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Full Length Research Paper

Upper Nyong valley forest in Cameroon: Ethnobotanical uses and implications for biodiversity conservation

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The Upper Nyong valley belongs to the forest ecological area of Cameroon. Local people living around use drastically natural resources to enhance their livelihoods. According to the Cameroon forest law, more than 30% of natural area must be transformed into park and reserves. In the process of transformation, ecological studies can be conducted to evaluate potential resources available. This paper highlighted some results of a floristic survey conducted in the Upper Nyong valley through the Cameroon wildlife conservation project (CWCS), in order to evaluate the ecological and ethnobotanical uses of forest products and derived resources. The methodology used was based on linear transects and quadrats. As a result, 352 useful plants were inventoried and categorized into medicinal, food, traditional furniture, threatened and industrial plants. As implications and relevance to management, this study would help in the implementation of protected forest network coupled with the decentralization of forest resources. This could be the most sustained alternative for the conservation of this heritance from generation to generation. The immediate impact of this work is to stimulate governmental process for the implementation of this part of Cameroon valley into reserve. To achieve this goal, it is important to improve local people's livelihoods and sustainable management of these natural resources by making up community forest.

Key words: Floristic survey, local livelihoods, Upper Nyong valley, Cameroon forest law, forest product, protected forest network and forest decentralization, *in situ* and *ex situ* conservation, international union for nature conservation (IUCN) red data list, useful plants.

INTRODUCTION

It is generally admitted that forest resources and their habitats should be managed in order to meet social, economic, ecological and cultural needs for the present and future generations. Forests are among the richest and most stable ecosystems on Earth (WWF, 2000). Forests of the world contain more than 50% of the terrestrial biodiversity and the degradation of this biological heritage continues at distressing pace (GFW, 2000; CIFOR, 2005). Humid tropical forests are the most significant global sanctuaries of biodiversity, sheltering a highly varied fauna and almost half of the world's plant species (Oyono, 2002). In the understorey, plants like mosses, epiphytes, lianas, herbaceous and shrubs are found at different levels of vegetation and the majority of them are not yet identified. Meanwhile, there are serious problems in the forestry sector, such as environmental degradation, equity and persistent poverty, which translate into increased deforestation, unequal social access to resources and benefits, such as non forest timber product exploitation and trade, low productivity of land and labour and a weak policy and institutional environment (Cyprain et al., 2007). According to present rates of forest degradation, many of these plants are at

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risk of genetic erosion and may disappear without having been studied. In tropical countries, IUCN (2007) assess that the annual rate of deforestation is approximately 0.6%, or a mean of about 7.3 million hectares.

At this rate, the humid tropical forests will be fully destroyed within 160 years. According to the same source, on a global level, if 67% of the tropical forest were destroyed, which could happen by the end of the next century, and then more than half of the plants species would be destroyed. These alarming data highlight the need to implement new forest management practices in order to preserve and to perpetuate this rich natural inheritance. Meanwhile, the concept of decentralization should be applied to their management together with the ideas in the Forest Model proposals (Assembe, 2006; Cyprain et al., 2007; Oyono, 2002). These two concepts, focused on the partnership for sustainable forest management and environmental justice allow provincial governors and NGO's to share responsibility for forest resources conservation. Cameroon, a country with a proven significant potential in biological diversity, has also been affected by reforms of natural resources management policy, forestry in particular (FAO, 2003; Foteu, 1999). The imbalance between population growth and the provision of social amenities can be explained by the inadequacies of social policies during the period of the structural adjustment program in Cameroon (UNDP-Cameron, 1998).

The Upper Nyong vegetation has been greatly altered over the years by natural events which, increase climatic shifts. The major pressure arises from the manifold activities of man, which include uncontrolled timber exploitation, shifting agriculture and urbanization. There is enormous pressure on forest species as a source of wood, food, medicine, traditional furniture, and fuel wood. Many people trade their products (Jiofack and Ayissi, 2006). The rate of deforestation has been calculated at about 250,000 ha. yr^{-1} (WRI, 2000; CBFP, 2006). The causes of degradation include small scale subsistence farming; livestock grazing, craftworks, and fishing; which when carried out on large-scale or repeatedly are not ecologically friendly (MINEF, 1996). Such large forest areas require urgent conservation of species diversity because they support extensive biota.

One of the problems of conservation priorities is the presence of large numbers of taxa, many seemingly of no practical value at the present. It is common knowledge that a plant of known economic importance (such as food, fetish, medicine, shade, etc) to a region is often not destroyed when clearing for agricultural or building purpose (Jiofack and Ayissi, 2006).

There is very high demand for non forest timber products and timbers through prevailing economic recession; prices remain high as a result of prevailing genetic erosion. Rural areas have paid a higher price: population instability and natural resource degradation Over 90% of the population of Cameroon depends directly or indirectly on natural resources for its livelihood (Ogbe, 2001; Gardner, 2001). As a result, land, water, forest and other related resources are endangered. Hence it becomes very urgent to encourage the local people to participate in the conservation of the forest heritage which is the source of these plants and their preservation for posterity of this cultural heritage (Lotsmart, 2006). This paper therefore highlights some of the useful plants species recorded through the Cameroon wildlife conservation society (CWCS) project, and presents their ethnobotanical uses by the people in the Upper Nyong valley in order to serve as a stimulus for the sustainable management of this valley through proper management policy.

MATERIALS AND METHODS

Site of study

The study was carried out within the two CWCS research areas. The first study sites are located near the villages Kwpanzé (N 04° 23.59'; E 12° 37.17') and Mbaka'a (N 04° 02.83'; E 12° 23.83') in the Ayos district, Centre province of Cameroon. The second sites are in four villages of the Haut Nyong department, East province of Cameroon: in the localities of Ndjibot (N 03° 59.03'; E 13° 17.56'), Baiyong, (N 03° 59.97'; E 13° 17.08'), Djamonomine (N 04° 06.94'; E 13° 15.11') and Oboul I (N 03° 52.88'; E 13° 05.50'). This unit belongs to the Haut Nyong marshy forests domain with *Sterculia subviolacea* and *Macaranga asas*. This Haut Nyong is surrounded by the Dja river and the presence of *Sterculia subviolacea* and other species prospected in the Congo basin, reinforces the assumption of this grouping in the Dja Congo district (Letouzey, 1985). The forest cover is still less intact, due to human influence. It alternates with a mosaic of field, fallow lands, secondary forest and logged-over forest. Sometimes, dense secondary forest, marshy forest, ripicole and savannah riparian forests can by recorded in various sites. The mean annual rainfall is about 1,420.48 mm, with the mean relative humidity of 80.1% and average temperature of over 24.1°C.

Floristic sampling

Two methods of inventories have been used in this study. The first is based on the linear transect method and concerns all species with dbh > 10 cm: a method proposed by White and Edwards (2000) and used by Sonke (2005) in the Dja forest reserve. The second method concerns the square quadrats of 5 m side for all herbaceous species and shrubs with dbh < 10 cm. Here, a number of 155 sq have been assessed during the study. Any transects had variable length depending on the locality of the forest area sampled. Using the first method, ten irregular length linear transect of 5 m width have been done according to the Table 1, Along them, all woody species of > 10 cm dbh were recorded together with their reproductive status and health, as well as exploitation status (exploited/not exploited), whether standing, broken or fallen, alive standing and un-harvested. This sampling was supplemented by socio-economic surveys carried out with almost one-third of the households occupying the 6 localities of the study area. This allowed us to obtain ethnobotanical information. Finally, in order to improve our sampling method, plants were collected from the forest and different sets of peoples such as traditional healers, old and experienced people, family and village heads, farmers and others were interviewed. This survey recorded responses from 250 interviewees (41.67% of households in the six districts).

Table 1. Summary of data collection during the survey.

Localities	Number of transects	Length of transect	Orientation	Assessed area	Number of quadrats
Nkpwanzé	3	6 km	120° SE and 230° ES	5000 × 3	60
Mbaka' a	3	6 km	230° SW and 120° ES	5000 ×3	60
Baiyong	1	1 km	330° NW	5000	10
Ndjibot	1	500 m	330° NW	2500	5
Oboul I	1	1 km	350° NW	5000	10
Djamonomine	1	1 km	30° NW	5000	10
Total	10	15.5 km		47.500 m^2	155

Data collection

Table 1 presents the total number of transects, quadrats and assessed area collected in the Project. This mechanism allowed us to collect many plant species. On each transect, the plants collected were presented for comment from the guide or the village heads or any people known to use them, on the ethnobotany, local names, parts used and economic value where relevant. In addition, information was filed on ecological data, geographic coordinates, biological type and useful status. This permitted us to classify plants collected into 5 categories of ethnobotanical patterns: medicinal plants, food plants, traditional furniture or plants for local construction (pygmy hut services plants), habitat plants, industrial plants and threatened plants (according to IUCN red data list plants of Cameroon). All plants collected were identified directly using (Vivien and Faure (1985); Letouzey (1985); Tailfer (1990); Wilks and Issembe (2000); Letouzey (1983, 1986); White (1989); Aubreville (1959); Pauwels (1993); Blanc (1989)). All the scientific names were confirmed in the Yaounde National Herbarium while the vernacular names were confirmed using the collection compiled for some Cameroon woody species (Poame, unpublished).

RESULTS

The Upper Nyong Forest is one of the most important natural resources in Cameroon, performing multiple functions. It contributes very significantly to foreign exchange earning (through timber exportation and tourism) as well as satisfying high local demand for fuel-wood, building materials, wildlife game, parkland, herbs and medicinal plants. Inventories of 352 plants species belonging to 179 families were recorded, as shown in the Appendices. Ranking the ethnobotanical values of the upper Nyong forest, the total number of medicinal plants species was the highest (140, 40%), followed by food plants species (70, 20%) and industrial plants species (43.12% of rubber trees, 38.11% logged trees and 14.4% insecticidal trees species). Traditional furniture plants species are (47, 13. According to IUCN (2007), 53 of these plants species are endangered or threatened. Figure 1 shows the ethnobotanical distribution patterns of plant inventoried in the Upper Nyong valley. It presents the proportional distribution of all plants according to their ethnobotanical status (n = 352 individuals for the total inventory). Figure 2 ranks the distribution of families of plants according to their uses. Medicinal plants recorded belong to 60 families, followed by food plants (45). Insecticidal plants are represented by only 9 families.

DISCUSSION

This part of work providing discussion of any group of plant recorded is outlined as follow:

Medicinal plants

The proportional distribution exhibited (Figure 1) shows that medicinal plants are most highly represented in the total inventory. This is a proof that upper Nyong valley forest has a lot of plant which can be used to treat number of diseases. Local peoples does not go to the hospital and their primary treatment is based on these plant found in their environment.

The trees and shrubs ranked highest (113 species) amongst the plants recorded in the present study, probably because of their availability throughout the year and the different parts, such as stem-bark, root-bark, leaves, being used. Further, the valley is in the forested area, usually characteristic of a mature forest; the next ranking is herbs (27 species), which are easily cultivated. The practice of traditional medicine is relatively high because there was no hospital in this valley. In serious cases, and when traditional medicine might have failed, the patients were rushed to a hospital. Obviously, the practice of traditional medicine plays a very important role in the health-care of this region. Most ethnobotanical plants in and around the valley are harvested from their natural habitats, for various medicinal preparations and only a very few herbal practitioners had their plants grown in a homestead. Such a practice coupled with the increasing worldwide use of traditional medicine has adverse effects on the forest resources and has also increased the cost of herbal plants (Jiofack and Ayissi, 2006; Begombe, 2002).

Food plants

This part includes all plants which provide food products,

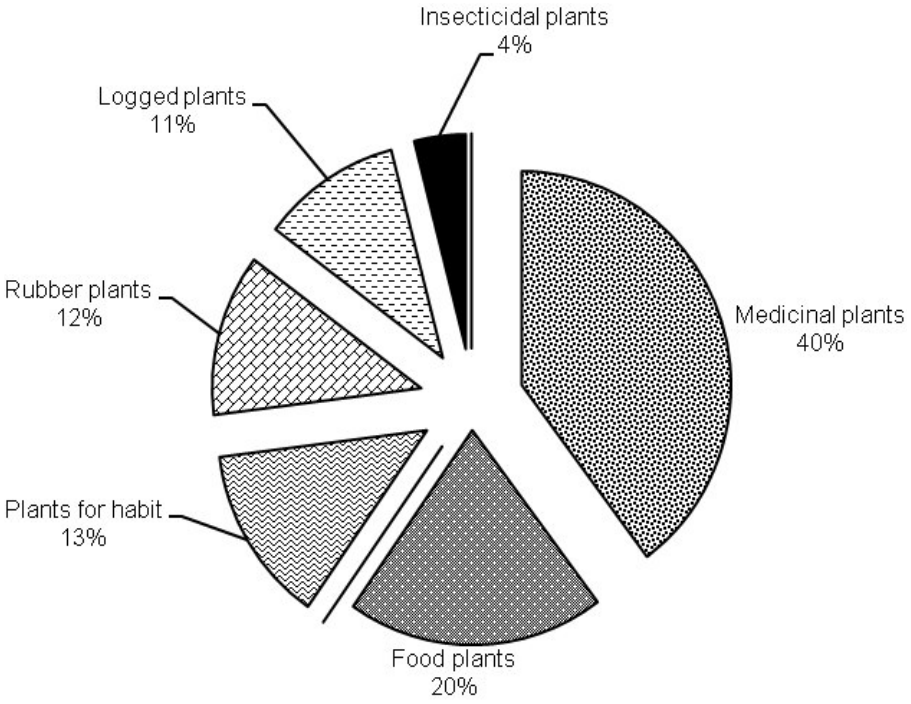

Figure 1. Ethnobotanical distribution patterns of plants inventorised in the upper Nyong valley and its environs.

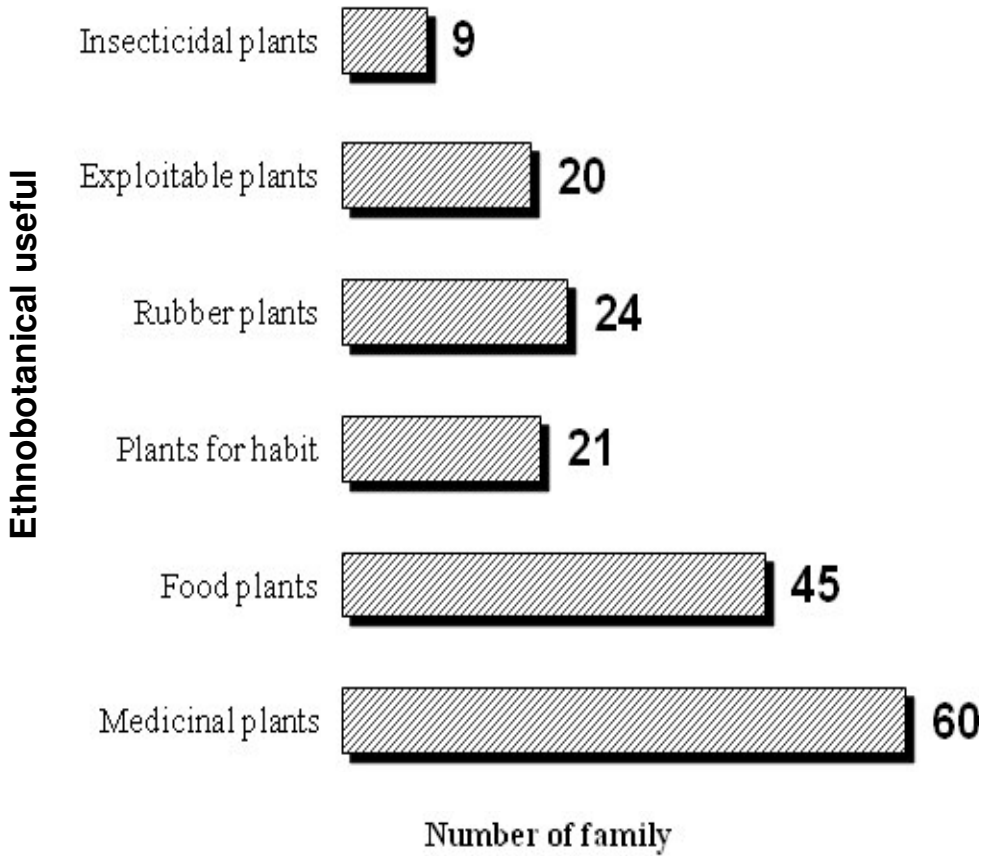

Figure 2. Comparison of number of plants families depends of ethnobotanical patterns.

natural drinks, oils and spices as well as other introduced and cultivated crops. Local populations show a passionate concern for the forest. They naturally depend on the forest, which must feed them. The list of forest food products (70 species) used to improve their life and their incomes is presented in Appendix II. This represents approximately 20% of the total plants listed. All social strata use them for their own consumption; they can also improve their incomes by selling significant quantities. The test for the success of this study should not be only the protection of these food plants particularly and/or the ecosystem conservation in general, but also the improvement of the conservation value of biological resources, as well as the safety food component of the households. This is because the socio-economic studies conducted in this site reveal that more than 90% of women interviewed estimate that products harvested from the cultivated food plants and collected in the forest constitute their principal source of income with more than 48,000 FCFA as annual income. Moreover, the sale of non timber forest products (NTFP) can provide an annual average income of 35,000 FCFA. More than 70% of women can get the same benefits when the vegetables harvested are sold at 50% associated with cassava and plantain. According to more than 10% of male interviewees, the sale of cocoa earns approximately 160,000 FCFA per annum. This report clearly shows the need for an effective policy or an adoption of an agricultural system of production including several actors. This remains valid for all industrially exploited plants.

Industrial plants

The inventoried plants of this section can be blocks or logs, resinous, latex plants usable in paper factories and insecticidal plants. According to Appendix III, 43 of the plants recorded produce rubber or latex, which represents 12% of the total inventory, followed by 38 logged trees (11%) and 14 insecticidal plants (4%). The present list is not exhaustive according to the compendium of Cameroon market timber and industrial plants established by Poame (unpublished). It's also due to the relative inventory rate (2%) use during this preliminary survey. The rubbers trees are those which promise a strong industrial latex production. These plants also include those producing good quality papers, as used by the Cameroon Company for rubber production, Cellulose du Cameroun (CELLUCAM). This is another proof that the Upper Nyong valley particularly has promising biological potential in producing raw materials. Cameroon can become a major paper pulp producer in Africa. According to the local people's experience, the insecticidal plants recorded are those commonly used for crop protection compounds against insect pests, due to the action of certain substances such as terpenoids contained either on the leaves or the whole plant.

Traditional furniture or habitat plants

These are those used by local people to improve their well being and livelihoods, such as sheets for building or roofing, lianas for chairs, boats, spears, cupboards, benching and basket manufacture. Those recorded are 47 and represented 13% of the total inventory (Appendix IV), the IUCN red data list. In summary, as can be shown in Figure 3, certain plant species are multifunctional and can therefore be considered under several categories. The major plants listed can be used as both medicinal and logged plant belonging to the IUCN red data list (4 plant species), logged trees belonging to the IUCN red data list (13 plants), medicinal and logged plants (8 plants), medicinal and insecticidal plants (4 plants), and finally medicinal plants belonging to the IUCN red data list (3 plants species). Generally, except for the major plants presented (Figure 3), more than 10% of total listed plants provide more than three uses in medicine, food and habitat, 30% provide two uses and more than 60% provide a single use. A major concern is that many of them are very vulnerable. The IUCN red data list (2007) includes many of these multi-use Cameroon plants species inventoried in the Upper Nyong valley and its environs (Appendix V). Many are logged species, and also provide food resources. Adequate measures should be taken towards good sustainable management of these resources, considering the high percentage of those belonging to this list.

Conclusion and perspective of management

Since there are abundant living resources in the Upper Nyong Valley, there is a crucial need for local sustainable conservation. This would increase food security in the part of the country where people depend more or less directly on the forest products. They use more than 140 plant species to cure several prevalent diseases. It is known that 25% of medicinal compounds derive from living resources found in tropical forests (Nkongmeneck et al., 2007). There is every reason to believe that there could be more such possibilities. There remain more secrets to discover in the humid tropical forest universe; but the deforestation and destruction of these ecosystems through human activities greatly increases the risk of disappearance of many species before they can even be analysed. This report shows the necessity to introduce effective conservation strategies or the adoption of an agricultural production system by local communities, which will facilitate sustainable management of these resources. The process of decentralization of forest resources which continues in Cameroon (Assembe, 2006) is also beneficial to the implementation of legal provisions relating to council and community forests, that could be matched with collective action at the local level (Arnold, 2001). In addition, the

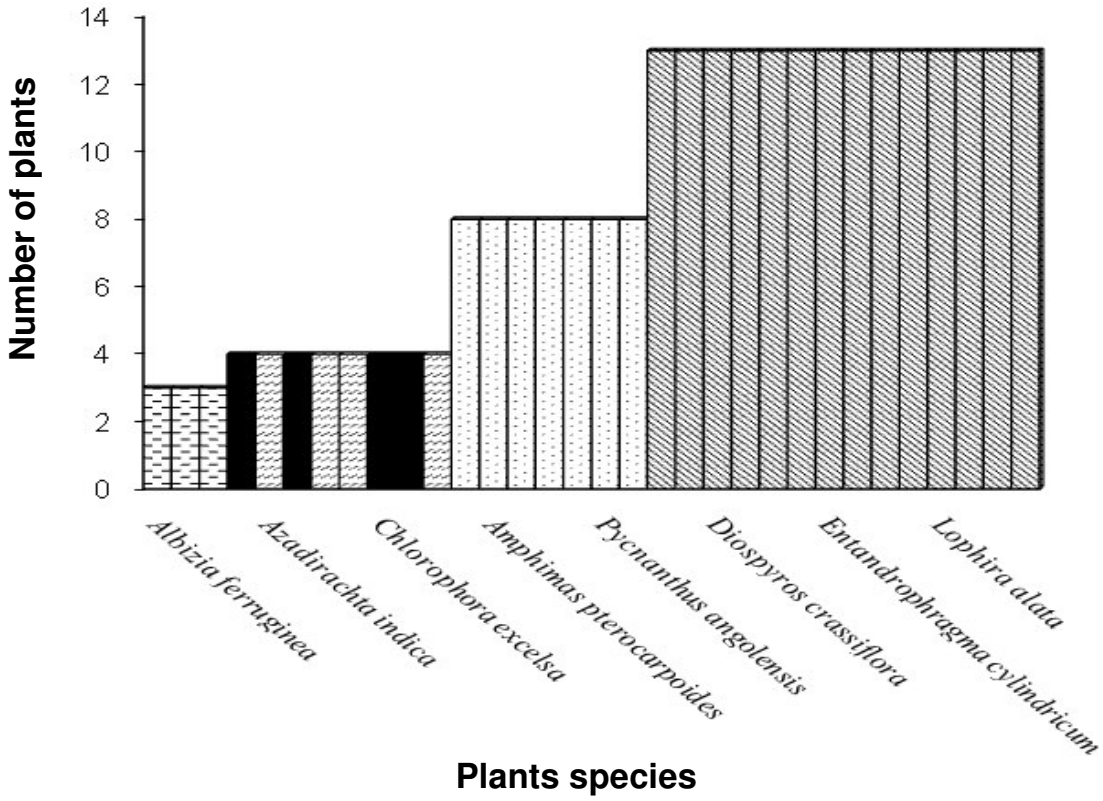

Figure 3. Distribution of major plants according to their ethnobotanical status.

transfer of forest management powers to local communities provides important opportunities for forest revenues to become stable endogenous sources of incomes for local development (Kiss and Dinah, 2002). There is an urgent need to halt and avoid future negative consequences for the forest ecosystem in Cameroon. Such efforts may require the expansion of the scope and management of natural resources to include non-traditional actors in the domain: so that all stakeholders in forest exploitation become responsible for the future of the forest. This has not really been the case in the past (Gardner et al., 2001; Lotsmart, 2006).

The Upper Nyong valley at the moment has no management plan in which the communities have power and responsibility. Environmental education of the communities and their inclusion in the formulation of policy for management of the valley and for implementation of that policy is essential: nothing but just. Since the growth in population and poverty are likely to continue, a better management strategy of the forest in Cameroon must be devised, and implemented with courage (Lotsmart, 2006; FAO, 2003). A good system of resource management should also be implemented by a creation of community farms and the development of a protected forest network, using simultaneous *in situ* and *ex situ* conservation of resources. This system of management allows a sustainable conservation of living resources (Begombe, 2002). That would apply to any forest owners who must act according to the standards and regulations in force (Nguenang et al., 2005). But they could act with a view to conservation and the support of unborn generation from that conservation of the endangered biodiversity of the Upper Nyong valley.

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Appendices

Appendix 1. Inventoried medicinal plants species used in traditional pharmacopoeia.

Scientific names	Families	Scientific names	Families
Abrus precatorius	Fabaceae	*Erythrophleum suaveolensb*	Caesalpiniaceae
Abrus sp.	Fabaceae	*Euphorbia hirta*	Euphorbiaceae
Acanthus montanus	Acanthaceae	*Fagara xanthoxyloides*	Rutaceae
Acnella caulirhiza	Asteraceae	*Funtumia elastica*	Apocynaceae
Afzelia bipindensis	Caesalpiniaceae	*Gambeya lacourtiana*	Sapotaceae
Agelanthus brunneus	Loranthaceae	*Garcinia cola*	Clusiaceae
Ageratum conizoïdes	Asteraceae	*Globimetula braunii*	Loranthaceae
Albizia adianthifolia	Mimosaceae	*Glyphea brevis*	Tiliaceae
Albizia ferruginea	Mimosaceae	*Guarea cedrata*	Meliaceae
Albizia glaberima	Mimosaceae	*Habenaria* sp.	Orchidaceae
Alchornea cordifolia	Euphorbiaceae	*Haunania danckelmaniana*	Marantaceae
Alchornea floribunda	Euphorbiaceae	*Hibiscus rosa-sinensis*	Malvaceae
Alchornea laxiflora	Euphorbiaceae	*Hibiscus surratensis*	Malvaceae
Alstonia boonei	Apocynaceae	*Hyptis suaveolens*	Labiaceae
Ampelocissus sp.	Vitaceae	*Irvingia grandifolia*	Irvingiaceae
Amphimas pterocarpoides	Caesalpiniaceae	*Kigelia africana*	Fabaceae
Anglycocalyx vermeulorii	Fabaceae	*Lantana camara*	Verbenaceae
Anonidium mannii	Annonaceae	*Laportea ovalifolia*	Urticaceae
Anthocleista vogelii	Loganiaceae	*Leptonychia multiflora*	Sterculiaceae
Antrocaryon klaineanum	Anacardiaceae	*Mangifera indica*	Anacardiaceae
Antrocaryon micraster	Anacardiaceae	*Margaritaria discoidea*	Euphorbiaceae
Asystasia gangetica	Verbenaceae	*Microdesmis puberula*	Euphorbiaceae
Azadirachta indica	Meliaceae	*Mimosa pudica*	Mimosaceae
Baillonella toxisperma	Sapotaceae	*Mitracarpus scaber*	Asteraceae
Baphia sp.	Fabaceae	*Momordica charantia*	Cucurbitaceae
Barteria nigritana	Passifloraceae	*Myrianthus arboreus*	Cecropiaceae
Berlinia grandifolia	Caesalpiniaceae	*Nauclea diderrichii*	Rubiaceae
Bidens pilosa	Asteraceae	*Nephrolepis biserrata*	Densteidtiaceae
Bridelia ferruginea	Euphorbiaceae	*Neuropeltis* sp.	Convolvulaceae
Bridelia micrantha	Euphorbiaceae	*Olax gambecola*	Olacaceae
Calanchoe crenata	Crassulaceae	*Oldenlandia lancifolia*	Rubiaceae
Caloncoba glauca	Flacourtiaceae	*Paulinia pinnata*	Sapindaceae
Caloncoba sp.	Flacourtiaceae	*Pennisetum,purpureum*	Poaceae
Canarium schweinfurthii	Burseraceae	*Pentaclethra macrophylla*	Mimosaceae
Canthium sp.	Rubiaceae	*Phragmantera capitata*	Loranthaceae
Capsicum frutescens	Malvaceae	*Phyllanthus amarus*	Euphorbiaceae
Carapa procera	Meliaceae	*Picralima nitida*	Apocynaceae
Casersisia seretii	Sapotaceae	*Piper guineensis*	Piperaceae
Cassia alata	Caesalpiniaceae	*Piper umbellatum*	Piperaceae
Cassia sp.	Caesalpiniaceae	*Piptadeniastrum africanum*	Mimosaceae
Catharanthus roseus	Apocynaceae	*Portulaca oleraceae*	Portulacaceae
Ceiba pentandra	Bombacaceae	*Psychotria* spp.	Rubiaceae
Celtis adolfi-friderici	Ulmaceae	*Psydium guajava*	Myrtaceae
Celtis tessmanii	Ulmaceae	*Pterocarpus soyauxii*	Fabaceae
Centella asiatica	Apiaceae	*Pycnanthus angolensis*	Myristicaceae
Chenopodium ambrosioïdes	Chenopodiaceae	*Rauvolfia vomitoria*	Apocynaceae
Chlorophora excelsa	Moracea	*Renealmia africana*	Zingiberaceae
Cissampelos mucronata	Menispermaceae	*Scoparia dulcis*	Scrophylariaceae

Appendix 1. Cont.

Cissus sp.	Vitaceae	*Securidaca longepedunculata*	Polygalaceae
Cleistopholis patens	Annonaceae	*Senna alata*	Caesalpiniaceae
Cleistopholis sp.	Annonaceae	*Senna podocarpa*	Caesalpiniaceae
Clerodendron scandens	Verbenaceae	*Senna sieberiana*	Caesalpiniaceae
Cola nitida	Clusiaceae	*Solanum aethiopicum*	Solanaceae
Combretodendron macrocarpum	Lecythidaceae	*Solenostenom monostachyus*	Asteraceae
Combretum bipindensis	Combretaceae	*Spathodea campanulata*	Bignoniaceae
Combretum micrantum	Combretaceae	*Strychnos* spp.	Loganiaceae
Commelina benghalensis	Commelinaceae	*Tapinanthus bangwensis*	Loranthaceae
Costus afer	Zingiberaceae	*Tephrosia vogelii*	Fabaceae
Crescentia eujete	Bignoniaceae	*Terminalia superba*	Combretaceae
Crosopterix febrifuga	Rubiaceae	*Trema guineensis*	Ulmaceae
Croton oligandrus	Euphorbiaceae	*Trichilia rubescens*	Meliaceae
Cyathula prostata	Asteraceae	*Trichilia* sp.	Meliaceae
Diospyros conocarpa	Ebenaceae	*Trichoscypha acuminata*	Anacardiaceae
Dissotis rotundifolia	Melastomataceae	*Trilepisium madagascariense*	Moraceae
Dracaena sp.	Agavaceae	*Uapaca* sp.	Euphorbiaceae
Drypetes sp.	Euphorbiaceae	*Vernonia colorata*	Verbenaceae
Elaeis guineensis	Arecaceae	*Vitex doniana*	Verbenaceae
Eleusine indica	Asteraceae	*Voacanga africana*	Apocynaceae
Emilia coccinea	Asteraceae	*Xylopia aetiopica*	Annonaceae
Enantia chlorantha	Annonaceae	*Xylopia* sp.	Annonaceae
Eremomastax speciosa	Acanthaceae	*Zanthoxylon* sp.	Rutaceae

Appendix 2. List of various species used as food plants in the Upper Nyong valley.

Scientific names	Families	Scientific names	Families
Acacia pennata	Mimosaceae	*Hibiscus esculenta*	Malvaceae
Aframomum spp.	Zingiberaceae	*Hibiscus sabdarifa*	Malvaceae
Afrostyrax lepidophyllus	Styracaceae	*Ipomoea involucrata*	Convolvulaceae
Alium spp.	Liliaceae	*Irvingia gabonensis*	Irvingiaceae
Amaranthus hybridus	Amaranthaceae	*Klainedoxa gabonensis*	Irvingiaceae
Ammi majus	Apiaceae	*Lophira alata*	Ochnaceae
Ananas comosus	Bromeliaceae	*Mangifera indica*	Anacardiaceae
Annona muricata	Annonaceae	*Manihot esculenta*	Euphorbiaceae
Annonidium mannii	Annonaceae	*Mimosa pudica*	Mimosaceae
Arthocarpus communis	Moraceae	*Musa* spp.	Musaceae
Arachis hypogaea	Fabaceae	*Myrianthus arboreus*	Cecropiaceae
Baillonella toxisperma	Sapotaceae	*Ocimum canum*	Labiaceae
Baphia sp.	Fabaceae	*Ocimum gratissimum*	Labiaceae
Bridelia micrantha	Euphorbiaceae	*Olax gambecola*	Olacaceae
Cananga odorata	Annonaceae	*Pentandiplandra brazzeana*	Pentandiplandraceae
Canarium schweinfurthii	Burseraceae	*Pentacletha macrophylla*	Mimosaceae
Capsicum spp.	Labiaceae	*Piper guineensis*	Piperaceae
Carica papaya	Caricaceae	*Psydium guajava*	Myrthaceae
Ceiba pentandra	Bombacaceae	*Ricinodendron heudelotii*	Euphorbiaceae
Cissus dinlagei	Vitaceae	*Saccharum officinale*	Poaceae
Citrus spp.	Rutaceae	*Scorodophleus zenkeri*	Caesalpiniaceae
Cochorus olitorius	Tiliaceae	*Solanum macrocarpum*	Solanaceae
Cola nitida	Clusiaceae	*Solanum melonguena*	Solanaceae
Cola pachycarpa	Clusiaceae	*Solanum torvum*	Solanaceae

Appendix 2. Cont.

Cola semecarpophyla	Clusiaceae	*Terminalia superba*	Combretaceae
Colocasia esculenta	Araceae	*Tetracera alnifolia*	Dillenniaceae
Cordia platythyrsa	Boraginaceae	*Tetrapleura tetraptera*	Mimosaceae
Coula edulis	Olacaceae	*Theobroma cacao*	Sterculiaceae
Crescentia eujete	Biognoniaceae	*Triumfeta cordifolia*	Tiliaceae
Cyperus sp.	Cyperaceae	*Triumfeta* sp.	Tiliaceae
Dacryodes edulis	Burseraceae	*Uapaca guineensis*	Euphorbiaceae
Dioscorea spp.	Dioscoreaceae	*Vernonia amygdalina*	Asteraceae
Elaies guineense	Arecaceae	*Zanthosoma sagittifolium*	Araceae
Garcinia kola	Clusiaceae	*Zea may*	Poaceae
Gnetum africanum	Gnetaceae		
Gnetum bucholzianum	Gnetaceae		

Appendix 3. Inventoried industrial plants species of the Upper Nyong valley.

A – Logged trees.

Scientific names	Families	Scientific names	Families
Afzelia bipindensis	Caesalpiniaceae	*Funtumia elastica*	Apocynaceae
Afzelia pachyloba	Caesalpiniaceae	*Guibourtia tesmanii*	Caesalpiniaceae
Alstonia boonei	Apocynaceae	*Khaya grandifolia*	Meliaceae
Amphimas pterocarpoides	Caesalpiniaceae	*Khaya ivorensis*	Meliaceae
Aucumea klaineana	Burseraceae	*Lannea welwischii*	Anacardiaceae
Baillonella toxisperma	Sapotaceae	*Lophira alata*	Ebenaceae
Canarium schweinfurthii	Burseraceae	*Lovoa trichilioides*	Meliaceae
Ceiba pentandra	Bombacaceae	*Mansonia altissima*	Sterculiaceae
Chlorophora excelsa	Moraceae	*Nauclea diderichii*	Rubiaceae
Combretodendron africanum	Lecythidaceae	*Pericopsis elata*	Fabaceae
Cylicodiscus gabunensis	Mimosaceae	*Piptadeniastrum africanum*	Mimosaceae
Delonix regia	Caesalpiniaceae	*Polyalthia suaveolens*	Annonaceae
Diospyros crassiflora	Ebenaceae	*Pterocarpus soyauxii*	Fabaceae
Distemonanthus benthamianus	Caesalpiniaceae	*Pycnanthus angolensis*	Myristicaceae
Duboscia macrocarpa	Tiliaceae	*Ricinodendron heudelotii*	Euphorbiaceae
Entandrophragma angolense	Meliaceae	*Tectona grandis*	Verbenaceae
Entandrophragma candollei	Meliaceae	*Terminalia ivorensis*	Combretaceae
Entandrophragma cylindricum	Meliaceae	*Terminalia superba*	Combretaceae
Entandrophragma utile	Meliaceae	*Triplochiton scleroxylon*	Sterculiaceae

B- Rubber trees.

Scientific names	Families	Scientific names	Families
Afzelia bipindensis	Caesalpiniaceae	*Klainedoxa gabonensis*	Irvingiaceae
Alstonia boonei	Apocynaceae	*Lophira alata*	Ochnaceae
Anthocleista sp.	Loganiaceae	*Maranthes glabra*	Chrysobalanaceae
Anthonotha ferruginea	Caesalpiniaceae	*Morinda lucida*	Rubiaceae
Aucumea klaineana	Burseraceae	*Musanga cecropioides*	Cecropiaceae
Caelocaryon preussii	Myristicaceae	*Mytragyna ciliata*	Rubiaceae
Calpocalyx dinklagei	Mimosaceae	*Nauclea diderrichii*	Rubiaceae
Canarium schweinfurthii	Burseraceae	*Newtonia leucocarpa*	Mimosaceae
Corynanthe pachyceras	Rubiaceae	*Pausinystalia* sp.	Rubiaceae

B- Rubber trees (contd.).

Coula edulis	Olacaceae	*Piptadeniastrum africanum*	Mimosaceae
Desbordesia glaucescens	Irvingiaceae	*Polyalthia suaveolens*	Annonaceae
Dialium bipindensis	Caesalpiniaceae	*Pycnanthus angolensis*	Myristicaceae
Dialium dinklagei	Caesalpiniaceae	*Sacoglottis gabonensis*	Humiriaceae
Diospyros crassiflora	Ebenaceae	*Sterculia tragacantha*	Sterculiaceae
Duboscia macrocarpa	Tiliaceae	*Strombosia glaucescens*	Olacaceae
Elaeis guineensis	Arecaceae	*Strombosia grandifolia*	Olacaceae
Enantia chlorantha	Annonaceae	*Strombosia tetandra*	Olacaceae
Erythrophleum ivorensis	Caesalpiniaceae	*Tabernaemontana crassa*	Apocynaceae
Gambeya lacourtiana	Sapotaceae	*Terminalia superba*	Combretaceae
Guarea sp.	Meliaceae	*Uapaca guineensis*	Euphorbiaceae
Homalium letestui	Flacourtiaceae	*Vitex grandifolia*	Verbenaceae
Irvingia gabonensis	Irvingiaceae		

C- Insecticidal plant species.

Scientific names	Families	Scientific names	Families
Annona senegalensis	Annonaceae	*Hymenocardia acida*	Euphorbiaceae
Antanda africana	Mimosaceae	*Nicotiana tabacum*	Labiaceae
Azadirachta indica	Meliaceae	*Pentaclethra macrophylla*	Mimosaceae
Carapa procera	Meliaceae	*Pterocarpus soyauxii*	Fabaceae
Chenopodium ambrosioides	Chenopodiaceae	*Schefflera* sp.	Bignoniaceae
Cymgopogon citratus	Poaceae	*Tephrosia* sp.	Fabaceae
Dichrostachys glomerata	Mimosaceae	*Vernonia* spp.	Asteraceae

Appendix 4. Some construction and habitat plants of the Upper Nyong valley.

Scientific names	Families	Scientific names	Families
Afzelia bipendensis	Caesalpiniaceae	*Haumania danckelmaniana*	Marantaceae
Altermidia conferta	Verbenaceae	*Hibiscus rosa-sinensis*	Malvaceae
Ancistrophyllon secundiflorum	Arecaceae	*Laccosperma* spp.	Arecaceae
Ancistrophyllum secundiflorum	Arecaceae	*Lovoa trichilioides*	Meliaceae
Baillonela toxisperma	Sapotaceae	*Magaphrynium macrostachium*	Clusiaceae
Caladium bicolor	Araceae	*Mansonia altissima*	Sterculiaceae
Calamus deërratus	Arecaceae	*Marantochloa purpurea*	Marantaceae
Calamus dëerratus	Arecaceae	*Musa paradisiaca*	Musaceae
Cananga odorata	Annonaceae	*Musa sapientium*	Musaceae
Canarium schweinfurthii	Burseraceae	*Musanga cecropioides*	Cecropiaceae
Ceiba pentandra	Bombacaceae	*Musanga cecropioides*	Cecropiaceae
Cola ficifolia	Clusiaceae	*Pericopsis elata*	Fabaceae
Cola semecarpophylla	Clusiaceae	*Polyscias fulva*	Araliaceae
Colocasia esculenta	Araceae	*Raphia* spp.	Arecaceae
Euphorbia cotinifolia	Euphorbiaceae	*Sacrophrynium prionogonium*	Marantaceae
Elaeis guineensis	Arecaceae	*Sanseviera thircifolia*	Agavaceae
Eremospatha macrocarpa	Arecaceae	*Schefflera* sp.	Bignoniaceae
Eremospatha wendlandiana	Arecaceae	*Spathodea campanulata*	Bignoniaceae
Euphorbia altissima	Euphorbiaceae	*Terminalia mentalii*	Combretaceae

Appendix 4. Some construction and habitat plants of the Upper Nyong valley.

Euphorbia cotinifolia	Euphorbiaceae	*Trachyphrinium braunianum*	Marantaceae
Ficus exasperata	Moraceae	*Triplochiton scleroxylon*	Sterculiaceae
Ficus spp.	Moraceae	*Triumfeta* spp.	Tiliaceae
Halopegia azurea	Marantaceae	*Zanthosoma sagittifolia*	Araceae
Halopegia azurea	Marantaceae		

Appendix 5. Threatened plants indexed in the IUCN red data list in Cameroon.

Scientific names	**Families**	**Scientific names**	**Families**
Afzelia africana	Caesalpiniaceae	*Daniellia oblonga*	Caesalpiniaceae
Afzelia bipindense	Caesalpiniaceae	*Dialium bipindense*	Caesalpiniaceae
Albizia ferruginea	Mimosaceae	*Dichapetalum madagascariense*	Dichapetalaceae
Aucumea klaineana	Burseraceae	*Diospyros barteri*	Ebenaceae
Autranella congolensis	Sapotaceae	*Diospyros crassiflora*	Ebenaceae
Autranella congolensis	Sapotaceae	*Drypetes preusii*	Euphorbiaceae
Baillonella toxisperma	Sapotaceae	*Enantia chlorantha*	Annonaceae
Begonia spp.	Begoniaceae	*Entandrophragma angolense*	Meliaceae
Brillantaisia lancifolia	Acantaceae	*Entandrophragma candollei*	Meliaceae
Bulbophyllum filiforme	Orchidaceae	*Entandrophragma cylindricum*	Meliaceae
Bulbophyllum korupense	Orchidaceae	*Entandrophragma utile*	Meliaceae
Calamus deëratus	Arecaceae	*Eremospatha wendlandiana*	Arecaceae
Calpocalyx cailiflorus	Mimosaceae	*Eribroma oblonga*	Sterculiaceae
Calpocalyx heitzii	Mimosaceae	*Eriocoelum sp.*	Sapindaceae
Calpocalyx klainei	Mimosaceae	*Garcinia cola*	Clusiaceae
Cananga odorata	Annonaceae	*Gaurea cedrata*	Meliaceae
Carex preussii	Cyperaceae	*Gnetum africana*	Gnetaceae
Chlorophora excelsa	Moraceae	*Gnetum bulchozianum*	Gnetaceae
Cleistopholis staudtii	Annonaceae	*Guirboutia tessmanii*	Caesalpiniaceae
Clerodendron anomalum	Verbenaceae	*Khaya ivorensis*	Meliaceae
Cola semecarpophylla	Clusiaceae	*Lophira alata*	Ochnaceae
Cola suboppotifolia	Clusiaceae	*Lovoa trichilioides*	Meliaceae
Cordia platythyrsa	Boraginaceae	*Mansonia altissima*	Sterculiaceae
Croton aubrevillei	Euphorbiaceae	*Millettia laurentii*	Fabaceae
Dalbergia melanoxylon	Fabaceae	*Nauclea diderrichii*	Rubiaceae
Dalbergia oligophylla	Fabaceae	*Newtonia camerunensis*	Mimosaceae
Daniellia klainei	Caesalpiniaceae	*Triplochiton scleroxylon*	Sterculiaceae