N.Hallé) Robbrecht var. pedunculosa	sb	bu	Sh	Lg	Co	
1980	Rubiaceae	Tricalysia reflexa Hutch. var. reflexa	sb	gn	Sh	Gu	Hl	
1981	Rubiaceae	Tricalysia soyauxii K.Schum.	sb	bu	Sh	Lg	Co	
1982	Rubiaceae	Tricalysia sylvae Robbr.	sb	bu	Sh	Lg	Co	
1983	Rubiaceae	Tricalysia talbotii (Wernham) Keay	sb	GD	Sh	Cam	Co	
1984	Rubiaceae	Tricalysia vadensis Robbr.	sb	bu	Sh	Lg	Co	
1985	Rubiaceae	Trichostachys aurea Hiern	sb	gn	Sh	Gc	Co	
1986	Rubiaceae	Uncaria africana G.Don subsp. africana	np	gn	Lwcl	Gc	Co	
1987	Rubiaceae	Uncaria donisii Petit	np	gn	Lwcl	Gc	Co	
1988	Rubiaceae	Vangueriella campylacantha (Mildbr.) Verdc.	sb	gn	Sh	Gc	Co	
1989	Rubiaceae	Vangueriella chlorantha (K.Schum.) Verdc.	sb	gn	Sh	Gc	Co	
1990	Rubiaceae	Vangueriella laxiflora (K.Schum.) Verdc.	sb	GD	Swcl	Cam	Hl	
1991	Rubiaceae	Vangueriopsis religiosa (K.Schum.) Verdc.	sb	gn	Sh	Gc	Co	
1992	Rubiaceae	Virectaria major (K.Schum.) Verdc. var. major	pi	gn	Hb	Gc	Co	
1993	Rubiaceae	Virectaria multiflora (Sm.) Brenan	pi	gn	Hb	Gc	Co	
1994	Rubiaceae	Virectaria procumbens (Sm.) Bremek	pi	gn	Hb	Gc	Co	
1995	Rutaceae	Citropsis gabunensis (Engl.) Swingle & Kellerman	sb	gn	Sh	Gc	Co	
1996	Rutaceae	Oricia lecomteana Pierre	sb	bu	Tr	Lg	Co	
1997	Rutaceae	Vepris glaberrima (Engl.) J.B.Hall	sb	gn	Sh	Gc	Hl	
1998	Rutaceae	Vepris heterophylla Letouzey	sb	bu	Sh	Gc	Hl	EN A1c, B1+2c
1999	Rutaceae	Vepris soyauxii (Engl.) W.Mziray	sb	gn	Sh	Gc	Hl	
2000	Rutaceae	Zanthoxylum dinklagei (Engl.) P.G.Waterman	pi	bu	Lwcl	Lg	Co	
2001	Rutaceae	Zanthoxylum gilletii (De Wild.) P.G.Waterman	pi	gn	Tr	Gc	Re	
2002	Rutaceae	Zanthoxylum heitzii (Aubrév. & Pellegr.) P.G.Waterman	pi	gn	Tr	Gc	Re	
2003	Rutaceae	Zanthoxylum lemairei (De Wild.) P.G.Waterman	pi	gn	Tr	Gc	Re	
2004	Sapindaceae	Allophylus africanus P.Beauv.	pi	gn	Tr	Tra	Co	
2005	Sapindaceae	Allophylus grandifolius (Baker) Radlk.	sb	bu	Tr	Lg	Co	
2006	Sapindaceae	Allophylus welwitschii Gilg	sb	gn	Sh	Gc	Co	
2007	Sapindaceae	Aporrhiza urophylla Gilg	sb	gn	Tr	Gu	Hl	
2008	Sapindaceae	Blighia welwitschii (Hiern) Radlk.	np	gn	Tr	Gc	Co	
2009	Sapindaceae	Cardiospermum halicacabum L.	pi	gn	Hcl	Pa	Hl	
2010	Sapindaceae	Chytranthus angustifolius Exell	sb	gn	Sh	Gu	Co	
2011	Sapindaceae	Chytranthus edulis Pierre	sb	bu	Sh	Lg	Co	
2012	Sapindaceae	Chytranthus gilletii De Wild.	sb	gn	Sh	Gc	Co	
2013	Sapindaceae	Chytranthus klaineanus Radlk.	sb	bu	Sh	Lg	Co	
2014	Sapindaceae	Chytranthus macrobotrys (Gilg) Exell & Mendonça	ri	gn	Sh	Gc	Co	

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2015	Sapindaceae	Chytranthus macrophyllus Gilg.	sb	bu	Sh	Lg	Co	
2016	Sapindaceae	Chytranthus mortehani (De Wild.) De Vold. ex Hauman	sb	gn	Sh	Gc	Co	
2017	Sapindaceae	Chytranthus setosus Radlk.	sb	gn	Sh	Gc	Co	
2018	Sapindaceae	Chytranthus talbotii (Baker f.) Keay	sb	gn	Sh	Gc	Co	
2019	Sapindaceae	Deinbollia cauliflora Hauman	sb	gn	Sh	Gu	Co	
2020	Sapindaceae	Deinbollia cuneifolia Bak.	sb	bu	Sh	Lg	Hl	
2021	Sapindaceae	Deinbollia dasybotrys Gilg ex Radlk.	sb	bu	Sh	Lg	Hl	
2022	Sapindaceae	Deinbollia macroura Gilg ex Radlk.	sb	BK	Sh	Campo-Ma'an	Hl	
2023	Sapindaceae	Deinbollia maxima Gilg	sb	bu	Sh	Lg	Co	
2024	Sapindaceae	Deinbollia mezilii D.W.Thomas & D.J.Harris	sb	BK	Sh	Campo-Ma'an	Co	
2025	Sapindaceae	Deinbollia pycnophylla Gilg ex Radlk.	sb	bu	Sh	Lg	Co	
2026	Sapindaceae	Dodonaea viscosa (L.) Jacq.	pi	gn	Sh	In	Co	
2027	Sapindaceae	Eriocoelum macrocarpum Gilg	sb	gn	Sh	Gu	Co	
2028	Sapindaceae	Eriocoelum petiolare Radlk.	sb	bu	Sh	Lg	Co	
2029	Sapindaceae	Eriocoelum racemosum Baker	sb	gn	Tr	Gc	Co	
2030	Sapindaceae	Laccodiscus ferrugineus (Baker) Radlk.	sb	bu	Tr	Lg	Co	
2031	Sapindaceae	Laccodiscus klaineanus Pierre ex Engl.	sb	bu	Sh	Lg	Co	
2032	Sapindaceae	Laccodiscus pseudostipularis Radlk.	sb	gn	Sh	Gc	Co	
2033	Sapindaceae	Lecaniodiscus cupanioides Planch. ex Benth.	sb	gn	Tr	Gc	Co	
2034	Sapindaceae	Lychnodiscus grandifolius Radlk.	sb	bu	Tr	Lg	Co	
2035	Sapindaceae	Pancovia laurentii (de Wild.) Gilg ex De Wild.	sb	gn	Tr	Gc	Co	
2036	Sapindaceae	Paullinia pinnata L.	pi	gn	Swcl	Tra	Co	
2037	Sapindaceae	Placodiscus angustifolius Radlk.	sb	gn	Tr	Gc	Co	
2038	Sapindaceae	Placodiscus glandulosus Radlk.	sb	bu	Tr	Lg	Co	
2039	Sapindaceae	Placodiscus opacus Radlk.	sb	bu	Sh	Lg	Co	
2040	Sapotaceae	Aningeria robusta (A.Chev.) Aubrév. & Pellegr.	np	sc	Tr	Gc	Re	
2041	Sapotaceae	Autranella congolensis (De Wild.) A.Chev.	np	bu	Tr	Gc	Re	CR A1cd
2042	Sapotaceae	Baillonella toxisperma Pierre	np	bu	Tr	Lg	Re	VU A1cd
2043	Sapotaceae	Chrysophyllum africanum sensu Baker	sb	rd	Tr	Tra	Co	
2044	Sapotaceae	Chrysophyllum beguei Aubrév. & Pellegr.	np	pk	Tr	Gc	Co	
2045	Sapotaceae	Chrysophyllum perpulchrum Mildbr. ex Hutch. & Dalziel	sb	gn	Tr	Gc	Hl	
2046	Sapotaceae	Chrysophyllum pruniforme Pierre ex Engl.	sb	gn	Tr	Gc	Co	
2047	Sapotaceae	Chrysophyllum ubangiense (De Wild.) D.J.Harris	sb	gn	Tr	Gc	Hl	
2048	Sapotaceae	Chrysophyllum welwitschii Engl.	pi	gn	Tr	Gc	Hl	
2049	Sapotaceae	Delpydora gracilis A.Chev.	sb	bu	Sh	Lg	Co	
2050	Sapotaceae	Delpydora macrophylla Pierre	sb	bu	Sh	Lg	Co	
2051	Sapotaceae	Englerophytum hallei Aubrév. & Pellegr.	sb	bu	Tr	Lg	Co	
2052	Sapotaceae	Englerophytum letestui Aubrév. & Pellegr.	sb	bu	Tr	Lg	Hl	
2053	Sapotaceae	Englerophytum stelechanthum Krause	sb	gn	Tr	Gc	Co	
2054	Sapotaceae	Gluema ivorensis Aubrév. & Pellegr.	np	bu	Tr	Gc	Co	VU B1+2c
2055	Sapotaceae	Lasersisia seretii (De Wild.) Liben	rh	gn	Tr	Gc	Co	
2056	Sapotaceae	Malacantha alnifolia (Baker) Pierre	pi	gn	Tr	Gc	Co	
2057	Sapotaceae	Manilkara obovata (Sabine & G.Don) J.H.Hemsley	pi	gn	Tr	Tra	Co	
2058	Sapotaceae	Neolemonniera batesii (Engl.) Heine	rh	GD	Tr	Lg	Co	
2059	Sapotaceae	Omphalocarpum elatum Miers	np	gn	Tr	Gc	Hl	
2060	Sapotaceae	Omphalocarpum procerum P.Beauv.	np	gn	Tr	Gc	Re	
2061	Sapotaceae	Pachystela brevipes (Baker) Baill. ex Engl.	rh	gn	Tr	Gc	Co	
2062	Sapotaceae	Synsepalum brevipes (Baker) T.D.Penn.	sb	gn	Tr	Tra	Co	
2063	Sapotaceae	Synsepalum dulcificum (Schum. & Thonn.) Daniell	sb	gn	Tr	Gc	Co	
2064	Sapotaceae	Synsepalum longecuneatum De Wild.	sb	bu	Sh	Lg	Co	
2065	Sapotaceae	Synsepalum msolo (Engl.) T.D.Penn.	sb	gn	Tr	Tra	Co	
2066	Sapotaceae	Synsepalum subcordatum De Wild.	sb	gn	Sh	Gc	Co	
2067	Sapotaceae	Synsepalum zenkeri Aubrev. & Pelligr.	sb	bu	Sh	Lg	Co	
2068	Sapotaceae	Tieghemella africana Pierre	np	pk	Tr	Lg	Re	EN A1cd
2069	Sapotaceae	Tridesmostemon omphalocarpoides Engl.	np	gn	Tr	Gc	Re	
2070	Schizaeaceae	Lygodium microphyllum (Cav.) R.Br.	pi	gn	Ep	Tra	Hl	
2071	Schizaeaceae	Lygodium smithianum C.Presl. ex Kuhn	pi	gn	Ep	Tra	Hl	
2072	Scrophulariaceae	Alectra sessiliflora (Vahl) Kuntze var. monticola (Engl.) Melch.	pi	gn	Hb	Tra	Co	
2073	Scrophulariaceae	Artanema longifolium (L.) Vatke	sw	gn	Hb	Gc	Co	
2074	Scrophulariaceae	Lindernia crustacea (L.) F.Muell.	pi	gn	Hb	Tra	Hl	
2075	Scrophulariaceae	Lindernia diffusa (L.) Wettst.	pi	gn	Hb	Tra	Hl	
2076	Scrophulariaceae	Lindernia nummulariifolia (D.Don) Wettst.	pi	gn	Hb	Tra	Hl	
2077	Scrophulariaceae	Scoparia dulcis L.	pi	gn	Hb	Pa	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
2078	Scrophulariaceae	Torenia dinklagei Engl.	pi	gn	Hb	Tra	Co	
2079	Scrophulariaceae	Torenia thouarsii (Cham. & Schltdl.) Kuntze	pi	gn	Hb	Tra	Hl	
2080	Scytopetalaceae	Brazzeia congoensis Baill.	sw	gn	Sh	Gc	Hl	
2081	Scytopetalaceae	Brazzeia soyauxii (Oliv.) Tiegh. var. soyauxii	sb	bu	Sh	Lg	Hl	
2082	Scytopetalaceae	Oubanguia africana Baill.	ri	gn	Tr	Gc	Co	
2083	Scytopetalaceae	Oubanguia alata Baker f.	ri	bu	Tr	Lg	Co	
2084	Scytopetalaceae	Oubanguia laurifolia (Pierre) Tiegh.	sb	bu	Tr	Lg	Co	
2085	Scytopetalaceae	Pierrina zenkeri Engl.	sb	GD	Sh	Cam	Co	
2086	Scytopetalaceae	Rhaptopetalum coriaceum Oliv.	sb	bu	Sh	Lg	Co	
2087	Scytopetalaceae	Rhaptopetalum depressum Letouzey	sb	bu	Sh	Lg	Hl	
2088	Scytopetalaceae	Rhaptopetalum sessilifolium Engl	sb	BK	Sh	Sw-Cam	Hl	
2089	Scytopetalaceae	Scytopetalum klaineanum Pierre ex Engl.	sb	gn	Tr	Gc	Co	
2090	Selaginellaceae	Selaginella blepharophylla Alston	pi	gn	Hb	Gc	Co	
2091	Selaginellaceae	Selaginella cathedrifolia Spring	sb	bu	Hb	Lg	Co	
2092	Selaginellaceae	Selaginella kalbreyeri Baker	sb	gn	Hb	Gc	Co	
2093	Selaginellaceae	Selaginella kraussiana (Kunze) A.Braun	pi	gn	Hb	Tra	Co	
2094	Selaginellaceae	Selaginella molliceps Spring	pi	gn	Hb	Gc	Co	
2095	Selaginellaceae	Selaginella myosurus (Sw.) Alston	pi	gn	Hcl	Gc	Co	
2096	Selaginellaceae	Selaginella squarrosa Baker	pi	gn	Hb	Gc	Co	
2097	Selaginellaceae	Selaginella vogelii Spring	sb	gn	Hb	Tra	Co	
2098	Simaroubaceae	Brucea guineensis G. Don.	pi	gn	Tr	Gc	Re	
2099	Simaroubaceae	Hannoa klaineana Pierre & Engl.	pi	gn	Tr	Gc	Co	
2100	Simaroubaceae	Nothospondias staudtii Engl.	np	bu	Tr	Gc	Co	VU B1+2c
2101	Simaroubaceae	Odyendyea gabonensis (Pierre) Engl.	np	bu	Tr	Lg	Co	
2102	Simaroubaceae	Quassia africana (Baill.) Baill.	sb	gn	Sh	Gc	Co	
2103	Smilacaceae	Smilax anceps Willd.	pi	gn	Swcl	Gc	Co	
2104	Solanaceae	Physalis angulata L.	pi	gn	Hb	Tra	Hl	
2105	Solanaceae	Schwenckia americana L.	pi	gn	Hb	Tra	Co	
2106	Solanaceae	Solanum nigrum L.	pi	gn	Hb	Tra	Re	
2107	Solanaceae	Solanum terminale Forssk.	pi	gn	Hb	Tra	Re	
2108	Solanaceae	Solanum torvum Sw.	pi	gn	Sh	Pa	Co	
2109	Sterculiaceae	Byttneria guineensis Keay & Milne-Redh.	ri	gn	Sh	Tra	Hl	
2110	Sterculiaceae	Cola acuminata (P.Beauv.) Schott & Endl.	pi	pk	Tr	Gc	Re	
2111	Sterculiaceae	Cola altissima Engl.	sb	gn	Tr	Gc	Hl	
2112	Sterculiaceae	Cola argentea Mast.	sb	bu	Sh	Lg	Co	
2113	Sterculiaceae	Cola attiensis Aubrév. & Pellegr. var. bodardii (Pellegr.) N.Hallé	sb	bu	Sh	Lg	Co	
2114	Sterculiaceae	Cola brevipes K.Schum.	sb	bu	Sh	Lg	Co	
2115	Sterculiaceae	Cola caricaefolia (G. Don) K. Schum.	sb	gn	Sh	Gc	Co	
2116	Sterculiaceae	Cola cauliflora Mast.	sb	bu	Sh	Lg	Co	
2117	Sterculiaceae	Cola chlamydantha K.Schum.	sb	gn	Tr	Gc	Co	
2118	Sterculiaceae	Cola cordifolia (Cav.) R.Br.	np	gn	Tr	Gc	Co	
2119	Sterculiaceae	Cola digitata Mast.	sb	gn	Sh	Gc	Co	
2120	Sterculiaceae	Cola fibrillosa Engl. & Krause	sb	BK	Tr	Sw-Cam	Co	
2121	Sterculiaceae	Cola ficifolia Mast.	sb	bu	Sh	Lg	Co	
2122	Sterculiaceae	Cola flaviflora Engl. & K.Krause	sw	bu	Sh	Lg	Co	
2123	Sterculiaceae	Cola flavo-velutina K.Schum.	sb	bu	Sh	Lg	Co	
2124	Sterculiaceae	Cola gabonensis Mast.	sb	bu	Sh	Lg	Co	
2125	Sterculiaceae	Cola heterophylla (P.Beauv.) Schott & Endl.	sb	gn	Sh	Gu	Hl	
2126	Sterculiaceae	Cola hispida Brenan & Keay	sb	gn	Sh	Gu	Co	
2127	Sterculiaceae	Cola hypochrysea K.Schum.	sw	bu	Tr	Lg	Co	VU A1c
2128	Sterculiaceae	Cola lateritia K.Schum. var. lateritia	sb	gn	Tr	Gc	Co	
2129	Sterculiaceae	Cola lepidota K.Schum.	sb	bu	Tr	Lg	Co	
2130	Sterculiaceae	Cola letouzeyana Nkongmeneck	sb	GD	Sh	Cam	Co	
2131	Sterculiaceae	Cola marsupium K.Schum.	sb	gn	Sh	Gc	Co	
2132	Sterculiaceae	Cola nitida (Vent.) Schott & Endl.	pi	pk	Tr	In	Re	
2133	Sterculiaceae	Cola pachycarpa K.Schum.	sb	bu	Tr	Lg	Co	
2134	Sterculiaceae	Cola philipi-jonesii Brenan & Keay	sb	bu	Sh	Lg	Co	EN B1+2c
2135	Sterculiaceae	Cola praeacuta Brenan & Keay	sb	GD	Sh	Cam	Co	CR A1c+2c
2136	Sterculiaceae	Cola ricinifolia Engl. & K.Krause	sw	bu	Sh	Lg	Co	
2137	Sterculiaceae	Cola rostrata K.Schum.	sb	bu	Tr	Lg	Co	
2138	Sterculiaceae	Cola semecarpophylla K.Schum.	sb	bu	Sh	Lg	Hl	LR/cd
2139	Sterculiaceae	Cola subglaucescens Engl.	sb	BK	Tr	Sw-Cam	Hl	
2140	Sterculiaceae	Cola sulcata Engl.	sb	BK	Tr	Sw-Cam	Hl	
2141	Sterculiaceae	Cola verticillata (Thonn.) Stapf ex A.Chev.	sb	pk	Tr	Gc	Co	
2142	Sterculiaceae	Leptonychia batangensis (C.H.Wright) Burret	sb	bu	Sh	Lg	Co	

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2143	Sterculiaceae	Leptonychia echinocarpa K.Schum.	sb	bu	Sh	Lg	Co	
2144	Sterculiaceae	Leptonychia lasiogyne K.Schum.	sb	gn	Sh	Gc	Co	
2145	Sterculiaceae	Leptonychia macrantha K.Schum.	sb	gn	Sh	Gc	Co	
2146	Sterculiaceae	Leptonychia manezeuae Nkongmeneck	sb	bu	Sh	Lg	Co	
2147	Sterculiaceae	Leptonychia multiflora K.Schum.	sb	gn	Sh	Gc	Co	
2148	Sterculiaceae	Leptonychia pallida K.Schum.	sb	bu	Sh	Lg	Co	
2149	Sterculiaceae	Mansonia altissima (A.Chev.) A.Chev. var. kamerunica Jacq.-Fél.	np	pk	Tr	Gu	Re	EN A1cd
2150	Sterculiaceae	Melochia bracteosa F. Hoffm.	pi	gn	Hb	Tra	Hl	
2151	Sterculiaceae	Melochia corchorifolia L.	pi	gn	Hb	Tra	Hl	
2152	Sterculiaceae	Octolobus angustatus Hutch.	sb	gn	Tr	Gc	Hl	
2153	Sterculiaceae	Octolobus heteromerus K. Schum.	sb	gn	Tr	Gc	Co	
2154	Sterculiaceae	Octolobus spectabilis Welw.	sb	gn	Tr	Gc	Co	
2155	Sterculiaceae	Octolobus zenkeri Engl.	sb	bu	Tr	Lg	Co	
2156	Sterculiaceae	Pterygota bequaertii De Wild.	np	rd	Tr	Gc	Re	VU A1cd
2157	Sterculiaceae	Pterygota macrocarpa K.Schum.	np	rd	Tr	Gc	Re	VU A1cd
2158	Sterculiaceae	Scaphopetalum acuminatum Engl. & K. Krause	sb	BK	Sh	Campo-Ma'an	Hl	
2159	Sterculiaceae	Scaphopetalum blackii Mast.	sb	gn	Sh	Gc	Co	
2160	Sterculiaceae	Scaphopetalum brunneo-purpureum Engl. & K. Krause	sb	BK	Sh	Campo-Ma'an	Hl	
2161	Sterculiaceae	Scaphopetalum longipedunculatum Mast.	sb	bu	Sh	Lg	Hl	
2162	Sterculiaceae	Scaphopetalum macranthum K.Schum.	sb	bu	Sh	Lg	Co	
2163	Sterculiaceae	Scaphopetalum ngounyense Pellegr.	sb	bu	Sh	Lg	Co	
2164	Sterculiaceae	Scaphopetalum paxii H. Winkler	sb	BK	Sh	Sw-Cam	Hl	
2165	Sterculiaceae	Scaphopetalum thonneri Willd.	sb	gn	Sh	Gc	Co	
2166	Sterculiaceae	Scaphopetalum zenkeri K.Schum.	sb	BK	Sh	Sw-Cam	Co	
2167	Sterculiaceae	Sterculia oblonga Mast.	pi	bu	Tr	Gc	Re	VU A1cd
2168	Sterculiaceae	Sterculia tragacantha Lindl.	pi	gn	Tr	Tra	Re	
2169	Sterculiaceae	Theobroma cacao L.	pi	gn	Sh	In	Re	
2170	Sterculiaceae	Triplochiton scleroxylon K.Schum.	np	sc	Tr	Gc	Re	
2171	Thelypteridaceae	Cyclosorus afer (Christ) Ching	pi	gn	Hb	Tra	Co	
2172	Thymelaeaceae	Craterosiphon scandens Engl. & Gilg	np	gn	Swcl	Gc	Hl	
2173	Thymelaeaceae	Dicranolepis buchholzii Engl. & Gilg	sb	gn	Sh	Gc	Co	
2174	Thymelaeaceae	Dicranolepis disticha Planch.	sb	gn	Sh	Gc	Co	
2175	Thymelaeaceae	Dicranolepis glandulosa H.H.W.Pearson	sb	GD	Sh	Cam	Co	
2176	Thymelaeaceae	Dicranolepis vestita Engl.	sb	bu	Sh	Lg	Co	
2177	Thymelaeaceae	Octolepis casearia Oliv.	sb	bu	Sh	Lg	Co	
2178	Thymelaeaceae	Octolepis decalepis Gilg	sb	gn	Sh	Gc	Co	
2179	Thymelaeaceae	Peddiea africana Harv.	sb	gn	Sh	Gc	Co	
2180	Tiliaceae	Ancistrocarpus densispinosus Oliv.	pi	bu	Sh	Lg	Co	
2181	Tiliaceae	Christiana africana DC.	sb	gn	Tr	Pa	Hl	
2182	Tiliaceae	Clappertonia ficifolia (Willd.) Decne.	pi	gn	Hb	Tra	Co	
2183	Tiliaceae	Clappertonia polyandra (K.Schum.) Bech.	pi	gn	Hb	Gc	Co	
2184	Tiliaceae	Corchorus aestuans L.	sw	gn	Hb	Tra	Hl	
2185	Tiliaceae	Corchorus olitorus L.	sw	gn	Hb	Pa	Hl	
2186	Tiliaceae	Desplatsia chrysochlamys (Mildbr. & Burret) Mildbr. & Burret	sb	gn	Sh	Gc	Hl	
2187	Tiliaceae	Desplatsia dewevrei (De Wild. & T.Durand) Burret	sw	gn	Sh	Gc	Co	
2188	Tiliaceae	Desplatsia subericarpa Bocq.	sb	gn	Sh	Gc	Co	
2189	Tiliaceae	Duboscia macrocarpa Bocq.	sb	gn	Tr	Gc	Re	
2190	Tiliaceae	Glyphaea brevis (Spreng.) Monach.	sb	gn	Sh	Tra	Co	
2191	Tiliaceae	Microcos coriacea (Mast.) Burret	sb	gn	Tr	Gc	Co	
2192	Tiliaceae	Triumfetta cordifolia A.Rich.	pi	gn	Hb	Tra	Co	
2193	Tiliaceae	Triumfetta rhomboidea Jacq.	pi	gn	Hb	Pa	Hl	
2194	Triuridaceae	Sciaphila ledermannii Engl.	Sa	bu	Hb	Lg	Co	
2195	Ulmaceae	Celtis mildbraedii Engl.	np	gn	Tr	Gc	Re	
2196	Ulmaceae	Celtis tessmannii Rendle	np	gn	Tr	Gc	Co	
2197	Ulmaceae	Celtis zenkeri Engl.	np	gn	Tr	Gc	Re	
2198	Ulmaceae	Trema orientalis (L.) Blume	pi	gn	Sh	Pal	Re	
2199	Umbelliferae	Centella asiatica (L.) Urb.	pi	gn	Hb	Pa	Re	
2200	Umbelliferae	Cryptotaenia africana (Hook.f.) Drude	pi	gn	Hb	Tra	Hl	
2201	Umbelliferae	Eryngium foetidum L.	pi	gn	Hb	In	Re	
2202	Umbelliferae	Hydrocotyle bonariensis Lam.	pi	gn	Hb	Tra	Hl	
2203	Urticaceae	Boehmeria platyphylla D.Don	pi	gn	Hb	Pa	Co	
2204	Urticaceae	Elatostema paivaeanum Wedd.	sb	GD	Hb	Tra	Hl	
2205	Urticaceae	Laportea aestuans (L.) Chew	pi	gn	Hb	Tra	Hl	

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2206	Urticaceae	Laportea ovalifolia (Schumach.) Chew	pi	gn	Hb	Tra	Co	
2207	Urticaceae	Pilea sublucens Wedd.	pi	gn	Hb	Gc	Hl	
2208	Urticaceae	Pouzolzia denudata De Wild. & T.Durand	pi	gn	Hb	Gc	Hl	
2209	Urticaceae	Pouzolzia guineensis Benth.	pi	gn	Hb	Gc	Hl	
2210	Urticaceae	Procris crenata C.B.Robinson	pi	gn	Hb	Gc	Co	
2211	Urticaceae	Urera cameroonensis Wedd.	sb	gn	Hcl	Gc	Co	
2212	Urticaceae	Urera cordifolia Engl.	pi	gn	Hcl	Gc	Co	
2213	Urticaceae	Urera gravenreuthi Engl.	pi	GD	Hcl	Cam	Co	
2214	Urticaceae	Urera repens (Wedd.) Rendle	pi	gn	Hb	Gc	Co	
2215	Urticaceae	Urera thonneri De Wild. & T.Durand	pi	gn	Hcl	Gc	Hl	
2216	Urticaceae	Urera trinervis (Hochst.) Friis & Immelmann	pi	gn	Hcl	Tra	Co	
2217	Verbenaceae	Clerodendrum bipindense Gürke	pi	bu	Lwcl	Lg	Co	
2218	Verbenaceae	Clerodendrum buettneri Gürke	pi	bu	Swcl	Lg	Co	
2219	Verbenaceae	Clerodendrum capitatum (Willd.) Schum.	pi	gn	Swcl	Tra	Hl	
2220	Verbenaceae	Clerodendrum dusenii Gürke	pi	gn	Swcl	Gc	Hl	
2221	Verbenaceae	Clerodendrum melanocrater Gürke	pi	gn	Swcl	Gc	Co	
2222	Verbenaceae	Clerodendrum silvanum Henriq. var. buchholzii (Gürke) Verdc.	pi	gn	Swcl	Tra	Co	
2223	Verbenaceae	Clerodendrum umbellatum Poir.	pi	gn	Swcl	Gc	Hl	
2224	Verbenaceae	Clerodendrum violaceum Gürke	pi	gn	Swcl	Gc	Hl	
2225	Verbenaceae	Lantana camara L.	pi	gn	Sh	In	Co	
2226	Verbenaceae	Vitex doniana Sweet	rh	gn	Tr	Gc	Co	
2227	Verbenaceae	Vitex grandifolia Gürke	sb	gn	Tr	Gc	Re	
2228	Verbenaceae	Vitex lehmbachii Gürke	sb	gn	Sh	Gc	Co	
2229	Verbenaceae	Vitex oxycuspis Baker	sb	gn	Sh	Gc	Co	
2230	Verbenaceae	Vitex rivularis Gürke	np	gn	Tr	Gc	Re	
2231	Verbenaceae	Vitex thyrsiflora Baker	sb	gn	Sh	Gc	Co	
2232	Verbenaceae	Vitex zenkeri Gürke	sb	gn	Sh	Gc	Hl	
2233	Violaceae	Allexis batangae (Engl.) Melchior	sb	bu	Sh	Lg	Co	
2234	Violaceae	Allexis cauliflora (Oliv.) Pierre	sb	bu	Sh	Lg	Co	VU A1c, B1+2c
2235	Violaceae	Allexis obanensis (Baker f.) Melchior	sb	bu	Sh	Lg	Co	VU B1+2c
2236	Violaceae	Allexis zygomorpha Achoundong & Onana	sb	BK	Sh	Cam	Re	
2237	Violaceae	Rinorea albidiflora Engl.	sb	bu	Sh	Lg	Co	
2238	Violaceae	Rinorea angustifolia (Thou.) Baill.	sb	gn	Tr	Gc	Hl	
2239	Violaceae	Rinorea breviracemosa Chipp	sb	gn	Sh	Gu	Co	
2240	Violaceae	Rinorea campoensis M. Brandt ex Engl.	sb	BK	Sh	Campo-Ma'an	Co	
2241	Violaceae	Rinorea caudata (Oliv.) Kuntze	sb	gn	Sh	Gc	Co	
2242	Violaceae	Rinorea dentata P.Beauv.	sb	bu	Sh	Lg	Co	
2243	Violaceae	Rinorea exappendiculata Engl. ex Brandt	sb	bu	Sh	Lg	Co	
2244	Violaceae	Rinorea gabunensis Engl.	sb	bu	Sh	Lg	Co	
2245	Violaceae	Rinorea ilicifolia (Welw. ex Oliv.) Kuntze	sb	gn	Tr	Gc	Co	
2246	Violaceae	Rinorea kamerunensis Engl.	sb	bu	Sh	Lg	Co	
2247	Violaceae	Rinorea ledermannii Engl.	sb	bu	Sh	Lg	Co	
2248	Violaceae	Rinorea longicuspis Engl.	sb	gn	Sh	Gc	Co	
2249	Violaceae	Rinorea longisepala Engl.	sb	bu	Sh	Lg	Co	
2250	Violaceae	Rinorea microglossa Engl.	sb	BK	Sh	Sw-Cam	Hl	
2251	Violaceae	Rinorea oblongifolia (C.H.Wright) Marqua	sb	gn	Tr	Gc	Co	
2252	Violaceae	Rinorea sp. nov. 1 ined.	sb	GD	Sh	Cam	Co	
2253	Violaceae	Rinorea sp. nov. 2 ined.	sb	GD	Sh	Cam	Co	
2254	Violaceae	Rinorea subintegrifolia (P.Beauv.) Kuntze	sb	gn	Sh	Gc	Co	
2255	Violaceae	Rinorea subsessilis Brandt	sb	gn	Sh	Gc	Co	
2256	Violaceae	Rinorea umbricola Chipp	sb	BK	Sh	Gc	Co	
2257	Violaceae	Rinorea verrucosa Chipp	sb	bu	Sh	Lg	Co	
2258	Violaceae	Rinorea welwitschii (Oliv.) Kuntze	sb	gn	Sh	Tra	Co	
2259	Violaceae	Rinorea woermaniana (Buttn.) Engl.	sb	bu	Sh	Lg	Co	
2260	Viscaceae	Viscum congolense De Wild.	ep	gn	Ep	Gc	Hl	
2261	Vitaceae	Ampelocissus bombycina (Baker) Planch.	pi	gn	Swcl	Tra	Hl	
2262	Vitaceae	Ampelocissus gracilipes Stapf	pi	gn	Swcl	Pa	Hl	
2263	Vitaceae	Cayratia debilis (Baker) Suesseng.	pi	gn	Hcl	Gc	Co	
2264	Vitaceae	Cayratia gracilis (Guill. & Perr.) Suesseng.	pi	gn	Hcl	Gc	Co	
2265	Vitaceae	Cayratia ibuensis (Hook f.) Suesseng.	pi	gn	Hcl	Gc	Co	
2266	Vitaceae	Cissus amoena Gilg & Brandt	pi	bu	Swcl	Lg	Hl	
2267	Vitaceae	Cissus aralioides (Welw. ex Baker) Planch.	pi	gn	Swcl	Gc	Co	
2268	Vitaceae	Cissus barbeyana De Wild. & T.Durand	pi	gn	Swcl	Gc	Co	
2269	Vitaceae	Cissus barteri (Baker) Planch.	pi	gn	Swcl	Gc	Co	

No	Family	Species	Guild	Star	Habit	Chorology	Col.	IUCN/WCMC
2270	Vitaceae	Cissus dinklagei Gilg & Brandt	pi	gn	Lwcl	Gc	Co	
2271	Vitaceae	Cissus leonardii Dewit	pi	gn	Swcl	Gc	Co	
2272	Vitaceae	Cissus oreophila Gilg & Brandt	pi	gn	Swcl	Gc	Co	
2273	Vitaceae	Cissus planchoniana Gilg	pi	gn	Swcl	Gc	Co	
2274	Vitaceae	Cissus producta Afzel.	np	gn	Hcl	Tra	Co	
2275	Vitaceae	Cissus ruginosicarpa Desc.	pi	gn	Hcl	Gc	Co	
2276	Vitaceae	Cissus smithiana (Baker) Planch.	pi	gn	Hcl	Gc	Hl	
2277	Vittariaceae	Vittaria guineensis Desv. var. guineensis	ep	gn	Ep	Gc	Co	
2278	Vittariaceae	Vittaria owariensis Fée	ep	gn	Ep	Gc	Hl	
2279	Vochysiaceae	Erismadelphus exsul Mildbr. var. platyphyllus Keay & Stafleu	np	bu	Tr	Lg	Re	
2280	Woodsiaceae	Athyrium ammifolium (Mett.) C.Chr.	sb	bu	Hb	Lg	Hl	
2281	Woodsiaceae	Athyrium schimperi Moug. ex Fée	sb	gn	Hb	Tra	Hl	
2282	Woodsiaceae	Diplazium sammatii (Kuhn) C.Chr.	ep	gn	Hb	Gc	Co	
2283	Woodsiaceae	Diplazium welwitschii (Hook.) Diels	sb	gn	Hb	Gc	Co	
2284	Zingiberaceae	Aframomum citratum (Pereira) K.Schum.	pi	gn	Hb	Gc	Re	
2285	Zingiberaceae	Aframomum daniellii (Hook.f.) K.Schum.	pi	gn	Hb	Gc	Hl	
2286	Zingiberaceae	Aframomum flavum Lock	pi	bu	Hb	Lg	Co	
2287	Zingiberaceae	Aframomum hanburyi sensu Koechlin	pi	pk	Hb	Gc	Hl	
2288	Zingiberaceae	Aframomum limbatum (Oliv. & Hanb.) K.Schum.	pi	bu	Hb	Lg	Co	
2289	Zingiberaceae	Aframomum pilosum (Oliv. & Hanb.) K.Schum.	pi	bu	Hb	Lg	Co	
2290	Zingiberaceae	Aframomum sceptrum (Oliv. & Hanb.) K.Schum.	pi	gn	Hb	Gc	Hl	
2291	Zingiberaceae	Aframomum subsericeum (Oliv. & Hanb.) K.Schum. subsp. subsericeum	pi	gn	Hb	Gc	Co	
2292	Zingiberaceae	Aulotandra kamerunensis Loes.	sb	BK	Hb	Sw-Cam	Co	
2293	Zingiberaceae	Renealmia africana (K.Schum.) Benth.	sb	gn	Hb	Gc	Co	
2294	Zingiberaceae	Renealmia cincinnata (K.Schum.) Baker	sb	bu	Hb	Lg	Co	
2295	Zingiberaceae	Renealmia congoensis Gagnep.	sb	bu	Hb	Lg	Co	
2296	Zingiberaceae	Renealmia densispica Koechlin	sb	BK	Hb	Sw-Cam	Co	
2297	Zingiberaceae	Renealmia stenostachys K.Schum.	sb	gn	Hb	Gc	Co	

Where**:**

* Leguminosae-Caes. = Leguminosae-Caesalpinioideae
** Leguminosae-Mim. = Leguminosae-Mimosoideae
*** Leguminosae-Pap. = Leguminosae-Papilionoideae

Guild: ep = epiphyte, np = non pioneer light demanding, pi = pioneer, rh = rheophyte, ri = riverine, sb = shade-bearer, str = strangler and sw = swamp.

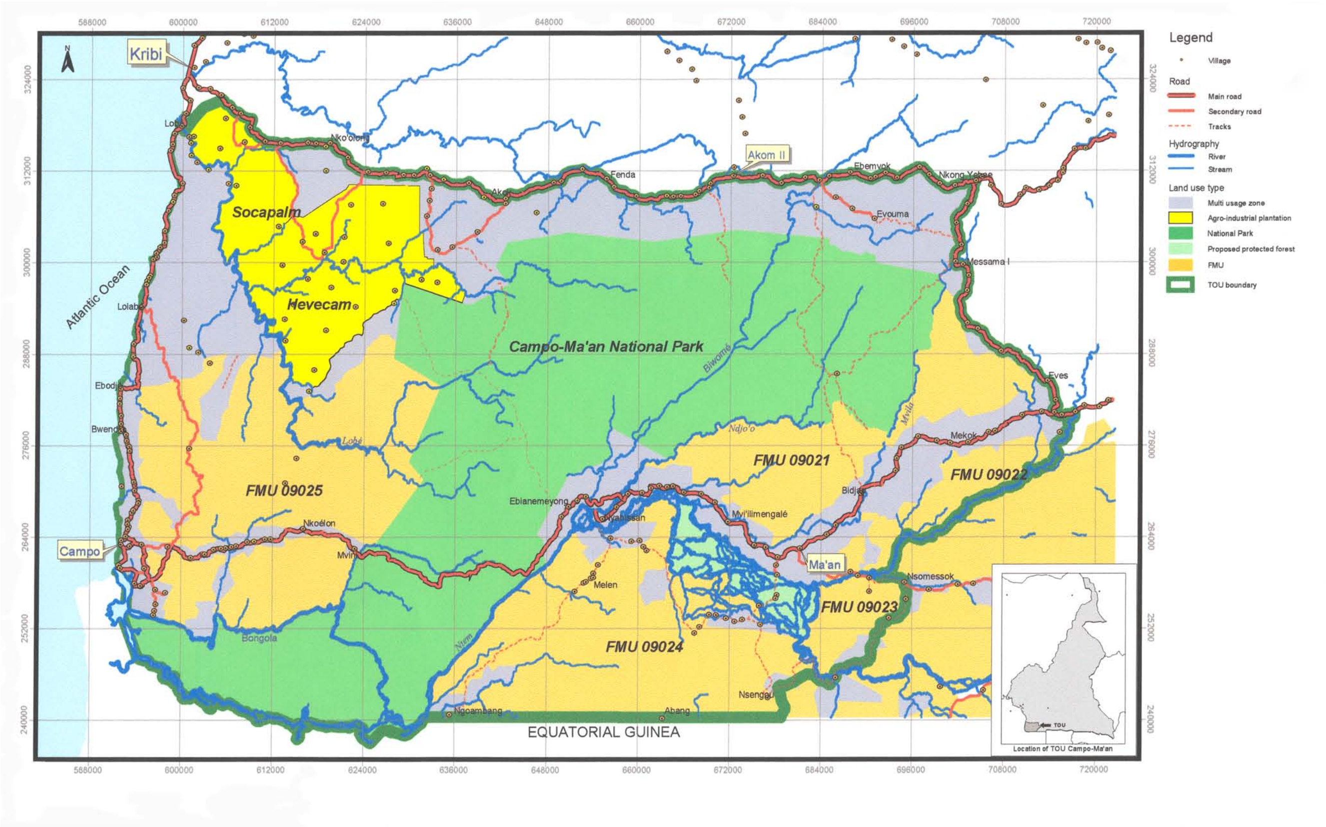
Star categories: BK = black star; GD = gold; bu = blue, sc = scarlet, rd = red, pk = pink and gn = green stars as defined in Table 5.1, Chapter 5.

Habit: Ep = epiphyte, Hb = herb, Hcl = herbaceous climber, He = hemi-epiphyte, Lwcl = large woody climber, Pa = parasite, Pal = palm; Sa = saprophyte, Sh = shrub, Str = strangler; Swcl = small woody climber and Tr = tree.

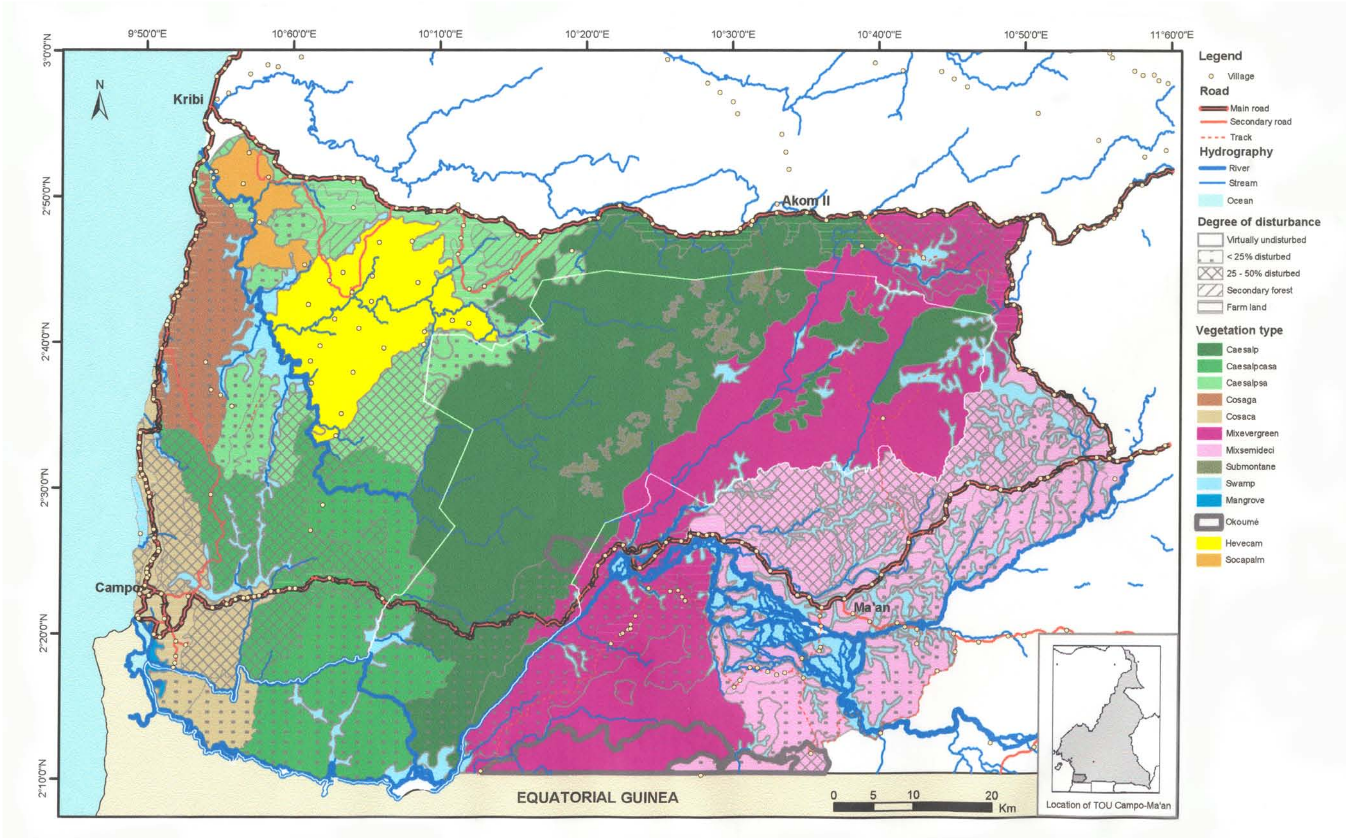
Chorology: Campo-Ma'an = strict endemic to Campo-Ma'an, Sw-Cam = endemic to southwestern part of Cameroon, Cam = endemic to Cameroon, Lg = Lower Guinea endemic, Gc = Guineo-Congolian endemic, Gu = Guinea endemic, Pa = Pantropical, Pal = Palaetropical, Tra = tropical Africa endemic, and In = introduced.

Col. = collection status: Co = specimens were collected during our study, Re = species without specimens recorded during the study, Hl = species recorded in Yaounde and Wageningen herbaria or in existing flora and monographs.

IUCN/WCMC conservation status: categories of threat as defined in IUCN (1994 & 2002) and WCMC (1998).



Annex 4. Present land use planning map of the Campo-Ma'an Technical Operational Unit (TOU)



Annex 5. Vegetation map of the Campo-Ma'an area (vegetation codes as defined in Table 2.1, Chapter 2)
NB: 10°60'0"= 10°00'0" and 11°60'0"= 11°00'0"

SUMMARY

Gildas Peguy Tchouto Mbatchou

SUMMARY

The fragile ecosystems that habour tropical rain forest biodiversity are of great concern and their conservation has become an issue of increasing priority because of the ongoing effect of human activities. In response to the growing international concern for the protection of global biological resources, the Ministry of Environment and Forestry, Cameroon created a Technical Operational Unit in the Campo-Ma'an area, to improve the conservation of biodiversity in the area and the sustainable management of natural resources. In such a large and complex forest ecosystem, sound taxonomic and ecological research is of paramount importance in order to identify conservation priorities and hotspots for biodiversity conservation. Therefore, the main objective of this study is the assessment of the botanical diversity of the Campo-Ma'an rain forest, both in terms of vegetation and flora with aim to identify, locate and map biodiversity hotspots.

After a study of the existing botanical literature, a reconnaissance trip was carried out in the Campo-Ma'an area during which representative and homogeneous vegetation types for sampling were selected on the basis of physical and human factors, such as climate (especially rainfall), altitude, soil and forest use. To be effective two types of samples were used during the assessment, the measured plots and the qualitative samples. Plots provided quantitative information on stand structure and composition of the forest, while additional qualitative information on species richness, life form and guild was provided by the qualitative samples. A total of 147 plots (0.1 ha each) and 136 subplots (5 x 5 m each) were established. Furthermore, over 2348 herbarium specimens and 4789 ecological specimens were collected in the plots, or in the various vegetation types/habitats. They belonged to 2297 species, 851 genera and 155 families of vascular plants, ferns and fern allies. One set of each collection number was mounted and preserved in the Kribi Herbarium. Duplicates were sent to the National Herbarium in Yaounde, Cameroon (YA) and the Nationaal Herbarium Nederland, Wageningen University Branch (WAG) for further identification and preservation.

Chapter 1 presented the objectives of this research, the study area and gave a succinct stage of knowledge of the Campo-Ma'an biodiversity. In Chapter 2, we classified, described and mapped the various vegetation types, and analysed their forest structure and composition. The results indicated that the Campo-Ma'an area supports a diverse range of forest communities with more than 11 vegetation types and sub-types that include the coastal forest, lowland evergreen forest, submontane forest, mixed evergreen and semi-deciduous forest, mangroves, seasonally flooded and swamp forests, riverine vegetation and secondary forests. The most characteristic vegetation type is the lowland evergreen forest rich in Caesalpinioideae with *Calpocalyx heitzii* and *Sacoglottis gabonensis,* which is so far only known from the Campo area. Taking into consideration the importance of environmental variables and human disturbance in determining plant species richness in tropical rain forests, we used the information gathered in 147 plots to study their effects on these vegetation types. The results showed that the vegetation in the Campo-Ma'an area is determined by rainfall, the proximity to the sea, altitude, soil and human disturbance. Consequently, the vegetation changes from the wetter coastal forest on sandy shorelines, through the lowland evergreen forest rich in

Caesalpinioideae, the submontane forest on hilltops, to the mixed evergreen and semi-deciduous forest in the drier Ma'an area. This results in an increase in species richness from the coast to the hilltops and a gradual variation in dominant species, from coastal indicator species along the coast to a forest rich in Caesalpinioideae and a mixed forest rich in semi-deciduous elements.

In Chapter 3, we studied the diversity patterns in the flora of the Campo-Ma'an rain forest. We tested out whether there is a correlation between tree species diversity and diversity of other growth forms such as shrubs, herbs, and lianas in order to understand if in the context of African tropical rain forest, tree species diversity mirrors the diversity of other life forms or strata. Are forests that are rich in tree species also rich in other life forms? To answer these questions, we analysed the family and species level floristic richness and diversity of the various growth forms and forest strata within 145 plots recorded in the various vegetation types. A comparison of the diversity and species richness within forest layers and within growth forms was done using General Linear Models followed by multiple comparison tests. The results showed that tree species accounted for 46% of the total number of vascular plant species with DBH ≥ 1 cm, shrubs/small trees 39%, climbers 13% and herbs less than 1%. Only 22% of the diversity of shrubs and lianas could be explained by the diversity of large and medium sized trees, and less than 1% of herb diversity was explained by the tree diversity. The shrub layer was by far the most species rich in the different plots and vegetation types. It was significantly more diverse and species-rich than the tree and herbaceous layers. More than 82% of tree species, 90% of shrubs, 78% of lianas and 70% of herbaceous species were recorded in the shrub layer. Moreover, shrubs contributed for 38% of the 114 strict and narrow endemic plant species recorded in the area, herbs 29%, trees only 20% and climbers 11%. These results indicated that the diversity of trees does not always reflect the overall diversity of the forest in the Campo-Ma'an area, and therefore it may not be a good indicator for the diversity of shrubs and herbaceous species. Furthermore, this suggests that biodiversity surveys based solely on large and medium sized tree species (DBH ≥ 10 cm) is not an adequate method for the assessment of plant diversity because other growth form such as shrubs, climbers and herbs are under-represented. Therefore, inventory design based on small plots of 0.1 ha, in which all vascular plants with DBH ≥ 1 cm are recorded, is a more appropriate sampling method for biodiversity assessments than surveys based solely on large and medium sized tree species.

Indicator species are usually defined as species whose status and ecology provide information on the overall condition of the ecosystem, and that reflects the quality and changes in environmental conditions. In the tropics, some of these indicator species are used to trace the location and extend of tropical rain forest refuges because of their limited dispersal and colonisation abilities. In Chapter 4, we studied the distribution patterns of 178 sensitive bio-indicator forest species such as strict and narrow endemics, as well as other well-known slow dispersal species, to find out whether the entire Campo-Ma'an rain forest was part of a late Pleistocene rain forest refuge or not. The distributions patterns obtained corroborate the view of many authors who argue that during glacial times, forests were restricted to the upper slopes of hills near the top, high altitude lowland forests, or along riverbanks, where there was enough humidity for their survival. Our findings, therefore, do suggest that the Campo-Ma'an area falls within a series of postulated rain forest refuges in Central Africa as proposed by previous authors.

The concept of sites of high diversity, or hotspots, has attracted the attention of conservationists as a tool for conservation priority setting. Generally, patterns of species richness and endemism are used for the identification of biodiversity hotspots. In Chapter 5, forest inventory data and taxonomic collections were used to examine the distribution and convergence patterns of strict and narrow endemic species. We analysed the trends in endemic and rare species recorded, using new quantitative conservation indices such as Genetic Heat Index (GHI) and Pioneer Index (PI), together with geostatistic techniques that help to evaluate and identify potential areas of high conservation priority. The results showed that the Campo-Ma'an area is characterised by a rich and diverse flora with 114 endemic plant species, of which 29 are restricted to the area, 29 also occur in southwestern Cameroon, and 56 others that are also found in other parts of Cameroon. Furthermore, 540 species recorded are Lower Guinea endemics, 1123 species are Guineo-Congolian endemics and 105 species are Guinea endemics. Although most of the forest types rich in strict and narrow endemic species occur in the National Park, there are other biodiversity hotspots in the coastal zone and in areas such as Mont d'Eléphant and Massif des Mamelles that are located outside the National Park. Unfortunately, these areas, supporting 17 strict endemic species that are not found in the park, are under serious threat and do not have any conservation status for the moment. Taking into consideration that with the growing human population density, pressure on these hotspots will increase in the near future, it is suggested that priority be given to the conservation of these areas and that a separate management strategy be developed to ensure their protection.

In Chapter 6, we discussed the implications of the outputs of this research on the conservation of the Campo-Ma'an rain forest, and provided recommendations for its conservation and effective management. Although the Campo-Ma'an has a rich and diverse flora, there are several human activities that are ongoing in the area with varying ecological impacts on its forest ecosystem. In order to ensure its conservation, there is an urgent need to properly demarcate the boundary of the National Park, reinforce its protection, and complete and implement its management plan. Furthermore, local communities should be encouraged to create community forests around other identified biodiversity hotspots located outside the National Park. Each community forest could have the identified biodiversity hotspot as the core conservation area, surrounded by a buffer zone. Moreover, remote sensing images and impact studies on human activities are required to monitor land cover changes, and the changes in vegetation and flora. This will enable the park management to act appropriately whenever undesired changes on the forest ecosystem occur.

RESUME

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RESUME

La biodiversité des forêts tropicales denses humides est d'une importance particulière et sa conservation constitue de plus en plus une priorité à cause de la pression humaine continuelle et grandissante que subissent ces forêts. C'est dans le soucis de préserver sa biodiversité et d'assurer la gestion rationnelle de ses ressources naturelles que le gouvernement Camerounais a créé l'Unité Technique Opérationnelle (UTO) de Campo-Ma'an comme un site prioritaire pour la conservation de la biodiversité au Cameroun. La gestion d'un tel grand complexe forestier suppose une bonne connaissance du milieu. A ce sujet, des études botaniques et écologiques ont été réalisées dans le site afin d'identifier les zones prioritaires pour la conservation de la biodiversité. C'est pour cette raison que l'objectif principal de cette étude était d'analyser la diversité floristique de Campo-Ma'an afin d'identifier les plantes prioritaires et produire des cartes de répartition montrant les zones prioritaires pour la conservation de la biodiversité dans la région.

Après une revue bibliographique, une visite préliminaire a été faite dans la région pour identifier des végétations homogènes et représentatives pour la réalisation des inventaires. La sélection de leur emplacement a été opérée sur la base des facteurs physiques et humains tels que: le climat (surtout la pluviométrie), l'altitude, le sol et le degré de perturbation liée à l'activité humaine. Pendant la récolte des données, nous avons utilisé une approche qui nous permettait d'avoir des informations quantitatives sur la composition et la structure de la forêt, et des informations qualitatives sur les types biologiques des espèces et la physionomie des forêts inventoriées. Au total 147 parcelles (de 0.1 ha chacune) et 136 sous parcelles (5 m x 5 m chacune) ont été établies. De plus, 2348 échantillons d'herbiers et 4789 spécimens écologiques ont été récoltés dans les parcelles/sous parcelles et dans les différents types de végétation inventoriés. Soit au total 2297 espèces de plantes regroupant 851genres et 155 familles. Des doubles de tous les spécimens récoltés ont été montés et préservés à l' herbier de Kribi, d'autres seront envoyés à l'herbier National de Yaoundé (Cameroun) et l' herbier de Wageningen, aux Pays Bas pour identification et préservation.

Le chapitre 1 présente les objectifs de cette étude, le site et les méthodes d'inventaires utilisées pour la récolte et l'analyse des données, ainsi qu'un aperçu sur l'état des connaissances actuelles de la biodiversité dans la région de Campo-Ma'an. Dans le chapitre 2 nous avons identifié, décrit et cartographié les différents types de végétation inventoriés. Il ressort de cette analyse que la région de Campo-Ma'an regorge plusieurs écosystèmes composés de plus d'une dizaine de différents types de végétation parmi lesquels les plus caractéristiques sont les forêts de basses altitudes riche en Caesalpinioideae, avec *Calpocalyx heitzii* et *Sacoglottis gabonensis,* qui sont endémiques à la région de Campo. On y retrouve également les forêts côtières, les mangroves, les forêts de basses altitudes riches en Caesalpinioideae, les forêts sub-montagnardes, les forêts mixtes toujours vertes atlantiques et semi caducifoliées, les forêts marécageuses et périodiquement inondées, et les forêts secondaires. Les données de base provenant de 147 parcelles de 0.1 ha chacune nous ont permis d'étudier l'influence des facteurs physiques et humains sur la végétation de Campo-Ma'an. Les résultats obtenus montrent que cette végétation est fortement influencée par la pluviométrie, la proximité de la mer,

l'altitude, les sols et l'activité humaine. C'est ainsi que l'on passe progressivement d'une formation végétale sur cordons littoraux sablonneux au niveau de la mer, à des forêts de basses altitudes riches en Caesalpinioideae, des forêts sub-montagnardes de hautes altitudes, aux forêts mixtes toujours vertes atlantiques et semi caducifoliées dans la région de Ma'an. On dénote également une augmentation d'espèces de la côte jusqu'aux sommets des collines, et une variation progressive des espèces dominantes de la côte vers l'intérieure.

Dans le chapitre 3 un accent particulier est mis sur la diversité floristique de Campo-Ma'an avec pour intention de vérifier s'il existe une corrélation entre la diversité des arbres et celle des autres types biologiques tels que les arbustes, les plantes herbacées et les lianes. Ceci dans le but de savoir si dans le contexte des forêts tropicales africaines, la diversité des arbres permet de prédire celle des autres types biologiques. En d'autres termes, est-ce que les forêts riches en espèces d'arbres sont également riches en d'autres types biologiques? Afin de répondre à cette question, nous avons fait une étude comparative de la diversité et la richesse floristique de tous les types biologiques recensés dans 145 parcelles de 0.1 ha chacune réparties dans 6 grands groupes de végétation. Il ressort de cette analyse que les arbres représentent 46% de toutes les espèces de plantes recensées avec un DBH $\geq$ 1 cm (diamètre à hauteur de poitrine), les arbustes 39%, les lianes 13% et les herbacées moins de 1%. Seulement 22% de la diversité des arbustes et des lianes peuvent être déduites à partir de celle des arbres et moins de 1% de celle des herbacées. La strate arbustive constitue de loin la plus riche et la plus diversifiée au niveau des parcelles comme au sein des différents types de végétation. Plus de 82% des espèces d'arbres, 90% des arbustes, 78% lianes et 70% des espèces herbacées furent collectées dans la strate arbustive. De plus, les arbustes représentent 38% des 114 plantes strictement endémiques à la région de Campo-Ma'an et au sud du Cameroun, les herbacées 29%, les arbres 20% et les lianes 11%. Ces résultats démontrent que la diversité des arbres ne reflète pas le plus souvent celle des autres types biologiques dans la région de Campo-Ma'an, et pour ce fait, elle ne serait pas un bon indicateur pour la diversité des arbustes, des lianes et des herbacées. Par conséquence, les inventaires botaniques basés uniquement sur les grands arbres (DBH $\geq$ 10 cm) ne sont pas appropriés pour les études de la biodiversité floristique parce que les autres types biologiques tels que les arbustes, les plantes herbacées et les lianes sont sous représentés. Ce qui nous amène à dire que les inventaires floristiques réalisés dans de petites parcelles de 0.1 ha chacune, dans lesquelles toutes les plantes ayant un DBH $\geq$ 1 cm sont recensées sont plus appropriés pour les études de biodiversité que les méthodes d'échantillonnage qui ne prennent en compte que les arbres.

Les bio-indicateurs sont très sensibles aux changements des conditions environnementales. Ils sont le plus souvent définis comme étant des espèces dont le statut et l'écologie permettent d'avoir les informations relatives au dynamisme des écosystèmes. Dans les tropiques, certains de ces bio-indicateurs sont parfois utilisés pour la localisation des refuges forestiers à cause de leur faible pouvoir de dispersion. Dans le chapitre 4 nous avons étudié la distribution de 178 bio-indicateurs sensibles des types forestiers tels que les plantes endémiques et d'autres espèces à faible capacité de dispersion, afin de vérifier si la région de Campo-Ma'an fait partie de la zone de refuge reconnue dans le sud du Cameroun. La répartition géographique de ces espèces nous a permis de confirmer le point de vue de nombreux auteurs qui argumentent que pendant les périodes de glaciation, quelques petits blocks de forêts étaient restreints sur les flancs supérieurs des collines au niveau des forêts d'altitude et le long des cours d'eaux parce que ces endroits leurs offraient des conditions d'humidité favorables à leur survie.

Le concept du site à grande richesse biologique ou "hotspot" a attiré l'attention des aménagistes qui le considèrent comme des sites prioritaires pour la conservation de la biodiversité. Pour ce fait, la richesse floristique et le taux d'endémisme sont fréquemment utilisés comme des critères primordiaux lors de la sélection des sites prioritaires pour la conservation. Dans le chapitre 5 les données de base provenant des inventaires et de la collecte des échantillons botaniques ont été utilisées pour examiner la répartition et la convergence des espèces endémique à la région de Campo-Ma'an. Une analyse statistique a été faite en utilisant de nouvelles indices de conservation telles que le ''Genetic Heat Index (GHI)'' et le ''Pioneer Index (PI)''et des techniques géostatistiques. Ce qui nous a permis d'évaluer et d'identifier les zones ayant une grande richesse biologique. Les résultats obtenus montrent que la région de Campo-Ma'an a une flore riche et diversifiée avec 114 espèces de plantes endémiques, parmi lesquelles 29 ne sont connues que de Campo-Ma'an, 29 autres sont également connues dans la région du sud Cameroun et 56 dans d'autres régions du Cameroun. On y trouve aussi 540 espèces de plantes endémiques à la région de Lower Guinea, 1123 espèces endémiques à celle de Guineo-Congolian et 105 espèces à la région de Guinea. Malgré le fait que plusieurs types de végétation recensées et qu'une grande majorité des espèces endémiques se trouvent dans le Parc National de Campo-Ma'an, 17 de ces espèces endémiques et certaines formations végétales sont situées hors du parc. Malheureusement, ces espèces endémiques se trouvent dans la zone côtière et dans les régions du Mont d'Eléphant et du Massif des Mamelles qui subissent pour l'instant de très fortes pressions de la part des populations locales. Une attention particulière doit être ainsi accordée à ces zones prioritaires (ou hotspots) situées hors du parc parce qu'elles n'ont pas encore un statut propre de conservation. De plus, il est nécessaire qu'un plan d'aménagement soit élaboré pour la conservation de la biodiversité et la gestion durable des ressources naturelles dans ces zones.

Le chapitre 6 traite des stratégies les plus adaptées et propose des perspectives pour une meilleure conservation de la biodiversité dans la région de Campo-Ma'an. Nonobstant le fait que cette région dispose d'une richesse biologique unique, elle subit une pression humaine grandissante et intense qui contribue malheureusement à sa déforestation. En ce qui concerne le Parc National de Campo-Ma'an, la stratégie d'intervention doit être principalement axée sur la délimitation de ses limites sur le terrain, l'élaboration et la mise en oeuvre du plan d'aménagement, et le renforcement des structures existantes pour un contrôle efficace. Pour d'autres zones prioritaires situées hors du parc, il est important que des forêts communautaires soient créées autour de celles-ci par les populations locales avec la participation et l'assistance technique et financière du MINEF et des organisations internationales œuvrant pour la conservation de la biodiversité. De plus, un suivi écologique et un système d'information géographique doivent être développés afin de fournir des données de bases qui vont permettre de mesurer la stabilité de l'écosystème et d'enregistrer les changements liés à l'activité humaine. Cela va permettre aux gestionnaires du parc et de l'UTO de prendre des décisions appropriées lorsque des développements négatifs sont signalés sur la flore, la faune et les écosystèmes forestiers.

SAMENVATTING

Gildas Peguy Tchouto Mbatchou

SAMENVATTING

De kwetsbare ecosystemen die de biodiversiteit van het tropisch regenbos herbergen staan tegenwoordig midden in de belangstelling. Ten gevolge van voortdurende menselijke beïnvloeding is de instandhouding ervan een onderwerp van toenemende prioriteit geworden. Als antwoord op de groeiende internationale roep om bescherming van dit mondiale biologische erfgoed heeft het Kameroenese Ministerie van Milieu en Bosbouw het Campo-Ma'an gebied daarom onder een zogenaamde Technisch Operationele Eenheid gebracht. Dit om een juridisch kader te scheppen voor de verbetering van de instandhouding van de biodiversiteit van het gebied en van het duurzame gebruik van de natuurlijke rijkdommen die er worden gevonden. In zo'n groot en ingewikkeld bosecosysteem is verantwoord wetenschappelijk taxonomisch en ecologisch onderzoek van het grootste belang om antwoord te kunnen geven op de vraag wat met voorrang beschermd moet worden, en vooral ook waar zich dat bevindt. Het voornaamste doel van deze studie is daarom het vaststellen van de botanische diversiteit die in het Campo-Ma'an regenbos voorkomt. Enerzijds gaat het hierbij om de vraag of, en zo ja welke verschillende vegetatietypen er te vinden zijn in dit ecosysteem, en waar deze zich bevinden. Anderzijds om de vraag welke plantensoorten deel uitmaken van de gevonden vegetatie eenheden, en wat de status van die soorten is. Met de verworven kennis is het mogelijk om te bepalen welke gebieden botanisch (zowel vegetatiekundig als floristisch) het belangrijkst zijn. Het lokaliseren van zulke botanische "hotspots" is essentieel voor het bepalen van de prioriteit waarmee gebieden voor bescherming in aanmerking komen.

Na een studie van de over Campo-Ma'an bestaande botanische en andere relevante literatuur is een verkenning van het Campo-Ma'an gebied uitgevoerd. Hierbij zijn representatieve homogene vegetaties die geschikt leken voor bemonstering geselecteerd op basis van fysische factoren en menselijke beïnvloeding zoals klimaat (vooral neerslag), hoogte, bodem en bodemgebruik. Om effectief te zijn werden twee manieren van bemonsteren toegepast, namelijk ten eerste via ingemeten proefvlakken en aanvullend het volgens een bepaald protocol verzamelen van zogenaamde kwalitatieve monsters. De proefvlakken verschaften de kwantitatieve gegevens over de structuur en numerieke gegevens over de floristische samenstelling van de vegetatie. Nog meer kwalitatieve informatie over soortenrijkdom, levensvormen en groepen van soorten met een overeenkomstige functie in het ecosysteem ("guilds") is verkregen uit de kwalitatieve monsters. In totaal zijn 147 proefvlakken van ieder 0,1 ha uitgezet met daarin bovendien nog 136 subplots van steeds 5 x 5 m. In de proefvlakken en/of in de verschillende vegetatietypen en habitats zijn meer dan 2350 herbarium nummers verzameld en daarnaast nog ca. 4800 zogenaamde "ecologische monsters", voornamelijk bestaand uit vegetatief materiaal. De verzameling bleek na determinatie 2297 soorten te bevatten, behorend tot 851 genera verdeeld over 155 families van vaat- en sporenplanten. Een exemplaar van ieder nummer is opgeplakt en bewaard in het herbarium in Kribi. Duplicaten zijn verstuurd naar het Nationaal Herbarium in Yaoundé, Kameroen (YA) en naar het Nationaal Herbarium Nederland, Wageningen University Branch (WAG) voor verdere identificatie en conservering.

In hoofdstuk 1 worden de doelstellingen van het onderzoek gepresenteerd, wordt het onderzoeksgebied beschreven, en wordt een beknopt overzicht gegeven van wat bekend is over de biodiversiteit van het Campo-Ma'an gebied. In hoofdstuk 2 worden de vegetatietypen die zijn onderscheiden beschreven, gerangschikt en in kaart gebracht, en vindt een analyse plaats van hun structuur en samenstelling. Het blijkt dat de vegetatie van het Campo-Ma'an gebied zeer gevarieerd is en dat een reeks van tenminste 11 verschillende vegetatietypen en subtypen kan worden onderscheiden, waaronder het kustbos, het altijd groene laaglandbos, het submontane bos, het gemengd altijd groene en gedeeltelijk loofverliezende bos, het mangrove bos, de periodiek overstroomde bossen en de moerasbossen, het bos op rivieroevers en de secondaire bossen. Het meest karakteristiek is het altijd groene laaglandbos rijk aan Caesalpinioideae met *Calpocalyx heitzii* en *Sacoglottis gabonensis* als kenmerkende soorten, dat tot dusver alleen bekend is uit de Campo regio. Wetend hoe belangrijk de milieuvariabelen en de verstorende invloed van de mens zijn voor de soortenrijkdom in tropische regenbossen, is de informatie die is verzameld in de 147 proefvlakken geanalyseerd en is gezocht naar verbanden tussen de afzonderlijke variabelen en de gevonden vegetatietypen. Het blijkt dat de vegetatie in het Campo-Ma'an gebied wordt beïnvloed door de neerslag, de nabijheid van de zee, de hoogte, de bodem en door menselijke invloeden. Als gevolg daarvan verandert de vegetatie gaande van het vochtiger bos langs de zandige kust via het altijd groene laaglandbos rijk aan Caesalpinioideae en het submontane bos op de heuvels in het gemengd altijd groene en gedeeltelijk loofverliezende bos zoals gevonden in het drogere Ma'an gebied. Dit resulteert in een toename in soortenrijkdom gaande van de kust naar de toppen van de landinwaarts gelegen keten van lagere bergtoppen. In dezelfde richting vindt een geleidelijke verandering plaats in de dominerende soorten, namelijk van soorten die kenmerkend zijn voor de kust via soorten die het bostype rijk aan Caesalpinioideae karakteriseren naar het gemengde bos waarin gedeeltelijk loofverliezende soorten op de voorgrond treden.

In hoofdstuk 3 zijn patronen in de diversiteit van de flora van het Campo-Ma'an regenwoud bestudeerd. Er is getest of er een correlatie bestaat tussen de diversiteit in de soorten bomen en de diversiteit van andere levensvormen zoals struiken, lianen en kruiden. De vraag is gesteld of in de context van het tropisch Afrikaanse regenwoud de diversiteit van de boomsoorten een afspiegeling is van de diversiteit van de andere levensvormen of vegetatielagen. Zijn bossen die rijk zijn aan boomsoorten ook rijk aan andere levensvormen? Om die vragen te beantwoorden wordt op familie- en soortsniveau de floristische rijkdom en diversiteit van de verschillende levensvormen en vegetatielagen geanalyseerd in 145 over de verschillende vegetatietypen verspreide proefvlakken. Bij de vergelijking van de diversiteit en soortenrijkdom binnen de vegetatielagen en binnen de groeivormen is gebruikt gemaakt van General Linear Models gevolgd door multiple comparison testen. De resultaten laten zien dat boomsoorten 46% van alle vaatplanten met een DBH $\geq$ 1 cm vertegenwoordigen, struiken en kleinere bomen 39%, lianen 13% en kruiden minder dan 1%. Slechts 22% van de diversiteit van struiken en lianen kan worden verklaard door de diversiteit van grote en middelgrote bomen, en minder dan 1% van de diversiteit van kruiden vertoont samenhang met de diversiteit van de bomen. In de verschillende proefvlakken en vegetatietypen blijkt de struiklaag veruit het rijkst aan soorten. Deze laag blijkt significant meer divers en soortenrijker dan de boom- en de kruidlaag. Meer dan 82% van de boomsoorten, 90% van de struikvormige soorten, 78% van de lianen en 70% van de kruidensoorten zijn vastgesteld in de struiklaag. Bovendien dragen struiken voor 38% bij aan de 114 strikt en nauw endemische soorten die in het gebied zijn vastgesteld, kruiden 29%, bomen slechts 20% en lianen 11%. Deze resultaten tonen aan dat de diversiteit van de bomen niet altijd een afspiegeling is van de totale diversiteit van het bos in het Campo-Ma'an gebied, en daarom is de diversiteit van de bomen vermoedelijk geen goede indicator voor de diversiteit van de soorten struiken en kruiden. Bovendien doet dit vermoeden dat biodiversiteitonderzoek, dat alleen is gebaseerd op grote en middelgrote boomsoorten (DBH $\geq$ 10 cm) geen geschikte methode is voor het vaststellen van botanische diversiteit. Andere groeivormen zoals struiken, lianen en kruiden blijven op die manier ondervertegenwoordigd. De conclusie is dat een inventarisatie methode, gebaseerd op kleine proefvlakken van 0,1 ha, waarin alle vaatplanten met een DBH $\geq$ 1 cm worden geregistreerd, voor het vaststellen van biodiversiteit meer geschikt is dan bepalingen die slechts zijn gebaseerd op grote en middelgrote bomen.

Indicatorsoorten worden gewoonlijk gedefinieerd als soorten, waarvan de status en de ecologie informatie verschaffen over de toestand van het ecosysteem, en die de kwaliteit van - en veranderingen in - de milieuomstandigheden weergeven. In de tropen wordt een aantal van deze soorten gebruikt voor het opsporen van de plaats en de uitgestrektheid van regenbos refugia uit hoofde van hun beperkte verspreidings- en kolonisatiemogelijkheden. In hoofdstuk 4 zijn de verspreidingspatronen van 178 gevoelige bio-indicatorsoorten bestudeerd, zoals strikte en nauwe endemen, alsook van andere soorten waarvan bekend is dat het langzame verspreiders zijn. Het doel hiervan was vast te stellen of het hele Campo-Ma'an regenbos deel uitmaakte van een verondersteld laat Pleistoceen regenbos refugium of niet. De gevonden distributie patronen ondersteunen de zienswijze van veel auteurs die stellen dat tijdens de ijstijden bossen beperkt waren tot de bovenste hellingen en toppen van heuvels en tot grotere hoogten in het algemeen, en daarnaast voorkwamen langs rivieren waar voldoende vocht aanwezig was voor hun overleving. Onze bevindingen doen daarom veronderstellen dat het Campo-Ma'an gebied deel uitmaakt van een reeks van gepostuleerde Centraal Afrikaanse regenbos refugia zoals voorgesteld door eerdere auteurs.

Het concept van "hotspots", gebieden met een grote diversiteit aan soorten waaronder ongewoon veel endemen, heeft de aandacht van natuurbeschermers getrokken om het te hanteren als instrument bij het stellen van prioriteiten voor behoud en bescherming. In het algemeen worden patronen van soortenrijkdom en endemisme gebruikt voor het vaststellen van deze "hotspots". In hoofdstuk 5 zijn bosinventarisatiegegevens en taxonomische collecties gebruikt bij het zoeken naar patronen die tot stand komen door het samenvallen van de verspreidingen van strikte en nauwe endemen. De trends die bij de vastgestelde endemische en zeldzame soorten hierbij naar voren komen zijn geanalyseerd met gebruikmaking van nieuwe kwantitatieve technieken voor milieubehoud zoals de Genetic Heat Index (GHI) en de Pioneer Index (PI) en met geostatistische technieken die behulpzaam kunnen zijn bij het vaststellen van gebieden die in aanleg een hoge prioriteit voor bescherming genieten. De resultaten laten zien dat het Campo-Ma'an gebied wordt gekarakteriseerd door een rijke en diverse flora die 114 endemische plantensoorten telt. Hiervan zijn 29 soorten strikt beperkt tot het gebied zelf, 29 andere soorten zijn beperkt tot het zuidwesten van Kameroen, en nog eens 56 komen ook voor in andere delen van Kameroen. Bovendien zijn 540 van de in het gebied vastgestelde soorten Lower Guinea endemen (verspreiding beperkt tot het laagland regenbos van zuidoost Nigeria tot het Mayombe gebied in Kongo), 1123 soorten zijn Guineo-Congolian endemen en 105 soorten zijn Guinea endemen. Hoewel de meeste van de bostypen die rijk zijn aan strikte en nauwe endemische soorten voorkomen in het Nationale Park, zijn er andere biodiversiteits “hotspots” die buiten het Nationale Park liggen, met name in de kuststreek en in gebieden zoals de Mont d’Eléphant en het Massif des Mamelles. Ongelukkigerwijze staan deze gebieden, die 17 strikt endemische soorten herbergen die niet in het Park worden gevonden, ernstig onder druk en hebben ze op dit moment geen enkele status van bescherming. Overwegend dat met de groeiende bevolking de druk op deze “hotspots” in de nabije toekomst zal toenemen wordt voorgesteld om prioriteit te geven aan de bescherming van deze gebieden, en om een afzonderlijke beheersstrategie te ontwerpen voor deze bescherming.

In hoofdstuk 6 worden de implicaties van de uitkomsten van dit onderzoek voor het behoud en de bescherming van het Campo-Ma’an regenbos besproken en worden aanbevelingen gedaan voor het behoud en doeltreffend beheer ervan. Hoewel het Campo-Ma’an bos een rijke en diverse flora bezit voltrekken zich in het gebied een aantal menselijke activiteiten die elk voor zich een verschillende ecologische impact op het ecosysteem van het bos tot gevolg hebben. Om behoud te verzekeren is het dringend noodzakelijk om de grens van het Nationale Park af te bakenen, om de bescherming te versterken en om het beheersplan af te maken en uit te voeren. Bovendien moeten lokale bevolkingsgroepen worden aangemoedigd om gemeenschapsbossen in te stellen rondom de vastgestelde “hotspots” die buiten het Nationale Park liggen. Zo’n gemeenschapsbos zou de vastgestelde biodiversiteit “hotspot” als beschermd kernareaal kunnen hebben, dat wordt omgeven door een bufferzone. Ook blijven remote sensing beelden en impact studies van menselijke activiteiten noodzakelijk om veranderingen in landgebruik en in vegetatie en flora te blijven volgen. Dit zal de parkleiding in staat stellen doeltreffend op te treden als zich ongewenste veranderingen in het bosecosysteem voordoen.

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CURRICULUM VITAE

Gildas Peguy TCHOUTO MBATCHOU was born on 27th June 1966 in Buea, Cameroon. He attended the Bilingual Grammar School in Buea between 1980 and 1986. In 1988 he was admitted to the Ecole Nationale des Eaux et Forêts, Cap Esterias, Gabon, from which he graduated as Ingenieur des Techniques des Eaux et Forêts with "mention bien" in 1991. Upon graduation, he was employed by the Cameroon Ministry of Environment and Forestry and posted to the Limbe Botanic Garden as a Forest Officer in charge of forest management and conservation. In 1993, he was appointed Curator of the Limbe Botanic Garden Herbarium. In 1995 he obtained an MSc in biodiversity and taxonomy of plants, with distinction, in the Faculty of Sciences and Engineering, University of Edinburgh, UK. Between 1996 and 1999 he continued to work with the Limbe Botanic Garden and the Mount Cameroon Project, where he contributed to the establishment of a reference herbarium in the Limbe Botanic Garden, and to the conservation of the Mount Cameroon rain forest biodiversity. In September 1999 he was awarded a scholarship by Tropenbos International (formerly Tropenbos Foundation, the Netherlands) to pursue a PhD degree program in the Biosystematics Group and National Herbarium of the Netherlands, Department of Plant Sciences, Wageningen University, the Netherlands. He carried out his PhD research work in the Campo-Ma'an tropical rain forest area and contributed to the elaboration of the strategic plan of the Technical Operational Unit of Campo-Ma'an (Schéma Directeur pour le Développement de l'Unité Technique Opérationnelle de Campo-Ma'an), and the management plan of the Campo-Ma'an National Park. He is specialized in plant taxonomy, tropical ecology and phytosociology, and biodiversity conservation. Peguy Tchouto is married to Quinta Ngombock and has five children: Tankeu Candy, Ngokingha Mireille, Mbatchou Thierry, Tchouto Ruth and Mbock.

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