Biodiversity and local priorities in a community near the Ivindo National Park Makokou, Gabon

Report

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Research mission carried out within the framework of the management and development of the Ivindo National Park (Ogooué-Ivindo/Gabon)
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All photographs were taken by M. Wan and M. Sassen from CIFOR unless specified otherwise.

Abbreviations

CENAREST	Centre National de Recherche Scientifique et Technologique
CI	Conservation International
CIFOR	Center for International Forestry Research
CNPN	Conseil National des Parcs Nationaux
FIGET	Fondation Internationale Gabon Eco-tourisme - Giuseppe Vassallo
IRET	Institut de Recherche en Ecologie Tropicale
IUCN	International Union for Conservation of Nature and Natural Resources
LUVI	Local User's Value Index
NGO	Non Government Organisation
PDM	Pebble Distribution Method
PNI	Parc National de l'Ivindo
PSVAP	Programme Sectoriel de Valorisation des Aires Protégées
WCS	World Conservation Society
WWF	World Wildlife Fund

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Summary

In countries such as Gabon that depend heavily on their natural resources, a tension arises between forest conservation, exploitation of forest resources and the need to address the poverty of forest dependent people. Decisions over land use have local effects, but often do not take into account local people's preoccupations. This leads to frequent, but rarely anticipated, negative results. Sustainable land use planning that can benefit both people and conservation outcomes, requires understanding local perceptions and making them known. CIFOR has developed a set of methods combining classical biodiversity assessments with information on local people's perceptions, needs and preferences.

This study took place in Loaloa, Makokou (Gabon) a community that is highly dependent on forest resources for its livelihoods.

The results show that the river and the forest (primary forest in particular) are the most important land types for almost all uses and values in people's lives. High biodiversity sites are sites with high numbers of locally useful species. Some of the most important species for people are listed as vulnerable on the IUCN Red Data list and others are protected in Gabon. Elephants are a major cause of crop depredation and locally hinder agricultural development. Local people have important ecological knowledge that should be recognised and used as a basis for negotiations and for the involvement of the community in democratic decision making processes.

People feel powerless about their ability to change and influence decisions that affect their environment and livelihoods, reinforcing short term visions and possibly a profit maximalisation attitude that will endanger the sustainability of the PNI. Management tools and processes that recognise and promote local knowledge and give value to people's opinions by taking into account their needs and perceptions will contribute to changing attitudes and prevent future conflicts and overexploitation.

A more detailed executive summary of this report is available in French.

1. Introduction

Context of the study

The conservation of Central African forests is the subject of global concerns expressed through significant international attention and pressure. Gabon has made a tremendous effort by reserving around 10% of its territory in protected areas. In 2002, 13 new parks were created by a presidential decree (Décret n° 612/PR/MEFEPEPN du 30/08/2002). In 2001, the "Programme Sectoriel de Valorisation des Aires Protégées" of Gabon (PSVAP) funded by the European Commission and the government of Gabon was started to promote the long term protection and valorisation of Gabon's ecosystems and to support the sustainable development of its protected areas. In a country that depends strongly on its natural resources, tensions arise between forest conservation, the economic exploitation of natural resources and the need to address the poverty of forest dependent people. Sustainable management of protected forests, but also of other forests outside these areas, will need to take into account the different stakeholders that are affected by management decisions.

External decisions that have local effects often do not take into account local people's preoccupations, leading to negative results that are rarely anticipated (e.g. Schwartzman *et al.* 2000, Brockington and Schmidt-Soltau 2004). In contrast to commercial enterprises and influential conservationists, local communities often remain unheard by policy and decision makers, and their priorities and needs are easily overlooked (Sharpe 1998, Lawrence *et al.* 2000, Berg and Biesbrouck 2000 and Sheil *et al.* 2006). Relevant and sustainable land use planning that can benefit both people and conservation outcomes, requires understanding local perceptions and making them known. Although this understanding will not provide direct and ready made solutions, it will give means to explore opportunities for collaboration and negotiation and to avoid predictable conflicts.

Since 1998, the Center for International Forestry Research (CIFOR) has developed and tested a suite of survey methods to assess local communities' perceptions and priorities with regard to forest landscapes and biodiversity in East Kalimantan, Indonesia. These methods linked 'conventional' biodiversity assessments with information on local people's perceptions, needs and preferences (Sheil *et al.* 2004, 2006). The study has, among others, helped identify locally important plants and animals that are harmed by reduced impact logging practices (Sheil *et al.* 2006). In order to validate and test them, these methods have been adapted and applied in various countries around the world (see http://www.cifor.cgiar.org/mla). In Papua, Indonesia, CIFOR applied the methods in a conservation planning and local capacity building project for Conservation International (CI).

The methods seek to answer the following questions: 1) what occurs where (as in classical biodiversity assessments) and 2) why does it matter and how much does it

matter to local communities. Based on the answers to these questions, one can 3) 'diagnose' or evaluate implications for conservation and livelihoods, and 4) share insights and implications with stakeholders and decision makers. This document reports primarily on activities falling under points 1 and 2, with some reflections on point 3 and recommendations for point 4.

One of the components of the PSVAP is the rehabilitation of the research station at Makokou: "Réhabilitation et Re-dynamisation de la Station de Recherche de l'IRET à Makokou/Ipassa, Composante II du Programme Sectoriel de Valorisation des Aires Protégées au Gabon PSVAP, 8ACP GA 009 – FED". Ipassa station was created in 1962 and in 1979 it became the Institut de Recherche en Ecologie Tropicale (IRET), depending on the Centre National de Recherche Scientifique et Technologique (CENAREST). The station is located in the Man and Biosphere (MAB-UNESCO) Natural Reserve of Ipassa created in 1971. This Reserve is now included in the Ivindo National Park (Parc National de l'Ivindo (PNI)) (300,000 ha), one of the 13 new parks created in 2002 and located in the Province of Ogooué-Ivindo, in northeastern Gabon (Figure 1.1).

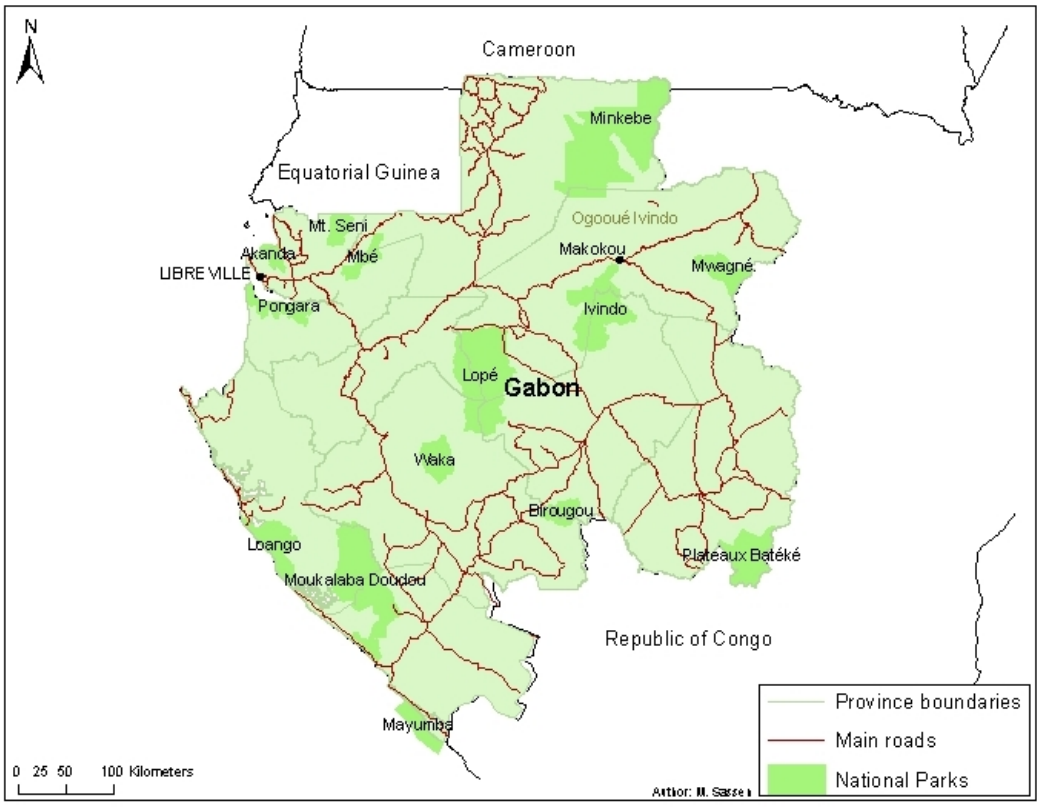


Figure 1.1. Map of Gabon and its national parks, based on data from the Institut National de Cartographie du Gabon (2004)

IRET/CENAREST and CIFOR are jointly implementing the rehabilitation project of the Ipassa research station. One of the objectives of this project is to support research that will inform and promote the sustainable management and development of the PNI. The development of conservation and valorisation activities within the PNI

is new to the area and involves changes that affect and worry local communities residing close to the park (inhabitants of Makokou and along the road north of the PNI, see Figure 1.1 and 1.2). Although a law exists in Gabon (Law 004/2001, article 15 and chapter IV) that recognises traditional use rights in protected areas, the affected communities have neither been involved in the plans for establishing the park nor in its future management plan. Communities have been informed of the park boundaries and they were given a map as well as a summary of the national park decree articles. A preliminary visit was made to the area in 2004 and community meetings were held in three villages (Epassendjé 1, Mbolo 3 and Loaloa) that make use of the park. From those meetings, it appeared that feelings of uncertainty, fear and powerlessness prevail, with regard to the park but also to logging around their villages. People are unsure of the consequences of the park for their activities. They referred to Article 7 of the decree, which permits 'customary rights of use' inside parks, asking what this meant in practice and whether buffer zones would be created around their camps. Many people's traditional territories (old villages) and economic activities are located along the Ivindo River (called "the Ivindo" from hereon) in the PNI (Figure 1.2) and alternative livelihood opportunities are scarce.

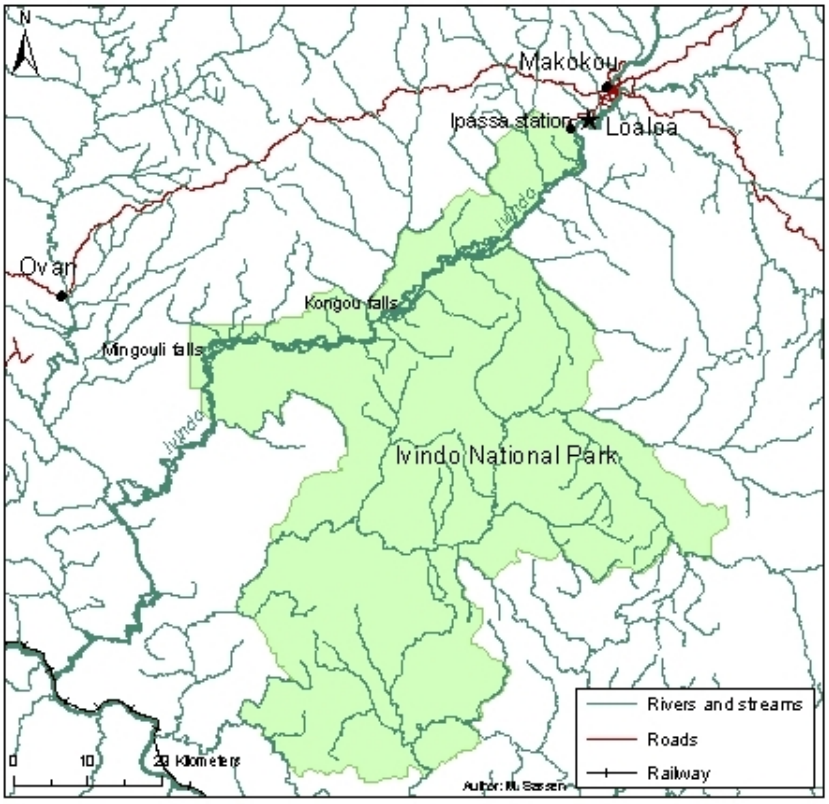


Figure 1.2. Location of Loaloa, the Ivindo National Park and the Ivindo River, based on data from the Institut National de Cartographie du Gabon (2004)

There is an urgent need to involve local communities in decision making processes that affect their livelihoods and thus to make their perceptions and needs heard. This study seeks to improve the understanding of local perceptions and priorities and to find points of common interest between development and conservation objectives in

the PNI area as well as opportunities for informed negotiation. For this, we have targeted a specific community (Loaloa, see Figure 1.2) that has an important presence in the PNI, due to the history of its people and the current use they make of the area.

So far very little efforts have been made to link local people's livelihood priorities and conservation objectives in the area (or in any of the national parks that have just been created). Makokou is one of the best studied sites in Africa regarding purely biological and ecological research (IRET 2003) but studies of local communities' uses and perceptions of forest resources in the area are fewer and focused on hunting (e.g. Lahm 1993, 1996, 2002; Vanwijnsberghe 1996; Okouyi Okouyi 2001), history and traditional culture (Perrois 1968, 1970, 1976, 1979; Doucet 2003; Pineau 1995; Hladik *et al.* 1996) and ethnobotany (Bourobou-Bourobou 1994; Walker and Sillans 1961).

Site

The region of Makokou is located slightly north of the equator, at around 500 m above sea level and on an ancient crystalline base. Dense evergreen humid forest covers the undulating plateaus. The main watercourse, the Ivindo River, a tributary to the Ogooué, is punctuated by numerous rapids and waterfalls (e.g. Kongou, Mingouli), which make navigation or floating of timber impossible. This, in combination with the absence of high value Au*coumea klaineana*, has delayed timber exploitation in the area upstream Kongou falls until 1998 (IRET 2003).

The climate is purely equatorial with mild temperatures (annual average 24˚C) and a weaker insulation than the northwest of Gabon. It is marked by four distinct seasons: two wet seasons and two dry seasons, each one long and one short. The relatively high humidity during the dry seasons explains the maintenance of a wet tropical forest despite the relatively low annual rainfall (1,700 mm).

The forests of north-eastern Gabon are part of the guineo-congolan phytochorological region and the floristic composition is intermediate between the Atlantic *Caesalpiniaceae* forest, which is part of the nigero-cameroonian-gabonese floristic sector and the congolian forest from the cameroono-congolese floristic sector, in transition with a more semi-deciduous forest type announcing the semi-deciduous *Sterculiaceae-Ulmaceae* forests of Cameroon (IRET 2003).

Only one third of the estimated 7000 plant species of Gabon are described in the Flore du Gabon (78 families, 642 genera and 2100 species) and just 18% of the total estimated to be found in North-East Gabon has so far been inventoried. Many animal species still need to be inventoried; 128 mammal species and 424 bird species have so far been indexed and much remains to be done concerning invertebrates.

People

The population in the Makokou region is mostly made up of Fang and Bakota ethnic groups, with a minority of Bakwélé, Baka or Bakola pygmies and non-natives. The latter frequently originate from West Africa and are often traders and shopkeepers.

Administratively, Makokou includes several villages, formally considered neighbourhoods or "quartiers" in French. According to the census of 1993, population density in Ogooué Ivindo is very low, on average 1.1 people per km^2. In 1993, the province had an estimated 49,000 inhabitants and Makokou 10,000. Estimation of the current population of Makokou is 15,000 people. The main economic activity is agriculture but timber exploitation as well as commercial hunting and trading of forest mammals is increasing. A number of Makokou's "quartiers" and other villages on the Makokou-Ovan road (Figure 1.2) have regular activities in the park area, generally along the Ivindo (e.g. Loaloa, Epassendje II, Mbolo III and others).

2. Methods

The methods used in this study largely follow those developed in Kalimantan, Indonesia, and are described in a manual by Sheil *et al.* (2004) which can be downloaded in English, French, Indonesian and Spanish on CIFOR's website: http://www.cifor.cgiar.org/mla.

Some of the concepts used in the context of this study are defined below, following Sheil *et al.* (2004).

Landscape: The landscape is defined as a spatial entity that encompasses more than just the sum of its physical components, meaning territory, soil, spatial occupancy and vegetation cover. We also consider it a historical and cultural construction.

Biodiversity: Biodiversity includes the entire flora and fauna of the landscape under study. We have however, focused mainly on the vegetation.

Importance: We did not give a detailed definition of what we called "importance" because we wanted people to include all the values and criteria they considered important. We explicitly avoided using the word "value" because of its economic connotation and assumed that importance can be expressed a holistic rating of people's relative preferences.

The approach seeks to identify and understand what local people find important. This means that importance is not limited to conservation, natural resources or economic values in any conventional sense. Various community-based methods provided a framework for identifying, discussing and scoring the significance of local land types, species and sources of useful products.

Field work in Loaloa took place from 31 March to 26 April 2005 (4 weeks) with some preparation and data checking/input before and after those dates (see schedule in Appendix 2). The whole team stayed in a rented house in the village for the duration of

the fieldwork, which required two jointly coordinated sub-teams (village and field teams). For the list of team members see Appendix 1.

The activities started with a community meeting to introduce the survey, plan activities and select local informants. Then, two participatory landscape maps were drawn with women and men separately, resulting in lists of local land types and resources as well as their distribution on the maps. The mapping exercise also clarified the geography of resource use: we had to extend our base map with 20 km on the basis of people's accounts. The completed maps formed the basis for the field sampling. Clean copies of the maps were later fixed on wooden boards, plasticized and returned to the village.
We relied on local informants to assess the importance of sites, plants and animals in terms of the different uses people make of them. Cross-checking of information with informants was performed through both formal and informal means.

Household staff (two cooks) and informants who worked whole days with the team received wages based on local standards. People participating in village exercises were provided with refreshments and snacks and with a symbolic monetary reward at the end of the study.

Village based activities

Table 2.1 provides an overview of village based activities. Data collection largely followed Sheil *et al.* (2004), although adaptations to the local context lead to some changes in the questionnaires and in the types of data collected.

Structured interviews were conducted with the village head and elders, as well as other key informants, on the village's historical and cultural background, (traditional knowledge of) land use, the collection and sale of forest products, and on the regulations and taboos concerning land and forest use.

Household surveys used a questionnaire, covering demography, income, aspirations, beliefs and traditions, and the community's perceptions of threats to people and the environment. An assessment of the housing quality provided a measure of people's relative wealth.

Scoring exercises were used to assess the relative importance of land types, sources of products, and plant and animal species. These exercises took place in focus group meetings of four (men/women/young/old) or two (men/women) groups. We used the so called "Pebble Distribution Method" (PDM) where pebbles or other small objects (e.g. seeds) are distributed over items according to their perceived relative importance. In different exercises, the groups divided 100 stones over illustrations of land and forest types, use classes, species or time periods, to indicate their relative "importance" to them. Explanations were asked for and follow-up discussions clarified understanding of the choices and sometimes led to modifications. The final scores were the result of group discussion and consensus.

Table 2.1. Data collection techniques used in the village based activities

Information collected	Method and target group
Village description/perspective of land use	Interview with village head and elders
Cultural background of land use	Interview with village head and elders
Demography	Household survey (census)
Price of traded goods	Interview of shopkeepers
Household survey (includes questionnaire of problems and aspirations, with comments on needs and solutions)	Interview of head of household of 34 households
Traditional knowledge of land use	Interview of 3–5 key informants
Forest product collection and sale	Interview of 3–5 key informants
Settlement history and land use	Interview with village head and elders
Disasters and important events	Interview with village head and elders
Identification of land and forest types	Community meeting (with mapping exercise)
Identification of forest products	Community meeting
Scoring the importance of landscape units	Focus group discussion. Women/men, old/young
Scoring changes in importance of landscape units and natural resources over time	Focus group discussion. Women/men
Scoring the importance of different sources of products	Focus group discussion. Women/men
Scoring the most important species per use category	Focus group discussion. Women/men




Community mapping with women, scoring exercise with young men and household interview

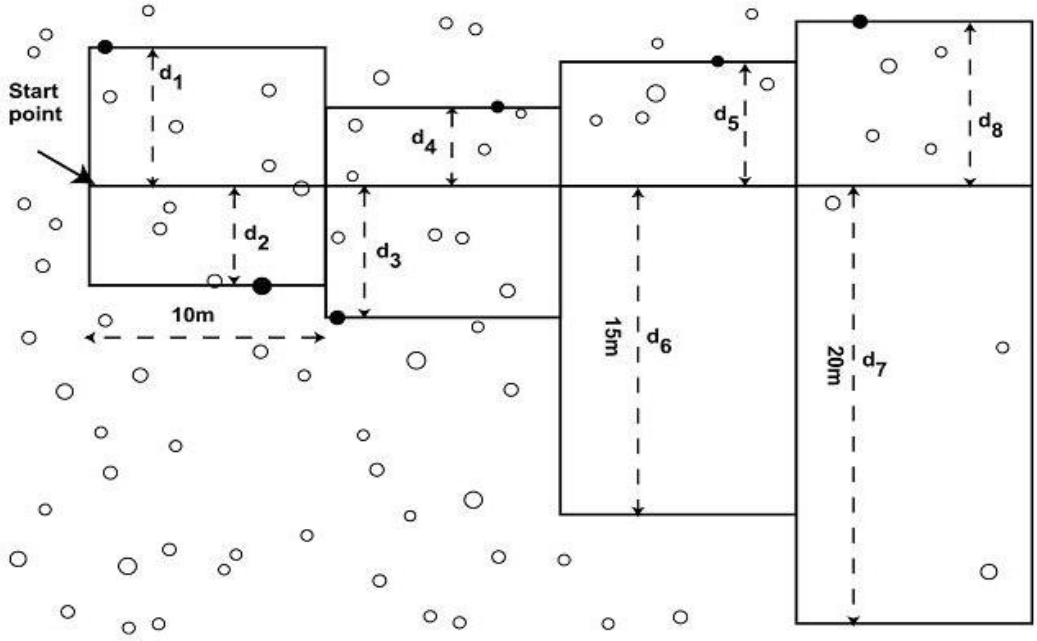
Field-based activities

The field survey assessed a variety of different vegetation types across the landscape, in 30 sites distributed around the village and along the Ivindo. Plots were selected by stratification according to land type and with guidance from community members to cover as broad a range as possible. Using efficient methods the field plots were established and described, recording information on location, vegetation, site use and local plant names.
For practical reasons, the soil survey initially planned in the study's terms of reference (Appendix 8) was finally not included.

The field survey was a combination of relatively standard scientific descriptions of terrain and vegetation, and of equivalent observations from local people's perspectives. Typically the team would be composed of 8-10 people: 2 local informants, 2 botanists, an ethnobotanist, a recorder, 2-4 assistants/boatmen.

The different steps of the field survey:

- Site description: a complete physical description of the terrain; a record of the dominant seedlings, saplings and shrubs; a description of the history of its use by our informants; the site's importance for different uses; its accessibility; the local names for the site, land type and vegetation.
- Herbs transect: a 40x5 meter transect subdivided into 10 subunits on either side of a 40 m transect line. In each of these subunits, herbs, climbers and other smaller plants were recorded. The botanists would name the species or collect specimens, while the ethnobotanist would ask informants for local names and uses.
- Tree sampling unit: a new sample unit, suitable for rapid assessments of tropical forest in heterogeneous areas was used (Figure 2.1, Sheil *et al.* 2003), along the same transect line as the herbs transect. Species, height and girth of a maximum of 40 trees with a diameter at breast height (dbh) ≥10 cm were recorded for each site. As with the herbs, local informants gave information about the use(s) of each tree.



The sample unit is composed of eight variable cells of 10 m wide that extend from the 40 m transect line. All distances are defined horizontally. Each cell captures five trees, or less, and the distance to the most distant tree included (filled in the figure) is recorded (d_1,d_2,.. etc.). The maximum distance to search in each cell before deciding it is 'empty' is 15 m (see d_6). The maximum distance to search to collect up to five stems is 20 m (see d_7).

Figure 2.1. Variable area sample unit for trees (Sheil *et al.* 2003)



Sample plot in a swamp, field team in a plot, and botany lesson from our local informant Mr Mangongwé

The identification of plant specimens was conducted at the Ipassa research station, using the IRET herbarium and library. The main reference was the Flore du Gabon published by the "Museum National d'Histoire Naturelle" in Paris. A flora of flowering plants and ferns has been published in six lists from 1964 to 1980 for the Makokou region. Further checking (synonyms, authors, etc.) used the online International Plant Names Index (IPNI) database (http://www.ipni.org).

Local ownership

As the potential exploitation of medicinal knowledge and locations of valuable resources are an important concern, the question of the ownership of local knowledge needs to be addressed. In community meetings we informed people about our intentions and goals regarding data collection. This required repeated explanation during the study. We emphasised that people need not tell us anything nor put resources on the map they did not want us (or others) to know about. Also, we never requested or recorded details of how medicinal plants were prepared and administered, even when provided to us voluntarily.

3. People, livelihoods, aspirations and the environment

Loaloa, people and livelihoods

Loaloa is located next to the Loaloa rapids on the Ivindo, about 7 km from Makokou's centre. An unpaved road runs from Makokou through Loaloa to the Ivindo bank where the Mayor of the town owns a house (former hostel). Makokou has a hospital with only two doctors and one secondary school. A primary school was built just outside Loaloa in 2004 with funds from an ecotourism project by an Italian NGO (Fondation Internationale Gabon Eco-tourisme - Giuseppe Vassallo (FIGET)). The village is delimited by the school in the North, the Ivindo in the South and at the start of the rapids in the East and by the Ipassa research station in the South West (at 3 km). The houses are all built along the road leading to the river.

Administratively, Loaloa is part of the town of Makokou. It has its own elected representative: the official village chief. In the last published census (1993), the population was estimated at 237 people in 47 households. People in Loaloa are in majority from the Kota ethnic group with some Makina and Fang. According to the villagers the Fang are mainly women married to Kota or Makina men, but the village has had Fang chiefs. Kota people are known for their relationship with the forest and their hunting skills, while Fang are considered good agriculturalists and businessmen.

Loaloa is one of the villages with the most fishing and hunting camps along the Ivindo (Lahm 2003). These camps are often located on or near old village sites and most are included in what recently became the new national park. People stay in the camps from a few days to a few weeks at a time, with short trips home for marketing products and getting supplies. Camps that are closer to the village are used more often but for shorter stays. The majority of camps are found between the village and the Kongou falls; although the villagers report going as far as the Mingouli falls (see Figure 1.2). People's main activities are fishing, hunting, sand extraction and agriculture (Table 3.1). Only 43% of the respondents have a formal job. Formal jobs are often in civil service (usually older men) or in development or conservation projects (younger men). An important indicator of household wealth is given by the materials used to build the main house (kitchens are separate). In Loaloa, 66% of people have earthen walls, 18.2% use wooden planks and 4.5% use concrete. The poorest have walls made of corrugated iron. Roofs are usually made of corrugated iron sheets (95.5%), grass or palm leaf roofs are rare. Floors inside the houses are made of beaten earth (68.2%), concrete (29.5%) or a combination of both.

Table 3.1. Sources of income and livelihoods in Loaloa

Sources of income and livelihoods	**Response from household heads** (number of answers among 44 households; more than one response allowed)	
What activities can be considered as a source of income or livelihood for your household?	Main activity	Secondary activity
- Fishing	16	20
- Agriculture	10	13
- Sand extraction	8	19
- Hunting	4	11
- Civil servant (Chief, Mayor and mayor's office staff)	9	
- Employment in project (IRET, FIGET)	6	
- Traditional healing	2	
- Nurse	2	
- Other employment	2	
- Shopkeeper/commerce	1	1
- Retirement pension	1	
- Forest product collection		1
Does anyone else but you contribute?		
- Wife	24	
- Nobody	17	
- Children or others	5	

Fishing is the most important livelihood and income generating activity in Loaloa (Table 3.1 and see Mamboundou 2005). Men fish in the Ivindo, from camps situated between Loaloa and Baya Baya (after Kongou) and their catch is generally sold (fresh or smoked) to traders. The tools used include nets and lines. Women usually fish for home consumption in the tributaries of the Ivindo. In the dry seasons they use baskets and dams to catch fish and shrimp.

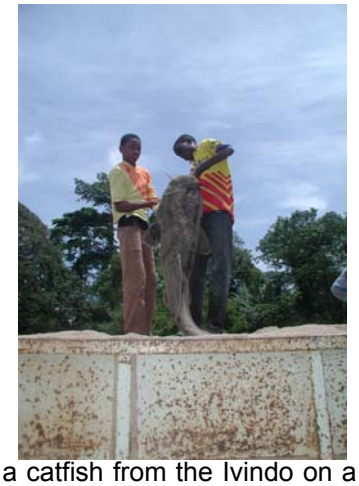
Agriculture is a subsistence activity, usually not producing enough surpluses for sale. Most female household heads reported it as their household's primary source of income. Only four men said agriculture was their main activity and always in combination with fishing, hunting and/or sand extraction. Cassava (*Manihot esculenta*) is the staple but several crops are usually combined and planting takes place twice a year, in the short (e.g. maize, cassava, and "cucumber") and in the long (e.g. groundnut, cassava and vegetables) wet season. Fields are found on both sides of the road, behind the houses. In the gardens directly behind the houses people plant or keep fruit trees (papaya, avocado, mango, oil palm, bush plum (*Dacryodes edulis*)), vegetables (taro, gombo, chili, etc.) and medicinal plants. Goats, sheep and chicken are only kept as a sign of wealth, to give away as presents or for sacrifice in rituals.

Sand extraction from the river bed is a significant source of income for younger men. It is however a high risk activity: the men dive down to the river bed near the rapids and scoop up the sand using buckets, which are emptied into a wooden canoe until it almost sinks. The sand is then pilled-up on the river bank, waiting to be sold. Sand trucks came through the village almost everyday day.

Hunting is an important provider of cash and protein, but also culturally significant. Unemployed men, who are not fishermen or sand collectors, hunt for an income and a social status. According to the villagers, hunting from the camps takes them up to about 5 km from the river banks. The best hunting is reportedly around Kongou. Hunters use guns and cable wires for snares. A few people own hunting dogs, and night hunting is common. Group hunting with nets has disappeared. Hunting activities are most intense in the wet season, when it is easier to follow animal tracks on the wet floor and when many forest trees are fruiting, attracting game.

Interestingly forest product collection was mentioned only once in the household survey and as a secondary activity (Table 3.1), although traditional healing (two responses) also involves the use of wild plants (and animals). This is probably due to the fact that most interviewed household heads were men while women and children collect most wild products. Also, wild plants' collecting generates less cash income than fish, game or sand. The major non-animal forest products being sold are fruits, vegetables, mushrooms and wrapping leaves. Forest products are collected in and around the village and in the forest (camps).




Cassava from the fields in a rattan basket, turtle *(Kinixys* sp.*)*, a catfish from the Ivindo on a sand truck

History, culture and traditions

The name Loaloa reportedly comes from “Boloaka na boloaka” = continuous (rapids). According to the village elders, Loaloa exists as a village since the 1950s. Before that, it was a fishing camp at the height of the rapids. The Bakota “grand-parents” came from the area below the Mingouli falls, and as far as the Ogooué. They gradually travelled up the Ivindo, the Amvong and Djidji rivers. Around 1930 the French colonial authorities made people settle along the road between Makokou and Ovan (see Figure 1.2). According to the villagers, they progressively moved to Loaloa by themselves. However, Lahm (2003) reports that their movements were the result of repeated conflicts with local communities, then forced settlement near Loaloa by the French and, finally, a forced move to Loaloa by Gabonese authorities in the 60’s to control misconduct[1]. The original fishing camp was then led by a Makina chief. He was later succeeded by a Fang, another Fang and then a Kota. The current chief is also Kota.

Before independence village chiefs were not elected but chosen by the elders, including the old chief if he was still alive. Chiefs were chosen for their wisdom and leadership qualities. According to the elders, this changed from 1996 when local administrative divisions (“arrondissements”) were created and the choice of a chief became driven by (local) politics. The previous chief (one of the current elders) told us he then resigned as he was from a minority party. The current chief was elected from among other candidates who all had clear party affiliations. Today everyone can be a candidate but, according to the elders, an elected chief remains in place only as long as the population is reasonably happy with him.

The village is organised into ethnic groups, clans and lineages. Within clans strict exogamy is enforced. The community also includes various societies or “initiatic groups” holding their own (initiation) ceremonies or “dances”, rituals and with specific taboos. Their goal is protection and healing, from psychological to physical illnesses.

[1] Problems in the community due to crime or people from Loaloa being accused of crime also appear in Table 3.2.

There are male, female and mixed societies. Apart from public dances, non-initiates are not allowed to attend the ceremonies, which are held near the river, in places behind the houses or in the forest (see also Perrois 1968).

Young men are initiated to the traditional laws and regulations in circumcision ceremonies that form the basis for the organisation of traditional society. Even if, according to the elders, some concessions on ancient traditions are nowadays made, circumcision remains the most important ceremony in village life. Women are not allowed at the ceremony, except if they are the mother of twins and are thus considered the equal of men. A circumcision ceremony involves different dances or rituals. In many dances participants paint their bodies with dots from spotted cat species (e.g. leopard (*Panthera pardus),* genets and civets) (Perrois 1968, Mazzochetti 2005). For a more detailed description of the role and performance of these ceremonies see Perrois (1968). The leopard (*ngoye*) has a special place in Bakota life. The so-called "*hommes panthères*"; a common phenomenon in West and Central Africa, are believed to able to change into a leopard and vice versa. They are both revered and feared (Perrois 1968, Lahm 2002).

Apart from during circumcision ceremonies, dances are performed at the birth of twins and for healing. *Mungala* can be performed in all three instances. *Mbuti* and *Membiri* are male dances/rituals used to cure physical or mental illnesses. The hallucinogen Iboga (*Tabernanthe iboga)* is used to enter in contact with the ancestors and ask them about the illness and how to cure it. Iboga is also used in the initiation rites of these societies.

Villagers said that many old dances are not practiced anymore, or have been changed. Nevertheless, the ceremonies mentioned above were regularly referred to during our stay and are still practiced. The elders were pessimistic about the continued existence of traditions because, according to them, young people are not interested anymore. As an example: before, when someone broke traditional rules, they were punished by the spirits. Now, when someone is suspected of "cursing" another person, their family will take them to the police.

More than 95% of interviewed adults called themselves Christians; a mixture of Catholics, Protestants and some Baptists. Others mentioned their initiatic society as their religion. Most people seem to quite easily combine the "new" religions with their traditional beliefs.

Attitudes to researchers, participation in the survey

People often found it difficult to understand our intentions. They confused us with park authorities and conservation NGO's who do not seem to have a very good reputation among the villagers. We heard reports of harassment, confiscation of game and arrests. In fact, World Wildlife Fund (WWF) and World Conservation Society (WCS) provide logistical support to the government agents ("Eaux et Forêts") who should enforce laws and regulations in the PNI, leading to confusion among

local communities. Communication between stakeholders seems to be a general problem in the area. For example, a rope was placed across the Ivindo at the level of the Ipassa station with permission from the National parks Council (Conseil National des Parcs Nationaux (CNPN)) to census the number of people using the park as well as the quantity of fish or other resources taken out for research purposes. Unfortunately many local people saw this rope as a check point or a "barrier" making the position of the research station ambiguous in their eyes. People have apparently already found ways around the barrier.

Most people participated well in the first community meetings and mapping exercises but afterwards motivation varied. The village-based activities involved managing regular demands for alcohol: participants were not interested in the non-alcoholic refreshments and snacks provided during exercises. Drunkenness and internal conflicts were a recurrent problem. Nevertheless, we found sufficient motivated and interested people that were generally willing to share a lot of information and experiences. Women in particular made a lot of efforts showing and drawing the products they collect.

People sometimes tried to involve us in internal conflicts or dominant individuals sought to take advantage of other people's confusion about our goals and activities for personal gain. We were, for example, once publicly accused of taking advantage of "*poor and illiterate*" (their words) people without anything in return. The problem was solved by discussion and after we asked them if they wanted us to leave. It does show some of the difficulties in conducting research in such a conflicted society.

Aspirations and attitudes

People's main concern/wish for the future generations is education that will help them find a job and earn a better living (Table 3.2). People would like to see their village grow and become more modern, with electricity, employment and a paved road. Lack of infrastructure and unemployment are high in the list of threats (Table 3.2).

Famine is considered the most important threat to the community. Many people blame food shortage on crop raiding by elephants (*Loxodonta africana cyclotis*) (Table 3.2). Indeed, reportedly because of this, a large part of forest that was cleared for agriculture southwest of the village had to be abandoned again. Fields on the other side of the river were abandoned earlier for the same reasons. According to people from Loaloa elephants made it impossible for them to develop their agriculture.

When asked what they would do to change the situation/deal with the threats, most people do not know or are fatalistic (Table 3.2). Around a third of the complainants about elephants proposed to kill them, which does not bode well next to a national park.

Table 3.2. Local aspirations, attitudes and threats to the community

Questions to the head of household	**Response from local people** (number of answers among 34 households; more than one response allowed)
Local aspirations	
What is your perception of your life in the past, present?	
- My life was better in the past/is more difficult now	18
- My life is better now	12
- There is no big change between past and present	3
Your hopes for the young generations?	
- Access to education/finish school	14
- They are successful/become someone	8
- They find work	6
- They "manage"	2
- They build houses	2
- They can be sent to town for a better life	1
What are your hopes for the development of the village?	
- Get electricity	12
- Get more employment opportunities	11
- Development and growth of the village	6*
- Improvement of the road (tar)	5
- Get better water	3
- Get housing for school teachers	2
Local perceptions of danger	
What threats/diseases can be dangerous?	
- Famine	14**
- The park	10
- Elephants (dangerous for people and destroy plantations)	9
- Sickness	6
- Unemployment/no infrastructure	6
- Criminality	4
- Trouble with other villages, accusations of crime (theft, murder)	4
- Poverty	3
- Death	3
- Other animals destroy fields (Sitatunga, cane rats, birds, etc.)	2
- Drunkenness	2
- Ipassa station (cannot fish there)	1
- Gorillas who bother women in the forest	1
How to avoid or reduce these dangers?	
- Do not know/nothing can be done, le it be	16
- Kill elephants	6
- Make larger fields	5
- Move fields/chasse elephants	3
- Do other activities	2
- Use traditional medicines	1
- Vaccination	1
- Get a gun against thieves	1

* 1 respondent said the Park would bring development

** 7 respondents specifically blamed elephants' crop raiding

Local views of forest functions and threats to the environment

Despite the threat they represent (Table 3.2) elephants are seen as an important component of the forest (Table 3.3). They open trails in the forest and disperse seeds. It is along elephant trails that people/hunters move through the forest. According to some, the trails always end-up at the river so people can not get lost. Other animals are also important for the seed dispersal of fruit trees that promote for forest regeneration.

Table 3.3. Local views of forest functions and threats to the environment

Questions to the head of household	**Response from local people** (number of answers among 34 households; more than one response allowed)
What species of plants and animals are important for the protection and maintenance of forest functions?	
- No/do not know	14
- Elephants	9
- Fruit trees	7
- All animals	3
- Water chevrotain	3
- Red river hog	3
- Duikers	1
- Pangolin	1
- Birds	1
What is disturbing the maintenance of forest (including the river) functions and uses	
- Logging by timber companies	19
- Hunting (reduces or scares game away)	12
- There is no threat, or I do not know	7
- Use of poison for fishing	3
- Disturbance of animals (elephants, chevrotains)	3
- Fields that are opened and not maintained	2
What will you do if the forest disappears?	
- Die	17
- Find other income sources	6
- Suffer	3
- Move the village/fields	3
- Do not care (do not use the forest much)	2
- Impossible	2
- Pray to God	1

People have difficulty conceiving the possible disappearance of the forest ("we will die") but they are aware of the dangers from logging and hunting (Table 3.3). Most of the area around the PNI has been allocated as logging concessions. According to the villagers logging does not only cut down trees but also causes game to flee. A few people said that human activities disturbed animals that have an important role in maintaining the forest's functions and uses (Table 3.3).

When asked if there were places that they would like to see protected from external disturbance such as timber exploitation, people answered that they had no power to ever demand/obtain such a thing. Decisions on land use are made in Libreville and local communities have no influence. In fact, old village sites seem to be very important to them, not only because people use them for livelihood activities but also because they have an important historical and cultural value. According to the villagers, people that moved away still visit these places when they come back.

Traditional regulations and taboos in the use of land and forest

There are many restrictions on the consumption of forest animals, less on plants (Table 3.4). Most respondents listed at least one "regulated" species; some were typical of the clan (and often include the leopard), others were associated with past personal or family events. People did not know always remember the reasons for the restrictions; they are past on from generation to generation. Animals or plants used in a person's initiation/circumcision ritual are not to be eaten by him and his direct family. Women usually take on the food restrictions of their husbands.

Also, in initiation rituals, e.g. for *Mbuti* or *Membiri*, the initiates' hallucinations show them the animals that they are not allowed to eat (Table 3.4). The elephant was the most frequently mentioned species. People are also not allowed to eat animals or plants that were used for curing their illnesses as the effect will be undone or reversed.

Table 3.4. Restrictions and taboos on the use of land and forest

Questions to the head of household	**Response from local people** (number of answers among 34 households; more than one response allowed)
What are the taboos, restrictions on the use of plants, animals and other forest products?	
- I do not eat animals/plants used in *Membiri* ritual; e.g. elephant, (large) catfish, leopard, cassava leaves, yellow-backed duiker, sitatunga, bay duiker, taro leaves, black fronted duiker, etc.	40 (17 species)
- I do not eat specific animals/plants (unspecified reasons); e.g. leopard, elephant, gorilla, crocodile, mandrill, crab, taro leaves, etc.	19 (15 species)
- Do not eat animals and plants used at my circumcision ceremony; e.g. pike, monkey, bay duiker, banana, cassava leaves	5
- No access to places where ceremonies are held	3
- Do not eat animals seen in *Mbuti* ritual; e.g. elephant, leopard	2
- Will give a disease to children; e.g. de Brazza's monkey	1
-.Do not eat what was used in a cure; e.g. monkey (skull used)	1
- Do not eat spotted animals: father of twins	1
Are there special traditional rules concerning land and forest clearing?	
- No	27
- Yes (do not cut fruit/medicinal trees)	8

From group discussions with the elders additional restrictions and taboos emerged. Young people should not eat yellow-backed duiker (*Cephalophus silvicultor*) as it makes them sterile/unattractive to the other sex. Being single/sexually inactive is not considered normal. Women are traditionally not allowed to eat the black fronted duiker (*C. nigrifons*) (prolongs menstruation), red river hog (*Potamochoerus porcus*) (used in *Mungala* but also a meat favoured by men), bay duiker (*C. dorsalis*), turtles and pottos (*Perodicticus potto*). Some aphrodisiac plants are also forbidden for women. There are numerous other animals that women should not eat during pregnancy to avoid diseases and malformations for the foetus or newborn or problems at birth. Because they believe spotted carnivores can cause scabies, most people will not eat them but it is strictly forbidden only to women. Leopards (*Panthera pardus*), other spotted cats (e.g. *Genetta servalina, Civettictis civetta, Nandinia binotata* and *Profelis aurata*) and other animals that are not eaten are sometimes killed for ceremonial or healing purposes.

According to the villagers most taboos and restrictions on food are disappearing, particularly those for women and children. Young people are losing interest. Many species are killed and sold in other places where they are not subject to taboos.

When questioned, the elders said there were no specific places protected by traditional rules, although during our stay it became clear that some places where ceremonies are held are forbidden to outsiders.

Community mapping

Community mapping was done with women and men in separate groups. As the base map we provided did not feature all tributaries of the Ivindo (scale 1:200,000), we first asked people to add the missing streams and important places. The men named all the tributaries of the Ivindo on the map as they followed it downstream from Loaloa. The identification of the tributaries and the localisation of camps and old villages triggered a lot of discussion. The elders especially were telling stories and recounting adventures linked to the different places. The process became a geographical review of people's history. The importance of the river in people's lives and history transpired from the detailed nomenclature for the different elements of their river system (Table 3.5).

Table 3.5. River system nomenclature

Local name	Explanation
Zoa	Main river (Ivindo)
Esokuluma	Small stream without branches flowing directly into the main river
Ndondo	Stream: tributary (with branches) of the main river
Ekongo	Small stream flowing into tributary, starting at a ridge
Mapeza	Streams into tributary
Ibolo	"End"/Source of stream

After drawing and naming all the streams, we asked people to list the different land types they distinguished as well as the resources they found there and draw them on the map (Figure 3.1). It was difficult to make people position resources exactly on the map. They generally drew the resources next to the camps from where they collect them.

Table 3.6 shows just a few examples of the type of resources mentioned for each land type, but a long list of resources and their location was put together from information collected during the mapping exercises (Appendix 3). Women were particularly detailed in their accounts of fruit and medicinal trees and drew a more detailed map of the village, where they have most of their activities (Figure 3.2).

Table 3.6. Land types as perceived by the community

Land types, features		
Local name	**Description**	**Examples of resources**
Mboka	Village	Houses, kitchens, gardens
Mbia Mbia Ilungwe/Mbia tounda	Garden behind the house	Fruit trees, vegetables, taro, sugar cane
Mpoma	Small field near the house	Cassava
Kouba djihewoh	Current field (up to ±1 years since first planting)	Cassava, maize, peanut, cucumber, yam, chili, medicinal plants
Ekonda zok	Peanut field	Peanuts
Iboutou djihewoh	Young fallow (<5 years)	Cassava, medicinal plants
Iboutou diaka	Old fallow (>5 years)/secondary forest (“closed forest”)	Wild fruits, leaf vegetables (*Gnetum* sp.), wrapping leaves
Ekombo	Old village site	Wrapping leaves, fruits
Ebazi	River camp	Hunting, fishing, wild products collecting, “planted” citrus trees
Iswaka	Primary forest (“open forest”)	Wild fruits, leaf vegetables (*Gnetum* sp.), mushrooms, medicinal barks
Itaba	Clearings or Baï	Hunting place
Etobo-tobo	Seasonally inundated forest	Fishing place
Mandonbo	Swamp (forest)	White clay for use in ceremonies, worms for fishing
Zoa	River	Fish, sand
Ma yawa	Rapids	Fish

We asked people how far they usually go into the forest, particularly when in their camps. According to the villagers, fishermen usually stay close to the camp. They sometimes trap some animals near the camp and collect forest products they need (materials for building the camp, fruits, medicinal plants, etc.). Hunters go further into the forest, following trails opened by elephants. They reported distances between 5 and 10 kilometres from the river but said they do not usually meet people from the Ovan road on their trips. A more detailed account of hunting practices can be found in Viano (2005).

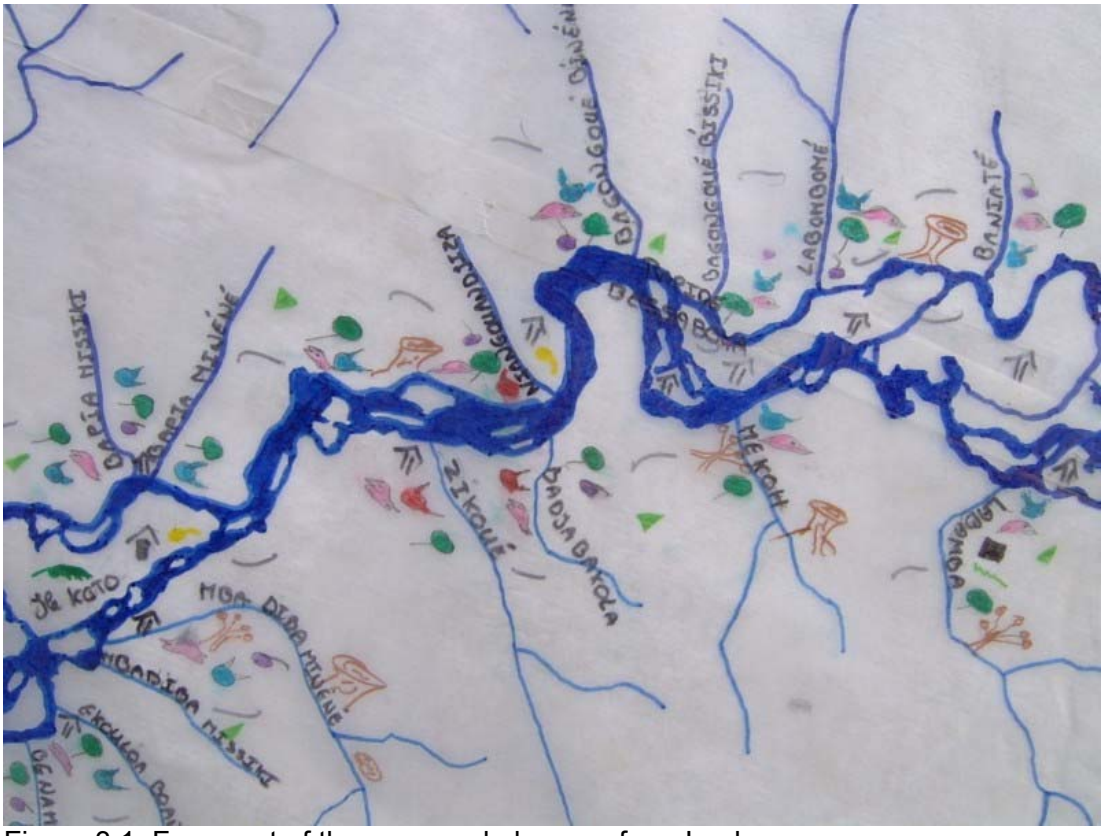


Figure 3.1. Fragment of the map made by men from Loaloa

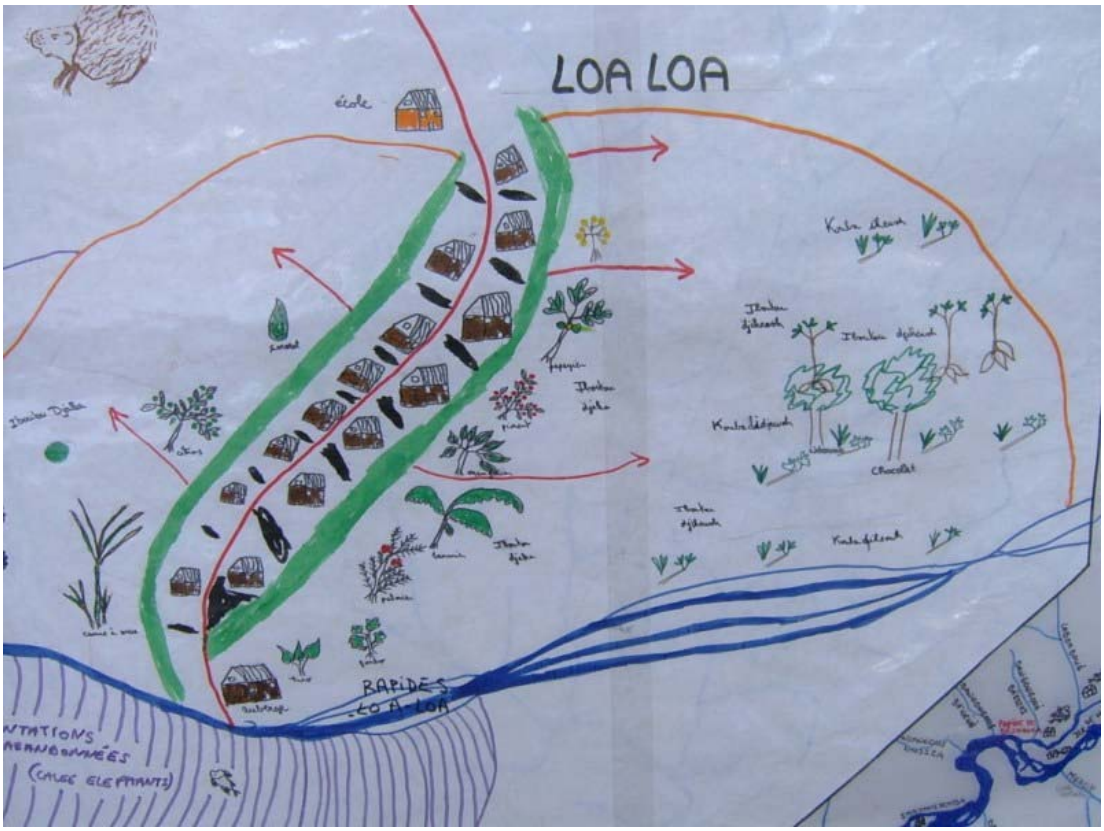


Figure 3.2. Map of the village made by women from Loaloa

No major changes in land use or availability seem to have taken place recently, except for the establishment of the park. When asked, our informants mentioned (again) the fields that were abandoned because of crop raiding by elephants. On a larger time scale, and with their progressive movement upstream, the forest they use has changed. Old village and camp sites are still used but people do not usually go as far as the Mingouli falls anymore. Most activities are restricted between Loaloa and the camps just below Kongou falls, where fishing is best. Indeed, we found boats and engines at a camp site there. We were regularly told that the perceived decline in fish between the village and Kongou was due to an increasing number of fishermen. This decline was nevertheless not mentioned as a threat to the community in the household survey, while diminishing game because of hunting was (see Table 3.3). The availability of other forest products such as fruits and mushrooms reportedly remained the same.



Smoked fish from the camp, wild mushrooms, *Megaphrynium macrostachyum* wrapping leaves

4. Results of the field survey

Plot selection and distribution

The choice for the location of the sample sites for the field survey was based on the community maps. We tried to sample all land types identified by the villagers, but emphasised on forest as it is the dominant land cover in the landscape. Most sample sites were located on both sides of the Ivindo between Loaloa and Kongou, others in and around the village (Figure 4.1). We surveyed 30 sites in 25 field days, with one plot per site. Two boat and camping trips of seven and five days each were undertaken for the furthest locations. Due to time constraints the survey was restricted to the area most frequently used and stayed relatively close to the river. Also our informants' age (60+) limited their ability to walk long distances.

The 30 plots included: 6 in primary forest, 9 in secondary forest (including natural secondary forest and old village/old agricultural sites), 3 in seasonally inundated

(called “riparian”) forest, 3 in swamp forest, 3 in swampy forest clearings (Baï), 2 in agricultural fields, 2 in young fallows (<5 years) and 2 in an old fallow (>5 years). A summary description of each sample plot is given in Table 4.1.

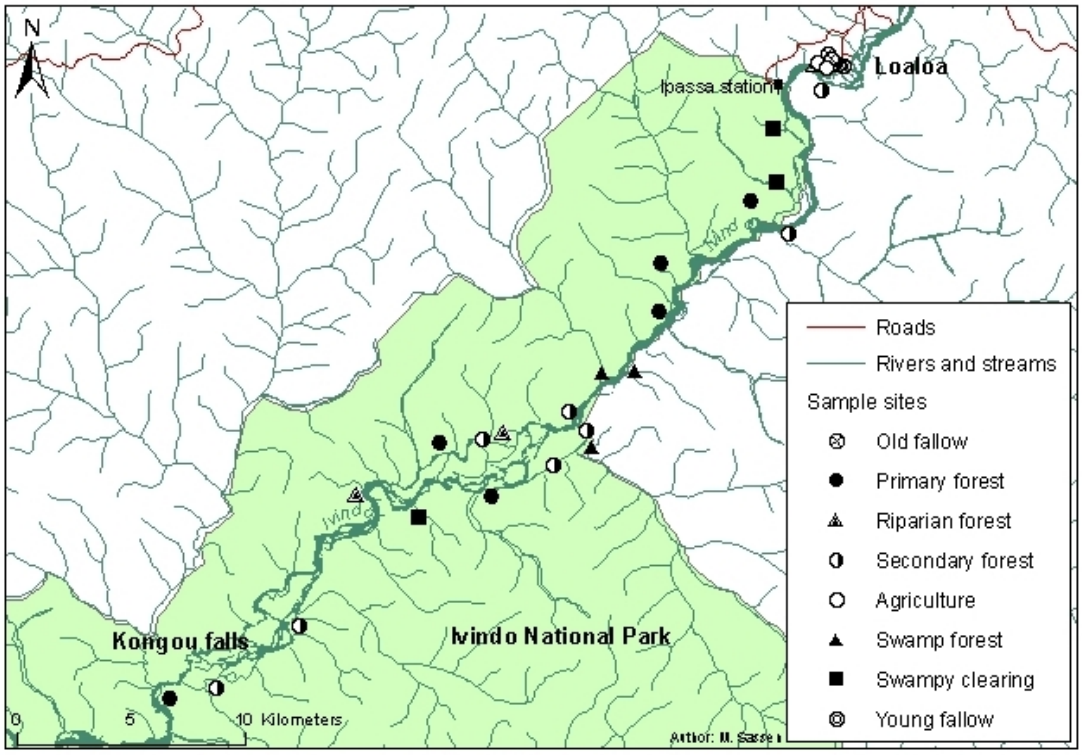


Figure 4.1. Location of sample plots. Base map based on data from the Institut National de Cartographie du Gabon (2004)

Table 4.1. Site description of each sample plot

Plot	Location	Eastings	Northings	Vegetation type	Remarks
1	Metolou ndéka béta	57983	257285	Riparian forest	Primary forest
2	Obo-ouboka	56854	257635	Secondary forest	Abandoned fields (30 years)
3	Bambomo	30122	228969	Primary forest	Closed canopy and open understory
4	Ekombo ya Ndambe	30590	230973	Secondary forest	Old village site on a plateau (85 years)
5	Mekoh	38094	239795	Swampy clearing (Baï)	Natural clearing
6	Ekombe Ebanda	33307	234641	Secondary forest	Old village site (100 years), low canopy with openings, fairly dense understory
7	Edjitchi ya Bangongwé	39074	237156	Riparian forest	Primary forest, low closed canopy, dense undergrowth
8	Nswaka moa Banyaté	41353	240810	Primary forest	High closed canopy, open understory
9	Boukolô	38972	243106	Primary forest	Low canopy and fairly dense understory

Plot	Location	Eastings	Northings	Vegetation type	Remarks
10	Editchi ya mbèlè na Badouma	41482	242714	Secondary forest	Abandoned fields (100 years), low canopy with openings, fairly dense understory
11	Ezingazinga ya Mpamoa walé	41162	247437	Swamp forest	Low canopy and open understory
12	Edjitchi ya Masoso	57946	258583	Young fallow	1.5 years old cassava field, still harvested
13	Edjitchi Ebongui	58041	258402	Young fallow	1.5 years, *Triumfetta cordifolia*, *Millettia mannii* sprouting
14	Edjitchi ya Mbiatounda	58089	258254	Secondary forest	Abandoned fields (40 years), low canopy and closed understory
15	Mbèlè Koumou	42688	246494	Secondary forest	Natural (wind disturbance), high closed canopy and open understory
16	Edjitichi ya Mosambo	41830	243608	Riparian forest	Secondary (wind disturbance), low and open canopy, open understory
17	Edjitchi ya Banganga	40370	245804	Secondary forest	Natural (150 years), low canopy and open understory
18	Ekombo ya Pendo	41852	247246	Secondary forest	Old village site (5 years), open canopy, very dense closed understory
19	Editchi ya Mionmion	44431	247864	Swamp forest	
20	Edjitchi ya Bawaka	47117	250499	Primary forest	
21	Etobotobo ya Bapounga	44463	249339	Swamp forest	With *Raphia* sp.
22	Editch ya Nyambala	49293	250575	Primary forest	Closed canopy, open understory
23	Itaba ya Zembi	52857	255555	Swampy clearing (Baï)	Natural clearing
24	Nswaka	52012	254461	Primary forest	Openings in canopy, open understory
25	Itaba ya Nyame Pendè	55229	255374	Swampy clearing (Baï)	Natural clearing
26	Iboutou ya Nzokoa dja midi	58503	257937	Old fallow	>10 years
27	Iboutou ya Mbiatounda	58213	258068	Old fallow	5 years
28	Edjitchi ya Metoulou kabéta	58120	257442	Agriculture	Non weeded 1 year old cassava field
29	Edjitchi ya Loaloa	57861	257840	Agriculture	Non weeded 1 year old cassava field
30	Ekombo ya Meye	50522	256136	Secondary forest	Old village site (2 years), no canopy, closed understory

Botanical summary

The botanical survey recorded a total of 1,987 plants. Table 4.2 gives an overview of the recorded and identified species for trees and non-trees (herbs, climbers, ferns, epiphytes, monocots, etc.) in the sample plots as well as for the most abundant seedlings, saplings, shrubs and monocots found on each site. When identification could not be made directly in the field, specimens were collected and stored at the Ipassa herbarium. A few unidentified records remain, mainly due to the difficulty in collecting fertile specimens.

Table 4.2. Summary of all plants recorded from the 30 plots

	Families	Genera	Species	Total records
Trees	38 Identified = 38	125 Identified = 125	160 Completely identified = 157 Identified up to genus = 3	836
Non-trees	69 Identified = 69	168 Identified = 166 Unidentified = 2	224 Completely identified = 216 Identified up to genus = 6 Unidentified = 2	954
Abundant seed/saplings, shrubs, monocots*	36 Identified = 35 Unidentified = 1	69 Identified = 68 Unidentified = 1	82 Completely identified = 60 Identified up to genus = 21 Unidentified = 1	197
All plants	97 Identified = 96 Unidentified = 1	308 Identified = 305 Unidentified = 3	425 Completely identified = 392 Identified up to genus = 30 Unidentified = 3	1987

* Species present on site, not in the sample plot

The records for most abundant species of seedlings, monocots, saplings and shrubs observed in each site (directly around the plot) are not exhaustive and will thus not be used in analyses of species richness and density calculations. Their numbers recorded per site are available in Appendix 4. Their identification contributes mainly to the description of the site.

As expected, the species richness and the mean number of trees were higher in forest than in other land types (Table 4.3). The highest numbers of trees were found in relatively undisturbed forest plots (including primary, riparian and swamp forest), but on average primary forest was richest in tree species. Swamp forest has a high number of trees but relatively lower species richness compared to the other forest types. As expected, regenerating and secondary vegetation has more non-tree species than undisturbed forests. Swampy clearings are poor in all plant species (Table 4.3).

Table 4.3. Mean numbers of species recorded per land type (data per plot in Appendix 4)

Land type	Richness*	Mean number of trees	Mean number species of	
			trees	non-trees
Primary forest	0.81	38.7	19.7	25.0
Secondary forest	0.79	33.8	16.0	37.2
Riparian forest	0.77	39.7	18.0	23.3
Swamp forest	0.73	39.0	15.0	20.3
Swampy clearing (baï)	0.37	3.3	2.0	17.7
Agriculture	0.42	3.5	2.5	35.0
Young fallow	0.00	0.0	0.0	51.0
Old fallow	0.65	23.5	9.0	33.5

*Richness (trees) = Log_{10}sp/log_{10}count

Table 4.4 shows a breakdown summary of the numbers of species in each life form class recorded in the non-tree samples. The classification in woody and non-woody climbers was sometimes difficult, depending on the age of the plant. Agricultural fields had been planted a year ago and, as people almost do not weed, were already being colonised by climbers and herbs while still in production (cassava mainly).

We did not find many species of rattan (Pl) in the sample sites. Only plot 1 and 11 (riparian and swamp forests) had more than one species (Appendix 5).

Table 4.4. Mean numbers of non-trees species recorded in each land type by life-form (data per plot in Appendix 5)

Land type	Life form								
	E	F	FE	FicE	G	H	L	Pl	PlA
Primary forest	1.0	1.5	1.2	0.0	0.3	9.8	11.0	0.3	0.0
Secondary forest	1.0	2.9	0.4	0.0	0.7	13.1	19.0	0.2	0.1
Riparian forest	0.7	2.0	1.0	0.3	1.0	7.0	10.0	1.3	0.3
Swamp forest	1.7	1.3	0.7	0.0	0.3	6.3	8.7	1.7	0.0
Swampy clearing (baï)	0.0	1.7	0.0	0.0	0.0	16.0	0.0	0.0	0.0
Agriculture	0.5	1.5	0.0	0.0	0.0	21.5	12.0	0.0	0.0
Young fallow	0.0	0.5	0.0	0.0	0.0	25.0	25.5	0.0	0.0
Old fallow	0.0	1.5	0.0	0.0	0.0	17.5	14.5	0.0	0.0

Note: E= Epiphyte, F= Fern, FE= Epiphytic fern, FicE= strangler fig, G= climber (non-woody), H= Herb, L= Woody liana, Pl= Palm family, PlA= tree palm

Forest structure

A summary of some key structural characteristics of the forest tree communities is provided in Table 4.5. As expected, the tallest trees (45 m), largest diameter (189 cm) and highest basal area per ha (49.70 m^2/ha) were found in primary forest. However, seasonally inundated (riparian) and swamp forests showed the highest mean tree densities (769.76 and 868.87 tree/ha). In secondary forest, high basal areas are found in some naturally disturbed forest plots and very old village sites or plantations (see e.g. plots 15, 6 and 4, Table 4.5).

The Bifurcation Index (BI), a measure of the branching of a tree (from one main stem into several) is expected to be low in previously undisturbed vegetation. The highest values (67.53 and 63.00) are found in secondary forest plots (plots 14 and 18).

Table 4.5. Forest structural characteristics

Land type	Plot	Mean dbh* (cm)	Max dbh* (cm)	Mean Height (m)	Max Height (m)	Mean BI**	Std Dev BI	Mean density (/ha)	Mean BA*** (m^2/ha)
Primary	3	29.29	95.00	18.93	**45.00**	28.93	31.99	461.24	31.85
forest	8	34.80	115.00	16.38	30.00	19.43	25.57	328.59	**49.70**
	9	35.38	**189.00**	13.75	26.00	17.41	22.61	267.79	44.01
	20	28.32	66.50	18.00	34.00	27.08	29.69	379.76	32.54
	22	27.47	97.30	16.57	28.00	12.95	20.89	434.23	44.62
	24	30.97	90.00	16.83	28.00	18.65	22.48	374.40	34.64
Secondary	2	21.11	130.00	13.63	40.00	16.21	24.44	326.98	17.98
forest	4	24.53	62.50	14.39	25.00	21.68	25.51	387.23	**23.47**
	6	26.59	100.00	13.24	28.00	22.24	28.94	299.31	**23.89**
	10	26.02	64.10	13.18	19.00	21.53	22.17	297.04	20.86
	14	20.52	99.00	11.68	25.00	**67.53**	28.66	228.14	11.52
	15	28.53	71.80	15.85	40.00	16.00	22.29	367.94	**34.92**
	17	29.06	60.00	15.16	23.00	33.66	25.18	241.47	21.05
	18	18.64	50.50	9.52	15.00	**63.00**	38.28	150.55	5.56
	30	28.35	62.80	12.18	19.00	11.73	26.14	71.91	5.82
Riparian	1	28.76	100.00	15.25	30.00	13.11	21.67	291.99	32.50
forest	7	23.07	59.60	13.69	22.00	28.21	26.65	598.63	34.37
	16	20.32	45.00	12.73	21.00	20.35	26.03	**769.76**	26.86
Swamp	11	23.41	74.50	13.47	30.00	21.42	25.29	525.98	30.48
forest	19	22.90	120.00	12.16	26.00	30.27	31.56	267.10	21.90
	21	16.16	41.70	11.40	20.00	17.05	27.78	**868.87**	24.10
Swampy	5	20.28	61.50	9.89	18.00	27.78	36.31	56.25	2.85
clearing	23	0	0	0	0	0	0	0	0
(baï)	25	35.30	35.30	8.00	8.00	-	-	6.25	0.61
Agriculture	28	25.93	56.40	15.14	26.00	4.43	11.72	50.00	3.70
	29	0	0	0	0	0	0	0	0
Young	12	0	0	0	0	0	0	0	0
fallow	13	0	0	0	0	0	0	0	0
Old	26	19.16	87.90	10.38	17.00	20.21	29.80	270.44	10.85
fallow	27	12.93	17.50	11.62	15.00	10.23	25.34	92.29	1.21

* dbh= diameter at breast height (1.30 m)

** BI= Bifurcation Index (1-100)

*** BA= Basal Area (BA=Pi*(diameter^2)/4)

Ethnobotany

During the plant survey, the ethnobotanist collected plant use data with help from the local informants. For each plant recorded in a plot, the informants were asked for the local name and use(s) according to their knowledge. Different species would sometimes be given the same name if they had the same use or a generic (general) name if they have no use (e.g. many ferns). Our botanists were of the same ethnic group as our informants,

enabling cross checking and sometimes leading to discussions. Agreement was generally reached but if not, because local differences can exist, we usually retained the local informants' opinion.

From the thirty plots, we recorded 1,071 instances of specific plant uses and 477 records of "no-use". An overview of the numbers of valued non-tree and tree species per plot and per land type is presented in Table 4.6. The overall percentages are high. Trees seem to have proportionately more uses than non-trees. Primary forest had the highest numbers of useful tree species. The trees in fields and fallows are generally useful trees that are planted or left standing when the fields are opened. Young fallows seemed (caution: only two plots) to contain the highest numbers of useful non-tree species. On average, fallows had the highest percentages of useful non-tree species, followed by primary forest. Swampy clearings were the least useful to people in terms of plants species.

Table 4.6. Number and percentage of useful tree and non-tree species per plot by land type

		---------- Trees ----------			---------- Non-trees ----------		
Land type	**Plot**	**Number of species**	**Number of useful species**	**% useful**	**Number of species**	**Number of useful species**	**% useful**
Primary forest	3	21	16	76.19	17	12	70.59
	8	24	21	87.50	30	19	63.33
	9	16	14	87.50	22	17	77.27
	20	20	15	75.00	30	15	50.00
	22	18	17	94.44	27	18	66.67
	24	19	13	68.42	24	17	70.83
Secondary forest	2	23	18	78.26	47	29	61.70
	4	23	21	91.30	24	18	75.00
	6	19	15	78.95	32	22	68.75
	10	11	6	54.55	38	22	57.89
	14	17	12	70.59	48	28	58.33
	15	21	16	76.19	31	19	61.29
	17	13	11	84.62	30	17	56.67
	18	10	8	80.00	42	25	59.52
	30	8	5	62.50	43	34	79.07
Riparian forest	1	26	15	57.69	40	26	65.00
	7	14	13	92.86	10	4	40.00
	16	14	9	64.29	20	8	40.00
Swamp forest	11	20	11	55.00	33	21	63.64
	19	16	7	43.75	18	5	27.78
	21	9	6	66.67	10	5	50.00
Swampy clearing	5	5	1	20.00	12	2	16.67
(baï)	23	0	0	NA	26	10	38.46
	25	1	0	0.00	15	5	33.33
Agriculture	28	5	5	100.00	31	21	67.74
	29	0	0	NA	39	25	64.10
Young fallow	12	0	0	NA	53	38	71.70
	13	0	0	NA	49	33	67.35
Old fallow	26	14	13	92.86	32	21	65.63
	27	4	4	100.00	35	26	74.29
Average				70.65			58.52

A complete list of all recorded species, their use value and the land type they were found in is given in Appendix 6.

Richer plots provided more useful species for both trees and non-trees (Figure 4.2)

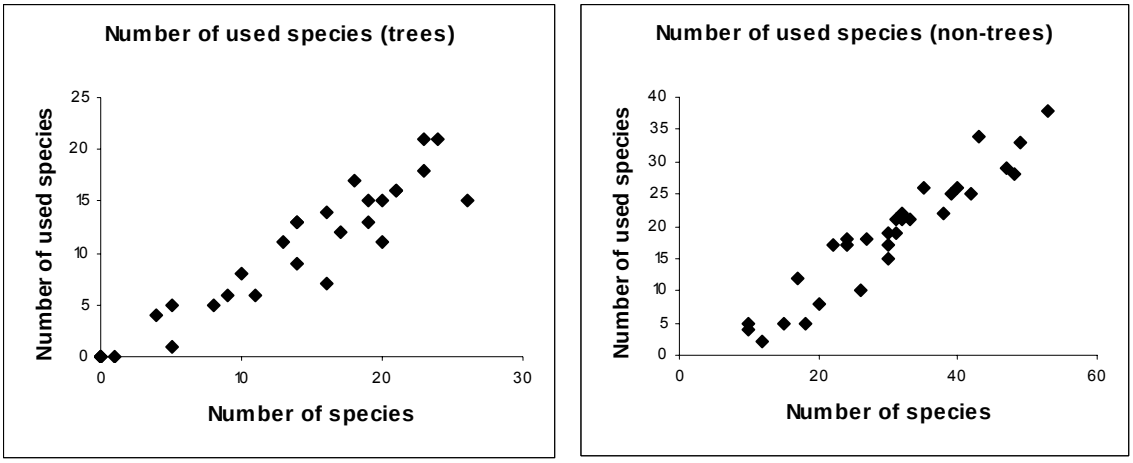


Figure 4.2. Number of useful species against species diversity in all plots for tree and non-tree species

The number of useful species recorded per use category for each plot can be found in Tables 4.7 and 4.8 for trees and non-trees respectively. Figures 4.3 and 4.4 show the total number of species recorded in each use category.

As expected, the highest numbers of useful tree species were found in uses requiring wood such as firewood, boat and heavy (house) construction but also in medicine (bark) and as a hunting tool (Figure 4.3): fruit trees attract animals. Fruit trees are also an important source of food. Primary forests provide the highest numbers of useful tree species for important uses such as food, hunting (protein), house construction and tools. Secondary forest provides most medicinal and firewood species (Table 4.7).

The percentages of useful species per land type and the results of the PDM exercises for the same land types are highly consistent (see Tables 5.1 and 5.2)

The highest number (by far) of useful non-tree species are found in the medicinal use category (Figure 4.4). Agricultural fields, fallows and secondary forests contain most medicinal species (Table 4.8). Species used in rituals and traditional ceremonies are often non-tree and found in the same land types as medicines. The same species are often used for both categories and the difference between medicinal and ritual use is sometimes hard to define.

As with trees, the forest is an important provider of useful non-tree species. Basketry and rope materials are species that are more often found in secondary forest. This

type of forest also provides many food items such as roots and a highly appreciated leaf vegetable (*Gnetum* sp.).

Some uses of non-tree species such Marantaceae (for fishing hooks) and lianas (for fishing nets) were listed, but people said that most have now been replaced by modern materials.

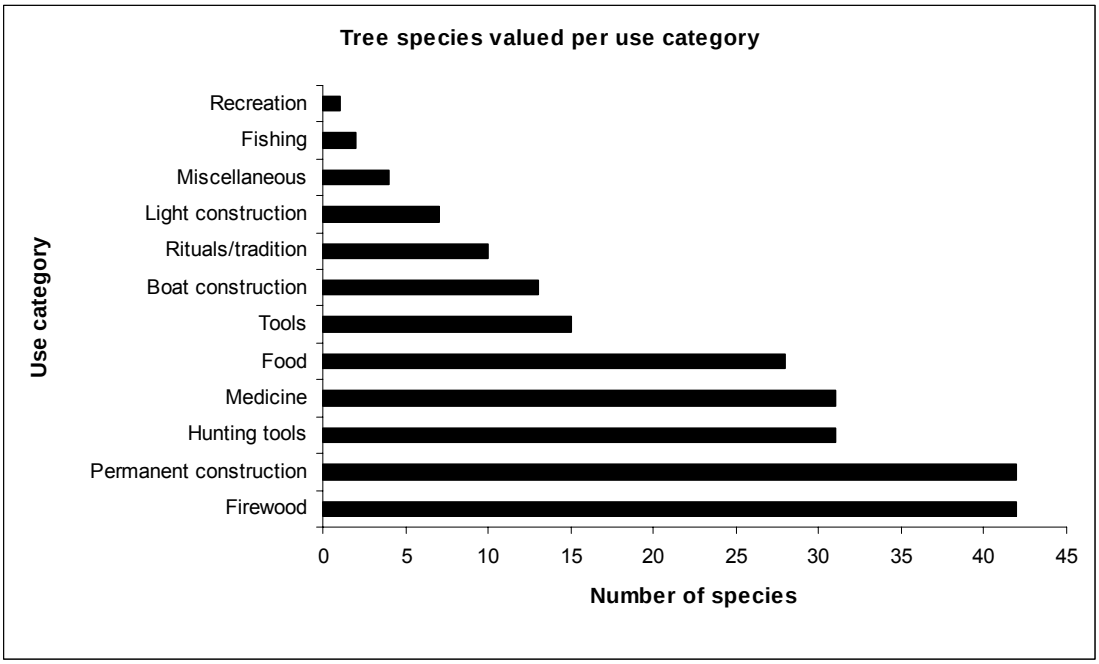


Figure 4.3. Number of useful species per value class for trees

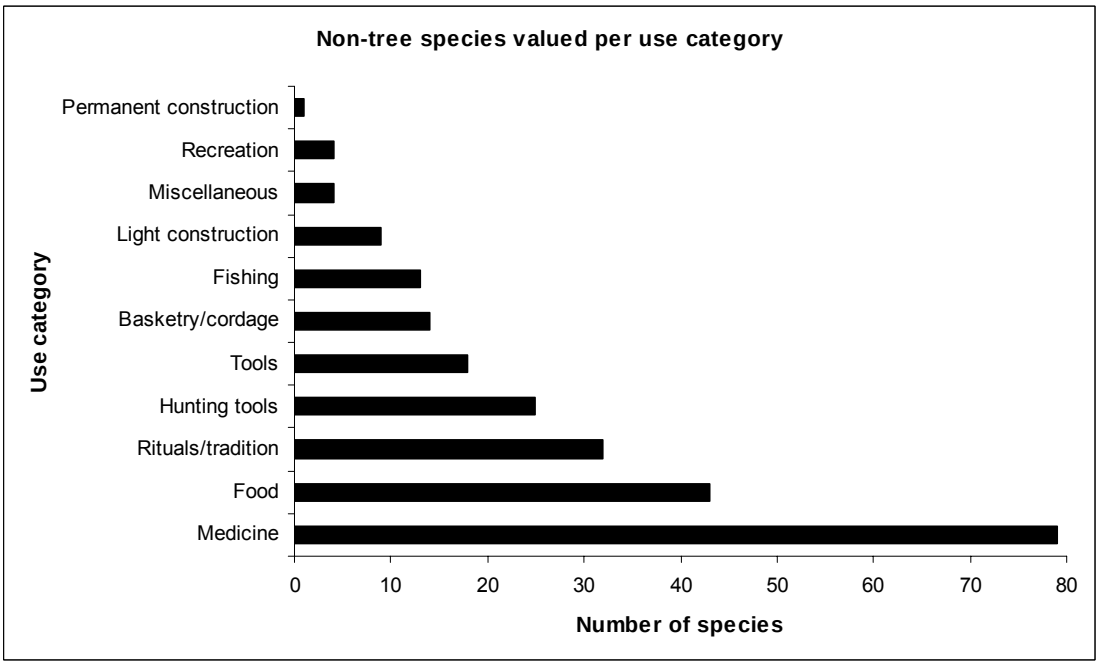


Figure 4.4. Number of useful species per value class for non-trees

The use category “marketable items” was not mentioned specifically during the field survey. Almost all species that have a use and that people appreciate can be sold. This is particularly the case of species providing food and medicinal species (see also Section 6.2).

Table 4.7. Distribution of the numbers of useful tree species per plot by use category

Land type	Plot	Boat construction	Firewood	Fishing	Food	Hunting tools	Light construction	Medicine	Miscellaneous	Permanent construction	Recreation	Rituals/tradition	Tools
Primary forest	3	4	1		6	7		2		3	1	2	3
	8	2	1		7	7		2		6		1	4
	9		4		6	5		1		5		1	2
	20	2			4	5				6		1	2
	22	2			4	3		3		7		1	2
	24	3			6	6		3		3		1	2
Secondary forest	2	1	7		4	3		5	1	3			
	4	1	9		4	5		6		3			2
	6		1		3	1		5	1	7			1
	10		1		4	3							1
	14	1	9		2			3				1	
	15	3	2		8	3		1		8		1	1
	17	2	1		3	3				6			2
	18	1	2		2	1	1	1				2	
	30		2		3	2							
Riparian forest	1	1	1		7	4		7	1	2		1	
	7		2	2	1	2	1			6			1
	16		4		1	2	1	1		2			2
Swamp forest	11		1		2	4	1	1		3			2
	19		1		1	3	2			1			1
	21		4	1		2	1	1					1
Swampy clearing (baï)	5							1					1
	23												
	25												
Agriculture	28		2		1	1		1		2			
	29												
Young fallow	12												
	13												
Old fallow	26	2	6		2	1		3	2			3	1
	27		3					1					

Note: there were no trees in plots 12, 13, 23 and 29; only 1 tree in plot 25 but no use known

Table 4.8. Distribution of the numbers of useful non-tree species per plot by use category

Land type	Plot	Basketry/cordage	Fishing tools*	Food	Hunting tools*	Light construction	Medicine	Miscellaneous	Permanent construction	Recreation	Rituals/tradition	Tools
Primary forest	3	1	1		2		3				3	2
	8	2	1	3	3		8				2	3
	9	2	1	1	2		8				4	2
	20		2	3	2		6				1	3
	22	1	1	1	3	1	8				1	2
	24	1	2	1	2		7				2	3
Secondary forest	2	1	3	4	3		12	1			5	3
	4	2	2	2	3		4			1	4	3
	6	2	1	3	3	1	7			1	2	4
	10	4	2	1	4		8	1			2	1
	14	1		6	1		14			1	8	2
	15	3	2	1	2		5	1		1	3	3
	17	1	2	2	1	1	8				2	2
	18	1		2			18				4	2
	30		3	7	2	1	13				7	3
Riparian forest	1	2	3	2	4		9	1	1		3	5
	7		1	1	2							
	16		4	1	2	1			1			1
Swamp forest	11	3	3	5	3	1	4		1		2	1
	19	1	2			1	1					2
	21		1		2	1	1					1
Swampy clearing (baï)	5			1	2							
	23			5		2	1				2	1
	25			2		2	1			1		
Agriculture	28			5	1		12				4	1
	29			8	1		14				3	2
Young fallow	12		1	8	1	1	22				6	1
	13			11			19			1	7	1
Old fallow	26			4			10				7	2
	27			5	2		16				4	1

* Includes fetishes for good results and protection during hunting/fishing

Many species have more than one use. Table 4.9 lists the species for which four or more use values were recorded (see also Appendix 6).

Table 4.9. Plant species which have four and more uses

Botanical Name	Family	Basketry/cordage	Boat construction	Firewood	Fishing place/tools	Food	Hunting place/tools	Light construction	Medicine	Miscellaneous	Permanent construction	Recreation	Rituals/tradition	Tools
Aframomum pseudostipulare	Zingiberaceae				■	■	■	■	■					
Aucoumea klaineana	Burseraceae		■				■				■			■
Baillonella toxisperma	Sapotaceae					■	■		■		■			
Cleistanthus sp.	Euphorbiaceae					■	■		■		■			
Coelocaryon preussii	Myristicaceae			■		■	■				■			
Coula edulis	Olacaceae					■	■		■		■			
Cryptosepalum congolanum	Leguminosae/Fab./Caesal.			■			■	■			■			■
Dioscorea bulbifera	Dioscoreaceae					■	■		■			■	■	
Elaeis guineensis	Palmae/Arecaceae					■	■			■				■
Haumania danckelmaniana	Marantaceae	■							■				■	■
Myrianthus arboreus	Cecropiaceae			■		■	■		■					
Nephrolepis undulata	Nephrolepidaceae				■	■	■		■				■	
Oddoniodendron micranthum	Leguminosae/Fab./Caesal.			■		■	■				■			
Pachypodanthium staudtii	Annonaceae			■	■			■	■					
Pentaclethra eetveldeana	Leguminosae/Fab./Mimos.			■			■		■		■			
Santiria trimera	Burseraceae		■	■		■	■						■	
Scorodophloeus zenkeri	Leguminosae/Fab./Caesal.			■		■			■		■			
Scyphocephalium ochocoa	Myristicaceae					■	■		■		■			

Aucoumea klaineana and *Baillonella toxisperma* are considered vulnerable in the IUCN Red List of Threatened species. Their vulnerability is caused by habitat loss (agriculture), logging and, for *B. toxisperma*, harvesting and trade of fruits (the seeds contain oil) (IUCN 2006).

Some uses require plants that can not be replaced. Table 4.10 gives the numbers of species per general use category which are unique for a specific use within that category. A complete list of these plants can be found in Appendix 7. Medicinal (often in relation to childbirth) and rituals or traditional ceremonies (notably circumcision) require the most unique plants (Table 4.10).

Most species are “non-trees” and are not the subject of conflictual use with other forms of land use. Still, one tree species, *Pterocarpus soyauxii*, is also a high value timber species. It has a very distinctive red wood. Local people scrape it and use the obtained red paste in circumcision ceremonies. This is the only species for this purpose. Moreover, in the PDM exercises, this species was considered the most important overall plant species in the community (see Table 6.2). The tree *Santiria trimera* provides an implement to carve canoes out of tree trunks (the traditional and most common type of boat) but this is not a commercially logged species. A rattan, *Ancistrophyllum secundiflorum*, provides a specific food source (also called “asperge”

- asparagus) in the forest and the construction of forest camps requires the use of other specific palm species for roofing (e.g. *Calamus deerratus*) and bedding (*Raphia hookeri*). Reduced Impact Logging guidelines that recommend the slashing of climbers could create conflicts about rattans if applied indiscriminately.

Table 4.10. General use categories and number of exclusive species within those categories

General use category	Number of species
Medicine	24
Rituals/tradition	21
Tools	6
Light construction	4
Fishing tools	3
Hunting tools	3
Food	2
Boat construction	1

5. Local perceptions of the landscape

Importance of land and forest types

Table 5.1 shows the results of scoring exercises for the overall importance of land and forest types. In Loaloa, the forest, the river and the village were considered the most important land types. Among the forest types, primary and secondary forest were preferred. Secondary forests are valued for their resources but also because they often are old village sites. These have a cultural value and often contain left behind useful plants (fruits, medicines).

Table 5.1. PDM exercise summary. Scores and score means per land and forest type

Land and forest type	OW	YW	OM	YM	Mean all
Village	17	**20**	**22**	15	18.5
Old village	1	6	5	6	4.5
Gardens	13	11	9	6	9.8
Fields	13	17	14	16	15.0
Fallows	11	7	13	10	10.3
Rivers	21	18	17	**24**	20.0
Forest	**24**	**21**	20	**23**	**22.0**
Total	100	100	100	100	100.0
Primary forest	**27**	24	**30**	**60**	**35.3**
Secondary forest	**26**	**26**	26	40	29.5
Riparian forest	24	22	15	0	15.3
Forest clearing	15	11	21	0	11.8
Swamp forest	8	17	8	0	8.3
Total	100	100	100	100	100.0

OW: women >35 years, YW: women <35 years, OM: men >35 years, YM: men <35years

Women traditionally fish in seasonally inundated (riparian) forest, using dams built from the clayey soil also found in swamps; which is why they valued this forest type

more than men. Forest clearings are sometimes used by men to shoot animals in the open and the white clay of their soils is used for rituals (also see their values for different uses in Table 5.2).

After scoring the relative importance of the different land types for overall importance, we asked people to do the same for 13 separate use and value categories. Doing the exercise for different categories makes it easier for people to focus and consider all the criteria that are important for a particular use. The answers are more precise than when looking at overall importance. The mean results of these exercises for the community are presented in Table 5.2.

For most uses and values the villagers considered the forest to be the most important land type and primary forest the most important forest type. The elders in the village said "*the forest commands man, because it is in the forest that man makes its fields, hunts, collects fruits and medicine and after many years old villages become the forest again*."

Table 5.2. PDM exercise summary. Means per land and forest type, per use-class, for all groups (each result is the mean of four groups, two groups of men and two groups of women)

Land and forest types	Basketry/ropes	Boat construction	Firewood	Food	Hunting/fishing tools/place	Light construction	Marketable items	Medicine	Permanent construction	Recreation	Rituals/tradition	Tools	The future
Village	8.5	1.3	1.3	6.5	2.0	3.8	4.5	9.5	2.5	**34.0**	13.5	0.0	**26.0**
Old village	0.0	7.5	10.0	5.3	8.8	17.3	11.0	12.3	15.8	2.0	7.5	8.3	9.8
Gardens	0.0	5.8	14.0	14.3	2.5	12.3	9.0	18.0	0.0	16.5	20.0	4.5	7.3
Fields	0.0	1.3	**28.8**	17.3	6.0	0.5	12.0	11.5	0.5	1.8	3.0	0.0	8.0
Fallows	16.8	18.8	11.5	12.0	10.8	23.3	12.3	14.3	24.0	2.5	10.5	21.8	7.0
Rivers	32.8	27.0	14.0	20.3	**35.0**	10.8	**24.8**	8.8	23.0	**33.3**	17.0	18.8	21.8
Forest	**42.0**	**38.5**	20.5	**24.5**	**35.0**	**32.3**	**26.5**	**25.8**	**34.3**	10.0	**28.5**	**46.8**	20.3
Total	100	100	100	100	100	100	100	100	100	100	100	100	100
Primary forest	26.3	**65.0**	40.3	**38.5**	**46.0**	**49.8**	**64.5**	**53.0**	**62.0**	**70.0**	**30.8**	**56.5**	**51.5**
Secondary forest	**36.0**	28.0	**44.8**	25.8	14.8	21.0	13.5	47.0	19.5	30.0	**28.8**	30.8	48.5
Riparian forest	22.8	7.0	5.0	13.5	14.3	16.8	9.0	0.0	10.3	0.0	16.3	6.3	0.0
Clearing in forest	5.0	0.0	5.0	12.5	10.8	3.8	3.8	0.0	0.0	0.0	11.5	1.5	0.0
Swamp forest	10.0	0.0	5.0	9.8	14.3	8.8	9.3	0.0	8.3	0.0	12.8	5.0	0.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

People thought that the forest and river were more important for food than the fields, which illustrates a high dependency on wild products (see also Section 6.1). Rivers and forest are also the main providers of marketable items. Apart from fish and sand, people often said that the river (Ivindo and tributaries) provides them access to the

forest to hunt and collect the products they need. This explains the scores given to the river for uses such as e.g. construction, basketry and firewood. The later can also be found washed up on the river banks.

The forest is important for traditional uses but many important species are also cultivated in the gardens behind the houses, where some rituals *(*e.g. *Mungala*) also take place.

Clearing a field involves cutting down trees and burning (usually in secondary forest). A substantial amount of dead wood usually remains, which is a major source of firewood for the villagers. All the villagers use the river for bathing, washing up, laundry, usually in groups with their children, but also for swimming and play. Many young people preferred Makokou for recreation. Recreation in primary forest consists mostly in collecting fruits.

The village is important for the future because it is where people live and have their families. Among forest types, primary and secondary forest were considered essential for the future. Man-made secondary forest belongs to the lineage ("*for our grandchildren*") of the person who cleared the original primary forest.

We were told that materials for basketry and ropes were more readily found in secondary forests than in the other forest types. These and the scores for secondary forest in the medicine and rituals/tradition categories are consistent with results found in the ethnobotanical survey (Tables 4.6 and 4.7).



The village, gardens behind the houses (note the graves), new cassava field

Importance of the forest in time

Another set of scoring exercises compared the importance forest 30 years ago, now and in 20 years time (see Table 5.3). Women and men had very different views. Women thought forest had a much higher overall value in the past (69), compared to the present (16) and the future (15) because in the past the forest was rich, but nowadays and in the future, the park, timber companies and poachers would destroy the forest and its usefulness for local people. Men thought forest would become more important to them in the future (40) compared to the present (20) because the park would induce animals to come closer to the village as motorboats (only two people have engines in the village) and hunting by outsiders would be prohibited in the park. They clearly had hopes of being allowed at least some hunting.

Table 5.3. PDM exercise summary for the past, present and future importance of forest. Mean of two groups (men and women, all ages)

	30 years ago	Present	In 20 years
All (sum=100)	54.5	18.0	27.5
Basketry/ropes	6.0	8.0	5.0
Boat construction	8.0	5.5	7.0
Firewood	4.5	7.0	8.0
Food	11.0	11.0	11.0
Hunting/fishing tools and place	5.5	8.0	7.5
Light construction	5.5	5.0	5.5
Marketable items	5.5	12.5	11.5
Medicine	10.0	8.5	7.5
Permanent construction	12.0	9.0	11.0
Recreation	2.5	2.5	2.0
Rituals/tradition	6.5	5.5	4.5
Tools	4.5	5.0	4.5
The future	**18.5**	**12.5**	**15.0**
Total	100.0	100.0	100.0

The relative importance of the forest for fishing, hunting and marketable items (including sand) seems to increase over time. The future was considered a very (if not the most) important value of the forest. People considered it to be their most reliable or even only means of continued existence, which is not surprising considering the lack of alternative sources of income and poor development of agriculture.

The relative score of "medicine" decreased over time as people increasingly use modern health care and many old beliefs and traditions are disappearing. Medicine also included plants or animals with *magic* properties, for diseases but also other problems (e.g. marital problems). The relative value of forest for firewood is seen to increase. This could be linked to the perceived population growth (*"Our population is growing; we have many more children now than before"*).

Spice (*Afrostyrax lepidophyllus*) and crushing ball (*Strychnos congolana*), *Dacryodes buettneri*, and condiment made of *Irvingia gabonensis* kernels

6. Local perceptions of resources

Importance of different sources of products

We asked people to score the relative importance of different sources of plant and animal products. As Figure 6.1 shows, plants (total of 58%) were considered more important than animals (total of 42%) and wild sources of products (62.5%) more important than cultivated (28.5%) or purchased ones (9.0%), which confirms the results of Table 5.2.

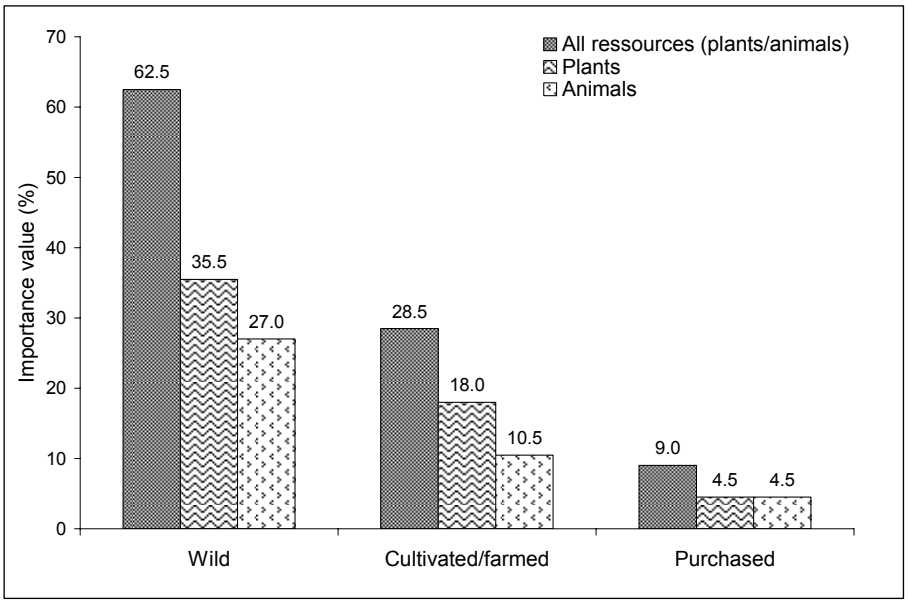


Figure 6.1. The importance of sources of animal and plant products for people from Loaloa. Mean of two groups (men and women, all ages)

People highly depend on wild products for their livelihoods. Agriculture did not seem very productive and can be seen more as complement to wild products. Some people in Loaloa almost did not cultivate anything, and those who did usually had no surplus to sell.

Importance of forest plant and animal species and their uses

Women and men were asked separately to rate the relative importance of the forest for all 13 use and value categories. In this exercise, the river was considered part of the forest because of its importance to people and because of the relationship between forest and river, both ecologically and in the use people make of them. Then, for each category, they were asked to divide the 100 counters between animals and plants according to their relative importance. Finally, people were asked to list the 10 most important forest plants as well as animals and to rate them (separately) according to their importance. An example of the scores for plants and animals in the use category “food” is shown in Table 6.1.

Table 6.1. Example portion of PDM of plant and animal species importance for food by women of Loaloa

Plant name	Local name	PDM	LUVI x100	Animal name	Local name	PDM	LUVI x100
Gambeya lacourtiana	Mbambu	3	0.09	*Cercopithecus nictitans*	Zia	5	0.39
Dacryodes klaineana	Hambé	4	0.12	*Cercopithecus c. cephus*	Mpeka	5	0.39
Scyphocephalium ochocoa	Nsoko	21	0.64	*Hyemoschus aquaticus*	Yong	5	0.39
Poga oleosa	Bupo	3	0.09	*Cephalophus monticola*	Héli	5	0.39
Dacryodes buettneri	Nsia	6	0.18	*Manis gigantea*	Pidjé	13	1.00
Cola rostrata	Mahanda	18	0.55	*Manis tricuspis*	Kaka	13	1.00
Irvingia gabonensis	Mpétché	15	0.46	*Cephalophus callipygus*	Mbizi	10	0.77
Trichoscypha abut	Mbuta	6	0.18	*Atherurus africanus*	Ngomba	15	1.16
Baillonella toxisperma	Niabe	11	0.33	*Potamochoerus p.albifrons*	Nguéya	19	1.46
Coula edulis	Ngomba	13	0.39	*Cephalophus dorsalis*	Ehibo	10	0.77
Total		100	3.03	**Total**		100	7.70
Remaining		25	0.76	**Remaining**		0	0.00

An overall measure of a species' importance is the so-called Local User's Value Index (LUVI). It is based on the hierarchical principle that each species' value is a function of the values of the subsequent categories it belongs to: the relative value of the use category it was listed in, the importance of plants or animals in that category and the species' own score. See Sheil *et al.* (2004) for more details. To illustrate we will consider the importance for women of the species called Nsoko (*Scyphocephalium ochocoa)* of which people highly appreciate the fruit as a food.

Starting at the top of the hierarchy, the category "food" was given a score of 10 out of 100. No species were listed for two categories (the future and recreation) and their scores are arbitrarily reallocated to give a weight of 10/(100-5-8)=10/87 to the category "food". The next division was between plants and animals and plants received 33/100 for the category "food". In the top 10 most important plant species for food, Nsoko received 21/100. According to our informants, the value of the species not included in the top 10 was worth an additional 25. Thus the relative weight of Nsoko is 21/(100+25). The LUVI for Nsoko is the product of all these weights:

$$LUVI_{Nsoko} = (10/87)*(33/100)*(21/(100+25))=0.0064 \text{ or } 0.64\%.$$

This means that Nsoko's use as food represents 0.64% of the relative importance of all products recognised by women for all uses and values.

One species can be listed in different categories. All its LUVI scores are then summed to give the total LUVI for that species. Tables 6.2 and 6.3 list the 20 species of plants and animals with the highest total LUVI scores. Overall, plants received higher scores than animals (see also Section 6.1).

Trees dominate the top 20 of most useful plant species, confirming the results from the ethnobotanical survey where tree species had more uses than non tree species (see Section 4.4). The most important plant species is a timber tree (*Pterocarpus soyauxii*), highly preferred for house and boat construction; two important categories of forest use (see Table 6.2). *Pterocarpus soyauxii* is also valued as a medicinal

species by men. Other important species are also used in construction, such as *Cola altissima* and *Eurypetalum batesii*. Fruit trees such as *Coula edulis* and *Baillonella toxisperma* are valued for their fruit that can be eaten and sold and because they attract animals for hunting. Their timber is also used in house construction. *Lasianthera africana* is highly valued for its use in the construction of camps but also for making tool handles.

Table 6.2. The 20 most important species of forest plants as listed and scored by men and women from Loaloa

Scientific name	Life form	Local name	LUVI
Pterocarpus soyauxii	Tree	Mbélé	11.26
Cola altissima	Tree	Ibélu	7.75
Eurypetalum batesii	Tree	Izilong	4.87
Coula edulis	Tree	Ngomba	4.66
Baillonella toxisperma	Tree	Niabé	3.36
Lasianthera africana	Tree	Ilala	3.33
Dacryodes buettneri	Tree	Nsia	3.23
Polyalthia suaveolens	Tree	Tunga	3.10
Zanthoxylum heitzii	Tree	Mokokuani	3.10
Irvingia gabonensis	Tree	Mpétché	2.83
Diospyros crassiflora	Tree	Ehipilo	2.76
Harungana madagascariensis	Tree	Tonukwé	2.70
Myrianthus arboreus	Tree	Nkahu	2.66
Gilbertiodendron dewevrei	Tree	Mbembé	2.50
Xylopia aethiopica	Tree	Nka	2.41
Macaranga spinosa	Tree	Issaha	2.33
Ancistrophyllum secundiflorum	Rattan	Ingozi	2.16
Raphia hookeri	Palm	Issé	2.01
Strychnos congolana	Liana	Iyohu	1.93
Haumania danckelmaniana	Herb	Ihinlé	1.87

Some of the species in this top 20 are listed on the IUCN Red List of Threatened species: *Diospyros crassiflora* (Endangered), *B. toxisperma* (Vulnerable) and *I. gabonensis* (Low Risk/Nearly Threatened) (IUCN 2006).



Stomach medicine in wrapping leaves, pounding instrument (*Lasianthera africana*) and wood transport in a rattan basket

The two most important animal species are preferred food that also have a high value as a marketable product: *Potamochoerus p. albifrons* (red river hog) and *Atherurus africanus* (african brush-tailed porcupine) (Table 6.3). *Genetta servalina* (servaline genet) plays a very important role in traditional rituals and ceremonies. The elephant was listed once, by men: its knee articulation can be used as a crushing kitchen tool. This one score probably gives a biased image as it was the only animal in the tool category. Shrimp and worms are valued as bait for fishing. The presence of White-crested hornbill indicates the presence of other species such as monkeys in fruit trees.

Most other species are appreciated for a combination of three values: as food, as a source of cash through marketing and for medicinal uses.

Table 6.3. The 20 most important species of forest animals as listed and scored by men and women from Loaloa

Scientific name	Group	Local name	Common name	LUVI
Potamochoerus p. albifrons	Mammal	Ngueya	Red river hog	3.58
Atherurus africanus	Mammal	Ngomba	African brush-tailed porcupine	2.39
Genetta servalina	Mammal	Ihindji	Servaline genet	1.97
Loxodonta africana	Mammal	Zokou	African elephant	1.92
Manis gigantea	Mammal	Pidjé	Giant pangolin	1.74
Clarias pachynema	Fish	Mpwussi	Catfish	1.61
-	Crustacean	Mohon	Shrimp	1.50
Hyemoschus aquaticus	Mammal	Yong	Water chevrotain	1.48
-	Worm	Igwalé	Earth worm	1.40
Cephalophus dorsalis	Mammal	Ehibo	Bay duiker	1.38
Manis tricuspis	Mammal	Kaka	Tree pangolin	1.35
Cephalophus monticola	Mammal	Héli	Blue duiker	1.30
Tropicranus albocristatus	Bird	Mbobozi	White-crested hornbill	1.13
Kinixys spp.	Reptile	Kulu	Turtle	1.10
Cephalophus callipygus	Mammal	Mbizi	Peters' duiker	1.10
Barbus compinei	Fish	Kokosso	Barbus	1.06
Cercopithecus nictitans	Mammal	Zia	Putty-nosed guenon Hocheur	0.98
-	Mammal	Tséma	Monkey	0.91
Schilbe grenfelli	Fish	Ombeze	Catfish	0.81
Osteolaemus tetraspis	Reptile	Nkotsé	Dwarf crocodile/Crocodile nain	0.74

More animals than plants from this top 20 are listed in the IUCN Red List of Threatened Species: *L. africana* and *O. tetraspis* are vulnerable; *M. gigantea, C. dorsalis* and *C. callypygus,* are considered low risk/nearly threatened; *H. aquaticus* (water chevrotain) is data deficient, but concerns for possible declines exist (IUCN 2006). The other animal species are either not listed or considered at low risk of extinction (IUCN 2006). Some of the species in Table 6.3 are protected animals in Gabon: the water chevrotain and the giant pangolin (entirely protected), the dwarf crocodile and the red river hog (partially protected).




Part of a *P.albifrons*, a *C. nictitans* and a *Cephalophus monticola* in a rattan carrying basket, skin of a *G. servalina* (photo N. van Vliet) for healing/ritual purposes and diverse fresh fish

7. Linking conservation and people's livelihoods

In this section we review and link outcomes from different elements of this study, evaluating some of the implications for conservation and people's livelihoods.

Despite their proximity to the town of Makokou, the inhabitants of Loaloa are highly dependent on the forest for their livelihoods. Most people do not have formal jobs and agriculture is not very significant. Their primary aspirations concern basic needs such as schooling, jobs and infrastructure. The lack of food is considered a major threat to the community and this is perceived as the result of crop raiding by elephants. Frequent crop destruction is also a reason for people not to expand their agricultural activities and for their continued dependence upon wild products. A more detailed study should perhaps be conducted on the extent of this problem and possible solutions sought for in collaboration with the community. The presence of a protected area nearby could well exacerbate the problem. As men said, animals might come closer to the village (Section 5.2). This could be good for hunting but not for agriculture. The new park is also seen as a threat that would stop people from using an area of forest that is a basis for their livelihoods.

The high importance of the forest for people's livelihoods is obvious from the results of both ethnobotanical survey and scoring exercises. The outcomes of different elements of the study (botany, ethnobotany, scoring exercises) are highly consistent. Species rich land types and those containing most trees had most uses: primary forest types were richest in tree species, they contained the most useful species and, in the scoring exercises, they were the most important forest type for almost all uses. Consistency is highest for uses requiring trees such as construction, medicines, food and hunting (attraction of game). Secondary vegetation (secondary forest, fields and fallows) contained more non-tree species than primary forest, thus more useful species in that category. The category "medicine" included the most non-tree species and they were often found in fields and fallows. However, scoring exercises showed a preference for forest for medicinal uses.

Preference is thus not only based on quantity or access (fields and fallows are nearer than forest) but also on quality, i.e. the importance of the species found. Another indicator of the importance of forest for people for all use and values is the fact that trees and forest mammals dominate the list of most important plant and animal species as listed by the people from Loaloa.

Most questions in this study were related to the forest. The river was just one of the other land types considered. Yet, the river is an essential component of the landscape and people often said that without the Ivindo, they would not be able to reach the forest where they fish, hunt and collect important products. The river also has an importance as the basis of people's history. Old village sites along the Ivindo are not only places where people go to make a living, they are also important culturally, as part of people's collective memory and history.

From the discussions on the importance of forest in time, two views arose: one where overexploitation and lack of access would make the forest less important for people and the other where it was hoped that the PNI would protect game from disturbance by outsiders and thus make hunting easier close to the village. In general, people tend to have short term visions, particularly when asked directly for their opinions. Nevertheless, the fact that people rated the future as an important value of forest provides an opportunity for discussion on the consequences of their use of the forest, if they want future generations to still be able to benefit from it. This will be difficult though as people do not see the park as something that is protected for their and future generations' benefit.

People's knowledge of forest ecosystem functions stems from their dependence upon the forest, e.g. they can list which species can be found when, in which land types or in which specific sites; they also know the role of animals in seed dispersal and which animals are attracted to which trees. Elephants, despite the danger they represent, are seen as important for creating the trails that people use when hunting but also as seed dispersers of preferred fruit trees. Also, people are very aware of the fact that some of their activities, such as hunting, threaten the forest and the sustainability of its use. This knowledge should be recognised and built upon in park management and development processes.

Some important concerns for conservation arose during this study. The relative importance of the forest for cash generating activities will probably increase over time, as more people need more money for modern amenities. This means natural resource exploitation will probably increase, especially if there are no employment alternatives and agriculture remains marginal. Also, traditional fishing and hunting tools (hooks, nets and traps from natural materials) have mostly been replaced by more efficient modern implements, leading to more rapid resource depletion.

Several plant species that have multiple uses are considered vulnerable from overexploitation by the IUCN Red List of Threatened Species like Okoumé (*Aucoumea klaineana*) or Moabi (*Baillonella toxisperma*). Okoumé is certainly more

threatened by logging than from local population but Moabi is a highly preferred species locally, both for its fruit and its timber and both indiscriminate logging or fruit collecting could hinder the regeneration of the species. Quantitative studies on the effects of current levels of harvesting of this species in the area are badly needed. Another tree whose timber is highly valued by timber companies, but that is also an important local species, is *Pterocarpus soyauxii.* It is (by far) considered the most important local plant species and provides an important element of circumcision ceremonies. All of the forest around the PNI has been allocated to timber companies and conflicts about multiple use species could arise that could be avoided by knowing what matters and for whom (the purpose of this study). Also, if these species are logged out, the only place where people will still find them will be the PNI. Based on sound information of local preferences, reduced Impact Logging practices (such a climber cutting) that remove important species for local people should be revised.

A number of animals are listed on the IUCN Red List and/or are protected under Gabonese law. Some are preferred species for food or for sale (i.e. water chevrotain, giant pangolin, two duiker species and red river hog). Regulations and compromises should be found for the use, or non-use, of these species, if possible by appealing to people's own knowledge of the forest ecosystem. Gabonese law allows hunting for subsistence purposes of non protected animals with traditional tools (no night hunting though). Hunting activities are usually restricted to a distance of 5 to 10 km from the riverbanks, and the idea of a regulated hunting buffer zone on either side of the Ivindo between Loaloa and Kongou should be further investigated. The understanding of source and sink mechanisms for wildlife populations should be developed. Options for community monitoring and involvement in management should also be considered. During a preliminary visit to the area in 2004, villagers in Loaloa and other communities told us that they would be prepared to reduce or even stop hunting activities in the park if they would be allowed to continue fishing.

Fishermen in Loaloa reported a decrease in fishing success between their village and the Kongou falls, although in a study of fisheries that included Loaloa and three other communities, people reported being reasonably satisfied with their catches (Mamboundou 2005). According to Mamboundou, the low population density, lack of motorised boats and overall bad state of nets also indicates that, for now, fishing is probably still sustainable. There are no fish census figures for the Ivindo system but more detailed research should be undertaken to investigate the sustainability of this activity. Prohibiting fishing in the Ivindo is not realistic considering its importance as a livelihood activity, but regulation seems unavoidable, particularly in the park area. Development of (semi-wild) fish cultivation should perhaps be considered. The effects of sand extraction on the river bed and flow should also be studied.

Sometimes traditional regulations and taboos can be used as tools to achieve conservation goals that are acceptable to local communities. However, in this case this is difficult as most seem very specific per individual, initiatic society or clan. This could be looked into further (see also master's thesis by Mazzochetti 2005). Some

species are generally not eaten such as spotted carnivores and even elephants and the potential for regulation should be investigated for these species, trying to get from “not eating” to “not killing” altogether, perhaps allowing hunting only for specific, local traditional uses. However, many of these forest-related traditions are disappearing.

Loaloa has some serious problems with crime and alcoholism that could make it difficult to involve people in constructive and truly participatory discussion and negotiation processes. It will be difficult to find true representatives of the community. The new system where chiefs are elected under influence of local politics does not seem to provide this. Not only the chief, but respected elders, women and also younger people should be involved.

8. Conclusions

The study has responded to the two first questions addressed in the introduction: 1) what occurs where in the area used by the people from Loaloa and 2) why it is important and how important it is for them. The linked answers to these questions led to a number of implications for the future sustainable management of the PNI (question 3): As long as there are no alternative sources of income, people will use their environment for their livelihoods but also for their further development, and if needed they will find ways to do so illegally. People are understandably afraid that their livelihood means will be taken away from them once park regulations are enforced. They also have a very negative perception of enforcing authorities and particularly conservation NGO’s that seems largely due to miscommunication and unclear roles. Resentment, feelings of powerlessness and of losing “ownership” or control over what people consider to be theirs can even lead to intensification of exploitation; especially when it is coupled to widespread short term visions and fatalism. Showing people that their opinion matters and is taken into account and reinforcing cultural identity and social cohesion in the face of changes could strongly enhance people’s self esteem and creativity.

Furthermore, the possibilities for developing agriculture (involving a solution to crop raiding) should seriously be investigated. This should not only involve the technical aspects but also the role agriculture can play in providing a relatively stable source of income outside fishing and hunting.

This leads to recommendations for question 4): there is an urgent need to share the insights from this study with all relevant stakeholders, develop them and use them in more democratic decision making processes where local needs are taken seriously and compromises are sought on all sides. In the end, considering local communities as potential allies seems to be the only realistic and viable option for biodiversity conservation in this type of environment.

Preferably the scope of the study should be expanded to include more communities who dependent on the area or, at least, the results of this study should be presented

to them under an appropriate form to seek validation and or corrections as well as identify community specificities.

A better and longer term quantification of the resources used from the park should be conducted but this would require a large effort of communication with the local communities. A start has been made by Viano (2005) and currently a study of the economic benefits from the PNI is taking place in the framework of the PSVAP. This would enable a better analysis of people's needs and a more informed investigation of economic alternatives outside of the park. The possibilities for agricultural development as a source of income outside hunting and perhaps fishing should be investigated.

References

Berg, J. van den and Biesbrouck, K. 2000. The social dimension of rainforest management in Cameroon: issues for co-management. Tropenbos-Cameroon series 4.

Bourobou-Bourobou, H. 1994. *Biologie et domestication de quelques arbres fruitiers de la forêt du Gabon.* Thèse de doctorat. Université de Montpellier II. Montpellier.

Brockington, D. and Schmidt-Soltau, K. 2004. The social and environmental impacts of wilderness and development. *Oryx* 38: 140–142.

Doucet, J.L. 2003*. Le monde animal joue un rôle prépondérant dans l'expression des valeurs morales chez les Mahongwe du Gabon*. Thèse annexe de doctorat. Faculté universitaire des sciences agronomiques de Gembloux.

Hladik, C.M., Hladik, A., Pagezy, H., Linares, O.F., Koppert, G.J.A. and Froment, A. (Eds). 1996. *L'alimentation en forêt tropicale: interactions bioculturelles et perspectives de développement*. Éditions UNESCO, 2 volumes, 1407 p.

IRET. 2003 (draft). *Station de recherche d'Ipassa, Makokou, Gabon. Presentation et publications (1962-2003).* IRET/CENAREST, Libreville, Gabon.

IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on 09 May 2006.

Lahm, S. 1993. *Ecology and Economics of Human/wildlife interaction in northeastern Gabon.* Doctoral thesis, University of New-york, 324 p.

Lahm, S. 2002. *L'orpaillage au nord-est du Gabon: Historique et analyse socio-économique.* Multipress Gabon, Libreville, Gabon, 136 p.

Lahm, S.A. 1996. Utilisation of forest resources and local variation of wildlife populations in northeastern Gabon. In: *Tropical Forests, People and Food,* Hladik, C.M., Hladik, A., Linares, O.F., Pagezy, H., Semple, A. and Hadley, M. (eds.), Man and the Biosphere Series, volume 13, Paris, UNESCO and Parthenon Publishing Group.

Lawrence, A., Ambrose-Oji, A., Lysinge, R. and Tako, C. 2000. Exploring Local Values for Forest Biodiversity on Mount Cameroon. *Mountain Research and Development Vol 20 No 2: 112–115*.

Mazzocchetti, F. 2005. Utilisations et Représentations de la Faune Sauvage (tachetée) chez les Bakota de la région de Makokou (Gabon). Mémoire de Master 2. 0rléans, France.

Mamboundou, J-B. 2005. La pèche dans le bassin de l'Ivindo (Makokou, Gabon) : Regard sur un système de production rural. Mémoire de Master 2. Université d'Orléans, France.

Museum National d'Histoire Naturelle. Flore du Gabon. Paris

Okouyi Okouyi, J. 2001. *Exploitation de la faune sauvage autour de la réserve Intégrale du Plateau d'Ipassa-makokou (Nord-est du Gabon). Aperçu général.* DEA Aden., Université de Lille 1, IRD Orléans, Lille: 63pp.

Perrois, L. 1968. *La circoncision Bakota, Gabon.* Cahiers ORSTOM, série Sciences Humaines, vol. 5, n°1, p 7-60.

Perrois, L. 1970. *Chronique du pays Kota (Gabon).* Cahiers ORSTOM, Série Science Humaine, vol VII, n° 2, pp 15-110.

Perrois, L. 1976. *Tradition orale et histoire: intérêts et limites d'une enquête de terrain sur les migration Kota (Gabon).* Cahiers ORSTROM, série Sciences Humaines, Vol.8, N°4, pp. 143-146.

Perrois, L. 1979. Rites et Croyances funéraires des peuples du Bassin de l'Ogooué. In: *Les Hommes et la Mort: rituels funéraires à travers le monde.* Dir. Jean GUIART, Objets et Monde, Tome 19, Paris, pp. 293-304.

Pineau, W. 1995. *Réflexion sur les plantes médicinales chez les Fangs, les Bakotas et les Bakwélés de la région de Makokou au Nord-est du Gabon-perspectives d'avenir*. Mémoire de fin d'études, ISTOM Insitut d'Agrodéveloppement international, Cergy-Pontoise, France; PRO-NATURA, IRET: 79pp. + 7 annexes.

Schwartzman, S., Moreira, A. and Nepstad, D. 2000. Arguing Tropical Forest Conservation: People versus Parks. *Conservation Biology* 14 (5): 1370–74.

Sharpe, B. 1998. First the forest: conservation, community and participation in south-west Cameroon. *Africa 68 (1): 25-45.*

Sheil, D., Ducey, M.J., Sidiyasa, K. and Samsoedin, I. 2003. A new type of sample unit for the efficient assessment of diverse tree communities in complex forest landscapes. *Journal of Tropical Forest Science* 15: 117-135.

Sheil, D., Puri, R.K., Basuki, I. van Heist, M., Syaefuddin, Rukmiyati, Sardjono, M.A., Samsoedin, I., Sidiyasa, K., Chrisandini, Permana, E., Angi, E. Mangopo, Gatzweiler, F., Johnson, B. and Wijaya, A. 2004. *A la découverte de la biodiversité, de l'environnement et des perspectives des populations locales dans les paysages forestiers. Méthodes pour une étude pluridisciplinaire du paysage.* CIFOR, Bogor, Indonesia. En ligne : http://www.cifor.cgiar.org/mla.

Sheil, D., Puri, R., Wan, M., Basuki, I., van Heist, M., Liswanti, N., Rukmiyati, Rachmatika, I. and Samsoedin, I. 2006. Local people's priorities for biodiversity: examples from the forests of Indonesian Borneo. *Ambio* 35 (1): 17-24.

Vanwijnsberghe, S. 1996. *Etude sur la chasse villageoise aux environs du Parc National d'Odzala.* AGRECO/CTFT, ECOFAC, Congo, 184 p.

Viano, M. 2005. Caractérisation des activités de la population de Makokou à l'intérieur du Parc National de l'Ivindo (province de l'Ogooué-Ivindo, Gabon). Mémoire de DES, Université de Gembloux, Belgique.

Walker, A. and Sillans, R. 1961. *Les plantes utiles du Gabon*. Encyclopedie Biologique LVI. Editions Paul Lechevalier, Paris.

Appendices

Appendix 1: Team members

No	Name	Function in team	Institution	Address
1	Marieke Sassen	Team leader, field recorder & soil assessments	CIFOR	CIFOR, PO Box 6596 JKPWB, Jakarta 10065, Indonesia
2	Meilinda Wan	Team leader assistant & village activities	CIFOR	CIFOR, PO Box 6596 JKPWB, Jakarta 10065, Indonesia
3	Nathalie van Vliet	Coordinator village activities	Graduate student	p/a IRET/CENAREST, BP 13354, Libreville, Gabon
4	Gwladys Sokoudjo	Village activities, in training	Ipassa station	IRET/CENAREST, Makokou, Gabon
5	Augustin Moungazzi	Botanist	Retired	p/a IRET/CENAREST, BP 13354, Libreville, Gabon
6	Prosper Mbazza	Botanist	Ipassa station	IRET/CENAREST, Makokou, Gabon
7	Raymonde Mboma	Ethnobotanist, in training	IRET	IRET/CENAREST, BP 13354, Libreville, Gabon
8	Jacob Emboni	Assistant village activities	Ipassa station	IRET/CENAREST, Makokou, Gabon
9	Constant Sambouza	Assistant village activities	Ipassa station	IRET/CENAREST, Makokou, Gabon
10	François Bebolou	Boatman, guide, field assistant	Ipassa station	IRET/CENAREST, Makokou, Gabon
11	Lucien Anvame	Boatman, field assistant	Ipassa station	IRET/CENAREST, Makokou, Gabon
12	André Mangongwé	Local plant specialist	Loaloa	Loaloa, Makokou, Gabon
13	Marie-Rose Iyéba	Local plant and land use specialist	Loaloa	Loaloa, Makokou, Gabon
14	Yvonne Bessila	Local plant and land use specialist	Loaloa	Loaloa, Makokou, Gabon

Appendix 2 : Work schedule (in French)

Étapes	Informations	Qui	Lieu
24/03-26/03 PREPARATION	- Administration - Départ pour Makokou	M. Sassen, M.Wan, R. Mboma	Libreville, bureau CIFOR
27/03-30/03 PREPARATION	- Revue de documents - Premiers contacts avec le chef de village - Plan opérationnel (Organisation des équipes, programme, etc.) - Présentation et explication des principes aux membres de l'équipe - Présentation aux autorités	Equipe entière	Station d'Ipassa
31/03 INTRODUCTION Présenter le concept et les membres de l'équipe à la communauté. Informer les gens sur le programme et le déroulement des opérations et des procédures	- Présentation de l'équipe - Explication et programme des activités (en concertation) - Information générale, questions - Emménagement de l'équipe au village	Autorités locales Habitants Equipe entière	Loaloa
01/04-02/04 CONTEXTE LOCAL Obtenir des informations de base sur la démographie, la culture, l'économie et l'histoire du village	- Description du village - Valeurs et pratiques culturelles concernant l'utilisation des terres - Histoire du village, désastres et événements importants	Autorités villageoises et traditionnelles Equipe entière	Loaloa
02/04-04/04 COUVERT VEGETAL ET USAGE DES TERRES Déterminer et cartographier l'étendue du territoire traditionnel ainsi que les éléments majeurs du paysage	- Nommer les éléments du paysage sur le fonds de carte - Identifier la localisation des couverts végétaux et des types d'usage par catégorie - Localiser les ressources naturelles importantes	Communauté Equipe entière	Loaloa
04/04-05/04 BIODIVERSITE Début du travail de terrain : description et importance des sites, utilisation et importance des plantes.	- Description et importance du site - Relevés botaniques (arbres et autres plantes) - Informations ethnobotaniques - Description du sol	Equipe terrain	Loaloa
04/04-10/04 DEMOGRAPHIE ET PERCEPTIONS Collecte des données socio-économiques (population, âge, occupation, etc.) et des aspirations de la communauté par rapport aux ressources	- Données sur les foyers - Micro économie - Éducation - Aspirations et perceptions - Produits commerciaux et tendances de consommation	34 foyers Epiciers, marchands Equipe village	Loaloa
06/04-12/04 BIODIVERSITE	- Description et importance du site - Relevés botaniques (arbres et autres plantes) - Informations ethnobotaniques - Description du sol	Equipe terrain	Kongou et environs
11/04-12/04 DETAILS SUR L'UTILISATION DES TERRES ET LES PRODUITS FORESTIERS Utilisation et des terres et classification Identification des plantes et des animaux utilisés par les communautés locales	- Usage et classification des terres (forestières) - Produits forestiers collectés, prix de vente	Entretiens avec les informateurs clés Equipe village	Loaloa
13/04 BIODIVERSITE	- Traitement spécimens récoltés sur le terrain	Equipe terrain	Station d'Ipassa
14-25/04 PERSPECTIVES LOCALES SUR L'UTILISATION DES TERRES ET LES PRODUITS FORESTIERS Quantifier les préférences locales pour différents types de terres et produits forestiers et d'autres valeurs	- Types de terres et de forêts - Valeurs des unités paysagères à travers le temps - Distance et valeurs des unités de paysage - Types de valeurs et origine des types de territoires - Détermination des espèces les plus importantes par type d'usage/valeur	Discussion en Groupe Cible (DGC) Exercices de MDC Equipe village	Loaloa

Étapes	Informations	Qui	Lieu
14/04-20/04 BIODIVERSITE	- Description et importance du site - Relevés botaniques (arbres et autres plantes) - Informations ethnobotaniques - Description du sol	Equipe terrain	Loaloa Rapides Bagnaté
21/04 BIODIVERSITE	- Traitement spécimens récoltés sur le terrain	Equipe terrain	Station d'Ipassa
22/04-26/04 BIODIVERSITE	- Description et importance du site - Relevés botaniques (arbres et autres plantes) - Informations ethnobotaniques	Equipe terrain	Loaloa
27-28/04 VERIFICATION et SAISIE Vérifier et intégrer toutes les données au possible (équipes de village et de terrain)	- Continuation saisie des données - Vérification des saisies - Traitement spécimens récoltés - Mise au propre cartes participatives - Présentation cartes et premiers	Villageois Equipe entière	Station d'Ipassa/Loaloa

Appendix 3: Plant and animal resources and their location (in French)

Animal forest resources

Produits forestiers (Nom local)	**Lieu** (Nom de l'endroit ou de la rivière proche)
Poissons/crustacés	
Poisson Ekwala (poisson courant)	Loa Loa
Poisson Mwa zoa (poison à nez « galleux »)	Loa Loa
Poisson Ibonio	Loa Loa
Poisson Ilé (Synodantis)	Zone Ipassa
Poisson Ingahia (poisson chat)	Zone Ipassa et Niabala
Poisson Kouné (Distichodus)	Zone Ipassa
Poisson Ipondji (famille des poissons chats)	Zone Ipassa
Poisson Ebondou	Makinamazombé
Poisson Ihazo (Xenocharax)	Madikamazombé
Poisson Ngongwe	Madikamazombé
Poisson Poussi (Silure)	Meyi
Poisson Itsétséle (Tilapia)	Meyi
Poisson Gogomana	Niabala
Poisson Mbezé (Yara)	Loa Loa, Mawoudji, Bagatsi, Meyi, Bawaka, Igondolo, Badetse, Mbelet, Baniate, Bessaboka, Imanya, Mekomba, Koto, Sakouba Inene, Koungou, Tsété, Bodja, Madjimasokou, Iyowa, Dia Mekowa, Ebayabaya
Mionhaw (crevettes)	Ekongo et Dongo
Mammifères	
Ngweyia (Potamochère)	Kongou
Yonwou (Chevrotain aquatique)	Kongou
Niaté (Buffle)	Kongou
Pidjé (Pangolin géant)	Koungou
Ekundasse (Oryctérope)	Kongou
Zokoumadiba (Hypopotame)	Kongou
Héli (Céphalophe bleu)	Loa Loa
Ngomba (Porc epic/Athérure)	Loa Loa
Zokou (Eléphant)	Loa Loa et Kongou
Etsili ngomba (Aulacode)	Loa Loa
Zibo (Céphalophe à dos jaune)	Womba, Baniaté, Bessaboka, Koto, Kongou
Mbizi (Céphalophus callipygus)	Bessaboka, Mbélé, Imayamekomba, Bapia, Pabakounga, Ilolo
Zombé (Céphalophus nigrifrons)	Mepoussi, Tsété, Enamabatséma
Ehibo (Cephalophus dorsalis)	
Modjongo (Sitatunga)	
Oiseaux	
Zanga (Calao)	Loa Loa
Kalala (Calao)	Kongou
Ibébi	Partout quand l'Ivindo est en crue
Epondé	Mesouaka
Ngoua (Perdrix)	Plantations

Etsinokou (Calao)	partout
Mouwan (Calao)	partout
Koho (Perroquet)	Kongou et Loa Loa
Niamakokou (Oiseau cailloux)	Rapides (posé sur les rochers de l'Ivindo)
Reptiles	
Kotchié (Crocodile)	Kongou
Ngando (Caïman)	Koungou
Ngombet (Varan)	Loa Loa

Plant forest resources

Produits forestiers (Nom local)	**Lieu** (Nom de l'endroit ou de la rivière proche)
Arbres	
Petchié (*Irvingia gabonensis*)	Loa Loa
Ingomba (*Coula edulis*)	Loa Loa
Ibambou (*Gambeya lacourteana*)	Loa Loa
Issia (*Dacryodes buettneri*)	Loa Loa
Hanhou	Loa Loa
Ekobakoba	Kongou
Ngouma (Okoumé)	Kongou
Mbassissa (famille des safous)	Kongou
Ibélou (Colatier)	Kongou
Katibomo	Kongou
Niabé (Moabi)	Kongou
Boupo	Kongou
Nyabe (Moabi)	Pendo, Bessizi, Boukolo
Mahanda (*Cola rostrata*)	
Ikendjé (Parasolier)	
Ibouta (*Trichosypha abut*)	Mawoudji, Igodolo
Ntsili (*Trichosypha acuminata*)	Mabenga, Bessaboka, Koto, Kongou
Hombé	Mawoudji,Bagatsé, Baniaté,Bodja, Baniate
Mbélou	Mbéni
Mpamgue	Rien qu'à Loa Loa
Mbate (soigne le dos)	Baniaté, Mékouma, presque de Loa à Kongou
Mokokami	
Mbele (Padouk)	
Ntomba (Bilinga)	
Nonjei (Ilomba)	
Indemba (Bilinga de marécage)	
Fruits	
Bouta	Loa Loa
Mahanda (*Cola rostrata*)	Dobé wa Loa Loa
Ebondo (fruit du Moabi)	Pédo
Soko (Sorro)	Medoumala
Ngomba (*Coula edulis*)	Ipassa
Idemba	Loa Loa

Hombè	Madikamazombé
Ngota (*Porosa*)	Loa Loa
Petché (Chocolat)	Madikamazombé, Baniaté, Meyi, Bawaka, Siaka, Baganga
Issia (Atanga sauvage/*Dacryodes buettneri*)	Mbelet, Bessaboka, Koto, Kongou
Ibouta (*Trichosypha abut*)	Mawoudji, Igodolo
Ntsili (*Trichosypha acuminata*)	Mabenga, Bessaboka, Koto, Kongou
Ianda (*Panda oleosa*)	Presque tout le long de l'Ivindo de Loa Loa à Kongou
Boupo (comme l'arachide)	Beacoup à Babomo et Enamabatséma
Ebambou (*Gambeya lacourteana*, mangé par les gorilles)	Mapowan, Imayan, Mekomba
Nyabe (Moabi),	Pendo, Bessizi, Boukolo
Gomba (*Coula edulis*)	Mawoudji, Bagatsé, Baniaté, Impamwakounga, Benamabatséma, Mbienguelé, Bodja

Plantes, fleurs, lianes et champignons	
Koumou (*Gnetum africanum*)	Loa Loa
Mbouza (feuille de manioc)	Loa Loa
Maboli (feuille de taro)	Loa Loa
Podje (amaranthe)	Loa Loa
Bebiala (Begonia)	Kongou
Zéni (Begonia)	Kongou
Sanga (Oseille)	Kongou
Mabobilanga (Begonia)	Kongou
Essahou (Oseille)	
Bembiala (Begonia)	
Ntomtombou	
Ntontonda (Begonia)	
Kombo (champignon)	
Ambembe (champignon)	Metobo, Nyabaré, Mékouma
Kounga (liane)	Mékouma, Mawoudji, Koto
Enkozi (liane)	Bagatsé, Etomba, Madikamazombé
Anangwe (liane)	Kongou
Mepossa (liane)	Mékouma, Obo Iboka, Madikamazombé
Balou (liane)	Koto, Issaha, Baniaté, Ipassa, Loa Loa
Intete (liane)	Mekouma, Madikamazombé
Issa (liane)	Kongou
Bonyodji	Ipassa

Appendix 4: Total numbers of species recorded in each plot

Land type	Plot	Richness trees*	Number of trees	Number of species of trees	Number of species of non-trees	Abundant (on site) seedlings	Abundant (on site) monocots	Abundant (on site) saplings	Abundant (on site) shrubs
Primary forest	3	0.83	40	21	17	0	2	1	2
	8	0.86	40	24	30	3	0	3	3
	9	0.79	34	16	22	1	0	1	5
	20	0.81	40	20	30	3	1	2	5
	22	0.79	38	18	27	3	0	3	3
	24	0.80	40	19	24	2	0	4	5
Secondary forest	2	0.84	40	22	47	3	2	3	5
	4	0.86	38	23	24	3	0	4	2
	6	0.82	37	19	32	1	1	1	5
	10	0.65	40	11	38	1	1	2	3
	14	0.78	37	17	48	1	1	0	3
	15	0.83	40	21	31	1	0	0	3
	17	0.71	37	13	30	3	1	4	4
	18	0.72	24	10	42	2	0	0	2
	30	0.87	11	8	43	0	0	0	5
Riparian forest	1	0.88	40	26	40	1	2	2	1
	7	0.72	39	14	10	3	0	3	4
	16	0.72	40	14	20	2	2	3	1
Swamp forest	11	0.81	40	20	33	1	3	0	1
	19	0.77	37	16	18	3	2	3	3
	21	0.60	40	9	10	0	1	3	1
Swampy clearing (baï)	5	0.73	9	5	12	1	1	1	0
	23	0	0	0	26	0	2	0	0
	25	NA	1	1	15	0	1	0	0
Agriculture	28	0.83	7	5	31	1	0	0	4
	29	0	0	0	39	0	1	0	1
Young fallow	12	0	0	0	53	1	1	0	2
	13	0	0	0	49	0	0	4	1
Old fallow	26	0.75	34	14	32	0	0	3	4
	27	0.54	13	4	35	0	1	0	3

*Richness (trees) = $Log_{10}sp/log_{10}count$

Appendix 5: Number of non tree species recorded in each plot by life form

Life form	Plot	Number of species per plot																													
		Primary forest						Secondary forest									Riparian forest			Swamp forest			Swampy clearing (baï)			Agri culture		Young fallow		Old fallow	
		3	8	9	20	22	24	2	4	6	10	14	15	17	18	30	1	7	16	11	19	21	5	23	25	28	29	12	13	26	27
Epiphytic	E	2	1		1	2		2	1	1	1		1	2		1			2	3	1	1					1				
Fern	F	1	2	1	1	2	2	3	2	4	2	5	3	1	3	3	2	3	1	3	1		2	2	1	1	2	1		2	1
Epiphytic Fern	FE	1	1	1	2	2			1					2	1		1	1	1		1	1									
Strangler Fig	FicE																1														
Climber (non-woody liana)	G	1		1				2			2			2			3			1											
Herb	H	5	10	13	10	10	11	10	7	13	10	12	9	6	28	23	11	3	7	9	7	3	10	24	14	17	26	24	26	13	22
Liana (woody liana)	L	7	15	6	16	11	11	31	13	13	22	31	18	16	11	16	19	4	7	14	8	4				14	10	28	23	17	12
Palms family	Pl		1	1							1			1			3		1	3	1	1									
Palms (tree palm)	PlA									1									1												

Appendix 6: Complete list of the use values of all recorded species and the land type they were found in

			Use category													
Botanical Name	**Family**	**Land type**	**B**	**BC**	**F**	**FI**	**FO**	**HU**	**LC**	**M**	**MI**	**PC**	**RE**	**RI**	**TO**	**N**
Acacia pennata	Leguminosae/Fabaceae/Mimosoideae	1 6								√						
Acacia pentagona	Leguminosae/Fabaceae/Mimosoideae	2 6								√						
Acacia floribunda	Chrysobalanaceae	3										√				
Acroceras zizanioides	Gramineae/Poaceae	2 5 6 7 8														√
Adenia cissampeloides	Passifloraceae	2 3												√		√
Adenia lobata	Passifloraceae	2														√
Adenia mannii	Passifloraceae	2 8												√		√
Adiantum vogelii	Pteridaceae	3 7				√				√						
Aframomum giganteum	Zingiberaceae	2 5 6 7 8								√						√
Aframomum pseudostipulare	Zingiberaceae	2 3 4 7 8				√	√	√	√	√						√
Afrobrunnichia erecta	Polygonaceae	1 2 3 6						√								√
Agelaea paradoxa	Connaraceae	1 2 3													√	√
Agelaea pentagyna	Connaraceae	3													√	
Agelaea poggeana	Connaraceae	1													√	√
Ageratum conyzoides	Compositae/Asteraceae	2 6								√						
Albizia adianthifolia	Leguminosae/Fabaceae/Mimosoideae	2 6 8			√							√				
Alchornea cordifolia	Euphorbiaceae	2 4 6 7 8								√						
Alchornea floribunda	Euphorbiaceae	2 8								√						
Allanblackia gabonensis	Guttiferae/Clusiaceae	2					√									
Allophylus africanus	Sapindaceae	2														√
Allophylus cobbe	Sapindaceae	2														√
Alstonia boonei	Apocynaceae	2 8								√						
Amaranthus gracilis	Amaranthaceae	2								√						
Amphimas ferrugineus	Leguminosae/Fabaceae/Papilionoideae	1												√		
Anchomanes difformis	Araceae	2								√						
Ancistrophyllum secundiflorum	Palmae/Arecaceae	1 2 4 5				√	√	√								√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Ancistrophyllum sp.	Palmae/Arecaceae	1 2 3					√									
Aneilema beninense	Commelinaceae	2 5 6 8														√
Aneilema umbrosum	Commelinaceae	1 2 7												√		√
Angylocalyx oligophyllus	Leguminosae/Fabaceae/Papilionoideae	1 2			√											
Angylocalyx sp.	Leguminosae/Fabaceae/Papilionoideae	2														
Anonidium mannii	Annonaceae	1					√	√						√		√
Anthocleista vogelii	Loganiaceae	2														√
Anthoclitandra robustior	Apocynaceae	2														√
Anthonotha macrophylla	Leguminosae/Fabaceae/Caesalpinioideae	1 3			√							√				√
Antiaris africana	Moraceae	8									√					
Antrocaryon klaineanum	Anacardiaceae	2					√	√								
Aphanocalyx djumaensis	Leguminosae/Fabaceae/Caesalpinioideae	2 3 4			√				√							√
Aphanocalyx ledermannii	Leguminosae/Fabaceae/Caesalpinioideae	3 5							√							√
Aphanocalyx microphyllus	Leguminosae/Fabaceae/Caesalpinioideae	2							√							
Aphanocalyx sp.	Leguminosae/Fabaceae/Caesalpinioideae	3 5														√
Arachis hypogaea	Leguminosae/Fabaceae/Papilionoideae	7					√	√								
Artabotrys pierreanus	Annonaceae	4														√
Ascolepis capensis	Cyperaceae	5							√							√
Asparagus angolensis	Asparagaceae	2 7 8												√		
Asplenium africanum	Aspleniaceae	1 2 3 4 5 8					√			√						√
Asplenium geppii	Aspleniaceae	4					√									
Asplenium hallei	Aspleniaceae	2 3					√									√
Asplenium variabile	Aspleniaceae	1														√
Asystasia gangetica	Acanthaceae	2 7					√			√				√		√
Aucoumea klaineana	Burseraceae	1		√				√				√			√	
Baikiaea insignis	Leguminosae/Fabaceae/Caesalpinioideae	4														√
Baillonella toxisperma	Sapotaceae	1					√	√		√		√				
Baissea floribunda	Apocynaceae	2 4 6 8						√								√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Baphia buettneri	Leguminosae/Fabaceae/Papilionoideae	4														
Baphia burttii	Leguminosae/Fabaceae/Papilionoideae	4														√
Baphia cf. *maxima*	Leguminosae/Fabaceae/Papilionoideae	1 2 3 4	√													√
Baphia leptobotrys	Leguminosae/Fabaceae/Papilionoideae	1 2 3 4			√							√				√
Barteria fistulosa	Passifloraceae	1								√						
Begonia auriculata	Begoniaceae	2					√									
Begonia hirsutula	Begoniaceae	4														√
Beilschmiedia fulva	Lauraceae	2														√
Beilschmiedia sp.	Lauraceae	1 3													√	√
Berlinia confusa	Leguminosae/Fabaceae/Caesalpinioideae	3 4														√
Bikinia evrardii	Leguminosae/Fabaceae/Caesalpinioideae	4							√							
Bikinia grisea	Leguminosae/Fabaceae/Caesalpinioideae	4							√							
Bombax buonopozense	Bombacaceae	2														
Brachystegia laurentii	Leguminosae/Fabaceae/Caesalpinioideae	2 4										√				√
Brazzeia klainei	Scytopetalaceae	3														√
Bridelia micrantha	Euphorbiaceae	2			√											
Bromelia sp.	Bromeliaceae	2								√						
Bulbostylis cf. *densa*	Cyperaceae	5 7							√	√						√
Bulbostylis laniceps	Cyperaceae	5														√
Calamus deerratus	Palmae/Arecaceae	3 4 5							√			√			√	
Calopogonium mucunoides	Leguminosae/Fabaceae/Papilionoideae	6														√
Calycobolus africanus	Convolvulaceae	1 2 4 7												√		√
Camoensia brevicalyx	Leguminosae/Fabaceae/Papilionoideae	2														√
Canarium schweinfurtii	Burseraceae	1 8		√			√	√								
Canthium sp.	Rubiaceae	2 3 8														√
Carapa procera	Meliaceae	1 2								√						
Ceiba pentandra	Bombacaceae	8												√		
Celtis tessmannii	Ulmaceae	1 2						√				√				√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Centroplacus glaucinus	Pandaceae	1										√				
Cercestis congensis	Araceae	1						√								
Cissus aralioides	Vitaceae	2													√	
Cissus barterii	Vitaceae	2 7 8								√					√	
Cissus dinklageii	Vitaceae	2 6 8					√			√				√		√
Cissus mildbraedii	Vitaceae	2								√						
Citrus sp.	Rutaceae	2					√			√						
Cleistanthus gabonensis	Euphorbiaceae	4										√				
Cleistanthus polystachyus	Euphorbiaceae	1 3 4			√							√				√
Cleistanthus sp.	Euphorbiaceae	1 2 4					√	√		√		√				
Cleome ciliata	Capparaceae	4														√
Clerodendron bipindense	Verbenaceae	2 7 8								√					√	√
Cnestis ferruginea	Connaraceae	1 2														√
Coelocaryon preussii	Myristicaceae	2 4			√		√	√				√				
Coffea sp.	Rubiaceae	2														√
Cogniauxia podolaena	Cucurbitaceae	2 6								√						√
Cola rostrata	Sterculiaceae	1					√	√								
Colocasia esculenta	Araceae	6					√									
Combretum bipindense	Combretaceae	1 2														√
Combretum platypterum	Combretaceae	2 6 7														√
Combretum racemosum	Combretaceae	2 3				√										√
Commelina capitata	Commelinaceae	2 7														√
Commelina diffusa	Commelinaceae	7														√
Connarus griffonianus	Connaraceae	3 7														√
Conyza aegyptiaca	Compositae/Asteraceae	6 7					√									√
Copaifera mildbraedii	Leguminosae/Fabaceae/Caesalpinioideae	2														
Corynanthe mayumbensis	Rubiaceae	1		√									√		√	
Costus afer	Costaceae	2 5 7 8								√						

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Costus lucanusianus	Costaceae	2 6 8								√				√		
Coula edulis	Olacaceae	1 2					√	√		√		√				
Croton oliganthus	Euphorbiaceae	8								√						
Crudia gabonensis	Leguminosae/Fabaceae/Caesalpinioideae	1 2										√				√
Cryptosepalum congolanum	Leguminosae/Fabaceae/Caesalpinioideae	2 3 4 5			√			√	√			√			√	√
Cryptosepalum pellegrinianum	Leguminosae/Fabaceae/Caesalpinioideae	2 3 4						√							√	√
Ctenitis pilosissima	Dryopteridaceae	3 4 5					√	√								√
Culcasia lanceolata	Araceae	1 2 3 4								√						√
Culcasia panduriformis	Araceae	4														√
Cyathula prostrata	Amaranthaceae	2 6 7 8								√				√		
Cyclosorus striatus	Thelypteridaceae	2 5					√	√								√
Cynometra mannii	Leguminosae/Fabaceae/Caesalpinioideae	3										√				
Cyperus papyrus	Cyperaceae	2 5 6														√
Cyperus rotundus	Cyperaceae	7														√
Cyperus sphacelatus	Cyperaceae	7														√
Cyrtosperma senegalense	Araceae	5														√
Dacryodes buettneri	Burseraceae	1 2 3		√			√	√								
Dacryodes edulis	Burseraceae	2					√									
Dacryodes klaineana	Burseraceae	1 3					√	√								
Dacryodes normandii	Burseraceae	1 2 4					√	√								√
Dacryodes pubescens	Burseraceae	1 4					√	√						√		√
Dalbergia cf. *rufa*	Leguminosae/Fabaceae/Papilionoideae	2 4														√
Dalbergia hostilis	Leguminosae/Fabaceae/Papilionoideae	2 7	√													√
Dalhousiea africana	Leguminosae/Fabaceae/Papilionoideae	1 2 3 6	√													√
Desmodium salicifolium	Leguminosae/Fabaceae/Papilionoideae	2 6 7 8						√		√				√		√
Desmodium velutinum	Leguminosae/Fabaceae/Papilionoideae	2 6 8								√						√
Detarium macrocarpum	Leguminosae/Fabaceae/Caesalpinioideae	1		√												
Dialium bipindense	Leguminosae/Fabaceae/Caesalpinioideae	3 4										√				

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Dialium dinklagei	Leguminosae/Fabaceae/Caesalpinioideae	1						√								
Dialium pachyphyllum	Leguminosae/Fabaceae/Caesalpinioideae	1 3 4			√			√				√				
Dialium tessmannii	Leguminosae/Fabaceae/Caesalpinioideae	1 2						√				√				√
Dichapetalum integripetalum	Dichapetalaceae	1 2 3 7 8														√
Dichapetalum unguiculatum	Dichapetalaceae	1 2 4								√			√	√		√
Dichostemma glaucescens	Euphorbiaceae	1 2			√											√
Dicranolepis sp.	Thymelaeaceae	1														√
Dictyophleba stipulosa	Apocynaceae	2 4						√								√
Didelotia africana	Leguminosae/Fabaceae/Caesalpinioideae	3			√											
Dioclea reflexa	Leguminosae/Fabaceae/Papilionoideae	2 7								√				√		
Diodia scandens	Rubiaceae	2 6 7 8					√			√						
Diogoa zenkeri	Olacaceae	1 2										√				
Dioscorea bulbifera	Dioscoreaceae	2 7 8					√	√		√			√	√		√
Dioscorea mangenotiana	Dioscoreaceae	6 7					√									
Dioscorea minutiflora	Dioscoreaceae	3 6 7					√							√		
Dioscorea preussii	Dioscoreaceae	2 6 7 8					√									
Diospyros bipindensis	Ebenaceae	3 5										√				√
Diospyros crassiflora	Ebenaceae	1														√
Diospyros iturensis	Ebenaceae	1 4							√							√
Diospyros obliquifolia	Ebenaceae	2											√			
Dipteropeltis poranoides	Convolvulaceae	1 2 7 8	√													√
Discoglypremna caloneura	Euphorbiaceae	2			√											√
Dissotis multiflora	Melastomataceae	4 7					√									√
Distemonanthus benthamianus	Leguminosae/Fabaceae/Caesalpinioideae	1 2 8		√								√				
Dorstenia picta	Moraceae	1 8														√
Dracaena arborea	Dracaenaceae	2								√						
Dracaena sp.	Dracaenaceae	1 4								√						
Duvigneaudia inopinata	Euphorbiaceae	2			√											

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Elaeis guineensis	Palmae/Arecaceae	2 6 7 8					√	√			√				√	
Elytraria marginata	Acanthaceae	2								√						
Emilia coccinea	Compositae/Asteraceae	6 7 8								√						
Emilia sagittata	Compositae/Asteraceae	6								√						
Englerophytum hallei	Sapotaceae	4														√
Engomegoma gordonii	Olacaceae	3														√
Entada gigas	Mimosaceae	3 7 8												√		√
Eremospatha sp.	Palmae/Arecaceae	3														
Eremospatha wendlandiana	Palmae/Arecaceae	1 2 3 4	√													√
Eriocoelum macrocarpum	Sapindaceae	1														√
Eriocoelum racemosum	Sapindaceae	1														√
Erythrophleum ivorense	Leguminosae/Fabaceae/Caesalpinioideae	2								√						
Eurypetalum batesii	Leguminosae/Fabaceae/Caesalpinioideae	1 2 4										√				
Ficus asperifolia	Moraceae	7				√										
Ficus elastica	Moraceae	2 3									√					√
Ficus exasperata	Moraceae	8			√										√	
Ficus mucuso	Moraceae	2 8			√						√					
Fillaeopsis discophora	Leguminosae/Fabaceae/Mimosoideae	1		√												
Friesodielsia enghiana	Annonaceae	2														√
Funtumia africana	Apocynaceae	2 3									√					
Geophila afzelii	Rubiaceae	1 2 3 6 7 8								√						
Geophila involucrata	Rubiaceae	1 2								√						
Geophila obvallata	Rubiaceae	1 2 4								√						
Gilbertiodendron dewevrei	Leguminosae/Fabaceae/Caesalpinioideae	1 2 3										√			√	
Gilletiodendron pierreanum	Leguminosae/Fabaceae/Caesalpinioideae	2 3 4													√	√
Gloriosa superba	Colchicaceae	1 8								√						√
Gnetum africanum	Gnetaceae	1 2 3 6 7 8					√									
Gnetum buchholzianum	Gnetaceae	1 2 4					√									

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Grewia coriacea	Tiliaceae	4														√
Grewia malacocarpa	Tiliaceae	4														√
Griffonia physocarpa	Leguminosae/Fabaceae/Caesalpinioideae	2 3 7 8								√				√		√
Guarea glomerulata	Meliaceae	1														√
Guibourtia tessmannii	Leguminosae/Fabaceae/Caesalpinioideae	3								√						
Hallea ciliata	Rubiaceae	4 5								√					√	
Haumania danckelmaniana	Marantaceae	1 2 3 6 8	√							√				√	√	
Heisteria parvifolia	Olacaceae	1 3										√				
Heteranthera callaefolia	Pontederiaceae	5														√
Heterotis decumbens	Melastomataceae	5 7								√						√
Hibiscus rostellatus	Malvaceae	5 6 8					√									
Hugonia planchoni	Linaceae	1 2														√
Hylodendron gabunense	Leguminosae/Fabaceae/Caesalpinioideae	1			√											
Hymenostegia pellegrinii	Leguminosae/Fabaceae/Caesalpinioideae	1 3										√				√
Hypselodelphys scandens	Marantaceae	1												√		
Hypselodelphys violacea	Marantaceae	1 2 3 4				√										
Icacina mannii	Icacinaceae	2 7 8								√				√		√
Ipomoea blepharophylla	Convolvulaceae	2					√									
Ipomoea involucrata	Convolvulaceae	2 6 7 8					√			√						√
Irvingia excelsa	Irvingiaceae	1 2					√									
Irvingia gabonensis	Irvingiaceae	2 3					√	√				√				
Irvingia robur	Irvingiaceae	2														√
Jardinea gabonensis	Gramineae/Poaceae	2														√
Justicia insularis	Acanthaceae	2 4 6 8				√				√						√
Klainedoxa gabonensis	Irvingiaceae	1 2 3										√				√
Kyllinga cf. *echinata*	Cyperaceae	5 7							√				√			√
Lactuca paradoxa	Compositae/Asteraceae	2 6 8					√			√						
Landolphia cf. *jumellei*	Apocynaceae	2 3						√		√						√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Landolphia incerta	Apocynaceae	1 2 3 4 6						√								
Landolphia mannii	Apocynaceae	2 3 4 8						√			√					√
Landolphia parvifolia	Apocynaceae	3						√								
Lasianthera africana	Icacinaceae	1 2 4													√	
Lavigeria macrocarpa	Icacinaceae	1 2 7								√	√			√		√
Leptaspis cochleata	Gramineae/Poaceae	1 2 3								√						√
Leptoderris congolensis	Leguminosae/Fabaceae/Papilionoideae	1 2 7												√		√
Leptoderris velutina	Leguminosae/Fabaceae/Papilionoideae	2														√
Leptonychia sp.	Sterculiaceae	1 2														√
Librevillea klainei	Leguminosae/Fabaceae/Caesalpinioideae	1														√
Loeseneriella africana	Celastraceae	1 2 4	√													√
Lomariopsis palustris	Lomariopsidaceae	2														√
Lophira alata	Ochnaceae	3 4										√				√
Ludwigia africana	Onagraceae	5					√									√
Lygodium smithianum	Schizaeaceae	2 5						√								√
Macaranga barteri	Euphorbiaceae	2			√											
Macaranga monandra	Euphorbiaceae	2			√					√						
Macaranga schweinfurthii	Euphorbiaceae	8			√											
Macaranga sp.	Euphorbiaceae	3 4			√							√				√
Macaranga spinosa	Euphorbiaceae	2 3 6 8			√					√						
Mammea africana	Guttiferae/Clusiaceae	1 3					√	√		√						
Manihot esculenta	Euphorbiaceae	6 7 8					√									
Manilkara sp.	Sapotaceae	4														
Manniophyton fulvum	Euphorbiaceae	1 2 3 4 7	√			√				√						√
Mapania sylvatica	Cyperaceae	1 3 4														√
Maranthes gabunensis	Chrysobalanaceae	2														√
Marantochloa filipes	Marantaceae	2 4 5	√						√						√	
Marquesia excelsa	Dipterocarpaceae	1														√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Megaphrynium gabonense	Marantaceae	2 3													√	
Megaphrynium macrostachyum	Marantaceae	2													√	
Megaphrynium velutinum	Marantaceae	2 3													√	
Mendoncia lindaviana	Acanthaceae	2														√
Microdesmis puberula	Pandaceae	2 6 8								√						
Mikania cordata	Compositae/Asteraceae	6 7								√						
Millettia barteri	Leguminosae/Fabaceae/Papilionoideae	1 2 3 4	√											√		√
Millettia laurentii	Leguminosae/Fabaceae/Papilionoideae	1														√
Millettia mannii	Leguminosae/Fabaceae/Papilionoideae	2 7 8			√									√		
Millettia sp.	Leguminosae/Fabaceae/Papilionoideae	7														√
Mimosa pudica	Mimosaceae	6														√
Momordica cabraei	Cucurbitaceae	2 5 7								√						√
Momordica foetida	Cucurbitaceae	2 7 8						√		√						
Monanthotaxus letestui	Annonaceae	1														√
Morinda lucida	Rubiaceae	2								√						
Mostuea brunonis	Loganiaceae	1 2 3					√			√	√					√
Mostuea sp.	Loganiaceae	4														
Mucuna flagellipes	Leguminosae/Fabaceae/Papilionoideae	7													√	√
Musa acuminata	Musaceae	6					√								√	
Musa sp.	Musaceae	2														
Musanga cecropioides	Cecropiaceae	2 8		√	√									√		
Myrianthus arboreus	Cecropiaceae	2 6 7 8			√		√	√		√						
Napoleonaea vogelii	Lecythidaceae	1 2														√
Nauclea diderrichii	Rubiaceae	2								√		√				
Nauclea pobeguinii	Rubiaceae	4								√					√	
Nephrolepis acutifolia	Davalliaceae	1 2 3 8					√			√						√
Nephrolepis undulata	Nephrolepidaceae	1 2 3 4 5 6				√	√	√		√				√		√
Nephthytis gravenreuthii	Araceae	1 2 3 4						√								

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Neuropeltis acuminata	Convolvulaceae	1 2 8					√									√
Neuropeltis velutina	Convolvulaceae	4														√
Nymphaea maculata	Nymphaeaceae	5														√
Ochthocosmus africanus	Ixonanthaceae	2														√
Ocimum gratissimum	Labiatae/Lamiaceae	2								√						
Ocimum sp.	Labiatae/Lamiaceae	2								√						
Oddoniodendron micranthum	Leguminosae/Fabaceae/Caesalpinioideae	1 2			√		√	√				√				
Oldenlandia affinis	Rubiaceae	5						√								√
Olyra latifolia	Gramineae/Poaceae	1 2 3								√						
Oncoba dentata	Flacourtiaceae	2			√					√						
Oncoba welwitschii	Flacourtiaceae	2 8			√					√						
Ophioglossum reticulatum	Ophioglossaceae	2 8								√						√
Otomeria guineensis	Rubiaceae	7								√						
Oubanguia africana	Scytopetalaceae	3				√										
Pachypodanthium staudtii	Annonaceae	3 4			√	√			√	√						
Palisota ambigua	Commelinaceae	1 2												√		√
Palisota lagopus	Commelinaceae	1 2 3 6								√				√	√	
Palisota thyrsiflora	Commelinaceae	1 2 3 4 6 7 8								√				√	√	
Pancovia pedicellaris	Sapindaceae	3														√
Panda oleosa	Pandaceae	1 2 3 4					√	√		√						
Paropsia grewioides	Passifloraceae	2			√											√
Paspalum commersonii	Gramineae/Poaceae	6 8														√
Paspalum conjugatum	Gramineae/Poaceae	2 6 7							√	√						√
Passiflora foetida	Passifloraceae	7					√			√						
Paullinia pinnata	Sapindaceae	2								√						
Pausinystalia macroceras	Rubiaceae	1 2										√			√	
Pausinystalia yohimbe	Rubiaceae	1 3								√						√
Pentaclethra eetveldeana	Leguminosae/Fabaceae/Mimosoideae	1 2 3 6			√			√		√		√				√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Pentaclethra macrophylla	Leguminosae/Fabaceae/Mimosoideae	2 3								√						
Pentaclethra sp.	Leguminosae/Fabaceae/Mimosoideae	3														
Pentadiplandra brazzeana	Capparaceae	6 7								√						
Persea americana	Lauraceae	2			√		√									
Petersianthus africanus	Lecythidaceae	2								√						
Petersianthus macrocarpus	Lecythidaceae	1 2 6			√					√						√
Phyllanthus discoides	Euphorbiaceae	2			√											
Phyllanthus sp.	Euphorbiaceae	2 5 6 7 8								√				√		
Picralima nitida	Apocynaceae	1													√	
Piper guineense	Piperaceae	4					√									
Piptadeniastrum africanum	Leguminosae/Fabaceae/Mimosoideae	1 2									√					√
Plagiosiphon emarginatus	Leguminosae/Fabaceae/Caesalpinioideae	3 4														√
Plagiostyles africana	Euphorbiaceae	1 2 3								√				√	√	
Platycoryne buchananiana	Orchidaceae	5														√
Podococcus barteri	Palmae/Arecaceae	3 4	√													√
Polyalthia suaveolens	Annonaceae	1 2 4						√				√			√	
Portulaca oleracea	Portulacaceae	2 7					√									
Pseuderanthemum tunicatum	Acanthaceae	3 4														√
Pseudoprosopis gilletii	Leguminosae/Fabaceae/Mimosoideae	2 4	√													
Pseudosabicea floribunda	Rubiaceae	5														√
Pseudospondias longifolia	Anacardiaceae	2					√					√				√
Psidium guajava	Myrtaceae	2 8			√		√			√						
Psychotria peduncularis	Rubiaceae	2 8														√
Psychotria sp.1	Rubiaceae	1 3 4														√
Psychotria sp.2	Rubiaceae	2										√				√
Psydrax arnoldiana	Rubiaceae	2 6			√							√				
Pteris atrovirens	Pteridaceae	4					√									
Pterocarpus soyauxii	Leguminosae/Fabaceae/Papilionoideae	1 2		√										√		

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Pycnanthus angolensis	Myristicaceae	1 3														√
Pycnobotrya nitida	Apocynaceae	1 2 3						√		√			√			
Quassia africana	Simaroubaceae	1								√						
Raphia hookeri	Palmae/Arecaceae	3				√			√							
Raphia sp.	Palmae/Arecaceae	3 5				√			√			√				
Raphiostylis ferruginea	Icacinaceae	1 2														√
Rauvolfia mannii	Apocynaceae	1														
Rauvolfia vomitoria	Apocynaceae	2 6 7 8			√			√								
Renealmia macrocolea	Zingiberaceae	1 2 4							√							
Rhaphiostylis ferruginea	Icacinaceae	3														√
Rhektophyllum mirabile	Araceae	1 2 4 6					√	√						√		
Rhynchospora corymbosa	Cyperaceae	4 5														√
Rinorea sp.	Violaceae	2											√	√		√
Rourea cassioides	Connaraceae	1 2 3						√								√
Rourea erythrocalyx	Connaraceae	1 2 3 7	√							√						√
Rourea obliquifoliolata	Connaraceae	1 2 3 6 7 8	√													√
Sabicea capitellata	Rubiaceae	2 7								√						√
Salacia debilis	Celastraceae	1														√
Salacia elegans	Celastraceae	1 2 3 7 8					√									√
Sansevieria trifasciata	Dracaenaceae	3 4														√
Santiria trimera	Burseraceae	1 2 3 4		√	√		√	√						√		
Sarcophrynium schweinfurthianum	Marantaceae	1 2 3 4													√	
Scadoxus cinnabarinus	Amaryllidaceae	2 3														√
Scaphopetalum blackii	Sterculiaceae	2 3														√
Scaphopetalum thonneri	Sterculiaceae	3														√
Scleria boivini	Cyperaceae	2 5 6 8												√		√
Scleria verrucosa	Cyperaceae	5														√
Scorodophloeus zenkeri	Leguminosae/Fabaceae/Caesalpinioideae	1 2 3			√		√			√		√				

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Scottellia klaineana	Flacourtiaceae	2								√		√				√
Scyphocephalium ochocoa	Myristicaceae	1 2 3					√	√		√		√				
Scytopetalum klaineanum	Olacaceae	3			√											
Selaginella myosurus	Selaginellaceae	2 5												√		
Setaria megaphylla	Gramineae/Poaceae	2								√						
Sherbournia kiliotricha	Rubiaceae	7								√						
Sida acuta	Malvaceae	2 6 7								√						
Smilax kraussiana	Smilacaceae	2 4 6 7 8								√				√		
Solanum torvum	Solanaceae	7														√
Solenostemon repens	Labiatae/Lamiaceae	5 7								√						√
Solenostemon scutellarioides	Labiatae/Lamiaceae	2 8								√						
Stachyothyrsus staudtii	Leguminosae/Fabaceae/Caesalpinioideae	4														√
Stachytarpheta indica	Verbenaceae	2 6 7														√
Stephania laetificata	Menispermaceae	2 7								√						√
Sterculia tragacantha	Sterculiaceae	8														√
Strephonema pseudocola	Combretaceae	4														√
Strombosia pustulata	Olacaceae	1 2										√				
Strombosiopsis tetrandra	Olacaceae	4														√
Strychnos malacoclados	Loganiaceae	2 3													√	√
Strychnos phaeotricha	Loganiaceae	2														√
Strychnos sp.	Loganiaceae	2														√
Stylochiton zenkeri	Araceae	1						√								
Synedrella nodiflora	Compositae/Asteraceae	2 6														√
Synsepalum longecuneatum	Sapotaceae	1 2 4														√
Synsepalum sp.	Sapotaceae	4														
Syzygium cf. *staudtii*	Myrtaceae	5														√
Tabernaemontana crassa	Apocynaceae	2														√
Tectaria angelicifolia	Dryopteridaceae	1 2 6				√										√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Tectaria varians	Dryopteridaceae	2				√										
Tessmannia africana	Leguminosae/Fabaceae/Caesalpinioideae	2		√										√		
Tetracera alnifolia	Dilleniaceae	1 2 3 6 7 8					√			√						
Tetrapleura tetraptera	Leguminosae/Fabaceae/Mimosoideae	2					√									
Tetrorchidium didymostemon	Euphorbiaceae	2			√					√						
Thomandersia congolana	Acanthaceae	1 2 6			√					√						√
Thonningia sanguinea	Balanophoraceae	1								√						
Thunbergia affinis	Acanthaceae	2 3 4 5 7														√
Trachyphrynium braunianum	Marantaceae	1 2 3 4				√										
Treculia africana	Moraceae	4														
Trema orientalis	Ulmaceae	6								√						
Tricalysia macrophylla	Rubiaceae	2			√			√				√				
Trichilia tessmannii	Meliaceae	2 3														√
Trichoscypha abut	Anacardiaceae	1 2					√	√								
Trichoscypha acuminata	Anacardiaceae	1 2 3					√	√		√						
Trichoscypha mannii	Anacardiaceae	1														√
Tristemma mauritianum	Melastomataceae	7 8					√									√
Tristemma oreophyllum	Melastomataceae	2 5 7 8					√			√						√
Triumfetta cordifolia	Tiliaceae	7													√	
Triumfetta sp.	Tiliaceae	2													√	
Uapaca paludosa	Euphorbiaceae	1						√								
Uncaria africana	Rubiaceae	7														√
Unknown1 unknown1	Euphorbiaceae	7					√			√						
Unknown2 unknown2	Menispermaceae	2 7														√
Unknown3 unknown3	Unknown3	6 8														√
Urena lobata	Malvaceae	2 7												√	√	√
Uvaria scabrida	Annonaceae	2 7								√						√
Vangueriopsis calycophila	Rubiaceae	1														√

Botanical Name	Family	Land type	Use category													
			B	BC	F	FI	FO	HU	LC	M	MI	PC	RE	RI	TO	N
Vernonia smithiana	Compositae/Asteraceae	2 6 7								√						
Vitex sp.	Labiatae/Lamiaceae	7														√
Warneckea sp.	Melastomataceae	1														√
Xylopia hypolampra	Annonaceae	1 2 7			√							√				
Xylopia staudtii	Annonaceae	5														√
Zanthoxylum heitzii	Rutaceae	2		√												
Zanthoxylum macrophyllum	Rutaceae	1		√												

Land type:
1=primary forest, 2=secondary forest, 3=riparian forest, 4=swamp forest, 5=swampy clearing, 6=agriculture, 7=young fallow, 8=old fallow
Use category:
B=basketry/cordage, BC=boat construction, F=firewood, FI=fishing place/tools, FO=food, HU=hunting place/tools, LC=light construction, M=medicine, MI=miscellaneous, PC=permanent construction, RE=recreation, RI=ritual/tradition, TO=tools, N=no use known

Appendix 7: List of species that are unique for a specific use

Botanical Name	Family	Use type
Acacia pentagona	Leguminosae/Fabaceae/Mimosoideae	Medicine
Amphimas ferrugineus	Leguminosae/Fabaceae/Papilionoideae	Rituals/tradition
Ancistrophyllum sp.	Palmae/Arecaceae	Food
Aneilema umbrosum	Commelinaceae	Rituals/tradition
Anonidium mannii	Annonaceae	Rituals/tradition
Aphanocalyx djumaensis	Leguminosae/Fabaceae/Caesalpinioideae	Light construction
Ascolepis capensis	Cyperaceae	Light construction
Asparagus angolensis	Asparagaceae	Rituals/tradition
Calamus deerratus	Palmae/Arecaceae	Light construction
Calamus deerratus	Palmae/Arecaceae	Tools
Costus lucanusianus	Costaceae	Medicine
Costus lucanusianus	Costaceae	Rituals/tradition
Ctenitis pilosissima	Dryopteridaceae	Hunting tools
Cyathula prostrata	Amaranthaceae	Medicine
Dacryodes pubescens	Burseraceae	Rituals/tradition
Desmodium salicifolium	Leguminosae/Fabaceae/Papilionoideae	Rituals/tradition
Elaeis guineensis	Palmae/Arecaceae	Tools
Entada gigas	Mimosaceae	Rituals/tradition
Ficus exasperata	Moraceae	Tools
Gilbertiodendron dewevrei	Leguminosae/Fabaceae/Caesalpinioideae	Tools
Griffonia physocarpa	Leguminosae/Fabaceae/Caesalpinioideae	Rituals/tradition
Haumania danckelmaniana	Marantaceae	Medicine
Haumania danckelmaniana	Marantaceae	Rituals/tradition
Icacina mannii	Icacinaceae	Medicine
Justicia insularis	Acanthaceae	Medicine
Landolphia incerta	Apocynaceae	Hunting tools
Lavigeria macrocarpa	Icacinaceae	Medicine
Leptoderris congolensis	Leguminosae/Fabaceae/Papilionoideae	Rituals/tradition
Mammea africana	Guttiferae/Clusiaceae	Medicine
Manniophyton fulvum	Euphorbiaceae	Fishing tools
Manniophyton fulvum	Euphorbiaceae	Medicine
Momordica cabraei	Cucurbitaceae	Medicine
Nephrolepis undulata	Nephrolepidaceae	Rituals/tradition
Olyra latifolia	Gramineae/Poaceae	Medicine
Oncoba dentata	Flacourtiaceae	Medicine
Oncoba welwitschii	Flacourtiaceae	Medicine
Oubanguia africana	Scytopetalaceae	Fishing tools
Palisota lagopus	Commelinaceae	Rituals/tradition
Palisota thyrsiflora	Commelinaceae	Medicine
Paullinia pinnata	Sapindaceae	Medicine
Phyllanthus sp.	Euphorbiaceae	Rituals/tradition
Phyllanthus sp.	Euphorbiaceae	Medicine
Piper guineense	Piperaceae	Food
Plagiostyles africana	Euphorbiaceae	Rituals/tradition
Polyalthia suaveolens	Annonaceae	Tools
Pterocarpus soyauxii	Leguminosae/Fabaceae/Papilionoideae	Rituals/tradition
Pycnobotrya nitida	Apocynaceae	Medicine
Pycnobotrya nitida	Apocynaceae	Hunting tools
Quassia africana	Simaroubaceae	Medicine

Raphia hookeri	Palmae/Arecaceae	Fishing tools
Raphia sp.	Palmae/Arecaceae	Light construction
Rinorea sp.	Violaceae	Rituals/tradition
Sabicea capitellata	Rubiaceae	Medicine
Santiria trimera	Burseraceae	Boat construction
Scleria boivini	Cyperaceae	Rituals/tradition
Selaginella myosurus	Selaginellaceae	Rituals/tradition
Sida acuta	Malvaceae	Medicine
Smilax kraussiana	Smilacaceae	Rituals/tradition
Solenostemon scutellarioides	Labiatae/Lamiaceae	Medicine
Strychnos malacoclados	Loganiaceae	Tools
Thonningia sanguinea	Balanophoraceae	Medicine
Tristemma oreophyllum	Melastomataceae	Medicine
Urena lobata	Malvaceae	Rituals/tradition
Vernonia smithiana	Compositae/Asteraceae	Medicine

Appendix 8: Terms of reference (in French)

Etude Pluridisciplinaire du Paysage à Makokou : A la découverte de la biodiversité, de l'environnement et des perspectives des populations locales dans les paysages forestiers.

Cadre

Les objectifs globaux du Programme Sectoriel de Valorisation des Aires Protégées du Gabon sont la protection et la valorisation à long terme des écosystèmes du Gabon et l'appui à la valorisation durable des aires protégées au Gabon. Plus spécifiquement, le programme veut mettre en place une filière durable du tourisme dans les Parcs Nationaux au profit de la conservation et des populations riveraines et le renforcement des capacités d'aménagement durable au Gabon par la recherche et le développement d'outils d'aménagement appropriés.

La conservation des forets d'Afrique Centrale est le sujet de fortes inquiétudes exprimées par une importante attention et pression internationales. Le Gabon a consenti un effort important en érigeant près de 10% de la superficie du pays en aires protégées. Dans des pays comme le Gabon, fortement dépendants de l'exploitation de ressources naturelles, il existe une tension entre la conservation de la forêt, l'exploitation de cette ressource à grande valeur économique et le besoin de lutter contre la pauvreté des populations locales. Une gestion durable des aires protégées, mais également des forêts situées hors de ces aires protégées et dont leur sauvegarde dépend, devra prendre en compte tous les acteurs et parties prenantes concernées.

Les décideurs nationaux et internationaux, les acteurs de la conservation et les opérateurs économiques ont souvent des facilités à faire valoir leurs intérêts : ils ont les moyens et les relations leur permettant d'exprimer clairement leurs demandes. Ceci n'est souvent pas le cas des populations locales et la connaissance de leurs besoins et perceptions nécessite des efforts spécifiques. Des décisions externes ayant des impacts locaux, prises sans prendre en compte les préoccupations des populations locales, engendrent des résultats négatifs courants mais rarement prévus. Il est nécessaire de mieux comprendre les besoins locaux et d'améliorer la participation des communautés locales dans la prise de décision.

Afin de mieux concilier les besoins des communautés locales avec le maintien de la biodiversité des paysages, les décideurs ont besoin d'informations pertinentes et utilisables. Ils ont souvent du mal à mettre en rapport avec d'autres problématiques, les listes d'espèces et autres données écologiques issues des études de biodiversité conventionnelles. Le CIFOR à développé au Kalimantan Est (Bornéo indonésien) une suite de méthodes qui améliore la compréhension de ce qui est important localement : déterminant ce qui est important, pour qui, dans quelle mesure et pourquoi (voir Sheil *et al.* 2004). Cette étude pluridisciplinaire du paysage (Multidiciplinary Landscape Assessment en anglais ou MLA) a également été

appliquée en Bolivie et au Cameroun (voir le site Internet http://www.cifor.cgiar.org/mla).

Les méthodes utilisées placent la biodiversité dans un contexte plus large, incluant des facteurs tels que les options agricoles et les sites à valeur culturelle, facilitant une analyse plus intégrée des différentes options de gestion. Les méthodes permettent également de mettre en évidence les intérêts communs entre la conservation et les populations locales et favorisent un dialogue plus éclairé. Celles-ci, même si la notion de 'biodiversité' ne les intéresse pas à première vue, ont des intérêts dans sa conservation qu'il convient d'identifier. Par exemple, en Indonésie où les méthodes furent développées, la protection des tombeaux en forêt s'est révélée importante pour les deux parties.

Parc National de l'Ivindo et ses environs

Les populations locales de la région de Makokou sont très préoccupées par les activités qui se développent dan la zone (voir le rapport de mission Cibler la Fierté Nationale Gabonaise **:**Une Stratégie pour la Protection des Parcs Nationaux et le Bien-être Humain par Carol J. Pierce Colfer, Sally A. Lahm , Marieke Sassen). Ces activités incluent la création du Parc National de l'Ivindo mais également l'exploitation forestière. Des permis d'exploitation sont attribués par l'administration sur ce que les populations locales considèrent comme leurs terres ancestrales. Des conflits au sein des communautés proviennent de l'attraction des gains financiers pour certains et des inquiétudes au sujet de la disparition de ressources naturelles pour d'autres. Concernant le Parc, de fortes inquiétudes sont exprimées quant au conséquences de la délimitation du Parc qui inclue une partie des zones traditionnellement utilisées pour la chasse, la pêche et la cueillette. Les inquiétudes varient selon les communautés ou les groupes ethniques et leurs activités traditionnelles respectives.

Pour une gestion durable et efficace du Parc, les intérêts des populations riveraines devront être pris en compte. Il existe pour l'instant très peu ou pas d'informations au sujet de l'utilisation de la forêt et la perception de leur environnement par les populations riveraines du Parc. Les intérêts et priorités des populations par rapport à la biodiversité n'ont jamais réellement été étudiées. Quelques informations peuvent être dérivées d'études sur la chasse (dont Lahm 1993, Okouyi Okouyi 2001) et de quelques études sur les aspects culturels (Doucet 2003, Pineau 1995, Hladik *et al.* 1996) et ethnobotaniques (Bourobou-Bourobou 1994, Walker et Sillans 1961).

L'approche pluridisciplinaire préconisée par le CIFOR permet de relier des descriptions biophysiques conventionnelles du paysage aux besoins, aux préférences et aux systèmes de valeurs locaux. En plus de fournir les bases pour des recommandations en matière de gestion du Parc et du paysage forestier qui l'entoure et un meilleur dialogue entre les parties prenantes, ces méthodes peuvent servir de base à de futures recherches plus approfondies sur des aspects plus spécifiques des interactions entre l'homme et la forêt.

Les nouveaux paradigmes de la gestion forestière durable nécessitent un changement de mentalité et une formation renouvelée des acteurs de terrain. Une étude pilote MLA menée dans un site (un village) de Makokou par un groupe de chercheurs du CENAREST, sous la supervision d'un chercheur du CIFOR, permettrait de les familiariser avec ces nouvelles méthodes. Cette formation pratique viserait à créer un groupe de chercheurs capables de mener et d'adapter des études similaires dans d'autres sites. De plus, ils apprendront à saisir ces données dans une base de données ACCESS qui pourra être utilisée pour des analyses et complétée avec les données d'autres sites étudiés. Une base de données sur les besoins, perceptions et les intérêts des populations locales par rapport à leur environnement et à sa biodiversité sera ainsi initiée.

Nous proposons de mener cette première étude dans le village ou 'quartier' de Loa Loa. Ce village semble avoir la plus grande présence dans le Parc, par rapport au nombre de campements de pêche sur les rives de l'Ivindo. La plupart de ces campements sont également utilisés pour la chasse.

L'étude

L'étude implique un séjour de 3 à 4 semaines au sein de la communauté. Ce séjour dans le village est important pour établir la confiance et obtenir une bonne appréciation de la réalité de la vie de la communauté. L'équipe de recherche est divisée en deux selon les activités: une équipe de village et une équipe de terrain. Les premiers contacts et les réunions de cartographie communautaire se font ensemble. Ces activités permettent également d'identifier des experts locaux de l'histoire, des pratiques et des institutions du village ainsi que des experts de la forêt/des plantes/des sols.

Une équipe standard est constituée de huit à dix membres spécialisés dans divers domaines : un ou deux botanistes, un assistant/coordinateur de parcelle, un ou deux enquêteurs de terrain, un pédologue, deux à quatre enquêteurs/ chercheurs pour le village et un coordinateur pour la logistique. Des interprètes peuvent s'avérer nécessaires si les différentes ethnies de la communauté ne sont pas représentées chez les enquêteurs eux-mêmes. L'équipe de terrain inclut également des experts locaux.

Après l'étude il convient de compter une soixantaine de jours de travail (man units) pour la saisie et vérification des données dans la base de données. Ceci peut être fait par plusieurs personnes sous la direction d'un coordinateur.

Activités de village :

L'équipe de village collecte des informations de base sur les opinions, les besoins, la culture, les institutions et les aspirations de la communauté. Elle examine les perceptions du paysage local ainsi que les relations avec celui-ci. Les méthodes utilisées incluent la cartographie communautaire, une enquête dans les foyers (30 minimum), des interviews semi structurées de personnes ressources préalablement

identifiées et des exercices d'évaluation de l'importance relative de différentes unités du paysage, sources de produits et produits forestiers (voir tableau 1 pour détails). La carte communautaire du village et des ressources importantes permet également de sélectionner les sites d'étude de terrain (voir 'Activités de terrain'). Elle est dessinée sur un fonds de carte basé sur un Système d'Informations Géographiques (SIG) de la zone d'étude, construit avec les informations disponibles et celles que l'on aura pu collecter sur le terrain.

Les exercices d'évaluation se font par groupe cible. En général les gens sont divisés en hommes/femmes, jeunes/vieux, donc en quatre groupes, pour chaque ethnie de la communauté. En effet les différentes ethnies ont probablement des perceptions différentes de leur environnement et de l'importance des unités de paysage et des produits forestiers liées à leurs activités traditionnelles. De plus, les noms locaux peuvent varier d'une ethnie à l'autre. Idéalement, dans le cas de Loa Loa, il faudra faire trois fois quatre groupes.

Tableau 1 : Activités de village

Données	**Méthode**
Description du village/perspectives sur l'utilisation des terres	Entrevue avec le chef de village
Contexte culturel de l'utilisation des terres	Entrevue avec le chef coutumier
Prix des produits négociés	Entrevue avec les commerçants
Historique du village et de l'utilisation des terres	Entrevues avec le chef de village/ chef coutumier
Catastrophes naturelles et événements importants	Entrevues avec le chef de village/ chef coutumier
Identification des terres et types de forêt	Réunion de la communauté (avec exercice de cartographie)
Identification des produits forestiers	Réunion de la communauté (avec exercice de cartographie)
Cartographie du paysage	Réunion communautaire, cartographie participative
Démographie	Recensement par ménage et documentation par le chef de village
Enquête dans les ménages	Questionnaire sur les problèmes et aspirations, relation avec l'environnement. Chefs de famille de 30 ménages au moins
Connaissances traditionnelles de l'utilisation des terres	3–5 informateurs clés
Récolte et vente de produits forestiers	3–5 informateurs clés
Importance relative des unités du paysage et des types de forêt	MDC*. Femmes/hommes, âgés/jeunes séparément
Evolution de l'importance relative des unités du paysage dans le temps	MDC*. Femmes/hommes, âgés/jeunes séparément
Influence de la distance sur l'importance relative des unités du paysage	MDC*. Femmes/hommes, âgés/jeunes séparément
Importance relative de différentes sources de produits (plantes et animaux, sauvages et domestiques)	MDC*. Femmes/hommes, âgés/jeunes séparément
Importance relative d'espèces de plantes et d'animaux par catégorie d'usage	MDC*. Femmes/hommes, âgés/jeunes séparément

* : MDC= Méthode de Distribution des Cailloux. Méthode d'évaluation de l'importance relative de différentes unités de paysage, espèces etc. par la répartition de 100 jetons (ou cailloux) sur des cartes illustrées.

Activités de terrain :

L'équipe de terrain collecte des données biophysiques et ethnographiques dans des lieux spécifiques géoréférencés (voir le tableau 2). Ces lieux sont sélectionnés à l'aide de la carte communautaire afin de représenter le degré de variation dans le paysage local. Des endroits spéciaux ou d'importance particulière sont recherchés par l'intermédiaire d'informateurs locaux car ils sont souvent associés à des biotas restreints.

Chaque site est décrit, les caractéristiques de la végétation et les espèces végétales individuelles sont identifiées et une étude détaillée du sol est menée. Dans chaque cas, les informateurs locaux inclus dans l'équipe fournissent des informations détaillées sur les différents aspects de chaque site, incluant les sols. Ils donnent le nom local et l'usage de chaque plante, l'histoire de l'usage du site et les espèces animales que l'on peut y trouver ainsi que les pratiques de chasse.

Pour les noms locaux, la question de langue est importante. Il est préférable d'avoir sur le terrain des experts locaux connaissant plusieurs des langues de la communauté ou bien un représentant de chacune d'elles.

Les parcelles, situées de part et d'autre d'une ligne de transect de 40m sont inventoriées pour les herbacées, lianes, épiphytes et monocotylédones dans 10 sous-unités de 5m de large chevauchant la ligne et ensuite pour les arbres dans 8 sous unités (4 de chaque coté de la ligne) de 10m de large et de longueur variable (voir Sheil *et al.* 2004 pour détails sur les parcelles a surface variable).

Tableau 2 : Activités sur le terrain

Activités	**Méthode**
Etablissement des parcelles	Site basé sur la carte participative, au hasard sur le site
Description du site	
Description du site par les informateurs	Interview des informateurs
Inventaire des herbacées	Transect 5x40m
Inventaire des ligneux	Transect à surface variable, 8 cellules de 10m de large
Usage des plantes	Interview des informateurs
Propriétés du sol	Analyse de profil et prise d'échantillons
Description locale du sol	Interview des informateurs

La question de la propriété intellectuelle des connaissances locales, particulièrement concernant les plantes médicinales et leur usage commercial est importante. Nous insistons sur le fait que les informations fournies par les informateurs sont volontaires. Nous n'enregistrons expressément pas les détails de la posologie et de la préparation des médicaments. En Indonésie, certaines informations sur la localisation de ressources n'ont pas été publiées en dehors des cartes laissées aux villageois afin de protéger ces ressources.

Gestion des données

La préparation d'une liste finale des plantes dans ce genre d'étude demande en général un grand travail de vérification en herbier et de références. La durée de ce travail dépend de la connaissance existante de la végétation dans la zone d'étude.

Toutes les données issues de l'étude seront saisies dans une base de données relationnelle ACCESS. Une seule personne devra être responsable du contrôle de la base et des corrections qui y seront progressivement ajoutées.

Trois bases de données seront créées : la base des données du village, la base des données des parcelles et la base des données SIG. Les données des parcelles sont liées avec celles du village dans le territoire duquel les parcelles ont été établies et dont les habitants ont été les informateurs. Ceci est important surtout si la base contient les informations de plusieurs villages. Toutes les parcelles sont géoréférencées et les informations les concernant (description, végétation, sols etc.) peuvent donc être liées au SIG. Certaines informations (parc, routes, localisation des villages) sont disponibles, d'autres le sont mais à grande échelle seulement (hydrographie). Il faudra vérifier si d'autres informations (topographie, images satellites) pourront l'être au moment de mener l'étude.