



THE FORESTS OF THE CONGO BASIN

State of the Forest 2006



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The Congo Basin Forest Partnership (CBFP)

The CBFP is a non-binding Type II partnership composed of approximately 30 governmental and non-governmental organizations. It was launched at the 2002 World Summit on Sustainable Development in Johannesburg, South Africa in order to promote the sustainable management of the forests of the Congo Basin and improve the quality of life of the region's inhabitants. The CBFP's main objectives are to improve communication among its members and support coordination between members' projects, programs, and policies.

The partnership is facilitated by one member of the partnership. Facilitation by the United States, from 2003 to 2004, has been followed by French facilitation since February 2005. The partnership works by bringing its members together periodically to exchange information.

The partnership actions are concentrated on six priority areas:

- strengthening mechanisms for regional consensus-building,
- establishing a working group for funding mechanisms,
- increasing human capacity within the regional forest/environment sector,
- strengthening the Executive Secretariat of COMIFAC,
- improving governance within the forest sector
- promoting and communicating on the activities of the CBFP and its members.

The thirty founding members of the CBFP fall into three major categories: governments, inter-governmental organizations, and non-governmental organizations. As a group, the founding members committed to financing and/or implementing programs in line with the CBFP priority areas that totaled tens of millions of dollars over three to five years. Since its foundation, additional governments and non-governmental organizations have joined the partnership.

Partners

Governments

- Republic of South Africa (DWAF)
- Germany (BMZ, GTZ)
- Belgium (MAECECD)
- Cameroon (ONADEF)
- Canada (ACDI)
- European Union (EC, ECOFAC, JRC)
- USA (DSPI, CARPE-USAID)
- France (MAE, AFD, MEDD, CIRAD)
- Equatorial Guinea
- Gabon
- Japan (Embassy of Japan in France)
- Netherlands (SNV)
- Central African Republic
- Democratic Republic of Congo
- Republic of Congo (MEFE)
- United Kingdom (DFID)

Intergovernmental organizations

- World Bank
- COMIFAC
- FAO
- World Mecanism
- ITTO
- UNESCO
- GRASP

NGOs, research groups and associations

- American Forest & Paper Association
- *Association technique internationale des bois tropicaux* (ATIBT)
- Center for International Forestry Research (CIFOR)
- Conservation International (CI)
- Forest Trends
- Jane Goodall Institute (JGI)
- Society of American Foresters
- World Conservation Union (IUCN)
- Wildlife Conservation Society (WCS)
- World Resources Institute (WRI)
- World Wildlife Fund (WWF-USA)
- World Wide Fund for Nature (WWF-Int'l)

To find out more: <http://www.cbfp.org/>

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Table of Contents

Preface	5
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Foreword	6
----------	---

Part I

1. Forests of the Congo Basin	9
2. Human Populations in the Forest	14
3. Conservation	17
4. Industrial Logging: Current Status and Trends	29
5. Threats or the Vectors of Change	33
6. Priority Actions	42

Part II

7. Stakeholders in the Congo Basin Forest Sector	48
8. A Comparison of Forestry Legislation and Regulations in the Six Forest Countries of Central Africa	63
9. Central African Forest Cover and Cover Change Mapping	80
10. Importance, Constraints and Prevailing Trends of the Timber Sector in the Six Forest Countries of Central Africa	90
11. The Environmental Dimension of Industrial Logging	106

Part III

12. Monte Alén-Monts de Cristal Landscape	114
13. Gamba-Mayumba-Conkouati Landscape	121
14. Lopé-Chaillu-Louesse Landscape	138
15. Dja-Odzala-Minkébé (Tridom) Landscape	148
16. Sangha Tri-National Landscape	159
17. Léconi-Batéké-Léfini Landscape	169
18. Lake Télé-Lake Tumba Landscape	175
19. Salonga-Lukenie-Sankuru Landscape	184
20. Maringa-Lopori-Wamba Landscape	193
21. Maiko-Tayna-Kahuzi-Biega Landscape	198
22. Ituri-Epulu-Aru Landscape	205
23. Virunga Landscape	216

Bibliography	226
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Annexes

A. Institutional and Legislative Indicators	233
B. Industrial Logging Indicators	235
C. Biodiversity Indicators	238
D. Country Data with Maps Showing the Current State of Logging and Conservation	241
E. Acronyms	253

Preface

The Congo Basin Forest Partnership, which includes now 33 members of governments, the private sector, non-governmental organizations and research groups, was launched at the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg to focus world attention on the conservation of the second largest tropical rain forest in the world. The CBFP is a call to arms to ensure that the great biodiversity resources of this region are maintained for the ultimate benefit of the citizens of Central Africa and for global environmental health. This Partnership was inspired by the Central African Heads of State whose commitment and affirmation to the principles of international cooperation were upheld in the 1999 Yaoundé Declaration. These commitments were restated during a second Heads of State summit in Brazzaville in 2005.

Little objective information on the condition and extent of this vast natural resource is available to decision-makers and stakeholders, making a concerted international plan of action, in the framework of the CBFP, difficult to establish. Furthermore, while it is generally considered that the forest is being rapidly degraded and biodiversity lost, there has not been a widely available system to help interested stakeholders understand the seriousness and origin of the threats and the impacts, both positive and negative, of human activities on the forest. This kind of information is of vital necessity for the CBFP partners to gauge the effectiveness of their efforts and to prioritize actions for efficient use of scarce conservation resources.

This first State of the Forest report is a joint effort between the partners and stakeholders to pool information from all available sources in one document. The effort to monitor this vast resource we believe will strengthen the partnership, build a common understanding of the challenges, successes and even failures and guide future common approaches. This is not intended to be a scientific document in the usual sense, but rather should serve to foster dialog amongst partners, build capacity in the region to monitor the resource base and serve as an inspiration for present and future partners.

We expect that as the experience grows, the State of the Forest will evolve to consider specific challenges and thematic topics. The partners are to be congratulated for rising to the challenge laid down at the WSSD to conserve the valuable Congo Basin natural resources as a tool toward poverty alleviation for the millions of Central Africans that depend on forest resources for their livelihoods.

The current level of collaboration for tropical forest conservation is, by any measure, unprecedented. We believe that future editions of this important State of the Forest report process will only serve to solidify the partnership and to strengthen resolve to conserve the rich flora and fauna of the Congo Basin while helping its citizens and their children to enjoy a more prosperous future.

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Foreword

The 2006 State of the Forest (SoF) report on the Congo Basin serves as a follow up to the preliminary report distributed at the 2005 Summit of the Heads of State of Central Africa in Brazzaville. In 2004, WWF and WCS proposed the idea of publishing a ‘State of the Forest’ within the framework of the CBF. This idea was adopted by the CARPE program. Initially, the report was to have appeared in two stages: a preliminary 40-page summary to be followed a few months later by a more exhaustive report. The summary was finalized in the second half of 2004 and appeared in print at the end of January 2005. Its preparation was coordinated by a drafting committee primarily comprised of American experts linked to CARPE. As a result, the report focused on the actions and results of the CARPE program. It was principally financed by USAID, although the European Union also contributed by providing the financial means to solicit the input of a specialist and translate the document into French.

The 2006 report is an in depth follow-up to the preliminary report and represents a collaborative effort on the part of the CBF partners. Preparations for the 2006 SoF began in September 2005. Since then, over 110 experts have contributed to its development and in February 2006 a preliminary version was submitted to a scientific committee. On March 15-17, 2006 a meeting was held in Kinshasa where the preliminary version was presented to some fifty experts representing CBF partners and the scientific committee. The purpose of this meeting was not to discuss in detail the content of the 2006 report, but rather to draw useful lessons from the drafting process and reflect on a procedure for subsequent versions, including guidelines to be established and specific themes to be addressed.

Forests

The word forest has many different meanings; some legal or utilitarian definitions are so vague that they include not only the true forests¹, but also woodlands and wooded savannahs. However, contrary to what is commonly presented, not all savannahs² are degraded forests. Savannahs are their own rich vegetation type, and despite the fact that some savannahs produce wood, they represent a unique ecosystem. They necessitate different management systems and should be considered alongside forests and deserts. Accordingly,

this report on the state of the forests of Central Africa is specifically concerned with dense humid forests.

Objectives

This 2006 SoF report aims to present the ‘baseline’ state, a starting point from which subsequent reports can be compared. As such, it is a working document that serves as both a monitoring tool and a coordination instrument for the CBF.

Timeframe

This report is primarily based on data from 2004 and 2005; data from after December 31, 2005 have not been incorporated.

Target audience

The SoF report’s primary audience is CBF partners, from policy and administrative decision makers to technicians and managers. However to ensure maximum transparency, the report should also be circulated beyond this ‘specialized’ group. To this effect, it was proposed at the Kinshasa meeting to produce multiple versions of the report for different audiences.

Structure and content

The report is divided into three main parts:

- Chapters 1-6 offer an overview of the Congo Basin forests, human populations in the forest, industrial logging, conservation, the threats to biodiversity and forest resources and priority actions to be undertaken.
- Chapters 7-11 provide more detailed information on specific cross-cutting themes.
- Chapters 12-23 detail the Landscapes.

The 2006 report builds off of the 2005 preliminary report by developing in greater detail aspects that are considered imperative both to facilitate interpretation of the 2006 report and to facilitate understanding of subsequent reports. These subsequent reports, the frequency of which is still to be decided by the CBF partners, will develop additional cross-cutting themes—and there is no shortage of them—but will only include the Landscapes in a more condensed form at intervals of 2, 3 or 5 years. Therefore, subsequent reports will likely be shorter and focus on

¹ Forests are habitats where trees are dominant, where tree crowns form a more or less continuous layer and where grasses are virtually absent in the under story. The few grasses which are found in forests have broad leaves and are very different from savannah species. Forests are sensitive to fire.

² Savannahs are a grassy habitat type with or without woody vegetation of variable density. This woody vegetation is mostly fire-resistant.

changes or the priority actions that emerge as a result of these changes.

As much as possible, the 2006 report has been based on measurable indicators reflecting (1) pressures on the forest and its renewable resources, (2) the state of these pressures and (3) management measures undertaken to mitigate, as much as possible, the harmful effects of principal pressures. To this effect, a preliminary set of indicators was compiled based on existing documents produced through the CARPE program, the ECOFAC program (Pabanel & Pedrono, 2003), and WWF and World Bank activities. At a November 3-4, 2006 meeting in Kinshasa, the chosen indicators were presented for discussion and amendment to a panel of experts representing the main CBFP members.

The final set comprises three series of indicators:

- institutional and legislative indicators at the national scale (Annex A),
- industrial logging indicators at the national scale (Annex B),
- indicators concerning biodiversity at the Landscape level (Annex C)

Data collection forms were then circulated to the Landscape leaders and COMIFAC. The results obtained are summarized in the form of tables in Annexes A-C. Certain figures have been included in the various chapters of the report as well as in the data sheets for each country (Annex D).

The SoF process

The 2006 report constitutes the beginning of a process that is to be developed over the long term. This has proved to be essential in order to coordinate and evaluate the actions of the many CBFP partners and particularly to identify at regular intervals the directions to follow and the priority actions to be carried out with respect to management, conservation and sustainable exploitation of the renewable natural resources of the forests of the Congo Basin. This process will therefore involve all CBFP players.

Lessons learned

Preparing the 2006 report proved to be more complicated than expected and highlighted a number of difficulties in the way the CBFP currently operates in the field. It demonstrated that communications among the sectors of the same Landscape, or among NGOs acting in the same Landscape, need to be improved. This is especially true in Landscapes which straddle national borders. It also showed that Landscape managers and officials in government administration are hampered by problems associated with information, including access to information, the fact that information available on the same subject is often incompatible and the fact that the historical knowledge of experts and projects is somewhat superficial, often going back little more than ten years. It revealed gaps in technical knowledge and highlighted the need to produce a database or network of databases to remedy these obstacles. Finally, it clearly demonstrated that a great deal of work remains to be done before a significant set of measurable and realistic indicators can be elaborated.

The 2006 report therefore contains many gaps and, in several places, lacks precision. However, the fact that such a far reaching effort has been completed within a relatively short timeframe is a major success. Indeed it is the first time in the history of conservation in Central Africa that such a large number of partners and stakeholders, scattered over a vast forest area as well as three continents and facing chronic communication problems related to logistical difficulties inherent in the region, have managed to pool their ideas in a single document.

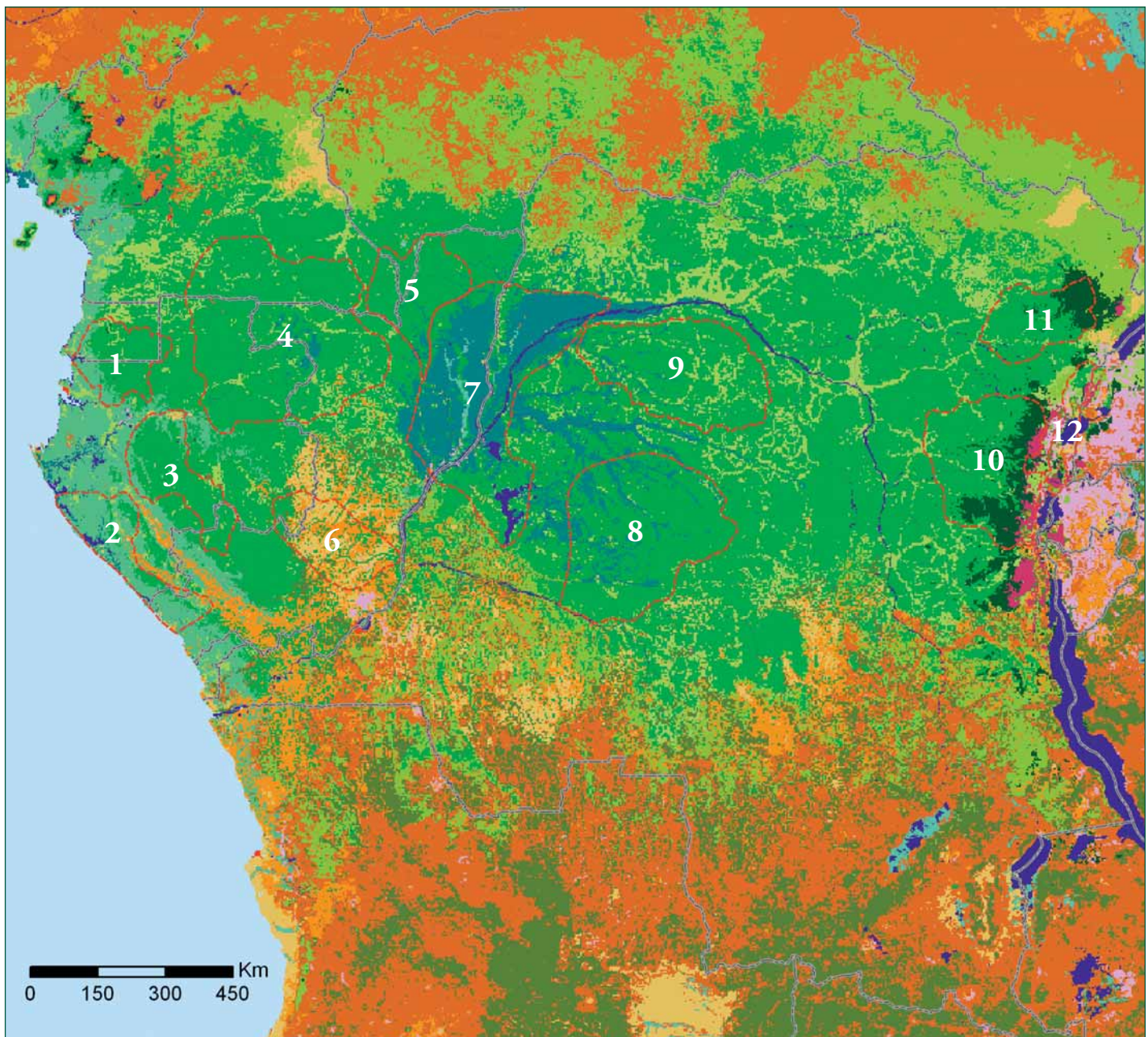


Figure 1.1. The forests of Central Africa (Source: JRC)



1. Monte Alén-Monts de Cristal Landscape
2. Gamba-Mayumba-Conkouati Landscape
3. Lopé-Chaillu-Louesse Landscape
4. Dja-Odzala-Minkébé (Tridom) Landscape
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11. Ituri-Epulu-Aru Landscape
12. Virunga Landscape

1. Forests of the Congo Basin

Overview

Following the Amazonian forests, the forests of the Congo Basin constitute the second largest area of dense tropical rainforest in the world. They stretch from the coast of the Gulf of Guinea in the west to the mountains of the Albertine Rift in the east¹ and cover about seven degrees of latitude on either side of the equator. They are mostly within the Guinea-Congo forest structure, of which they constitute over 80% of the total area. In the west of Cameroon and the east of the Democratic Republic of Congo, they also include the Afromontane forests.

This report focuses on the forests of the countries forming part of the CBFP partnership - Cameroon, Equatorial Guinea, Gabon, the Central African Republic (CAR), the Republic of Congo and the Democratic Republic of Congo (DRC). The area of these forests nears 200 million hectares (Figure 1.1); however estimates of their area vary considerably. Certain estimates are at the least surprising², but even the weakest estimates vary depending on what one considers to be forests. According to the FAO, which uses a wide definition, the area of the forests was 227.61 million hectares in 2005. According to MODIS and GLC2000 maps, the area was 180.46 million hectares in 2000 (page 82).

Relief and altitude

Unlike the tropical forests of Southeast Asia or West Africa, but similar to those of Amazonia, the forests of Central Africa still form a vast and more or less continuous block. However, whereas the Amazonian forests are largely situated just above sea level, 80% of the forests of Central

Figure 1.2. Relative abundance of the principal types of vegetation (Source: JRC).

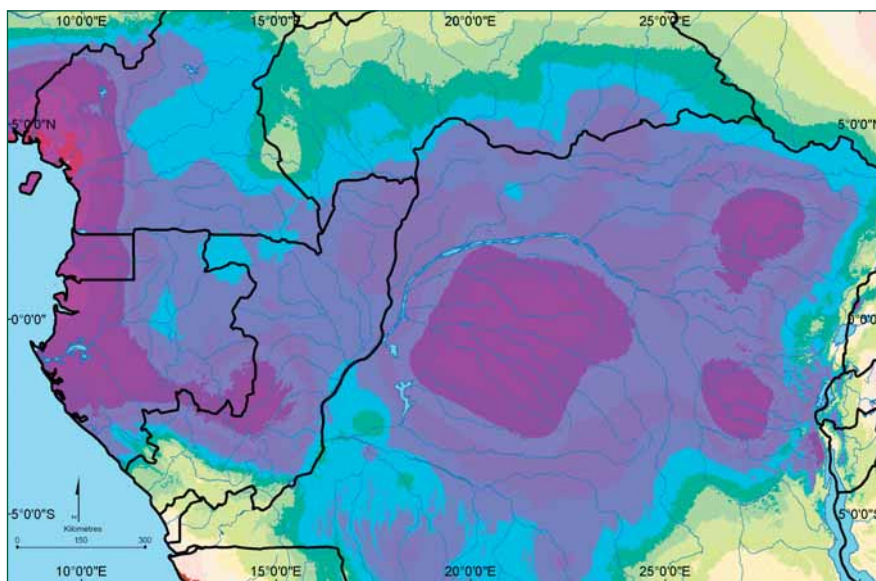
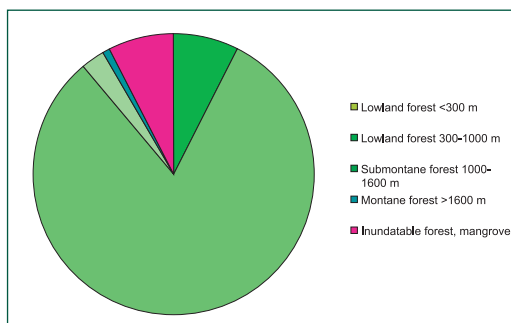


Figure 1.3. Precipitation in Central Africa (Sources : ESRI, Worldclim data, University of California, Berkeley, USA).

Africa are located between 300 and 1000 m of altitude (Figure 1.2). Only the forests in the coastal sedimentary basin, which represent 7% of the total area of the forests and are located mainly in Cameroon and Gabon, are at a height of less than 300m (page 82).

The submontane forests, at an altitude of between 1,000 and 1,600 m, cover 2.8% of the forest area and the montane forests, above 1,600 m, cover only 0.8% of the area. These forests are spread over two fragmented blocks separated by over 2,000 km. Comparable forests in South America form an almost uninterrupted strip all along the Andes Chain. Forests showing clear submontane influences cling to the mid-altitude features (650-1,200 m) which run parallel to the gulf coast of Guinea 100-200 km inland and capture the Atlantic clouds, especially in the dry season. Along with continual climatic variations that have affected and continue to affect Central Africa, this spatial configuration of the forests has played an important role in the evolution of its flora and fauna³.

Climate

Precipitation is the main factor determining vegetation in a tropical environment. Overall, precipitation varies between 1,600 and 2,000 mm a year on average. However, three areas with noticeably higher rainfall can be identified: the eastern edge and the center of the Congo Basin, with precipitation of around 2,000 to 2,500 mm per year on average, and the coastal area from Libreville in Gabon to the foot of Mount Cameroon, with precipitation averaging 3,000 to 11,000 mm a year (Figure 1.3).

¹ The forest relics of western Uganda and Kenya are also part of the Guinea-Congo forest structure.

² The State of Africa 2006 suggests a total area of 520 million hectares (Maury, 2006).

³ With changes in climate, species in the Andean forests have shifted both in an altitudinal and north-south direction, while African species have only shifted in an altitudinal direction. Even the Albertine Rift is not extensive enough for significant latitudinal shifts to appear.

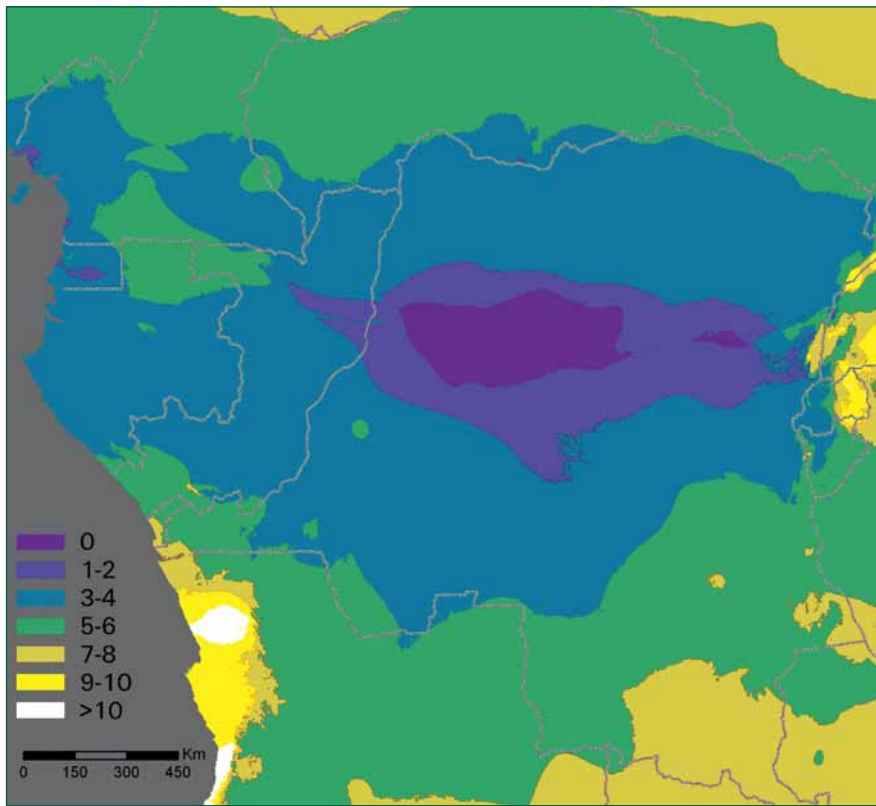


Figure 1.4. Number of dry months per year (Source: JRC)

The seasonal distribution of precipitation is bimodal in areas close to the equator but becomes unimodal further north or south. At the same time, the length of the dry season increases with latitude: it lasts one to two months on the equator but as much as three to four months at the northern and southern edges of the forest block (Figure 1.4). In Equatorial Guinea, most of Gabon, southeastern Cameroon and southwestern Republic of Congo, the effects of these rainfall gradients are tempered by the Atlantic influence, which considerably reduces the solar radiation, lowers the temperature by 2–3°C between July and September and reduces evaporation. Consequently, although they have a dry season of three months, these regions are covered with evergreen forests.

Fauna and flora

Vegetation

Along the Atlantic coast there is an irregular strip of evergreen forests including clumps of hyperhumid forests, in northeastern Gabon and western Cameroon, which receive more than 3,000–3,500 mm of precipitation annually. Approximately 100–200 km from the coast, on the mountain ranges (Monte Alén, Monts de Cristal, Monts Doudou, etc.), there is also an irregular strip of forests that are rich in Caesalpinids

and, above an altitude of 650 m, have submontane characteristics. Towards the north, this strip mixes with the submontane and montane forests of Mount Cameroon and the highlands of western Cameroon. Further to the east, most of the terra firma forests of the Congo Basin consist of a mosaic of evergreen and semi-evergreen formations, which are generally less rich in species. Among these formations are monodominant forests, of which the best known and most extensive are the *Gilbertiodendron dewevrei* forests. In the center of the Congo Basin there are 220,000 km² of swamp forests or floodplain forests that exhibit less diversity, but a fairly substantial degree of plant endemism. In eastern Gabon and northern Republic of Congo, there are also vast open-canopy Marantaceae forests. In the east of the Congo Basin, the land rises to the mountains of the Albertine Rift with submontane forests between 1,000 and 1,650 m and montane forests between 1,650 and 3,000–3,400 m. The northern and southern fringes of the forest block consist of semi-deciduous forests that give way to a mosaic of savannahs and gallery forests, less rich from a botanical point of view, but supporting high populations of large mammals.

History

The size and the continuity of the forests of Central Africa have varied considerably over time. During the last two million years, these forests have periodically been reduced and fragmented by world climate variations, largely linked to cyclical variations in the Earth's orbit. For the past 800,000 years, these cycles have lasted approximately 100,000 years with three phases of very unequal durations: for about 80,000 years, the climate was variable but on average a little drier and cooler than at present; for 10,000 years it was much cooler and drier—these are the glacial periods—and for the remaining 10,000 years it was warmer and wetter.

During the last glacial period, which peaked 15,000 to 18,000 years ago, rainfall in equatorial Africa was very low, the Atlantic Ocean had dropped by 120 m, the continental plateau received little water and most of the present forests were turned into a landscape of savannahs and gallery forests. The dense forests were limited to refuges, mainly situated along the low mountains near to the Atlantic coast, on the eastern edge of the Congo Basin and on the high mountains in the east. Substantial refuges, albeit probably very fragmented, would also have existed in the center of the Congo Basin⁴. Today, these refuge areas

⁴ Until 10–20 years ago, it was thought that during the glacial periods the Guinea-Congo forests were reduced to a small number of refuges, one in the east of the Congo Basin and one in Lower Guinea. We now know that these refuges were more numerous, fragmented and partially linked by a network of gallery forests that also contributed to the survival of many species.

still have a higher degree of endemism and greater diversity of species relative to other areas of the Congo Basin forests.

Climatic fluctuations are not limited to these great glaciation cycles. More localized variations, of the El Niño-La Niña type, appear depending on the distribution of the surface temperatures of the oceanic waters. The most recent natural recession of the forest formations dates back only 2,000 to 2,500 years. At that time, the forests underwent extreme fragmentation due to the spread of grasslands and even now they are still in the process of recolonizing areas where forests were lost. Due to this process, a large portion of the forests of Gabon are pioneer okoume (*Aucoumea klaineana*) forests in various stages of evolution. Okoume, a very important commercial timber species in Gabon, is one of the main species that colonizes savannahs, but it has difficulty regenerating in mature forests and is therefore eventually replaced by other species. In many other regions of Central Africa (Cameroon, Republic of Congo), rapid reforestation of the savannahs can also be observed.

This continual succession of expansion and regression of the forest, combined with the changes brought about by man, mean that the overall picture of the forests in the Congo Basin is very complex. Unfortunately, the implications of these processes for forest management and the conservation of biodiversity are still poorly understood.

Species richness and endemism

Overall, the forests of Central Africa have fewer species than those of America or Asia. This can be partially explained by their smaller size and the extreme contractions that they have undergone during the cold, dry spells of the Tertiary and, most significantly, the Quaternary periods. Nevertheless, the biodiversity of these forests is of worldwide importance because the fauna and flora in the forests of the Congo Basin do not exist anywhere else on earth. This uniqueness is found at the species and genus levels, as well as, to a lesser extent, the family level.

The flora in the low-altitude forests is comprised of over 10,000 species of higher plants, of which 3,000 are endemic. Some families are sparse or almost absent, particularly Dipterocarpaceae, Cactaceae, Bromeliaceae and Humiriaceae, but others, such as Euphorbiaceae, Leguminaceae, Meliaceae, Sapotaceae and Moraceae, are highly diversified. Nine families are endemic: Dioncophyllaceae, Huaceae, Hoplestigmataceae, Lepidobotryaceae, Medusandraceae, Octokne-

maceae, Pandaceae, Pentadiplandraceae and Scytopetalaceae (Figure 1.5). The flora of the Afromontane forests is comprised of only 4,000 species, but at least 70% of them are endemic. There are two endemic families—Barbeyaceae and Oliniaceae—and also conifer species of the *Podocarpus* genus.

With respect to fauna, these forests house forest forms of the African elephant and the buffalo, together with endemic species such as the okapi, the bongo (Figure 1.6), the bonobo and the gorilla. The Anomaluridae, most of the Cephalophinae and Colobinae and many Cercopithecidae are confined to these forests. Their avifauna includes the Congo peacock and several families endemic to Africa, notably the guineafowl (Numididae), the turacos (Musophagidae) (Figure 1.7), the puff-back and wattle-eyed flycatchers (Platysteiridae), the bush-shrikes (Malaconotidae) and the helmet-shrikes (Prionopidae).

Distribution and biogeography

The flora and fauna of the Congo Basin are very unequally distributed over the forests as a whole. Thus, the specific richness, as well as the composition of the associations and communities, varies enormously from one region to another.

Overall two areas with particularly high species richness can be identified: (1) the forests of Lower Guinea in the west (Cameroon, Equatorial Guinea, Gabon) and (2) those on the piedmont of the Albertine Rift in eastern DRC. These areas are separated by a vast, less rich area that covers the entire central region of the Congo Basin. The Guinea-Congo forests comprise three biogeographical entities of which two are in Central Africa: (1) the forests of Lower Guinea, which stretch from Nigeria to the eastern border of Gabon—this coincides with the separation of the Congo and Ogooué basins; (2) the Congolese forests, which are confined to the hydrographical basin of the Congo; and (3) the forests of Upper Guinea, which run from Ghana to Guinea and are separated from the other entities by the Togo and Benin savannah strip. Although the Lower Guinea and the Congolese forests are now contiguous, in the past they were often separated by a corridor of open countryside and swamp or flood-plain forests.

Recognizing that care must be taken when assessing the richness of species—it all depends on the scale on which one is working⁵—it would appear that the forests of Lower Guinea are the richest on the continent (Thomas, 2004). As for the relatively lower species richness of the Central



Figure 1.5. *Scytopetalum klaineianum*.



Figure 1.6. *The bongo* *Tragelaphus euryceros*.



Figure 1.7. *The giant turaco* *Corythaecola cristata*.

⁵ The number of species in a given zone is proportional to its area. The larger the area, the greater the potential for a more diverse set of habitats. One can therefore only compare zones with the same surface area.

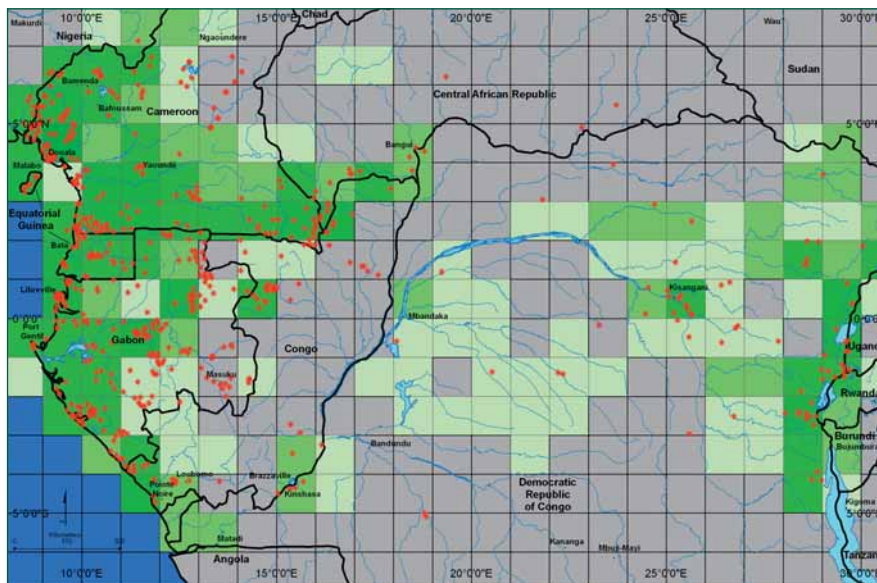


Figure 1.8. State of knowledge (Sources : ESRI, WWF-US).

Legend

- Area surveyed for 5 taxa
- Area surveyed for 4 taxa
- Area surveyed for 3 taxa
- Area surveyed for 2 taxa
- Area surveyed for 1 taxon

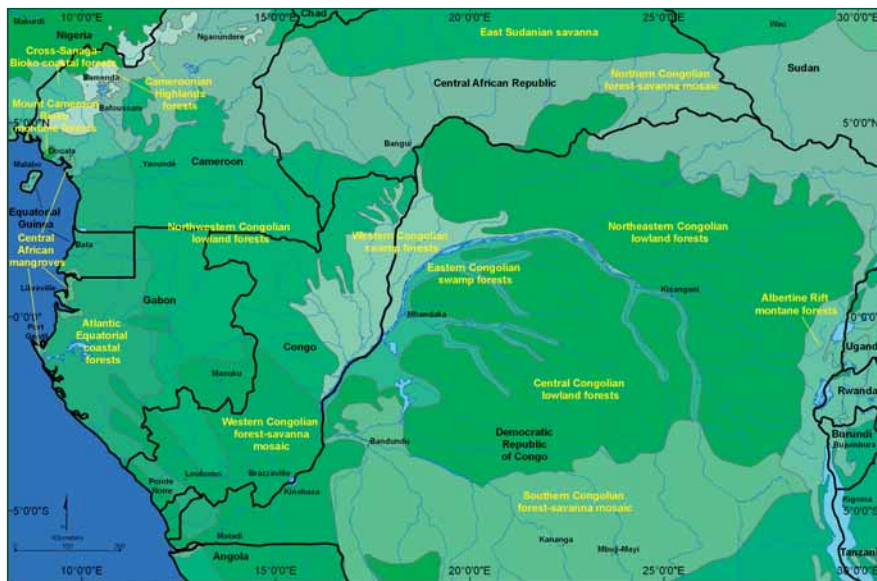


Figure 1.9. The 14 terrestrial ecoregions (Sources : ESRI, WWF-US).

nant species. Some formations contain a large number of species while others are dominated by a single species, generally a Leguminacea from the subfamily Caesalpinioidea. The best known are the *Gilbertiodendron dewevrei* forests which occur from Cameroon to eastern DRC, and which also cover very large areas on the edges of the Central Basin.

The biogeography of the forests of Central Africa is extremely complex. It reflects not only the ecological requirements of the various groups of organisms and their responses to environmental parameters, but also the history of the region over the last few million years.

Terrestrial ecoregions

Efforts for the conservation and sustainable logging of the forests of Central Africa face a major problem: on the one hand, knowledge is still incomplete and for many groups of organisms we do not know exact distributions. On the other hand, the knowledge that we do have shows that the biogeography of this region is very complex. In order to simplify the situation, primarily for practical purposes, the whole area has been subdivided into 14 ecoregions⁸ (Figure 1.9). This concept is widely used by conservation NGOs, especially WWF. However, for certain scientists this classification system is unsatisfactory because the boundaries between some of the ecoregions do not correspond to the reality on the ground⁹. In truth, ecoregions are more of a tool for planning than research.

Aquatic ecoregions

In Central Africa, the aquatic ecosystems and forest ecosystems are intimately linked, not only from the point of view of the fauna and flora but also through human activities and the economy. It is important to remember that the entire center of the Central Basin of the Congo River is taken up by the second largest marsh in the world, covered by various types of swamp or floodplain forests. From the hydrological point of view, the forests of Central Africa are drained by the Congo River

Basin, it is possible that this is partly the result of insufficient knowledge (Figure 1.8).

Going beyond these two main biogeographical entities, the distribution of species is much more complex and northeast and eastern distribution patterns vary from one taxonomic group to another. In the case of birds, over 90% of the species exist throughout the forest block. With mammals, on the other hand, the distribution of species is highly compartmentalized because large watercourses have proven to be insurmountable obstacles to dispersion⁶. In the case of plants, some species are very widely distributed while others are highly localized⁷. Furthermore, the relative abundance of species varies greatly from one place to another. Despite the very flat relief, the forests of the Congo Basin are divided up into a fine mosaic of formations based on their domi-

⁶ This phenomenon has been clearly demonstrated for species and subspecies of primates, particularly through the work of Colyn (1987, 1991).

⁷ The work of Sosef (1994) showed that for begonias of the subgenera *Loasibegonia* and *Scutobegonia*, 21 centers of endemism are evident in Central Africa: 5 in the Congo region, 17 in Lower Guinea.

⁸ An ecoregion is a relatively large area of land that contains an assemblage of habitats and species that is distinct from those of neighboring ecoregions.

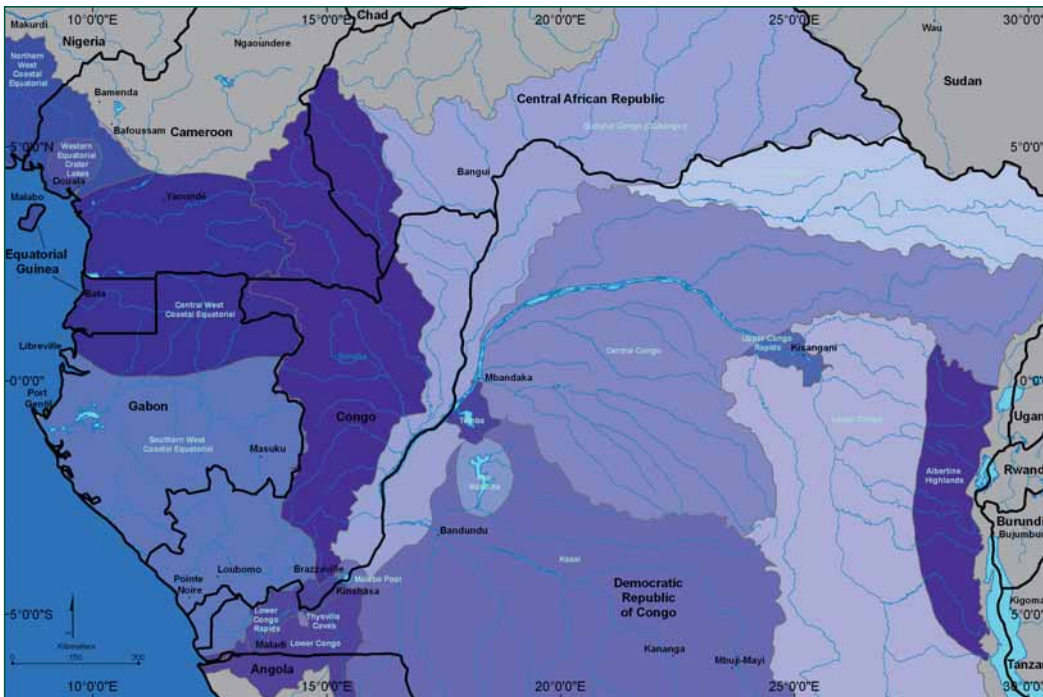


Figure 1.10. The 16 aquatic ecoregions (Sources : ESRI, WWF-US).

Basin and a series of coastal rivers which empty into the Gulf of Guinea. The largest of these rivers are the Sanaga, Ntem, Ogooué, Nyanga, Niari and Kouilou. The basin of the Congo River covers an area of 3.4 to 4.1 million km² — estimates vary — and can be subdivided into several sub-basins according to the quality of the water, the surrounding vegetation, the particular characteristics of the fauna and the seasonal flooding and receding of the waters. As is the case with the terrestrial environments, insufficient information is available on the aquatic ecoregions and vast portions of the Congo Basin have been barely explored. This is particularly regrettable in light of the fact that aquatic resources play an important role in the lives of the region's inhabitants. Similar to the terrestrial ecoregions it is possible to distinguish a number of different aquatic ecoregions, 16 of which lie within the forest block (Figure 1.10).

Ecological services

In addition to its species richness and endemic species, the Congo Basin also represents one of the last regions in the world where vast interconnected expanses of tropical rainforest permit biological processes to continue undisturbed. It is a rare example of a place where an animal the size of the forest elephant can still act freely on its ecosystem, like an 'engineer' transforming the landscape by influencing the distribution of species and maintaining natural ecological systems. Furthermore, because of their size, the forests of the Congo Basin constitute a carbon reserve of global significance for regulating the primary greenhouse gas, carbon dioxide. Finally, these forests also help to regulate the regional and local climates. In particular, they ensure that water is recycled as over 50% of the rainfall on the Congo Basin comes from local evaporation and evapotranspiration.

⁹ The Gabonese forests change very gradually and evenly from west to east. At the very most one could possibly identify a separating line between the forests of the coastal sedimentary basin and those of the inland plateaus and mountains (and this only to the north of the Ogooué), but the current dividing line between the ecoregion of the equatorial forests on the Atlantic coast and the ecoregion of the Congolese forests in the northwest is totally arbitrary. It would perhaps have been wiser to draw two or three demarcation lines: the first at the edge of the coastal basin; the second (optional) at the junction of the mountain chains and the central plateau; and the third more or less at the watershed between the Congo and the Ogooué basins. On the other hand, the ecoregion of the montane forests of Itombwe only represents a subregion of the Albertine Rift region. Its flora and fauna are slightly richer, but overall very similar to other forests of this ecoregion. In particular, it shares several endemic species with the Nyungwe forest of Rwanda.



Figure 2.1. Pygmy hunter in Gabon.



Figure 2.2. Pygmy woman from the northeast of the Democratic Republic of Congo.

2. Human Populations in the Forest

Origin of populations

Approximately 30 million people, from over 150 ethnic groups, currently live in the forests of Central Africa. Their presence in these forests can be dated back to different periods. Traces of human occupation from several hundreds of thousands of years ago have been found in multiple places within the forests¹. However, it is probable that for a very long time these populations lived in patches of savannah, at the edge of dense forests or along major watercourses. It remains very difficult to determine exactly when humans began to live in the heart of the forests. We do know that the Pygmies, who represent populations particularly well adapted to the forest environment, have existed for 20,000 to 25,000 years. The originally Neolithic and later metallurgist Bantu populations penetrated the forest from the northwest. In approximately 4,000 BP, they crossed the Sanaga and by 2,500 BP they occupied almost all of Lower Guinea. By around 1,000 BP, the whole forest block was colonized. In the north and the east, Ubangi and Sudanic populations intermixed with the Bantu migrations and influenced local cultures. Unlike the situation in Amazonia, the majority of the human populations still living in the Congo Basin forests are indigenous (Box 2.1).

¹ Near Lopé National Park in Gabon, sharpened stone tools dated at least 480,000 years have been found (Oslisly, 1994, 1998 and 2001).

2.1. Indigenous populations

In Amazonia, the indigenous Amerindian population represents less than 1% of forest dwellers. The remaining 99% originated from Europe, Africa or Asia. This situation led to the development of socio-political and environmental movements which for several decades have been working to protect these native populations. Similar movements also developed in certain parts of southeast Asia and in Africa. However in Central Africa the situation is different: populations originating outside Africa represent only a tiny fraction of the total population. All forest dwellers have been living in the forest and its immediate surroundings for more than 1000 years. Despite this, the term 'indigenous population' is used to describe nomadic (or semi-nomadic) hunter-gatherers in Central Africa. The term includes certain groups of Pygmies (Figures 2.1 and 2.2) even though some Pygmies have abandoned their hunter-gatherer livelihoods and become sedentary. Some Pygmies groups are also now mixed with Bantus, and certain Bantu groups have integrated Pygmies.

Interrelations

For 15,000 years, the Pygmies likely represented the only human populations living in the Congo forests. With the arrival of Bantu farmers, complex relations developed between the hunter-gatherers and farmers. The former were more familiar with the forest, but suffered from a scarcity of carbohydrates. They started to exchange labor and forest products such as meat, fish or honey for items rich in carbohydrates and, more recently, for manufactured products. The widely dispersed groups found today are distinguished by their degree of nomadism and their dependence on farmers.

Traditional agriculture in African forests was based on a cycle of forest clearance, cultivation, fallow periods and secondary reforestation followed once again by forest clearance. In the Neolithic age, the oil palm *Elaeis* and yams *Dioscorea* sp. played an essential agricultural role. Between 2,000 and 2,500 years ago, a banana from Asia was introduced and between 400 and 500 years ago plants of American origin, mainly manioc, beans, peanuts, maize and sweet potatoes, began to be cultivated.

This diversification altered the agricultural landscape, transformed habits and led to an overall increase in human population. The poor fertility of the soils found in the dense rainforests in Africa and the overall low productivity of tropical forests meant that the majority of the forest-dwelling populations in the Congo Basin continued to depend on the forests' natural resources. Furthermore the traditional lifestyle of hunter-gatherers and farmers is sustainable only in situations characterized by low human population density — probably less than 4 inhabitants/km² — and where the sole use of natural resources is local consumption. It was only in the high altitude regions of Cameroon and eastern DRC that more productive agriculture, often complimented by stock farming, was able to expand, resulting in higher human population densities.

Distribution

Human populations in the Congo Basin forests are very unevenly distributed (Figure 2.3). In the low-altitude regions, the largest human populations are found along the forests' edges in close proximity to adjoining savannahs. Additional populations are concentrated along the major

navigable watercourses, such as the Congo River, from Kinshasa to Kisangani, and the Ubangi River. These watercourses have always been important routes for communication, trade and transport, providing the local populations with food and various goods (Figure 2.4).

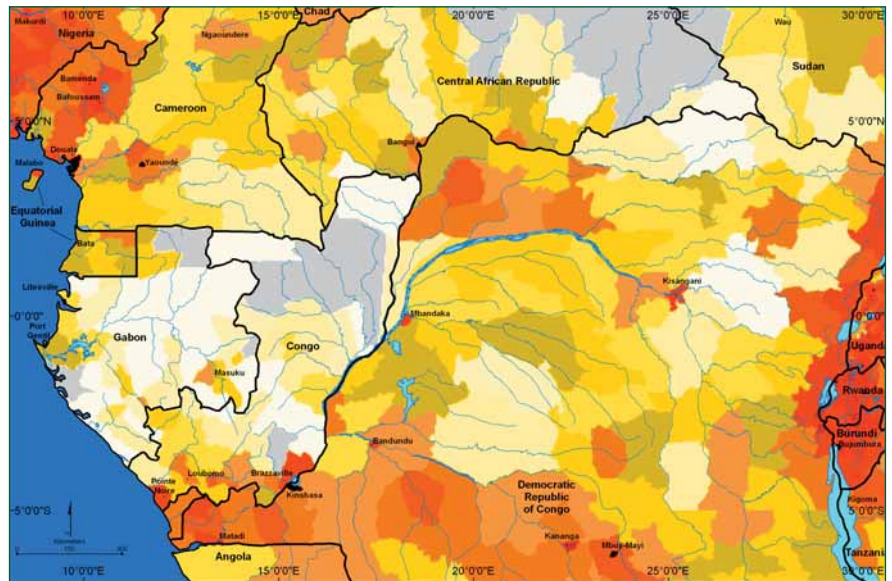
As all the rivers flowing into the Atlantic Ocean have rapids and waterfalls near their estuaries, access to the interior of the Congo Basin is difficult. Consequently, European influence on the interior of Central Africa was insignificant until the middle of the 19th century. Since that time, the distribution of human populations has been strongly influenced by the construction of railways and road networks for the extraction and removal of natural resources. This pattern, where villages re-locate near roadways, has been especially noticeable since 1930 in French Equatorial Africa and has resulted in vast expanses of forest with no human populations.

Today, roads still influence the rural complex (Figure 2.5). The construction of villages along roads creates halos, sometimes convergent, of human encroachment in the forest. At the same time, vast forest areas with no roads or navigable watercourses remain intact. This pattern of settlement, which is often driven by external economic forces and the aspirations of these populations to take advantage of development or health and educational infrastructure, leads to increasingly localized and unsustainable extraction of forest resources. Furthermore, the convergence of halos generates long strips of deforestation and degradation and results in the fragmentation of the remaining forested areas. These phenomena are exacerbated when local populations begin to export forest products to markets in large urban centers. Unfortunately, it is the same populations who subsequently suffer from the damaging effects of this process.

Apart from the ecological implications, the change in the distribution of human populations also has significant and complex cultural and socioeconomic implications. These implications



Figure 2.4. A village along the Congo River.



are demanding growing attention and include: changes in the way in which resources are used; the introduction of new harvesting and hunting techniques; transformations in the local economy and traditional power structures (Figure 2.6); and varying mechanisms which determine whether or not the local populations benefit from the utilization of resources. To these concerns must be added the contradictions and ambiguities associated with land tenure (pages 63-69).

In eastern DRC, highland populations do not live in villages, but are more or less dispersed throughout the countryside where they practice intensive agriculture marked by short fallow periods (Figure 2.7). This lifestyle has created a pattern of high population density with local areas of overpopulation. Since the 1970s and 80s, this situation has prompted large-scale migration towards lower altitudes. This migration has resulted

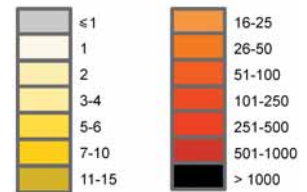


Figure 2.3. The human population density is variable from one region to another in Central Africa. In most of Gabon and the Republic of Congo it is below 2 inhabitants/km², while the high altitude regions of Cameroon and eastern DRC harbor over 150 or even 250 people/km² (Sources: ESRI, Gridd population of the worlds (GPWv3), CIESIN, Columbia University, City of New York).



Figure 2.5. A typical village in the forest.



Figure 2.6. A village chief in the Democratic Republic of Congo.

in conflicts between resident populations and immigrants, mainly due to the fact that the social habits and agricultural methods of the latter are different from those of the resident populations and may be poorly suited to the new conditions.

Current Situation

Traditional cultures in Central Africa have been significantly impacted by historical developments associated with the rise of the Atlantic slave trade in the 16th century, the growth of the Arab slave trade in the 19th century, and the colonial period (Vansina, 1990). Diverse ethnic groups have been impacted in different ways, but overall there has been a collapse of many social and political structures. While many urban populations continue to rely on forest resources, an ever widening gap has developed between the forest and town dwelling populations. This gap is not only apparent when comparing material aspects of the two populations; it is formalized by existing legislation, which was largely inherited from the colonial era and is often in direct contradiction to forest traditions (pages 63-69).

In Central Africa today, industrial harvesting of timber, the production of palm oil, immigration, natural population growth, commercial hunting, road construction and growing access to distant markets have driven traditional systems of natural resource management to the breaking point. Very few populations retain control over the resources on which they traditionally depend.

These same resources are being rapidly depleted.

In a world of growing wealth and consumption, one of the main challenges for natural resource management in the Congo Basin is the re-establishment of systems where local populations retain control over land use on an ethical self-regulating basis. Such systems make it possible to preserve the resources on which local populations depend and prevent the unregulated commercial offtake of these resources. In several areas, experiments on local management of the forests' natural resources are being conducted, however, refraining from marketing forest products raises an additional problem: how are local populations going to generate the necessary financial means to meet their basic needs, for example healthcare and education? Only increased production from agriculture and/or local stock farming can provide a solution. This solution still requires that products be taken away and marketed: a fact that necessitates development beyond the scope of local communities.

Another important factor affecting populations in the Congo Basin is the persistence or recurrence of conflicts in the Republic of Congo and, most notably, DRC. Since 1994, with the wars in the Great Lakes region, these conflicts have taken on an international dimension. They have driven human populations away from the roads and into interior forests and protected areas where they are less likely to encounter soldiers and armed gangs. Agriculture has been largely abandoned for a new style of gathering. These conflict generated movements have profound ecological and social effects. The mass movements of refugees, such as those seen since 1994 in eastern DRC, pose a major challenge. Despite aid from the United Nations, the environmental and social impact of such situations is extremely serious and in some cases irreversible.

Figure 2.7. The high mountains of the Albertine Rift, where forests have been replaced by intensive permanent agriculture, are a demographic time bomb that day after day sends people into the lowland forests to the west.



3. Conservation

Conservation began in Central Africa towards the end of the 19th century. The first elephant reserve was established in 1889 and the mountain gorilla has been fully protected since 1912. National parks began being established as of 1925, but until the 1970s they remained centered around savannahs and their mega fauna¹. Forest protected areas were only established from 1970 onwards, beginning with the creation of Salonga National Park in the DRC. Their number increased during the 1980s, at the same time as industrial logging activities, which until then had been limited to the coastal regions and along the major watercourses, started to spread across the whole of the interior of the continent. Currently, approximately 18.5 million hectares of forest are found within national parks or other protected areas (Table 3.1, Annex D).

Shifting approaches

Taking ecosystems into account

Conservation based solely on large charismatic species and the creation of national parks has proved inadequate in forest environments. On the one hand, the experience acquired shows that most national parks, except for the largest and most well protected, are too small to conserve over the long term their full range of species and ecological processes². Maintaining the function, structure and viability of ecosystems

means thinking and acting on the scale of entire ecosystems. On the other hand, it has been realized that the large dense forests, including the most remote and the most intact, are all inhabited by human populations to whom they provide essential subsistence resources. Successful conservation requires both sustainability at the ecological level and acceptance at the social level. Strategies must incorporate very diverse objectives related to protection, commercial exploitation, subsistence, agriculture, industry and urban development across a complex matrix of land and resource use. Focusing on charismatic species (Figure 3.1) has therefore given way to a more global vision of ecosystems: human populations have to be taken into account and conservation has to be envisaged on a scale going well beyond that of protected areas, no matter how large they may be.

The development of regional programs

This process required a pooling of efforts that only a regional vision could guarantee. Thus regional programs appeared, encompassing conservation, protected areas, extraction zones, production areas and development. In 1992, the ECOFAC program was launched under the financing of the European Development Fund (EDF). Initially, it intervened in six countries and in 2007 it will enter its fourth stage, incorporating the DRC. In 1995 USAID launched a planned 20 year initiative, the Central African Regional Program for the Environment (CARPE).



Figure 3.1. The Western Lowland gorilla
Gorilla gorilla.

Table 3.1. The protected areas of Central Africa.

Country	Area of protected forests		Area under IUCN category I-II		Area under IUCN category V		Area of protected forests in Landscapes		Area of conservation series ³ 1000 ha
	1000 ha	% ¹	1000 ha	% ¹	1000 ha	% ¹	1000 ha	% ²	
Cameroon	2,346	11.9	1,538	7.8	808	4.1	1,257	53	245
Eq. Guinea	515	27.1	354	18.6	161	8.5	382	74	0
Gabon	> 2,919	13.2	2,919	13.2	?	?	2,778	95	115
CAR	476	7.6	122	1.9	354	5.7	458	96	0
Republic of Congo	3,265	14.7	2,143	9.6	1,123	5.0	3,211	98	0
DRC	8,989	8.3	6,189	7.3	2,799	2.9	7,562	84	0
Central Africa	18,510	10.2	13,263	7.3	5,245	2.9	15,648	84	360

1) Relative to country's total forest area

2) Relative to country's total protected forest area

3) Zones set aside for conservation within exploitation concessions

¹ Even the national parks that used to contain vast expanses of forest, such as Lopé-Okanda in Gabon, Odzala in the Republic of Congo or Virunga in the DRC, were created around their nuclei of savannah.

² Studies in the United States (Soulé, 1987) have shown that to have a good chance of survival in the long term animal populations must comprise a sufficient number of individuals, generally in the thousands. The density of many species in tropical forests is very low, which means that vast areas must be conserved in order to maintain sufficiently large populations.

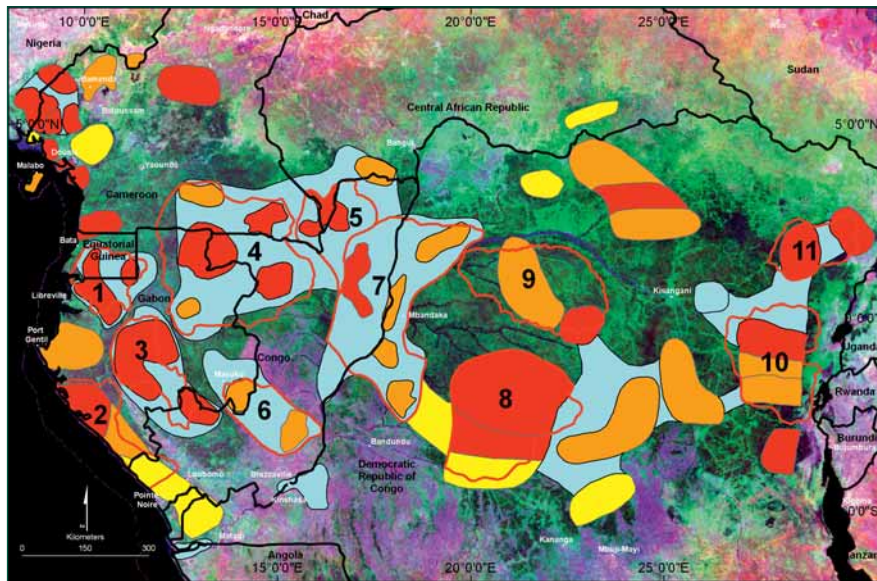


Figure 3.2. Priority areas for conservation and the Landscapes (Sources: ESRI, WWF-US, MODIS, UMD/SDSU).



Simultaneously, the States of Central Africa have been intensifying their regional coordination efforts with a view to ensuring the conservation of biodiversity and the sustainable management of forests throughout the Congo Basin. This desire for cooperation resulted in the signing of the Yaoundé Declaration of 1999 by the Heads of State of six forest countries in the region, the creation of the Central Africa Forest Commission (COMIFAC), the formulation of the 'Plan de Convergence' (Joint Plan) and the launch of the Congo Basin Forest Partnership (CBFP). The desire for cooperation was confirmed at the second meeting of the Heads of State held in Brazzaville in February 2005 (Box 3.1).

Defining priorities

In practice, the lessons learned from the ECOFAC program, CARPE activities and the initiatives of some major NGOs involved in conservation and sustainable management of forests in Central Africa quickly revealed that it was necessary to define conservation priorities. The Congo Basin forests are too vast and the available funds too limited. Urbanization, as well as the natural loss and degradation of habitats, has also created vast areas where ecosystems no longer function or function very poorly and where the fauna has disappeared or the biodiversity has been impoverished. Moreover, with population growth at around 3% in the Congo Basin, and with timber and mineral reserves among the richest in the world, the Central African nations are obliged to reconcile the integrity of ecosystems with human use. Unfortunately, the forest block is very complex and too poorly known for the priority conservation areas to be easily identified. In order to address this problem WWF organized a workshop in Libreville in March-April 2000 in which over 160 national and international experts in natural and human sciences participated (Kamdem Toham *et al.*, 2006). This gathering of formal and informal knowledge made it possible to identify and map the most important sites for biodiversity conservation in Central Africa (Figure 3.2). Some priority sites cover or harbor existing protected areas; others are located entirely outside of the protected area network.

The Landscape concept

On the initiative of the CARPE program, the priority sites were grouped into large relatively intact areas, termed 'Landscapes', based on their representativeness, the viability of their populations, the sustainability of their ecological processes, their integrity and the resilience of their ecosystems (Figure 3.3). The CARPE program chose 11 of the Landscapes to serve as their basic units for conservation planning and implementation. These Landscapes form a vast network, often crossing national borders. COMIFAC has since adopted this strategy in its 'Plan de Convergence'.

The Libreville meeting focused on low-altitude forest ecoregions, while the region of the Albertine Rift with its Afromontane forests was addressed within the framework of the ARCOS initiative, whose conclusions were not taken into consideration in the choice of the Landscapes. However, it is well known that this mountain region, situated at the transition between Central

Box 3.1. The Congo Basin Forest Partnership (CBFP)

The CBFP is a Type II partnership. As such, it represents a voluntary and free association of multiple stakeholders working to accomplish common objectives. Evidence of its success is apparent in the following achievements:

- In February 2005, it organized the Second Central African Heads of State Summit in Brazzaville.
- It has successfully obtained the involvement of the private sector in conservation.
- It has catalyzed a real collaboration between Central Africa, Europe, and North America.
- It provides support for the majority of national parks.
- It has established real transnational collaboration.

Africa and East Africa, contains environments of great conservation interest. Various partners of the CBFP are active in this Landscape, notably the European Union and multiple NGOs. For these reasons, a twelfth Landscape was added to the original 11: the Virunga Landscape, centered around Virunga National Park in DRC.

West Cameroon, probably the richest region of Central Africa³, with Mount Cameroon, Korup and Campo-Ma'an national parks and numerous forest reserves of great biological interest (Takamanda, Ejagham, etc.) has also not been included in the Landscape network. Whatever the reasons for its non-inclusion in the current network of Landscapes, it is likely that in the future these regions will also have to be included in the SoF process, especially as several CBFP partners are active in West Cameroon.

Similarly, in DRC it will one day be necessary to address the region with the richest mountain forests of the Albertine Rift: Itombwe, southwest of Bukavu (Figure 3.4).

Overall, the CBFP Landscapes cover about 685,400 km², covering approximately 38% of the forests in the Congo Basin, and contain around 30 important protected areas (national parks and wildlife reserves). The Landscape network is therefore approaching the threshold of 50% 'protected' land considered necessary to stop extinctions due to human actions. Every Landscape is centered on one or more core zones—generally protected areas—where biodiversity conservation takes priority over other forms of land use. If possible, these zones are linked by corridors so as to combat fragmentation, which is considered to be one of the main threats to biodiversity in tropical forests. Around the core zones, most Landscapes include industrial extraction areas—forest concessions and/or oil concessions—and rural areas with community forests.

With an average area of 62,314 km² (ranging from 26,746 to 141,096 km²), these Landscapes are sufficiently large to cover the territories used by species such as the forest elephant, large hornbills or the giant tigerfish and to conserve viable populations of rare species or species needing large spaces. In effect, each Landscape corresponds to a vast 'ecosystem' consisting of intact core zones, comprised of priority areas for conservation, with extraction and human impact zones increasing towards the edge. The threats to the core zones, which mainly come from the peripheral areas around the Landscapes, can be systematically identified and mitigative measures can be planned. A good understanding of the biological and human components of the Landscapes,

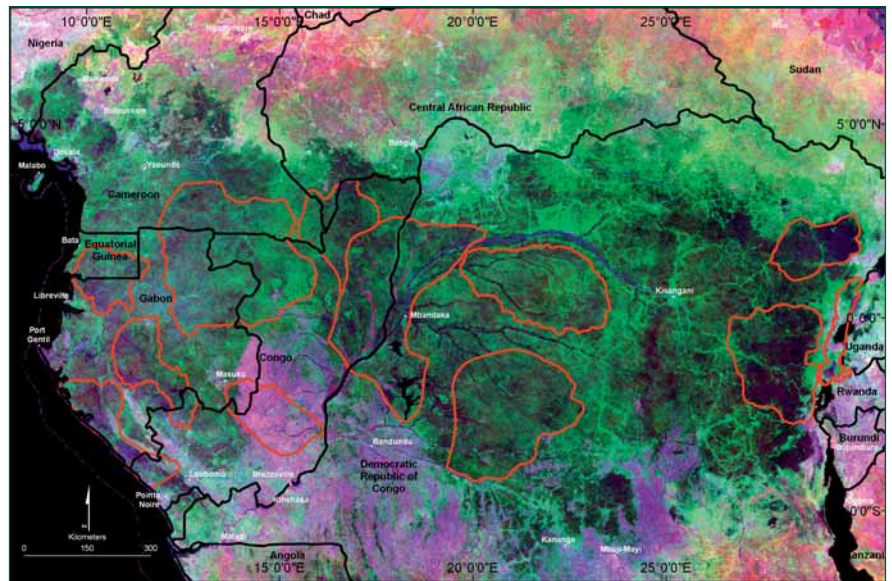


Figure 3.3. The 12 CBFP Landscapes (Sources: ESRI, WWF-US, MODIS, UMD/SDSU).



Figure 3.4. The Itombwe mountains have the richest forests of the Albertine Rift region.

obtained through discussions with governments and local populations, as well as research and on the ground experience, can help stakeholders develop and negotiate land use plans that incorporate both zones used for subsistence and zones for commercial exploitation, all the while protecting renewable natural resources.

The value of the Landscape concept is not only the fact that it incorporates protected areas into a wider context, but also and above all that it involves the communities that act in these protected areas, directly or indirectly, in conservation processes (Figure 3.5). In an increasingly democratic world, successful conservation relies on the creation of strong human relations among the main players within the Landscape. These relations

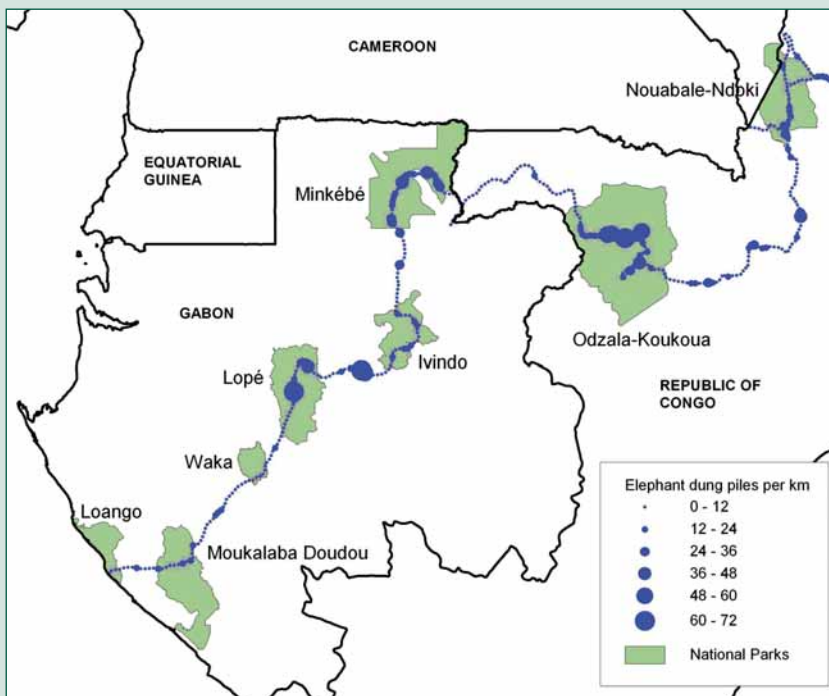
³ The region between the Cross and Sanaga rivers harbors many endemic species, including several endangered primates: Cross River gorilla *Gorilla gorilla diehli*, Preuss's monkey *Cercopithecus preussi*, the red-eared monkey *Cercopithecus erythrotis*, the drill *Mandrillus leucophaeus*, the northern needle-clawed galago *Eutotius pallidus* and the Calabar antgigwabo *Arctocebus calabarensis*.

Figure 3.5. An NGO agent organizing a meeting with the local community around Salonga National Park in DRC.



Box 3.2. Lessons from the Megatransect (1999-2000)

The Megatransect covered a 2000 km swathe of forest from northern Republic of Congo to the Gabonese coast, passing through protected areas and non-protected forest alike. The figure shows clearly the highly significant difference of over two-fold between elephant density inside versus outside protected areas ($Z = 3.24$, $P < 0.0001$). Furthermore, the size of protected areas and distance from the nearest road was strongly correlated with mean elephant abundance.



must be based on mutual respect, trust and common interests. Inside well-defined Landscapes, all stakeholders can be identified and involved. They can participate in negotiations as primary creators and implementers of land management plans designed around a sustainable common future in both ecological and social terms. This approach aims to gain not only acceptance of conservation, but also to promote the appropriation of conservation principles by local communities.

Unfortunately, within the CBFP, some voices are advocating transferring the focus of conservation efforts away from the management of national parks and other protected areas to management of the Landscapes in their entirety. This trend ignores the basic need for the Landscape approach, which aims to improve the preservation of the biodiversity inside of protected areas by incorporating these core zones in a matrix where threats decrease gradually as the boundaries of core zones are approached. The first step towards sound management at the Landscape level remains the establishment of adequate management for its core zones: national parks or other protected areas. Support for this management should include:

- establishing good relations with local populations, local and regional authorities, as well as the private sector, including logging companies
- improving the understanding of the context of conservation activities, including major threats and opportunities at different spatial and temporal scales

- putting in place management systems capable of coping with the increasing demand of Landscape level management
- developing activities that are realistic and feasible about the context in which activities are being implemented

Protected areas remain the only areas where relatively intact ecosystems survive amid an ocean of more or less modified habitats; national parks remain the only areas where conservation is the top priority. Their importance is clearly illustrated in the case of the forest elephant, a species which reflect a reality of conservation because of its extreme sensitivity to human threats. Two studies at the regional scale illustrate this case (Boxes 3.2 and 16.1). These studies demonstrate that wherever forest elephants still exist in Central Africa this species is being pushed into the most isolated forests and systematically eliminated from areas where environmental regulations are not respected. For this species and many others national parks represent their last stronghold and, as such, must remain the focus of conservation. When national parks are truly secure, have sufficient funding and when strong ties have been established between all stakeholders in the Landscapes—NGOs, populations, the private sector and local and national authorities—then it will be possible and necessary to address the many threats and opportunities associated with assuring that development is sustainable from both an ecological and socio-economic perspective over the long term.

The Landscape concept remains a strategic approach to conservation and not an end in itself. The conservation of protected areas, chosen for their biological value and their representativity, remains the priority objective, even if succeeding requires undertaking activities in the peripheral zones. The financial resources available for conservation in Central Africa, as substantial as they may be, are insufficient and can not replace the resources that should be made available for development in general. From this point of view, the immense size of some Landscapes is a challenge in itself and raises the question as to whether it would not be more realistic, in some cases, to reduce these areas to a more realistic size.

Sustainable management of the Landscapes

Planning

The ambitious conservation objectives and the enormous area covered by the Landscapes, combined with the lack of technical or financial means, the isolation of the sites and weak human capacity, constitute a challenge whose scale and implications have not yet been fully appreciated. In each Landscape there are a host of players whose actions are not always coordinated and are sometimes even conflicting (pages 48-62). In this complex human context, effective management to optimize the use of available funds requires rigorous planning based on: (1) the identification of specific objectives, (2) the identification of priorities, (3) the definition of strategies and actions and (4) the establishment of permanent or periodic monitoring.

The conceptual model

All of these management stages must be approached at multiple levels, ranging from the individual management unit to the Landscape and the region. They constitute a logical series of fundamental processes that must result in the introduction of sustainable management, as well as the preparation of the State of the Forest report. There are few systems more complex than the interrelations between humans and their environment or the implementation of sustainable natural resource management. All management planning must therefore include the development of a clear conceptual model of what we wish to achieve and how we want to achieve it. This exercise must be carried out in a transparent manner and involve a representative selection of interested parties from the management team, local partners, other stakeholders and funding agencies. The construction of a conceptual model also improves team spirit and motivation because everyone's experiences and points of view are represented.

The construction of conceptual models is the best way in which to begin planning and identifying the priorities of a new program; unfortunately this technique has not always been applied in the Congo Basin forests⁴. These models can however be introduced at any time, even in long standing programs. Within the CBFP framework, the management history of the Landscapes varies from 20 years of large-scale planning in the Sangha Tri-national to a few months in Landscapes such as Maringa-Lopori-Wamba. The CARPE

⁴ An initiative pertaining to this subject that warrants special mention is the planning exercise carried out each year by CNPN to define in a collective manner the annual working plans for the national parks of Gabon.

Figure 3.6. Within the context of the CBFP Landscape approach, conceptual models at the Landscape scale can be derived directly from the overall aim set out in the logical framework of the CARPE program. The example included here is based on a more comprehensive conceptual model developed for the Sangha Tri-national Landscape during the strategic planning stage of the CBFP. In this example, the managers decided that the overall aim of CARPE would be partly met once the conservation objectives, focused on habitats and key species, had been attained. In the first stage, the conservation objectives were defined. In the second stage, a meeting was held to bring together the project management team and certain key players to assess and identify priority threats to conservation objectives on the basis of imminence, degree of impact and reversibility. The latter factor took into account both the ability of managers to influence threats and the resilience of the systems involved. The threats over which the project could have no influence, such as global warming, were not included although they were raised in the discussions.

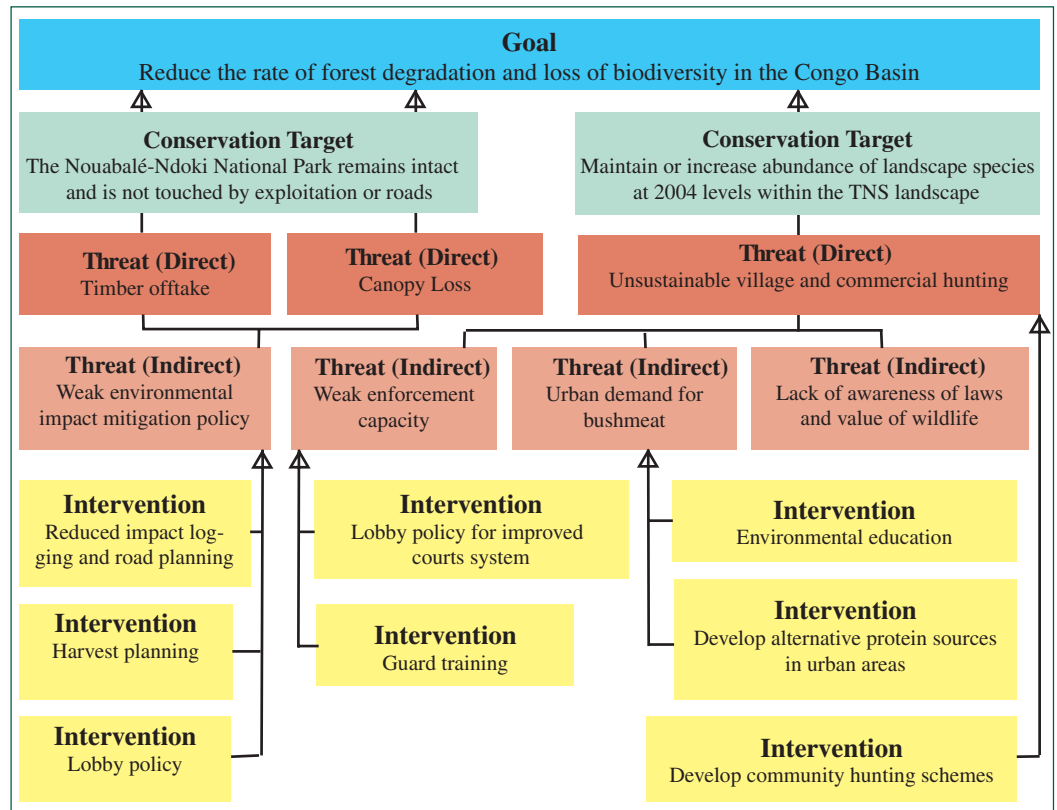
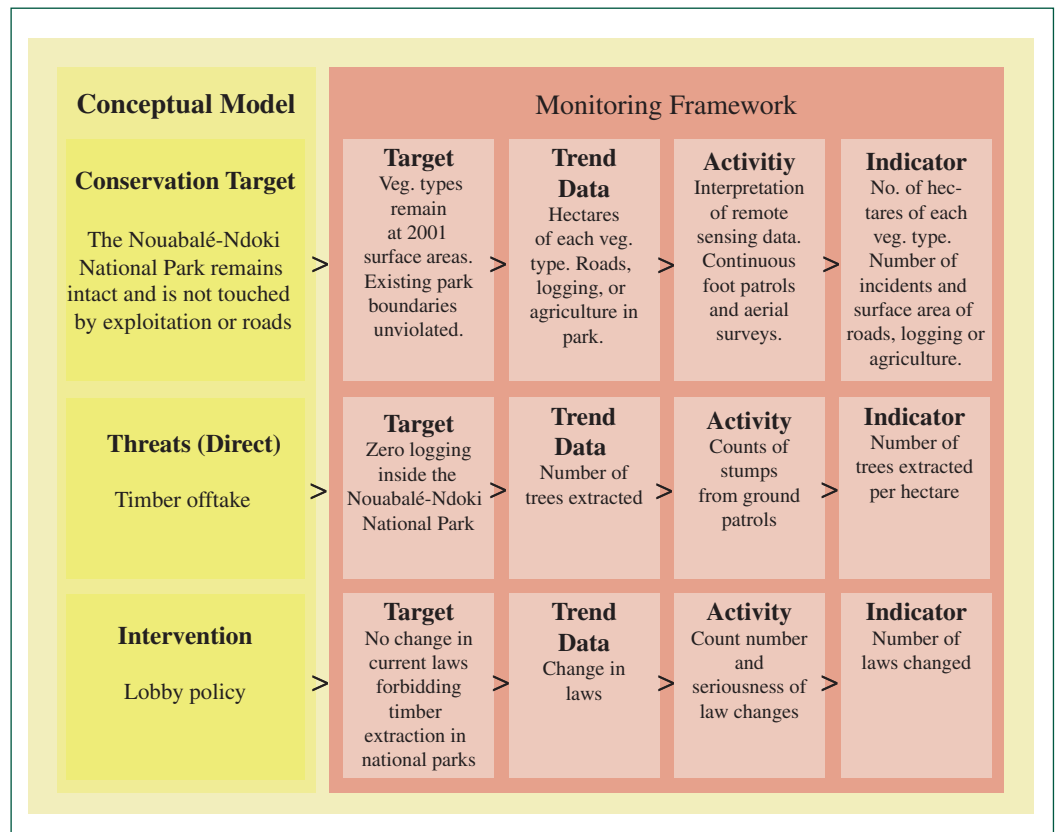


Figure 3.7. To each level of the conceptual model of the program (on the left) is attached a corresponding monitoring component (on the right). The monitoring component begins with a target (a quantitative description of the desired state and the necessary stages to demonstrate quantitatively if the targets are being met). It also includes the data required for the evaluation of trends, activities on the ground and indicators.



Operational Plan, which requires the production of periodic reports, is a starting point. The ultimate objective of CARPE and the CBFP partners is already clearly defined: reduce forest degradation and the loss of biodiversity through an enhanced capacity to manage natural resources at a local, national and regional level. This objective corresponds to one of the Agenda 21 objectives⁵.

Whether it is simple or complex, a conceptual model must comprise four components levels:

- the overall aim
- the objectives of natural resources management (a clear description of the conditions desired)
- the threats (practices and policies directly or indirectly affecting attainment of these objectives)
- the interventions (direct actions aimed at stopping or reducing threats)

A conceptual model offers not only a logical and transparent basis for the management of a project, but it also serves as the basis for the development of a monitoring process (Figure 3.6). The construction of a conceptual model for planning, management and monitoring is therefore not an abstract theoretical exercise, but represents a pragmatic way of demonstrating the links between causes and effects in order to plan logically the activities to be undertaken and to test which interventions have positive effects, which do not and why. Management strategies and actions can then be adapted accordingly.

Inventories and monitoring

Given the fact that knowledge of biological and human components in the Congo Basin is still rudimentary, the development of realistic conceptual models requires two basic elements:

- an inventory of the biological and human systems, essential for establishing quantitative bases for evaluating factors considered to be a priority⁶
- monitoring the trends for a series of these factors or appropriate indicators

The durability of management rests on both the capacity to react to challenging circumstances and the capacity for self-evaluation. It is therefore imperative to closely monitor activities and results. To accomplish this task it is important to know:

- the rate of achievement of conservation targets and positive impacts (if they exist)
- management activities that work or do not work and why

- guidelines suitable for adaptive management to ensure that the positive impacts will be maintained and/or improved

The challenge posed by Landscape management, as reflected in the process of preparing the State of the Forest report, consists of determining how and where to invest time, money and effort to compile these inventories and monitoring programs over an area as vast as the Congo Basin, which is so important in terms of global biodiversity, while at the same time working within the constraints imposed by funding, human capacity, security and technical feasibility.

Inventories and monitoring programs have to be based on a rigorous scientific approach and quantitative data. However, the collection and interpretation of appropriate scientific data for monitoring purposes is a major challenge for three reasons:

- Natural systems are dynamic at very different temporal and spatial levels, which makes it impossible to differentiate between abnormal changes and normal fluctuations.
- Human political, social and economic systems are also dynamic at both spatial and temporal levels.
- Interactions between human and biological systems are complex and unpredictable and therefore hide causal relationships.

In Central Africa, these difficulties are exacerbated for the following reasons:

- the size of the forest
- the ecological, cultural and socioeconomic complexity of the region
- war, conflicts and insecurity
- the lack of financial means and capacity
- the conflicts and competition among players, which generate inefficiency rather than synergy

At present, there is no common strategy for carrying out conservation inventories and monitoring in the Congo Basin and one of the objectives of this first State of the Forest report is to begin to lay the foundations for this strategy. For the purposes of this first report, a very broad approach was followed in order to try to compile and understand the extent and depth of the existing information as a first step towards the development of a monitoring strategy. A large number of indicators were selected from existing lists (Annex A-C). They include legislative and socioeconomic indicators as well as indicators for industrial exploitation, land use and biodiversity. The infor-

⁵ The Agenda 21 is an action program for the 21st Century aiming at supporting sustainable development. It was adopted by the countries that signed the Rio Convention in June 1992. Its primary objectives are: fighting poverty and social exclusion, the sustainable production of goods and services, and the protection of the environment.

⁶ The identification of quantitative bases is a delicate problem; too often there is a tendency to dismiss old data and restart with new criteria. This constant or periodic 'resetting of baselines' serves to mask the real amplitude of processes, notably the degradation of the forests.

mation selected comprises very different spatial scales, ranging for example from that of the entire Congo Basin for assessment of the forest cover to that of the Landscapes, segments of Landscapes or individual management units. A variety of sources were used, including government archives, the archives of private companies, the public domain, such as the Internet, the scientific community and other organizations or institutions involved in natural resource management in the Congo Basin. The information also includes sound quantitative data obtained through remote sensing or field programs, qualitative assessments and, in the absence of anything better, estimates.

Implementation of this State of the Forest process has revealed, for the first time, the enormity of the task ahead for developing a coordinated monitoring process for the whole of the forests of the Congo Basin. Not only has this task proved to be enormous and the resources available limited, but also it has become clear that the results are of critical importance in view of the expectations of the numerous partners and other players. In the future, the planning and rigorous implementation of inventories and monitoring will therefore be of utmost importance. An appropriate framework for the development of these inventories and monitoring programs cannot be determined in a logical manner if the specific objectives of the programs, the threats, the actions and the targets are not clearly defined. CARPE offers a useful framework that has already defined strategic objectives, anticipated results, major actions and critical indicators, as well as requiring the identification and definition of threats. Ideally, monitoring should take three aspects into consideration: (1) management, (2) threats and (3) achievement of conservation targets.

Indicators

As it is unthinkable to monitor in detail the entire conservation process, defining a system for monitoring at multiple levels requires the careful definition of appropriate indicators, as well as collection and analysis methods that are statistically valid, while also taking into account budgetary constraints. In general, the easiest and least expensive is the monitoring of conservation actions. This is followed by the monitoring of threats. Finally, the most demanding is the monitoring of the level of achievement of the conservation targets. Likewise, the monitoring of actions produces results very quickly, whereas monitoring the level of achievement of targets takes a great deal of time. However, confidence limits are highest

when the conservation targets are measured directly and lowest when monitoring interventions. For example, it is very easy to count the number of anti-poaching patrols in a national park (an action), but this does not reveal anything about the state of elephant conservation (an objective).

Measuring indicators inevitably requires sampling because complete measurements in socio-economic or biological systems are rarely possible. Three qualities are vital in the use of management indicators: high precision, low bias and the existence of a causal relationship.

(1) Precision

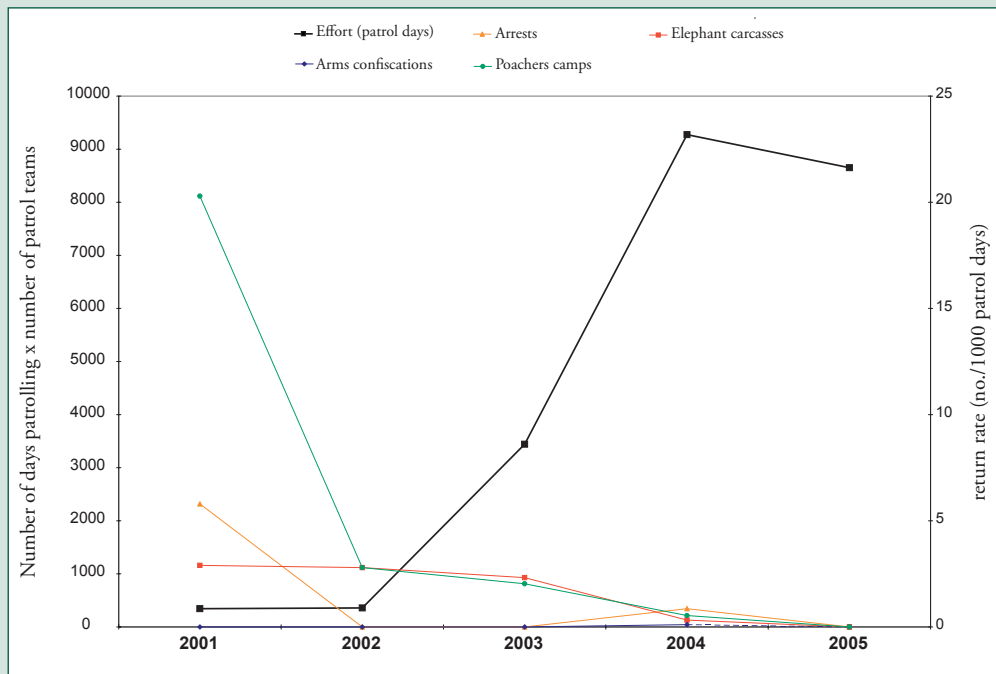
This represents the degree of reliability of an estimate. This is an important issue in monitoring because of the variability in ecological and human systems. It signifies, for instance, that two samples taken from the same population can produce different estimates of the size of this population, even if the two samples were taken at exactly the same time, using the same methodology and on the basis of the same sampling effort. The difference between the two estimates will depend on the size of the samples: the larger they are, the more precise the estimates will be. Thus, a monitoring system must use efficient indicators and methodologies, that is to say those which produce the largest possible sample for a given level of effort. Adequate detection of trends on a temporal scale requires a high degree of precision. If, in a series of household surveys, the estimate of protein consumption has a margin of error of 50%, it will probably not be feasible to detect anything more than a catastrophic decline in protein consumption over a 5-year period, making it impossible to alert managers and the government about a downward trend before the trend has negative effects on public health.

(2) Bias

Results are considered biased when they are not representative of the study population. This problem generally results from poorly designed monitoring. Ideally, monitoring indicators should not be biased and the change in the value of the indicator should be directly proportional to the change in the true value of the factor evaluated. The exact relationship between the two variables must be known.

Box 3.3. Monitoring law enforcement in Nouabalé-Ndoki National Park

In Nouabalé-Ndoki National Park (PNNN) in the Republic of Congo, managers are monitoring both anti-poaching patrol efforts (interventions) and the number of registered infractions (representing the level of threat for target species). The anti-poaching effort indicator is calculated as the product of the number of patrols and the number of teams patrolling. Threat indicators include arrest rates, numbers of elephant carcasses, numbers of seized guns, and the number of hunting camps discovered per 1000 patrol days. Since August 2003, patrolling effort has increased dramatically in reaction to growing evidence of elephant poaching. From 2003 to 2005, threat indicators (number of seized guns and number of arrests) were negatively correlated with patrolling effort. The objective indicator (number of carcasses) was also negatively correlated with patrolling effort, however not significantly. These results do not necessarily mean that a causal relationship exists between anti-poaching efforts and threat reduction or that progress is being made towards conservation objectives. Additional factors could explain these observations. For instance, patrol teams could have lost their motivation and consciously avoided known poaching zones or ammunition supplies for hunting guns could have become more difficult to procure. Nevertheless, it is probable that patrolling efforts are at least partially responsible for the decrease in poaching. Monitoring of law enforcement in PNNN provides a good example of conservation monitoring, but it also demonstrates some of the complexities associated with developing a technically strong monitoring program, even in what appear to be relatively simple cases. In all cases, it is necessary to monitor and include in the analyses as many factors that could be influencing responses to interventions as possible.



(3) *Causal relationships*

This is essential to understand why a trend in an indicator can change and how to adapt management in an appropriate manner. In reality, a monitoring program is not based on experimental manipulation, but on sampling and the deduction of conclusions is based on correlations rather than recognized causal relationships. Generally a high correlation is often sufficient for management requirements (Box 3.3). Once the requirements of unbiased sampling and the sampling effort itself have been satisfied, cause and effect conclusions with respect to biodiversity can generally be deduced from a spatial analysis. A high and well-documented correlation between the density of elephants and the distance from roads is a good indication that roads represent a threat for this species (because hunting starts from roads).

Apart from having these three essential qualities, an indicator must also:

- reflect changes at both a spatial and temporal level that are useful for management
- be simple to measure and respect the constraints imposed by human and financial resources
- be suitable for the collection, analysis and production of regular reports

Many of the indicators selected for this first report (Annex A-C) do not meet these criteria. Furthermore, there are too many of them⁷ and collection of all the necessary data would require resources that are not available. Much work remains to be accomplished in order to define an adequate assortment of indicators that will be recognized by the majority of actors.

Problems of scale

The objectives pursued in conservation, by CARPE for example, are on a regional scale. Yet interventions are made at a local, Landscape or national level.

This diversity of scales leads to several complications. First, it is obvious that not all the indicators are valid at all levels, and thus the choice is bound to be limited. Second, the way in which data from different sites (faced with different threats and different levels of threats) are incorporated into a global system for analysis is of crucial importance if real trends at the regional scale are to be identified.

To incorporate the data in this way, there are three main options:

- The first involves allowing projects to collect quantitative or qualitative data at different

sites using methods which are different but which are considered to be the most appropriate. When these data are centralized and analyzed together, a multivariate analysis can pinpoint trends for interventions, threats and conservation objectives. The advances made in analysis processes, particularly Bayesian and spatial modeling, allow valid comparisons on the basis of apparently disparate information.

- The second option consists of designing and implementing a monitoring program on the scale of the entire Congo Basin. This may seem surprising, but economies of scale favor such an approach in many cases, as illustrated by the monitoring of elephants, apes and human activities (Box 3.4). The data are collected, managed and analyzed in a program designed to meet the specific monitoring requirements.
- The third option consists of a combination of the first two, because there will always be specific monitoring requirements for sites and problems that will have to be tackled on a regional scale. The conservation partners will have to coordinate their efforts to find a happy medium between these different options and any coordinated monitoring effort will need appropriate technical personnel.

Data quality

A monitoring program can be no better than the data collected. Quality depends in particular on the design of the monitoring plan, the methodology used for collecting data and the competence of the personnel involved in collection, analysis and interpretation. For instance, different remote-sensing methods used to calculate the area of forest cover are technically valid and justifiable, but can produce different estimates. Choosing the best and most consistent method is not easy. Another problem that is rarely talked about is the fact that the funding agencies, the partners and the pride of some of those involved often put considerable pressure on individuals, projects and organizations to obtain positive conservation results. Consequently, there is a great temptation to manipulate the monitoring data or to interpret them 'erroneously' when they indicate that the targets have not been reached, especially as verification of the quality of data is rarely carried out and is difficult to apply. Overcoming these problems of quality will require considerable investments in training and unbiased independent audits on monitoring practices.

⁷ The preliminary list of indicators proposed at the Kinshasa meeting in November 2005 should have been reduced to a small number of essential indicators. Instead, the participants made it longer. In addition, for a good many indicators the data should be easily accessible and the fact that they could not be obtained illustrates the extent to which government archives are badly kept or otherwise rendered inaccessible.

Box 3.4. The cost of monitoring elephant populations in the Congo Basin

The objective of the CITES Monitoring of the Illegal Killing of Elephants (MIKE) program is to provide information to all the States where elephants exist in order to help them make appropriate decisions as concerns management, law enforcement and institutional capacity building for the long term management of their elephant populations. In 2003-2004, MIKE surveyed elephant populations in 6 Central African sites that were distributed over 5 countries and 3 landscapes. The surveys were based on dung counts along linear transects.

Based on these surveys, it is possible to estimate the total cost and effort required to carry out an elephant and great apes monitoring program across the Congo Basin. A reasonable objective for the SoF would include being able to detect a 10% change in population over a 10-year period with an 80% probability of detecting change and a 10% probability of not detecting change even if change exists. To achieve this degree of certainty, the TRENDS program calculates that the variation coefficient of each population estimate should not exceed 0.3. Given dung frequency (0-15/km), 833 transects would be necessary with a stratification of effort in correlation with the expected density. During the MIKE surveys, the mean cost of a transect was US \$500. Logistical improvements and greater efficiency could bring the cost down to approximately US \$350. Excluding training, equipment and a means of centralized coordination, the total cost of the proposed program would be US \$1,200,000. This could be a wise investment given the fact that these types of surveys do not only produce information on living elephants, but also on the illegal killing of elephants, the distribution of legal and illegal human activities, the abundance of great apes, forest structure and composition, and land use and land cover. In addition, such surveys would provide a means to 'ground truth' remotely sensed data. It should be noted, however, that that type of program would be able to detect change across the entire region, but not inside management units or within separate landscapes. Survey efforts carried out in each individual site would be insufficient to detect change at that scale, especially in sites where elephant density is low. Therefore, it remains important that the SoF process establish links with other on-going programs, like MIKE, in order to optimize budget resources and reinforce the political implications and the power of analysis in key conservation zones.

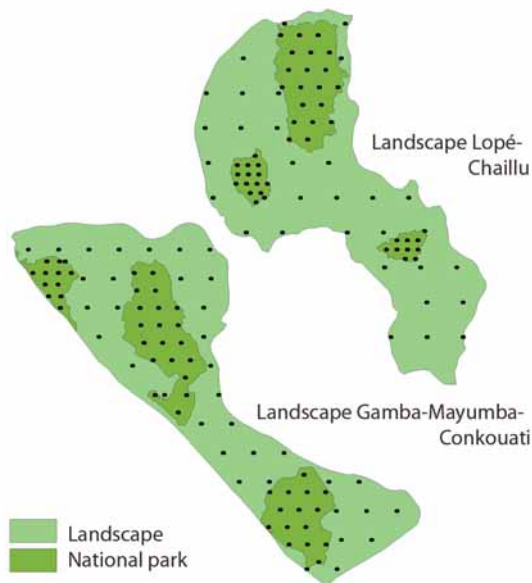
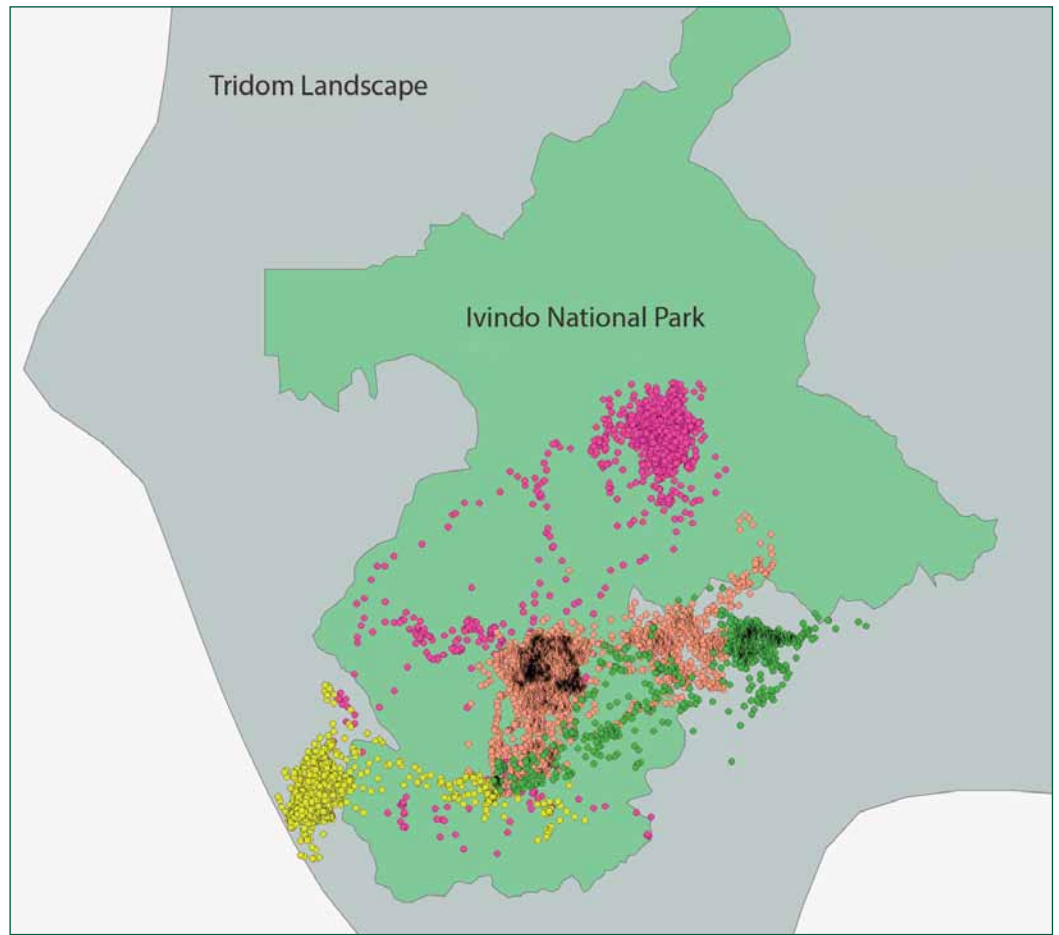


Figure 3.8. The movements of four elephants as watched by radio-tracking in Ivindo National Park in Gabon (scale: 1 cm = 7.8 km).



Data processing and analysis

Data are only useful when they have been suitably processed and analyzed. At the level of projects and programs, this activity is the responsibility of the project (Figure 3.8). However, data that are expensive to obtain and store, in terms of both time and financial resources, should be available for analysis on a regional scale. This would increase the value of the data sets. It is also, above all, a prerequisite for understanding regional plans and processes. The size of the task, in terms

of personnel and technical capacity, represented by the collection, collating, organization, analysis, checking and publication of data is considerable and will require suitable personnel with an appropriate mandate. Testing the links of causality between interventions, threats and conservation targets in a system as complex as the Congo Basin is a real challenge on a statistical level. It is therefore essential that the development of monitoring programs should be overseen by statisticians as well as biologists, socioeconomists and managers.

4. Industrial Logging: Current Status and Trends

Industrial logging began during the second half of the 19th century, but it was not until after World War II, with the appearance of bulldozers, front loaders and logging trucks that it really took hold. Initially it was localized in the coastal regions and along the major watercourses, but today it reaches most of the forests of Central Africa, of which about 60% of the total area is considered to be industrially exploitable. Logging thus represents a very important economic sector for the countries concerned: it accounts for between 0.7% (DRC) to 10-13% (CAR) of gross national product and accounts for approximately 20% of jobs, second to mining and/or oil extraction (pages 235-237). Industrial logging also generates a large number of indirect jobs and economic activities in both urban centers and rural areas, particularly in connection with various forms of transport, equipment maintenance, services and small scale agricultural or pastoral projects. Finally, the forest sector largely contributes towards socio-economic development through the construction and upkeep of roads and the creation of health and education infrastructure directly associated with forest concessions. Looking beyond the figures, which highlight its overall development, the industrial sector is undergoing profound changes, not only in terms of its image and people's overall conception of the sector, but also with respect to its management practices.

Surface area, production and export

The area allocated to logging has increased significantly over the last few decades. For the region as a whole, it amounted to 49,400,000 ha in 2004, equivalent to 36% of the total area of production forests and 27% of the total area of dense rainforests. In Equatorial Guinea, Gabon, CAR and the Republic of Congo, 77-93% of the production forests have been allocated (Table 4.1). In DRC, allocations only cover 18% of the production forests due to the fact that many logging permits were cancelled in 2003. At the same time, production has also risen considerably: it reached 8.5 million m³ for the region as a whole in 2004. In terms of production, Gabon has the highest, followed by Cameroon and the Republic of Congo. In DRC, production remains proportionately very low.

On average, 35% of production is exported as logs. In Equatorial Guinea this proportion rises to 85%, but in Cameroon it is only 6% following the severe legal restrictions on export logs. In terms of absolute volume, Gabon remains the main exporter of logs. On average, 19% of production is exported after undergoing first-stage processing. This percentage is lowest in Equatorial Guinea (5%) and highest in Cameroon (32%).

Table 4.1. Statistics on industrial logging in Central Africa (for further details, see pages 91-105). Total surface areas are derived from MODIS and GLC2000 maps (page 82).

Country	Total area of forests	Area of production forests		Areas allocated in 2004		Production	Log exports		Transborder exports	
	ha	ha	%	ha	%	m ³	m ³	%	m ³	%
Cameroon	19,639,000	12,000,000	61	5,400,000	45	2,375,000	141,000	6	758,000	32
Eq. Guinea	1,900,000	1,500,000	79	1,400,000	93	513,000	438,293	85	27,000	5
Gabon	22,069,999	17,000,000	77	13,800,000	80	3,700,000	1,517,000	41	515,000	14
CAR	6,250,000	3,500,000	56	3,000,000	86	570,000	194,000	34	57,000	10
Republic of Congo	22,263,000	13,000,000	58	10,000,000	77	1,300,000	659,000	50	284,000	22
DRC	108,339,000	90,000,000	83	16,000,000	18	90,000	58,000	64	15,000	17
Central Africa	180,460,999	137,000,000	76	49,400,000	36	8,548,000	3,007,293	35	1,656,000	19

The evolution of forestry concepts and the image of the forestry sector

Until 10-20 years ago, the forest was regarded solely as timber-producing capital and a source of revenue and foreign exchange. Meanwhile, within the global context of a growing awareness of environmental problems, the forest is now seen as a complex and multifunctional environment whose ecological, economic, social and cultural functions must be conserved by maintaining its overall equilibrium, avoiding irreversible measures and applying the precautionary principle.

At the same time, the image of the sector has also changed. Until recently, industrial logging had a very negative image: it was the source of the destruction of forests and the disappearance of fauna. It has certainly always had a number of negative impacts on the environment (pages 108-111), but more and more of its potentially positive aspects are also being acknowledged. Not only can it make a lasting contribution towards socioeconomic development, but it can also become a powerful ally of conservation. Examples in the Republic of Congo (CIB), Gabon (CEB) and Cameroon (Pallisco) show that well managed logging is a vital complement to the creation of protected areas, especially as forestry companies generally have more technical and financial resources than the national parks in the region and the latter will never cover much more than 10% of the forest block.

The evolution of management practices

The evolution of forestry concepts has led to the adoption of certain measures aimed at better ensuring the sustainability of the sector.

Management

Over the last decade, the industrial forestry sector has oriented itself more and more towards planning and management, replacing the 'mining' approach to exploitation. The forestry laws in force in the six forest countries of Central Africa also explicitly provide for the formulation and implementation of management plans. This requires a great deal of time and requires the mobilization of substantial human and financial resources. Furthermore, the areas under approved management remain proportionally small: 15 million hectares in 2003 (pages 235-237). The significant

improvement in the management abilities of several large companies is nevertheless a positive step towards more rational and ecologically sound exploitation of the forests.

Recognizing the rights of local populations

In recent years, the right of access to natural resources for local populations has received more and more attention in the forest sector. The forestry laws include measures to increase participation by local populations in the planning and implementation of logging activities. They also provide for the sharing of profits generated. Although much effort is still needed to achieve greater equity in this sector, clear progress is being made: several management plans explicitly recognize the right of local populations to use the forests' natural resources and tax redistribution systems have been introduced for the benefit of these populations. In Cameroon, Equatorial Guinea, Gabon and DRC, the forestry laws also provide for the creation of areas managed and logged by village communities—community forests—but so far these have only been implemented in Cameroon and Equatorial Guinea (pages 235-237).

Low-impact logging (LIL)

Approximately ten years ago, a number of techniques and measures, well known for many years but rarely applied, were put forward as a means of considerably improving the sustainability of logging. At the same time, it was also recognized that these measures were insufficient and did not in themselves guarantee sustainability. Large-scale studies show, however, that rational logging practices can increase productivity per hectare while reducing damage to the forest (page 111).

Certification

Many companies are trying to obtain certification, another important step towards improving the sustainability of logging. Several systems exist but the certification process remains complex and slow—taking an average of 4-5 years. A number of major companies, grouped together within the IFIA association and in partnership with the WRI's GFW program, governments and civil society, have initiated the creation of an independent and voluntary monitoring system; FORCOMS. Nevertheless, certification remains a market instrument, directed towards a sector of the American and European markets. It therefore

concerns only a small part of tropical timber consumption and has no effect on the growing Asian market.

The evolution of legislation

Transparency

Improved transparency in the allocation of logging permits is another positive development in Cameroon (Box 4.1), where closed negotiations have given way to public invitations to tender. In other countries, contrary to the law in force, lack of transparency persists. This is clearly apparent in DRC where new concessions have been allocated despite a moratorium (Box 4.2).

Forest taxation

Tax burdens have increased, while few if any incentives have been introduced to encourage the legal obligation of sustainable logging (pages 70-72).

Small-scale logging

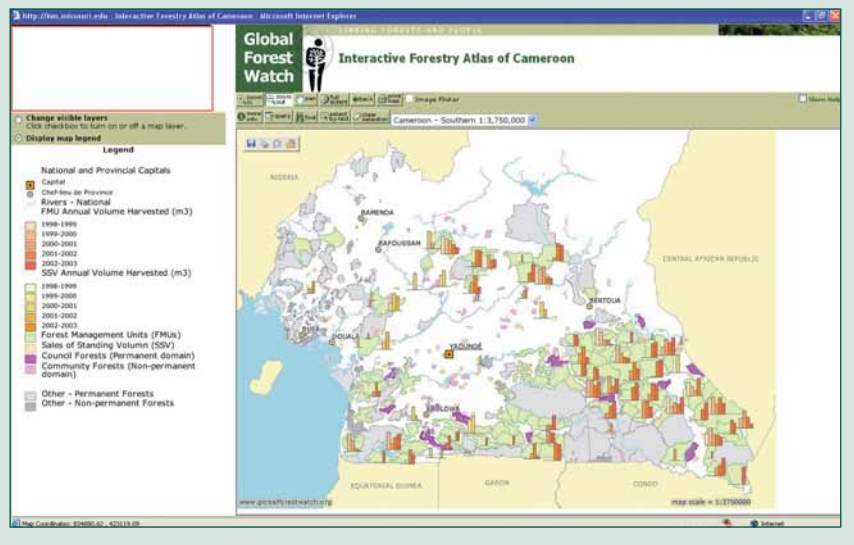
The legislation still does not provide a clear and secure structure for establishing small-scale logging and processing, even though these meet real needs that cannot be satisfied by industrial companies (page 75).

Application of the laws

Governments can be extremely overly fastidious in the application of certain regulations that have little influence on the sustainability of logging. Meanwhile, they sometimes appear to be very lax when it comes to compliance with laws as fundamental as those making sustainable management compulsory, but which could have major political implications (page 76).

Box 4.1. Interactive atlas of forests in Cameroon: the creation of a decision-making tool for the forest sector through partnerships

Within the context of a number of efforts aimed at improving the monitoring of forests, the Ministry of Forests and the Environment in Cameroon (MINEF) and the Global Forest Watch (GFW) initiative of the World Resources Institute (WRI) formalized a partnership to create an interactive forest atlas of Cameroon (Version 1.0). This MINEF-GFW collaboration is aimed at enhancing decision-making by improving the quality and accessibility of geographical information related to the forestry sector. This atlas contains the most recent verified information on the forest sector, including the limits of concessions and useful data on concessions, such as the state of progress on management plans, the year of allocation and annual timber production. A digital map of roads has been specially developed for this atlas through satellite images. The atlas is accessible on the Internet at the addresses <http://www.globalforestwatch.org> and <http://www.minef.com>, and in the form of a CD-ROM.



Box 4.2. Moratorium on the forestry sector in the Democratic Republic of Congo

In 1999, as part of an effort to clean up the forest sector, an inter-ministerial commission recommended the cancellation of all logging contracts that had not been inventoried or were not being actively pursued. Following this recommendation the contracts for 25 of the 41 million hectares allocated were cancelled in 2002. At the same time, a national moratorium was imposed on the allocation of new logging contracts. Despite these restrictions, 3 million hectares were allocated, bringing the total area allocated up to 19 million hectares in September 2005. In 2005, however, all existing logging contracts were due to be reviewed with a view to turning them into forestry concessions. This exercise would have led to further cancellations, reducing the total surface area allocated to about 10 million hectares.

Future trends

Improving processing

Not only is it necessary to increase the rate of processing and raise the output of first-stage processing units, but the quality of processed products must also be improved (pages 90-91).

Diversification of species

Within the context of sustainable logging, more species must be promoted (pages 90-91).

Improved economic and fiscal conditions

To achieve sustainability in logging, companies must have a secure framework in which to operate (pages 77-78).

Giving greater consideration to biodiversity

Although a great deal of progress has been made, much remains to be done in this field:

- Low-impact techniques are still based too heavily on purely technical considerations.
- Knowledge of the behavior of species must be improved and integrated.
- Minimum felling diameters must be reviewed.
- Opening up of the canopy must be optimized to ensure that floristic diversity is maintained.
- Sustainability of hunting associated with logging must be taken into account in a more realistic and pragmatic manner.

Taking artisanal logging into account

Only legal recognition of these activities can make them sustainable.

Harmonization of legislation

In the COMIFAC 'Plan de Convergence', harmonization of forestry legislation is seen as desirable, but this should not lead to 'blind' standardization. The different countries have widely differing situations which must be taken into account, particularly with respect to land status (pages 76-77). Harmonization of policies or the 'compatibility' of standards is still ambiguous in so far as the meaning of these terms has not been politically and technically explained. As concerns tax redistribution mechanisms, convergence is running up against institutional differences which go beyond the framework of the forest sector. To these differences must be added specific local political agendas and different types of governance. As far as taxation is concerned, the beginnings of convergence can be seen in the direction reforms introduced over the last ten years in this field have taken, often under the influence of the World Bank. However, important differences remain and the question of taxation remains a sensitive issue in the national political debate. As regards policies on exports and imports of forest products, these too have moved closer together, but the methods differ. Harmonization of legislation should be an opportunity for simplification of the laws and regulations, accenting key rules from the point of view of sustainable management of forest resources and the associated social aspects.

Figure 4.1. Logging in the central parts of the Congo Basin is limited by transportation problems, and is only possible in the vicinity of rivers.



5. Threats or the Vectors of Change

The next ten years will be critical for conservation and development in Central Africa. Population growth, immigration, the aspiration for higher standards of living and increasing demand at the global level, particularly with the rapid development that China is experiencing, will inevitably increase the pressures on natural resources. At the same time, efforts to strengthen capacities, develop monitoring, and improve governance will offer new opportunities to the inhabitants of Central Africa in their search for solutions. In many cases, the threats to the biodiversity and resources of the forests of the Congo Basin are closely linked to the region's economic development. With a comprehensive understanding of these threats and the forces underlying these threats, as well as greater attention to the development of mitigation strategies and compensation systems, a sustainable future for the forests of the Congo Basin could become a reality.

In practice, the loss of resources and biodiversity in the forests of Central Africa is due to three processes, which are not necessarily linked but whose effects often accumulate:

- (1) A reduction in the area of the forest, or **deforestation**, can by itself lead to the disappearance of certain species based on the concept that the total number of species in an ecosystem or region is proportional to the area of that ecosystem or region. Of course, there are many other factors that influence the number of species, but it is true that any major reduction in area is generally accompanied by a loss of species.
- (2) **Fragmentation** of the forests can also cause a loss of species due to the fact that populations may be divided into unviable subpopulations. It also exacerbates edge effects and increases the vulnerability of forests.
- (3) **Degradation** of the remaining forest formations.

The impact of a reduction in surface area and fragmentation is very variable and difficult to predict. Examples in East Africa (Rwanda, Uganda) suggest that these two processes alone must reach an advanced stage before they produce measurable effects¹. Degradation of the forest formations is therefore the most harmful process that does not directly involve loss of biodiversity, but it is much harder to evaluate and monitor than a reduction in surface area and fragmentation because it is less visible and more difficult to quantify.

Whatever the nature of their real impact, these three processes are themselves the result of various vectors of change that constitute immediate or remote direct and indirect threats. Some of these vectors can simultaneously have direct and indirect effects and certain vectors can produce both harmful and positive effects. Therefore, the overall impact of specific threats partly depends on the context and the presence of other threats. The evaluation of threats remains a delicate exercise with many uncertainties.

Direct threats

Poaching and the trade in bushmeat

In all the Landscapes, with the exception of certain Landscapes in eastern DRC (Ituri), hunting for the bushmeat trade is considered to be the most immediate factor in the degradation of biodiversity (Table 5.1). It leads to the extreme rarefaction or even local disappearance of the hunted species. The bushmeat trade has taken on such dimensions that almost all species of large and medium-sized mammals and birds are threatened.

In many regions, animal populations have already been reduced to such an extent that they will probably not be able to recover and some have become economically uninteresting to hunters (Bennett & Robinson, 2000). In a large part of Central Africa, including certain Landscapes in the center and the east of DRC, the fauna has virtually disappeared from vast areas and only survives in 'pockets'. As many tree species are dispersed by animals (birds, primates, ungulates, rodents, etc.), the disappearance or rarefaction of this fauna can seriously disturb the re-growth of forest formations. However, given the slow reaction time of these formations, these disturbances are difficult to detect and have been little documented thus far. Unsustainable hunting is therefore a multifaceted threat not only to the fauna, but also to the forest and the livelihoods of traditional forest peoples².

¹ At present, Kibale National Park in Uganda covers only 700 km², but it still has a virtually intact fauna and the primate density in Kibale is far higher than those found in the parks of Central Africa. Kibale's forests are largely secondary forests which only developed after the cattle plague at the end of the 19th century. The Nyungwe forest in Rwanda currently covers 900 km² and has lost several large mammals over the last 25 years (elephant, buffalo, giant forest pig and panther), not because of the reduction in the size of the forest - by the beginning of the 20th century it only covered 1,200 km² - but because of intensive hunting by gold panners.

² By way of example, 15 years ago, and therefore well before the war, malnutrition affected a substantial proportion of children in the forest villages of Kivu and Maniema in DRC, a result of the fact that the fauna had been decimated and transported on a large scale to the urban centers of Kisangani, Goma and Bukavu since the beginning of the 1980s (Vande weghe, 2004). A similar situation was observed in Bandundu province (Steel, pers. com.).

Table 5.1. The most important threats to the forests of Central Africa.

	Alén-Cristal	Gamba	Lopé-Chaillu	Tridom	TNS	Batéké-Léfini	Télé-Tumba	Salonga	Maringa	Maiko	Ituri	Virunga
Direct threats												
Poaching	●	●	●	●	●	●	●	●	●	●	●	●
Ivory trade	●		●	●	●		●			●	●	
Live animal trade										●		
Shifting cultivation	●	●	●	●			●	●	●		●	●
Intensive agriculture									●	●	●	
Industrial logging	●	●	●	●	●		●	●	●			
Informal logging										●	●	●
Industrial mining	●			●								
Artisanal mining	●	●	●	●	●					●	●	●
Oil drilling		●										
Pollution		●										
Illegal armed groups							●			●		●
Inland fishing		●		●			●	●			●	●
Fire			●			●	●					
Volcanoes												
Exotic invasive species			●	●	●							
Diseases			●	●	●							●
Collecting of turtle eggs		●										
Indirect threats												
Weak management capacity	●	●	●	●	●	●	●	●	●	●	●	●
Climate change							●					
Marine fishing		●										
Conflicts							●	●	●	●	●	●
Illegal trade of weapon								●				
Demographics	●	●	●	●	●	●	●	●	●	●	●	●
Human-wildlife conflicts				●								
Lack of information	●	●	●	●	●	●	●	●	●	●	●	●
Poor transborder cooperation	●	●										
Poor inter-ministerial cooperation	●		●									
Poor accessibility								●				

- Modern means of transport allow the products of hunting to be more easily transported to market — including by bicycle if necessary. Many of the roads and track used were created by logging activities.

Moreover, what was once a subsistence activity has now become a commercial activity generating monetary income. This development emerged in parallel with the deterioration of the economic situation. In DRC, it began during the 1970s and reached catastrophic proportions with the instability and war in the 1990s. Even in Gabon (Gamba-Mayumba-Conkouati Landscape, Lopé-Chaillu-Louesse Landscape) and Cameroon (Tridom Landscape), many observations show that the development of hunting is linked to economic recession and urban unemployment. Hunting is therefore not only a traditional activity of forest peoples; for many, it has become a last resort.

The ivory trade

In many areas, the ivory trade (Figure 5.3) has already led to the local extinction of elephants. Recent CITES studies under the MIKE program reveal that most elephant populations in national parks are declining³. In vast regions of DRC, particularly in the Maiko-Tayna-Kahuzi-Biega and Salonga-Lukenie-Sankuru Landscapes, elephants have become very rare. Elephant hunters are increasingly using the meat of the animals that they kill⁴. These hunters are often specialists, armed and supplied with ammunition by a complex network of dealers and civil servants, the ‘heads’ of which are located in the urban centers. Elephant hunters supply markets outside of Central Africa, including in West Africa and Asia⁵.

³ The only national park under the MIKE program where the elephant population appears stable is that of Nouabalé-Ndoki in the Republic of Congo.

⁴ In Bangui in CAR, elephant meat, especially smoked trunk, is highly appreciated and sells at 200,000 CFA a sack.

⁵ The two main markets are China and Japan. In 2000, Japan bought 60% of all the ivory marketed; in 2005, China became the leading purchaser of ivory.

The effects of excessive hunting are especially difficult to assess objectively as observations in several Landscapes show that they represent a relatively recent phenomenon that have only emerged or started to spread over the last 20-25 years:

- Community techniques like the use of nets have given way to new, more effective and more individualistic techniques, including guns and wire snares (Figure 5.1 and 5.2).
- Hunters are going much further from their base to hunt and practically no forest remains out of their reach (especially in DRC).
- Neither laws nor traditions are respected.



Figure 5.1. Only Pygmies still hunt with nets, an activity which requires the collaboration of the whole social unit.

Shifting cultivation or swidden agriculture

Shifting cultivation on burned land, as traditionally practiced in low-altitude forest regions in Central Africa, is not in itself a threat to the forests, even in a relatively populated country such as Cameroon (De Wachter, 2001). This practice has been part of the ecosystem for many centuries and contributes to its diversification and rejuvenation by maintaining a mosaic of crops and forests of different ages⁶.

This form of agriculture only becomes a problem when the fallow period becomes shorter and shorter and more and more 'primary' forests are cleared. This generally occurs along main roads and on the outskirts of urban centers (Figure 5.4). Given the low human population density in the forests of the Congo Basin, the overall impact of this predictable and legitimate development is not yet perceived as a major threat, but strips of deforestation are starting to occur along the main roads, particularly in DRC, Cameroon and Equatorial Guinea. In these areas, fragmentation of the forest is visible on satellite images (Figure 1.1). In Gabon, deforestation is still limited to the extreme north (province of Woleu-Ntem) and to the southwest in the Republic of Congo (Mayombe).



Figure 5.3. Confiscated ivory in eastern DRC.

Permanent or intensive agriculture

In the densely populated mountainous regions and high plateaus of western Cameroon and the east of DRC, a form of virtually permanent agriculture is developing with very short (1-2 years) or even non-existent fallow periods. In these same regions, there is also local stock farming (particularly cattle), which exacerbates the impact of agriculture on the forest formations: abandoned fields are turned into pasture and any secondary reforestation is prevented. The inhabitants of these regions make very little use of the natural resources from the forest and often only regard the forest as land awaiting 'development'. The paradox of this situation is that the remaining forests are often in a fairly good state with relatively abundant fauna, due to the fact that hunting plays only a marginal role. Given the high population densities in these regions, deforestation nevertheless reaches dramatic levels: about 0.3% per year in the Maiko-Tayna-Kahuzi-Biega Landscape (page 86). These mountainous areas are considered 'hot spots' of biodiversity, in particular the high altitude forests of western Cameroon and those of the Albertine Rift, not so much for their species richness, but because they contain many endemic species.

Unsustainable industrial logging

Industrial logging in the forests of the Congo Basin currently affects about half of the forest block (pages 241-252). It is generally of low intensity, the number of trees being felled for sale being around 0.5 to 3 per hectare, with a maximum of 4 per hectare. However this process is very selective, with the degree of selectivity being much higher inland (DRC, northern Republic of Congo) than in the coastal regions (Gabon, Cameroon) because companies can only harvest species whose commercial value exceeds the cost of transport to the ocean. In many regions, this exploitation is still of the 'mining' type, in which only the very highest value specimens are taken (*écrémage* – literally creaming off the best specimens), and is not ecologically sustainable. Despite laws and regulations, this practice continues because of current political and social uncertainties and fluctuations on the international market.

From a social point of view, many believe that timber exploitation results in the inequitable redistribution of profits to local populations and national governments. However, this is a very complex problem, because ultimately it is the international timber market that determines what is feasible and what is not. Recently a number of



Figure 5.2. A blue duiker in a trap.

⁶ In most of the Congo Basin, farmers burning forests clear a small plot every year (0.5 to 1.5 ha), usually at the expense of secondary forests aged between 15 and 20 years. Few primary forests are cleared due to the fact that it requires considerably more effort.



Figure 5.4. When population density increases, cleared areas increase and fallow periods become shorter. Primary forests give way to secondary forests and, finally, to scrub land.

companies, some of them leaders in sustainable management, have tried to pull out because of increased tax pressure.

From the environmental point of view, industrial logging has both inevitable direct impacts (Figure 5.6), including damage to the remaining forests (5-20% of the surface area) and various kinds of other disturbances (noise), and avoidable direct impacts, including soil erosion, water pollution, reduction in regenerative capacity and loss of genetic diversity (pages 108-111). Logging also increases human populations in the forest, removes nutrients and escalates forest fragmentation. However, many of the indirect impacts of logging can be avoided, including: increasing access to forests, hunting, deforestation, fires and the introduction of exotic species.

In practice, the use of low felling rates reduces the relative threat posed by the direct impacts of logging and makes increased hunting the most immediate threat posed by industrial logging. The threat posed by hunting is the result of increased access to forests, a growth in human populations and better means of transporting the meat to markets. Using their wages, the employees of logging companies can buy arms and ammunition or wire for snares. They can also hire the services of members of their families or outsiders to hunt on their behalf. In some places industrial logging of the forest also facilitates the installation of agriculture.

The departure of companies can also present a problem: a portion of the personnel emigrate in search of work elsewhere, but a portion also remain on site and rely on forest resources while waiting for another logging activity to start up. This scenario has been witnessed in Conkouati in

the Republic of Congo and Bayanga in CAR.

However, it would be a mistake to assume that the dramatic increase in hunting is only the consequence of industrial logging. In eastern DRC, there is little or no industrial logging, but hunting is nevertheless highly developed—in areas where there is still some wildlife left—and hunters will travel 100 or 200 km from their village of origin to hunt.

Informal logging

Outside the industrial sector there are informal, or artisanal, forms of logging. These forms supply local markets with construction timber and firewood. Surveys carried out in Cameroon suggest that these forms of logging involve larger volumes of timber than those from industrial logging. They have been little studied and statistics are scarce. Their impact could be more serious than that of industrial logging, especially as they are not subject any kind of regulation. In the Kinshasa region, the destruction of forest galleries on the Batéké plateau, up to 150 km away from the city, has reached alarming proportions. In eastern DRC, substantial but unknown volumes of hand sawn timber are exported to East Africa and the Arab Emirates. In Cameroon, charcoal from *terra firma* forests and mangroves is exported to Chad and Nigeria. It is therefore urgent to pay more attention to this sector, especially as it plays a fundamental socioeconomic role.

Mining

A large part of gold and diamond mining is conducted by small scale artisanal operators in small rivers and streams. In recent years the mining of coltan (a vital mineral for manufacturing cell phones and other electronic appliances) has increased significantly and has attracted international attention due to the severe environmental degradation caused by current practices. Working in small watercourses destroys these fragile ecosystems. Direct impacts, *in situ*, are generally fairly localized, but sedimentation and pollution can spread a long way from the mining sites. The indirect impacts are also considerable: agricultural activities tend to be abandoned and poaching tends to increase. Diamond mining is the main economic activity in CAR and some regions of DRC. Open-cast mining is rare. However, one of the largest iron ore deposits in the world is in Gabon, around Monts Minkébé and Monts Bélinga in the Tridom Landscape, and the mining of these deposits is now being considered. Mineral pros-

pecting also started in Monts de Cristal National Park (Monte Alén-Monts de Cristal Landscape) in 2005. Failure to apply better practices for appropriate attenuation of environmental impacts and a lack of compensatory measures are clearly a threat to forests and biodiversity in the Congo Basin.

Apart from direct threats, small-scale mining also has significant indirect consequences. In the mining regions, men give up agriculture, but as they obtain monetary resources they create markets for forest products (including bushmeat) from neighboring regions. In the south of the Salonga-Lukenie-Sankuru Landscape, bushmeat and fish are transported to the diamond-bearing regions of Kasai (page 187).

Oil extraction

The oil industry is important in the Gulf of Guinea and in the forests of the coastal sedimentary basin. The economies of Equatorial Guinea, Gabon and the Republic of Congo are heavily dependent on this industry. In the Gamba-Mayumba-Conkouati Landscape (page 130), this industry is a vital player and, despite the efforts of the big companies to mitigate them, substantial negative impacts on the environment have been observed. Pollution and the effects of seismic surveys remain worrying problems⁷. A major cause of damage seems to be or to have been the inappropriate abandonment of boreholes and pipelines. The oil industry also has indirect impacts, in particular an increase in local poaching as a result of the increased access to forests, despite mitigation efforts at the social level. In the long term, major problems are also to be expected when reserves are exhausted and the populations settled there by the oil industry, including within some protected areas, are abandoned and left to their own devices. Some populations will probably emigrate, but others will again turn to the natural resources at hand. Overall, the impact of oil companies varies considerably from one company to another and it would be unfair not to mention the enormous financial support offered by some large oil companies for conservation (Shell Gabon, Total Gabon).

Inland fishing

In the Congo Basin, aquatic environments and forest environments are intimately linked: more than 7% of forests are temporarily or permanently flooded. Although in both DRC and the Republic of Congo war has caused an over-



all reduction in fishing, what fishing remains has become concentrated in safe areas, where it has become unsustainable due to the excessive concentration of fishermen and the use of destructive techniques (nets with a smaller and smaller mesh, poison and explosives).

Elsewhere in Central Africa, fishing effort has increased in recent years and fishing remains the primary source of protein for a considerable proportion of the populations throughout the region (Figure 5.5). Very few impact studies have been carried out. However, and the suggestion that a slow degradation of the aquatic resource may aggravate the already precarious food security situation of the populations involved remains a cause for concern. It appears that several species of fish have already disappeared from Lake Tumba in DRC (page 181) and another species from the Nkomi Lagoon in Gabon (page 132). In a large part of the Ogooué Basin, fishermen complain of a serious reduction in their catch and the existence of territorial conflicts among groups of fishermen, especially in Cameroon, clearly shows that there are problems with access to fish resources. Only close cooperation among fishermen, scientific partners and administrations responsible for fisheries or conservation can ensure the sustainable management of fishing and aquatic resources. With the exception of the attempts made in the Lake Télé- Lake Tumba Landscape, there are virtually no known examples of such cooperation.

Finally, the introduction of exotic fish also constitutes a threat, not only for biodiversity but also for production. Fisheries in the center of Cameroon, for instance, are suffering from the introduction of Nile perch *Lates niloticus*.

Figure 5.5. Fishing has been a primary activity for a long time, but during periods of conflicts, such as in DRC for the last 10 years, many people abandon other activities to concentrate on fishing.

⁷ Pollution is concerned not only with major visible forms of pollution – black tides – but also constant pollution in small doses which could have more insidious effects that are more difficult to control, particularly on cetaceans. As for seismic surveys, they have the potential to disturb cetaceans during the reproductive season (mating, birth, suckling of calves) (Rosenbaum & Collins, 2006).

Diseases

Animal health, human health and biodiversity are closely linked. The best examples of this relationship are provided by malaria, HIV/AIDS and Ebola, all of which are having devastating effects on local human capacity in forest management, conservation and the environment. In addition to its occasional effects on humans, the Ebola virus has been exterminating great apes and other species of fauna in great swathes of forest for thirty years. The Landscape most affected is Tridom (page 153). The Sangha Tri-national Landscape could follow. These two Landscapes contain or used to contain the largest populations of Western gorillas -*Gorilla gorilla*- in the world. Insufficient knowledge of the links between human health and animal health, combined with a lack of infrastructure capable of minimizing the effects of epidemics, constitute major threats to sustainability in the region. Diseases could also have impacts even when they are not present. The halt on imports of poultry into Gabon, because of a fear of the bird flu epidemic spreading, could have unexpected effects on the bushmeat market.

Invasive species

In many places, invasion by exotic species, plant or animal, is an important factor in degradation and the loss of biodiversity. In tropical humid forests this phenomenon is generally not very prevalent and is rarely taken into consideration, with the exception perhaps of the plant *Chromolaena odorata* (page 111) and the ant *Wassmannia auropunctata*. As it has been such a long time since an invasive species has caused real problems, nobody is really paying attention to the issue, so it is likely that when a problem does surface it will be too late to take effectual measures. The case of the water hyacinth *Eichhornia crassipes* on the Congo River is a good example.

Indirect threats

Population growth

In most Landscapes, hunting is identified as the most immediate threat, but in the Landscapes of eastern DRC—Ituri, Maiko-Tayna-Kahuzi-Biega and Virunga—the most urgent problems are related to demography. These Landscapes are seeing an influx of people from the densely populated regions of the Albertine Rift. This is not a new phenomenon⁸, but it has accelerated substantially over the last few decades and could be-

come totally uncontrollable in the years to come with the return of security and the rehabilitation of roads.

Throughout Central Africa the human population is expected to grow from 76 million in 2005 to over 185 million in 2050 (Table 5.2). In the least populated countries, this may not cause any fundamental problems, but in Cameroon, Equatorial Guinea and DRC demographic pressures will become very intense. This is significant since human pressure is at the root of many of the above-mentioned threats.

In the least populated regions, particularly Gabon, an increase in immigration from West Africa will be virtually inevitable. This will exacerbate the pressure on natural resources, especially as immigrant populations are unfamiliar with the environments that they colonize and are generally more 'destructive' than the original resident populations⁹. This immigration could well give rise to social tensions.

Road construction

Roads are absolutely essential for development, but they fragment the forests, favor the advance of agriculture and facilitate hunting and trade in bushmeat (Figure 5.6). The damage that they cause is usually the result of a lack of planning and non-compliance with the laws in force. In certain cases, roads have positive effects and attract populations away from the forests, sometimes even out of protected areas. In effect, they allow these populations to develop activities other than hunting and gathering¹⁰. The construction or rehabilitation of roads is therefore a very ambiguous problem that, more than any other problem, requires an objective, rational and multidisciplinary approach (Wilkie *et al.*, 2000).

Lack of development of national parks

Other regions of Africa that tourism in national parks constitutes not only a way of developing parks, but also an important means of attenuating conflicts between conservation and local populations. However, tourism in the national parks of Central Africa is very poorly developed (or non-existent) at present and for many local populations the reasons for protected areas are poorly understood. In several countries in the region, the lack of development of national parks is due to unfavorable political and/or economic situations, but in other countries tourism could be developed.

⁸ Already by the end of the colonial era, Rwandan populations were emigrating to regions immediately to the west of the Rift, particularly Walikale. In the 1970s and 1980s, Shi from the Bukavu region emigrated to the low regions west of the Rift, and in the 1990s Rwandans moved to the Walunga region and further west in the direction of Shabunda. The wide cultural differences between the immigrants and the resident populations, from both the social point of view and from the point of view of agricultural practices, generated permanent conflicts.

⁹ For example, Nigerian populations who are moving into the mangroves of Gabon have begun to cut down mangroves for firewood, including within national parks.

¹⁰ In eastern DRC, the reconstruction of the Bukavu-Walikale road at the beginning of the 1990s attracted populations away from Kahuzi-Biega National Park.

Climate change

Although our knowledge of the effects of climate change in the Congo Basin is very limited, various studies suggest that in the long term they could be severe. Many localized endemic species could succumb to even slight changes in the climate. Montane species will see their habitat shrink and perhaps even disappear. An increase in seasonal and inter-annual variations and the more frequent occurrence of extreme climatic events could affect the forest formations, especially fragmented formations. In turn this could increase the pressures on human communities whose livelihoods depend on these resources.

Pollution

At present, soil pollution does not appear to constitute a major problem in the region. It remains localized and linked to urban areas and industrial activities. However, capacities for monitoring and protecting the environment from pollution are extremely low in the region and could be masking the true extent of the problem. For instance, mining and the growing urbanization and industrialization of certain regions considerably increase the risk of negative impacts. The storage of chemical residues by foreign companies has been noted as a worrying problem. In addition, pollution from the mining industry, which has become totally anarchic in DRC (Kasai, Katanga, etc.), could be even more serious and constitute a major threat for portions of aquatic ecosystems. Pollution of the oceans, independent of that caused by hydrocarbons, should not be underestimated either: the beaches of Gabon, particularly in the Gamba-Mayumba-Conkouati Landscape, are covered with waste from the Pointe-Noire region, Kinshasa, Brazzaville and Angola (page 133).

Marine fishing

The marine environments are far removed from the forest ecosystems, but industrial fishing could have consequences for terrestrial biodiversity. Industrial fishing started to develop after World War II and has increased considerably along the coasts of the Gulf of Guinea over the last few decades. In many cases, current regulations are ignored. Monitoring capacities are also minimal or non-existent. The agreements on coastal fishing are often not very transparent and are disadvantageous for the national governments. Finally, some parts of the Atlantic coast of Central

Table 5.2. Human population in Central Africa: state in 2005 and predictions for 2050 according to the UNFPA.

Country	2005	2050
Cameroon	15,456,000	37,290,000
Equatorial Guinea	465,756	1,122,000
Gabon	1,225,853	2,682,000
CAR	3,562,367	7,689,000
Republic of Congo	2,716,814	8,597,000
Democratic Republic of Congo	53,277,195	(131,475,000)
Total	76,701,000	188,000,000



Figure 5.6. Road construction.

Africa are being invaded by fishermen from West Africa. Certain communities have even moved into protected areas and fish intensively in spawning grounds and nurseries¹¹.

Artisanal fishing and industrial fishing have complementary effects and together are leading to the overexploitation of fishery resources. Even in inland areas, sea fish, often salted, represent an important source of proteins for local populations, supplementing fish from the rivers, lakes and lagoons¹². In the long term, the reduction in maritime production will inevitably step up the pressures on other resources, mainly those in the forest ecosystems.

¹¹ In Akanda National Park in Gabon, there are approximately 500 Nigerians and other West Africans who live essentially on fishing. The men fish far away from the coasts using longlines, while the women comb the banks in the national park, which serve as nurseries for 'shrimp' fishing (Vande weghe, 2005).

¹² In Makokou in eastern Gabon, about 400 km from the sea as the crow flies, small restaurants serve as much or more sea fish than freshwater fish, depending on the season.

Urbanization

In general, human populations in Central Africa are highly urbanized (up to 80% in Gabon). This urbanization has led to an exodus from the forests to the urban centers, reducing the rural populations and their impacts on the forests. However, urban populations continue to depend on available forest resources. All towns and cities have large game markets and consume enormous quantities of firewood.

In addition, waste treatment, sewage and pollution have become major problems. Urban services are unable to keep up with the dramatic growth rate and the environmental problems that urbanization generates. Finally, urbanization also draws the most skilled labor and the 'brains' to the towns and cities, leaving the rural world to fend for itself¹³.

Displaced populations and conflicts

Some countries in the region (CAR, Republic of Congo, DRC) or neighboring regions (Angola, Uganda, Rwanda, Burundi) have been ravaged by wars and/or civil disturbances that have led to large numbers of refugees and displaced persons. Despite United Nations assistance, these populations have been forced to depend on the country's natural resources and live in places where their impact has been very severe, both on natural ecosystems and on local populations. This problem is particularly acute in eastern DRC, in the Virunga Landscape and the Maiko-Tayna-Kahuzi-Biega Landscape. Furthermore, the conflicts have been financed to a large degree by logging, the ivory trade or diamond, gold and coltan mining.

World energy requirements

The problems of the post-petroleum period are manifest within the Landscapes, as is the case with the Gamba-Mayumba-Conkouati Landscape where oil extraction currently occurs. In the long term, they also risk affecting the whole forest block. The production of bio-fuels (plant-based fuels), a technology that could assume a scale of unknown proportions in the future, could affect enormous areas in the tropical regions.

The underlying causes

Corruption and the lack of good governance

These two problems are undermining progress towards conservation and sustainable management of forest resources in Central Africa. Corruption and bad business practices are causing or maintaining a lack of transparency and good governance in the awarding of forest concessions, often in contravention of the laws and regulations in force. This situation, along with growing tax pressure on companies, is perhaps discouraging long term investments vital to improving the sustainability of the forestry sector. Poor governance also diverts part of the profits from the exploitation of natural resources and reduces equitable distribution among the populations in the region.

Lack of institutional capacity

The limited allocation of government budgets to conservation means that many departments responsible for forests and fauna are understaffed and suffer from poor morale. This leaves these departments extremely weak. Knowledge and technical know-how to monitor the state of biodiversity are lacking and local populations are incapable of effectively safeguarding the natural resources on which they largely depend. In some countries, however, a growing national commitment to conservation is resulting in an increase in support from funding agencies for these departments, enabling more training and career opportunities. Despite insufficient funds and weak capacities, the commitment to conservation is considerable in some regions. In DRC, for example, the national park guards remained on duty during the war, endangering their own lives.

Insufficient long term funding

Conservation is a long term objective that requires long term investments. However, the principal funding agencies currently operate on short term planning cycles, generating the cyclical appearance and disappearance of projects. For the whole of Central Africa, 19 protected areas have short term financing, 11 medium term financing and only 4 long term financing (Annex C). Many newly created protected areas, or protected areas that have been neglected for many years, only exist on paper. Turning them into functional entities requires a sustained commitment, lasting decades and supported by substantial funding and capac-

¹³ For many university graduates, or holders of higher technical diplomas, assignment to a post far from town is too often regarded as a sort of administrative punishment.

ity building. The financing of conservation must be both long lasting and continuous. Too many programs suffer periods of interruption during which the personnel become less effective and poachers redouble their activities.

Lack of understanding of problems of scale

The understanding of the fundamentals of conservation must be strengthened in the Congo Basin at all levels. Many people living in or outside the region think that the forest is infinite and its resources inexhaustible. Even if the political commitment in the region is strong, efforts must be made to ensure that the value and vulnerability of these forests are understood by both the general public and government agents, so that the latter can make decisions more soundly based in conservation and the sustainable management of natural resources.

Lack of capacity among NGOs and community based organizations

Community based organizations must be strengthened and given the power to make a real contribution to the sustainable management of natural resources, but in most of the forest regions of Central Africa traditions in this direction are poorly developed. Societies are of an acephalous nature and the traditional decision-making processes at the level of the villages or communities are very complex. In addition, decisions taken at local level often conflict with those taken at the national level. The knowledge, traditional values and know-how of the local populations can contribute to the sustainable management of certain natural resources, but not all of them. For instance, there is no traditional knowledge of logging, an activity introduced by foreigners. In addition, community management runs up against a number of serious socio-cultural problems: traditional management of community forests does not correspond to traditional political practices and community forests risk becoming a political issue (Delvingt, 2002).

Lack of data, monitoring and evaluation

Lack of knowledge about the distribution and state of biodiversity is a major obstacle for conservation and sustainable development in the Congo Basin. Not only are the exact distribution and current size of the populations of most species unknown, but also very few reliable historical data exist. Furthermore, the few existing historical data are often either ignored or called into question. It is therefore virtually impossible to set realistic baselines for monitoring and evaluation. Yet the rapid decline of animal populations in the forests of Central Africa is a process that began a long time ago. Management at the Landscape level, however, is a new concept in Africa and the creation of baseline datasets is only just beginning. Improving tools and capacity is therefore essential so that decision-makers can have permanent access to the information in order to make the best possible decisions. The lack of available data is also partly a result of the slow-down in research since the end of the 1970s. This is largely due to the reduction in funding allocated to research and insecurity in certain regions. To some extent it is also a result of the administrative difficulties created by some actors in the region.

6. Priority Actions

The ultimate objective of CARPE and the CBFP is to reduce the rate at which biodiversity is being lost in the forests of Central Africa. As we have seen (page 33), this loss is due to deforestation, fragmentation and degradation. Reducing biodiversity loss comes down to combating these three processes. However, simply reducing the rate of loss would only postpone the problem and in the long term the end result may be the same. Consequently, we should go further and, wherever possible, ‘totally’ stop the loss of biodiversity at a time and a level that are considered acceptable. It is with this objective in mind, that the concept of ‘priority actions’ should be considered.

This is a very ambitious objective and clearly it can only be attained—if it ever really can be—in the long term. Therefore, action to combat deforestation, fragmentation and degradation must comprise multiple strategies:

- short term actions aimed at combating the most pressing threats so as to preserve the existing resource pool by preventing irreversible damage
- long term actions aimed at stabilizing a situation, which otherwise could deteriorate irreversibly

In addition, the planning and implementation of conservation measures must remain focused on protected areas. The Landscape approach only makes sense within this context and the objective of Landscape management should remain the conservation of priority areas for biodiversity, which most likely means focusing on protected areas.

Actions in the short term

Management of hunting

In all the Landscapes, with the exception of the Ituri and Maiko-Tayna-Kahuzi-Biega Landscapes, hunting is the primary or most visible threat. In many regions of Central Africa hunting has already caused serious and perhaps irreversible damage. Species that are particularly vulnerable are in real danger. In DRC, the elephant and several primates, particularly red colobus monkeys *Piliocolobus sp.*, have become rare, highly localized and some isolated populations are probably no longer viable in the long term. In Cameroon, several species of primates with a limited distribution, notably the drill *Mandrillus*

leucophaeus and the Preuss’s guenon *Cercopithecus preussi*, are species of concern in conservation. The primary reason for this situation is the fact that over the past 25 years, in parallel with economic collapse or recession, hunting has become a highly commercial activity. Whatever the causes of this development, it is important to curb it, at least in key areas (protected areas and large concessions) where there are still sufficiently large animal populations and where there is a reasonable possibility of successful intervention. Action must be undertaken at two levels.

(1) Actions to combat poaching

Actions to combat poaching must be stepped up both in the protected areas and in select forestry concessions in order to preserve sufficiently large populations of target species. Both oil and forestry concessions play an important role due to the fact that they encompass very large areas, the extraction companies control access to their concessions and they often have more technical and financial resources than national parks. On the ground, this action must be based on the technical means available: mobile patrols, fixed posts, checks on roads, trains and national airlines and, above all, informants. Indeed, in several Landscapes, infiltration of villages by informants has shown itself to be one of the most effective methods of combating poaching. Within forestry concessions, controlled access or track closures, through passive or preventive methods, have been shown to be effective¹. However, implementing such proven techniques requires long term financial support, trained personnel and political support at all levels.

(2) Monitoring and controlling trade

In urban and village markets, it is necessary to ensure that the existing laws concerning both bushmeat and ivory are applied. To accomplish this, the agents involved in this activity (police, gendarmerie, water and forests agents, customs officers, etc.) must be trained and made aware of the situation. In other regions of Africa, the laws governing hunting and the trade in wildlife are more respected and this should also be possible in Central Africa. Offenders should be prosecuted and, where applicable, sentences need to be enforced. This will require improved awareness among high level officials in administration and the courts. A few rare examples, particularly in the Gamba-Mayumba-Conkouati Landscape, demonstrate that the effective application of pen-

¹ It has also emerged that it is easier to prevent poaching from increasing than to stop it once it is well established and has garnered support in urban areas.

alties can reduce offences considerably. However, for this strategy to have lasting effects it may be necessary to review and adapt certain laws in order to bring them more into line with regional traditions. In forestry concessions in particular, the main bases and camps must be guarded, access to these areas must be controlled and marketing of wildlife outside the concessions must be prevented. Such measures are all part of low impact logging practices already being carried out in certain concessions; it is essential that these standards be extended.

Logging

The environmental impacts of logging are numerous and, in addition to controlling hunting and the marketing of bushmeat, it is imperative to apply low impact logging techniques and act against illicit logging by enforcing regulations and laws. To accomplish these tasks, it is essential to encourage management of concessions that incorporates biodiversity considerations and local populations in the following:

- providing legal protection to companies
- applying laws
- creating tax incentives
- developing partnerships between logging companies and conservation NGOs

Forest management objectives and actions undertaken need to be tailored to the type of forest and the nature of logging. For instance, the young okoume forests on the central plateau of Gabon, particularly in the Lopé-Chaillu-Louesse Landscape, are much less 'fragile' than the old forests of the Monte Alén-Monts de Cristal Landscape. Each partnership between a logging company and conservation NGO must also reflect these considerations. In particular, the conservation zones within logging concessions must be chosen according to their value for biodiversity and not their lack of value for logging. Going beyond conventional conservation actions, this type of partnership can help make logging and the appropriate manipulation of forests, a tool for the management of biodiversity.

In several countries, most notably Cameroon, Gabon and the Republic of Congo, there are already a number of partnerships with large companies. Effort must also be made to involve smaller companies; their impact is often more insidious, but also more detrimental, than large companies. In the Lopé-Chaillu-Louesse and Monte Alén-Monts de Cristal Landscapes in Gabon, numerous small companies play a preponderant role

(page 117). Engaging small companies is a challenge that should not be underestimated as these companies often have limited technical and financial resources, a short term vision and are managed or owned by politically important persons who generally do not want anyone intervening in their business.

Specific or local actions

(1) Industrial mining

In several Landscapes there are potential but imminent threats from industrial mineral extraction. In such cases, it is important that the agencies in charge of conservation, both governments and NGOs, are involved from the beginning in conducting impact studies to minimize these threats by appropriately adjusting certain developments. It is also essential that these impact studies are not reduced to simple rituals for which there is no follow up. They must result in the introduction of monitoring systems.

(2) Oil extraction

In the Gamba-Mayumba-Conkouati Landscape, large oil companies (Shell Gabon, Total Gabon) have made a substantial contribution to conservation and research through partnerships with NGOs. These partnerships must be strengthened and extended to include smaller companies less concerned with environmental problems. In particular, it is necessary to introduce maritime pollution detection or monitoring systems as well as strict standards to ensure conservation of critical marine species and habitats during the exploration and extraction phases. At present, the necessary process for assessing environmental impacts is applied on a case-by-case basis with little or no independent scientific supervision (Rosenbaum & Collins, 2006).

(3) Nature tourism

The development of tourism in national parks should be supported because not only does it contribute to the national economy, but it also can improve the perception of these protected areas and attenuate certain conflicts with neighboring populations. This is currently the case in Gabon, where the establishment of tourism companies must be encouraged.

However, in the development process it is important to bear in mind that:

- Not all national parks have the same tourism development potential—biodiversity and tourist value are two very different things—

and during the start-up stage this industry should concentrate first and foremost on the parks with the highest tourism potential, so as to minimize the risks associated with investment in this field. All facilities must be planned to protect nature and investors alike.

- Although ecotourism—a form of tourism developed as much as possible with, and to the benefit of, local populations—should be promoted, it does not constitute an alternative to the development of conventional tourism and generally can only be successfully developed on a sustainable basis in conjunction with conventional tourism (King & Stewart, 1996).
- As in the case of logging, tourism must be developed by tourism professionals, preferably in association with the conservation movement, but not by the conservation movement alone².

(4) Public health problems

In certain regions of Central Africa, human health problems have emerged in conjunction with wildlife disease outbreaks, most notably the formidable Ebola virus. The risk of such outbreaks and their negative impacts will increase as forests are opened up. In the countries affected, it is important to launch national information campaigns to teach populations how to minimize the risks of animal-human transmission.

(5) Fishing

Both inland and at sea it is vital to enforce laws and regulations concerning fishing. These need to be applied at the industrial and small-scale to curb illegal fishing and the use of destructive fishing methods.

(6) Communications

It is essential to develop communications via the national media so as to obtain the support of the populations through national NGOs and civil society.

Actions in the long term

Planning and zoning

It is inevitable that substantial areas of natural forests will be lost and/or fragmented in order to free land for agriculture, agro-forestry, industrial plantations, mining and the creation of infrastructure, such as roads. Neither deforestation, nor fragmentation, can be stopped, but it must be planned to preserve sufficiently intact areas of forest to be able to maintain biodiversity and forest resources. The intent of this report is not to decide what percentage of the forests should be conserved, but to stress the absolute necessity of identifying and respecting a permanent forest domain in each country and each Landscape, comprised of all the forests that are intended for conservation or sustainable logging.

In practice, zoning should include the identification of the following categories of zones: protection zones (protected areas); permanent forest domain zones, with production forests and their associated conservation areas; mining zones; important hydrological zones; urban zones; and rural development zones for village-scale hunting, agriculture, community forestry and forest or agro-industrial plantations. The preparation of zoning plans requires multiple stages of work or the implementation of numerous actions that are not necessarily linked, but are often complementary.

Zoning is also essential to protect investments, for example in the field of tourism. Zoning is particularly important in regions subject to high demographic pressures, such as the Ituri and Maiko-Tayna-Kahuzi-Biega Landscapes, which have seen an influx of populations from the Albertine Rift.

(1) Designing the network of protected areas

Central Africa already has a substantial network of protected areas, but some regions or ecosystems are either under or poorly represented. In each country, an evaluation of the protected areas system should be carried out and adapted if necessary so as to maximize the protection of biodiversity, the resilience to climate change and the tourism potential. This network should aim to cover 15% of the surface area of natural habitats and consist of a combination of large blocks capable of preserving all the functions of the ecosystems and species with large home ranges, and smaller blocks intended for the protection of species or habitats with a localized distribution³. In certain countries, the networks of protected areas are relatively new and were designed based on numerous

² Tourism is a complex economic activity that involves several types of professions and is subject to commercial rules and constraints that only professionals in the sector can handle. Too often, however, tourism development programs are initiated by conservation experts—and also these days by social scientists—without calling on tourism professionals.

³ 'Montane' habitats in particular are well suited for this type of protected area: isolated mountain peaks and inselbergs, for example, often contain very important species even though these features have never covered vast areas.

factors (Box 6.1). Elsewhere, protected area networks are more established, but through a lack of means or knowledge, some protected areas were demarcated in a somewhat opportunistic manner. In other cases, specific protected areas may be too large or poorly designed. In these countries, the networks need to be revised. In Cameroon and DRC, for example, several protected areas still exist on paper, but no longer exist on the ground. Finally, some habitats are still under represented in the existing protected areas

(2) Demarcation of Landscapes

As with many protected areas, the Landscapes, whose limits were drawn at the beginning of the present millennium, must be reassessed and possibly modified. Certain regions and protected areas where CBFP partners are active should be incorporated in new Landscapes in order to include currently under-represented ecosystems. For instance, the fact that the protected areas of western Cameroon have not been included in one or more Landscapes should be rectified. These montane or submontane forests have never covered very large areas and are now surrounded by large human populations, but this should not be a deterrent to conservation. After all, many of the national parks in East Africa are surrounded by more dense human populations and they are still successful. Conservation of smaller forests is probably more difficult, but it can also demonstrate that conservation 'by the people, for the people' is more than a slogan. Examples in Uganda and Rwanda suggest that this can become a reality.

Adaptation of laws

For zoning to be recognized and respected, it is essential to resolve the mismatches and contradictions that exist between the laws promulgated by States and land rights claimed by local populations. In particular, villagers' rights must be recognized, including for example, the right to prevent outsiders from hunting in their territories. Open access and the fact that game is common property are major obstacles to establishing the sustainable management of hunting⁴.

Box 6.1. The national parks network in Gabon

In Gabon, the national parks network created in 2002 was the result of a national evaluation of priorities in the field of biodiversity, including the most recent knowledge of forest refuges, predictions in the rise in sea levels, resilience in the face of climate change, botanical diversity measured in real terms, the presence of substantial concentrations of large mammals, the diversity of birds, reptiles, amphibians and fish, potential for logging or mining activities and human activities (socioeconomic studies mapped the areas used by villagers around all the sites selected). A second phase, involving a new evaluation, is currently under way to identify sites of smaller surface area, particularly cultural sites, in order to increase the area of the network from 3 to 4 million hectares or from 11% to 17% of the area of the country. Marine reserves will also be created.

Establishment of genuinely sustainable logging

Even when applying low impact logging practices and following management plans, it is unlikely that logging will be able to satisfy the demands of our growing population. Numerous studies on different continents have shown that the natural regeneration of nature's renewable resources is rarely if ever sufficient to offset logging, except in marginal cases of little used resources. Revision of the forest codes, actions to combat illegal logging and various forms of support for management plans are important steps towards sustainability in the short term, however, these actions will be insufficient to guarantee long term sustainability⁵. For this, it is vital to develop a vision in which the planning process integrates silviculture techniques and biological knowledge of the forests, particularly forest dynamics and the ecological behavior of the species harvested.

Unfortunately, very little research has been carried out in this field over the past 40 years, despite the fact that basic scientific knowledge has developed considerably. Too many CBFP partners are preoccupied with short term emergencies and ignore the fact that decisions taken before logging begins influence everything that follows, including future timber production. As a result, industrial logging in Central Africa is in a vicious circle of repeated logging cycles in which every 20 to 30 years—if not less—the baseline data are reset to zero, masking the inexorable impoverishment and degradation of the production forests.

⁴ In Europe too, there are countries where hunting rights are not linked to property law or land use. It is in these countries that protection of fauna poses the most problems.

⁵ This is a complicated problem due to the confusion that exists between logging and forestry. The former is an industrial activity that consists of harvesting the naturally occurring forest resources and relies solely on natural regeneration. The latter is an applied science that relies on appropriate manipulation of the forest cover to guarantee sustained and lasting production; it is practiced by highly qualified professionals.

This future vision of forests and forestry must entail different approaches in different places. In areas immediately surrounding protected areas, the emphasis must be placed on the 'light' harvesting of natural forests that are subject to little manipulation; elsewhere, more 'aggressive', but also more productive forestry must be developed in order to meet the demand for timber.

Establishment of systematic monitoring

It is important for conservation to be based on activity and results monitoring, so as to be able to adapt management to each new set of circumstances. This requires increasing capacity and research.

Capacity building

In all fields, including protected area management and logging, it is necessary to train technicians at all levels to implement the actions envisaged⁶.

In the field of protected areas:

- skilled personnel for management of national parks (Figure 6.1)
- personnel capable of carrying out biological monitoring
- good guides, a prerequisite for the development of tourism in the forest environment

In the field of logging:

- technicians at all levels, especially in DRC, provide the most effective means for on the ground implementation of the forest code

In the general field of the environment:

- experts capable of carrying out environmental impact studies

In addition to this, general environmental education should be promoted to assure sufficient support from civil society to pass on conservation and sustainable management concepts to more influential national and/or local NGOs.

Research

Although most funding agencies are not currently interested in financing research, it is clear that research is still essential. Indeed it is the key to all progress.

In the field of logging:

- Knowledge on the distribution of species must be improved, in order to be able to evaluate logging potential more precisely and formulate realistic management plans.
- The ecological niche and dynamics of commercial species must be much better understood so that appropriate silvicultural techniques can be developed.
- Known, but often neglected, silvicultural techniques must be adapted to regional and local conditions and opportunities.

In the field of biology:

- Knowledge on the distribution of plants and animals must be improved in order to evaluate more objectively the networks of protected areas⁷, this research must be approached in terms of 'gaps' in knowledge both at the spatial level and at the level of the choice of species; in particular, it is necessary to go beyond the classic flagship species⁸.
- Baseline data must be collected to develop essential biological monitoring systems for the evaluation of conservation activities and the impacts of logging.
- Poaching and the bushmeat trade must be the subject of socioeconomic studies so as to gain a better understanding of the unknowns that govern these illegal and widespread activities, which are constantly adapting to the constraints and opportunities that present themselves.
- Freshwater and marine ecosystems, so important for human populations, must be studied so as to be able to determine their sustainable utilization; in many regions, it is not even known what species are present and virtually nothing is known of their biology.
- It is necessary to study pollution from the large towns and cities in the region in order to identify means of control.

⁶ In the DRC, no technician has emerged from the forestry colleges for over 15 years. This highlights the lack of trained staff available to formulate concession management plans.

⁷ Certain biodiversity 'hotspots' are not included in protected areas merely because they are not sufficiently known.

⁸ Flagship species often have a fairly vast distribution and are subject to substantial hunting pressure. It is necessary to add 'control' species that are not subject to pressure from hunting and can provide clearer information on the impacts of changes in the Landscapes.



Figure 6.1. In many regions of Central Africa, like here in Virunga National Park, training of rangers remains an essential component of conservation activities.

In the field of climatology:

- It is necessary to study at the regional level what are, or could be, the real consequences of climate change, what can be used to limit greenhouse gas emissions and what means exist to improve or preserve carbon storage.
- It is necessary to study how to preserve the resistance of the forests to expected changes—the problem of climate change must be included in planning and zoning.
- Initiatives should be based on the recognition of carbon storage in natural forests, via the Kyoto protocol, through the establishment of an *ad hoc* lobby.

To encourage research, it is not only necessary to have sufficient funding, but it also necessary for States in the region to facilitate the development of research. In addition, national institutions and researchers must take a real interest in field research, which is often difficult and seen as being of little benefit. It is important to ensure that the overall quality of research does not suffer in the process.

Development of sustainable funding

All the activities mentioned above will require substantial financial resources and it is essential to develop sustainable funding mechanisms in order to avoid initiatives with no long term future.

Figure 6.2. Very large old trees will only survive in national parks. Here an okoume or Gabon mahogany *Aucoumea klaineana* in Ivindo National Park.



7. Stakeholders in the Congo Basin Forest Sector¹

Introduction

Because of its diverse resources, the forest sector involves a wide variety of stakeholders at different levels and with interests that are often more divergent than convergent. The identification of these players is a prerequisite for the development of any sustainable management approach to the forests of Central Africa. This identification is important for communication, assuring the mutual recognition of the rights or duties of stakeholders and supporting their involvement in the management process, from decision-making and implementation to the monitoring and evaluation of impacts.

While information on the various players can be found in numerous documents relating to Central Africa and/or of broader interest (for example: Bahuchet *et al.* 2001; Borrini-Feyerabend *et al.*, 2000; Colfer *et al.*, 2000; Doumenge *et al.*, 1994; Forests Monitor, 2001), we owe the first general overview of actors concerned with the forests of Central Africa and West Africa to the FORAFRI project (Gami & Doumenge, 2001). The summary presented here is based on this work, augmented and reshaped for the purposes of this document on the forests of the Congo Basin. It is not exhaustive, nor is it the only one that could be produced. The criteria for the categorizations are clarified further on, but it should be emphasized from the start that this summary is not the result of in-depth research, but rather of practical reflections and a synthesis of the authors' knowledge.

This chapter provides an overview of the diverse players involved in the forest sector, their respective roles and their interests in the management of the forests of Central Africa. It should be elaborated in future evaluations of the regional institutional landscape, particularly in the next 'State of the Forest' report in 2007.

Methodology: categories adopted

In this chapter, we present the players with a direct role in or having significant impact on the management, exploitation and conservation of Central African forests. Other stakeholders may have a more indirect or less appreciable impact on forest management. In most cases, we have not taken these additional stakeholders into account.

However, in forest-dominated countries like Gabon or Equatorial Guinea, which stakeholders and what activities are not linked to the forest, or

do not have a direct or indirect impact on these resources? For example, a foreseeable fall in revenue from oil can lead to renewed interest in the forest. Off-shore oil activities can impact mangroves and the entire coastal area as a result of pollution by hydrocarbons. Although we are aware of these links, we merely mention their existence without going into the details of these other fields of activity.

The categorization adopted in this chapter is based on a multifaceted approach:

- 'Functionality' relates to the role of these players in the management process. Some make decisions; others implement them or provide financial support for the management and administration of forests (Figure 7.1).
- 'Institutionalization' refers to how players are structured in organized groups that are recognized, to a greater or lesser degree, as separate entities or interest groups (public bodies, private companies, NGOs or associations, etc.).

In the following exercise, we occasionally emphasize institutions or networks of interest at a regional scale, however, we have not been able to detail the institutional landscape of each country due to a lack of space.

Finally, the main purpose of this chapter is to paint a regional picture of institutions in the forest-environment sector. It is not an attempt to develop an in-depth analysis of the theoretical or actual roles of each group of stakeholders and possible deviation from these roles. Such an



Figure 7.1. The main groups of stakeholders in the forest sector in Central Africa.

¹ This chapter was written by N. Gami and Ch. Doumenge.

analysis has already been outlined in Gami & Doumenge (2001). Certain issues are addressed, but the development of such a comprehensive analysis would require more time and space than provided for in this report on the forests of the Congo Basin.

Political stakeholders

Political decision-makers are the principal players in the formulation and implementation of forest policies at the international, regional, national, provincial and local levels. They define the general framework within which the other stakeholders act and therefore have a substantial impact on all players. They in turn are influenced by the other players in proportion to their degree of organization and their lobbying capacity. Political stakeholders are also subject to the traditional relations that define the links between these 'elites' and their base, or their networks of contacts (client-centered relations).

Whether it is a question of country representatives in international organizations or regional and national political stakeholders (Prefects, Governors, Departmental or Provincial Councilors, Ministers, State Representatives in regional institutions, etc.), the main task of all these personalities is to define or support (as in the case of Prefects, Governors, etc.) the different forestry and environmental policies at their level of responsibility. However, most of them have little more than a basic knowledge of forestry or the environmental field. To be well informed, their decisions must be based on the opinions of competent technicians. It should be noted that the current criteria for appointing representatives of the different countries in regional bodies are not in any way based on objective criteria from a technical point of view (for example the lack of open invitations for applications for important posts, etc.).

Political stakeholders, including first and foremost the Heads of State of Central Africa, are increasingly aware of the key role they can play in the sustainable management of natural resources and the development of the human societies that they represent: *'The Heads of State proclaim: ...their commitment to the principle of biodiversity conservation and the sustainable management of the forest ecosystems of Central Africa...the right of their peoples to be able to count on the forest resources to support their endeavors for economic and social development'* (Yaoundé Declaration, 17 March 1999, at the First Summit of the Heads of State of Central Africa on the conservation and sustainable management

of tropical forests, included in the COMIFAC Treaty, 2005). For the societies of Central Africa, the role of these leaders and their voluntarism are, and will continue to be, fundamental for the effective implementation of sustainable management of forest resources. These fine words and noble intentions cannot be given tangible form without a firm and constant commitment by the political players, particularly the region's Heads of State (Doumenge & Ndinga, 2005).

Box 7.1. Central Africa Forest Commission (COMIFAC)

COMIFAC, initially the Conference of Ministers of Central Africa before becoming a subregional intergovernmental institution, now brings together ten Central African states. It was created in December 2000, following the 1999 Summit of the Heads of State on the forests of Central Africa held in Yaoundé (Cameroon) and the signing of the Yaoundé Declaration. COMIFAC, headed by the Council of Ministers, is the political and technical body for orientation, coordination and decision-making with respect to conservation and sustainable management of the forest ecosystems of Central Africa. It harmonizes and coordinates the forest and environment policies of its Member States.

Adopted by the Council of Ministers, the COMIFAC 'Plan de Convergence' defines the common intervention strategies of the States and partners in the development of Central Africa as related to conservation and sustainable management of forest ecosystems and savannahs. The strategic priorities are:

1. harmonization of forest and taxation policies
2. knowledge of the resource
3. management of ecosystems
4. conservation of biological diversity
5. sustainable exploitation of forest resources / combating poverty / socioeconomic development / monitoring / timber sector / subregional timber market
6. strengthening of capacities / participation of players / information / training / consciousness-raising
7. research-development
8. development of financing mechanisms
9. cooperation and partnerships

COMIFAC works in close cooperation with other regional and/or African institutions, including:

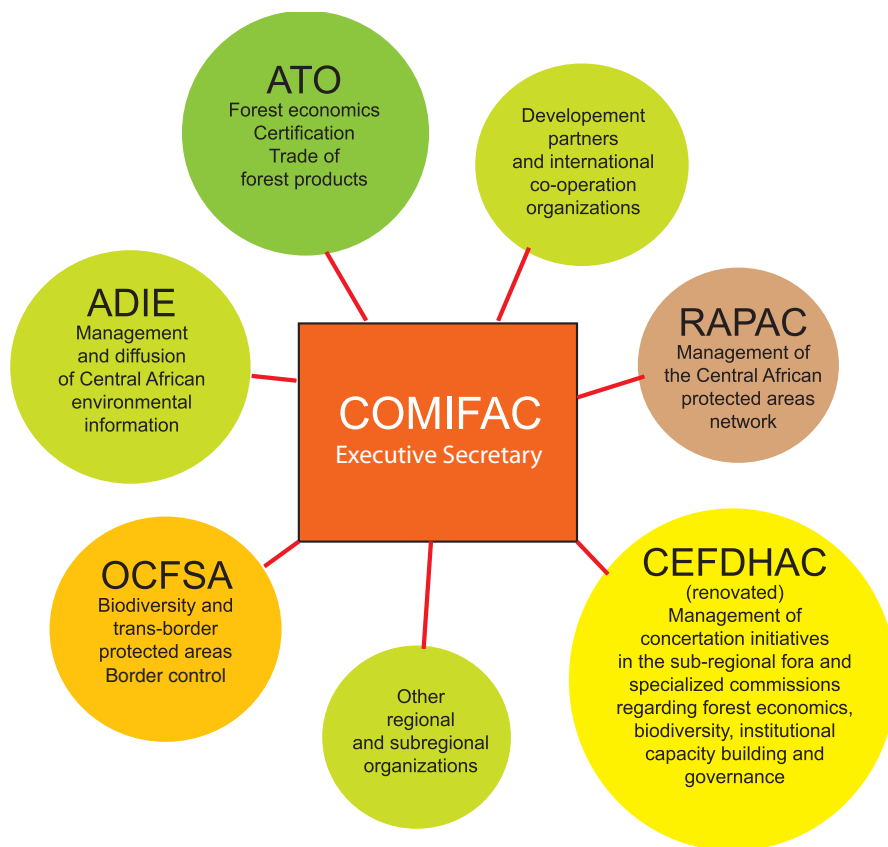
African Timber Organization (ATO), *Agence intergouvernementale pour le développement de l'information environnementale* (ADIE), *Organisation pour la conservation de la faune sauvage en Afrique* (OCFSA), *Réseau des aires protégées d'Afrique centrale* (RAPAC), *Conférence sur les écosystèmes de forêts denses et humides d'Afrique centrale* (CEFDHAC).

Apart from these regional institutions, COMIFAC also works with the different partners involved in the conservation and sustainable management of the forests of the Congo Basin.

To find out more: <http://www.comifac.org/accueilfr.htm>

Sources: Nagahuedi (2005), Hakizumwami & Ndikumagenge (2003) and COMIFAC (2006).

Figure 7.2. COMIFAC relational scheme.
 Source: COMIFAC (2006): Title IV,
 Article 31 of the Statutes.



Box 7.2. African Timber Organization (ATO)

Created in 1976, the ATO is an international cooperation and consultation body concerned with the forest economy and the trade in timber. Its objective is to encourage its member states to study and coordinate their activities in these fields in order to enable them to benefit more from their forest products.

The ATO is headquartered in Libreville (Gabon) and brings together 15 member countries producing African timber. In Central Africa, the member states are: Cameroon, CAR, the Republic of Congo, DRC, Gabon, Equatorial Guinea and Sao Tomé & Príncipe.

The ATO detailed its main objectives at its creation:

- ensuring a continuous exchange of information and mutual support among the member countries in regards to their policies on logging, conservation and exploitation of forest resources
- encouraging the formulation of national policies aimed at conservation and sustainable utilization of their forest ecosystems
- coordinating the industrialization policies of the member countries
- harmonizing their policies on reforestation, forest management and the environment

The organization's activities mainly revolve around the industrial timber exploitation sector. For several years, the ATO has been addressing questions such as the definition and promotion of principles, criteria and indicators of sustainable forest management.

Source: Christy et al. (2003) and Hakizumwami & Ndikumagenge (2003).

The Summit of Heads of State on the forests of the Congo Basin held in Brazzaville in February 2005, in conjunction with the Treaty deriving from it, represents some of the strongest commitments at the highest level to the sustainable management of forests in Central Africa.

This commitment was reflected in the creation of COMIFAC (Box 7.1 and Figure 7.2). The Commission strengthens the existing regional bodies such as the ATO (Box 7.2), an institution dealing with trade, processing and industrial exploitation of timber, which for several years has taken an interest in questions beyond simple logging, including both forest management and certification. Among the other regional initiatives and institutions, CEFDHAC (Box 7.3), the conference of ministers and multi-stakeholder forum, has made it possible to decompartmentalize the debates on the forests and the environment among public stakeholders, NGOs and the private sector. The existence of this forum has instigated reactions from various stakeholders, both in the sense of better collaboration and in resistance to change. The Summit of Heads of State of Central Africa (which took place in Yaoundé, Cameroon, in 1999) and COMIFAC came into being following the waves caused by CEFDHAC. The latter also supported the creation of a net-

work of parliamentarians on the sustainable management of forest ecosystems in Central Africa. This single network is aimed at encouraging and structuring the involvement of parliamentarians in regional and national debates on the forests (REPAR-CEFDHAC).

Stakeholders in forest management

Players in this category have in common an active participation and even a direct interest in the management of forest resources. Some live in, and depend on, the forest at a local level (rural populations). Others depend on the forest, but are impacted also by external concerns (industrial loggers). Still others do not depend directly on the forest, but are responsible for their management (administrations).

Water, forest and environment administrations

The water, forest and environment administrations do not obtain their revenue directly from the forest, at least in theory, but they do guarantee it is well managed. They must supervise and penalize any failure to comply with the established rules (loggers, farmers, hunters, etc.). These administrations are responsible for implementing, through technical directives, the forest policies decided on by the governments. They have traditionally had a fundamental role in the management of forests and the environment because in all the countries of Central Africa the forests belong to the State, which manages them through its institutions. They are represented from the central level (central administration) to the local level (operational services on the ground). Every country has its own institutional arrangements, either grouping closely related sectors within the same Ministry or spreading them out in several independent entities (for example, the services in charge of the forests and the environment are currently dissociated in Cameroon whereas they form part of the same Ministry in Gabon). It should be emphasized that corruption of the agents in these services by certain loggers who do not comply with the country's laws is a deplorable practice.

In the case of timber exploitation, management is delegated to the private sector (see further on). Application of laws and policies remains the responsibility of the administration, for example through the supervision of management plans and creation of logging arrangements. The lack of financial and human resources, as well as the

Box 7.3. CEFDHAC and REPAR

The Conference on the Ecosystems of Dense Tropical Rainforests of Central Africa is a sub regional organization bringing together States, national and sub regional non-governmental organizations, the private sector and other parties involved in management of the forests of Central Africa. It is the only forum where all the players in the forest-environment sector can get together, exchange points of view and develop a common vision and partnerships. CEFDHAC gives concrete expression to the desire of the parties involved to achieve a common vision of conservation and utilization of the forests in the region. Its goal is to encourage these players to conserve their forest ecosystems and ensure sustainable and equitable utilization of the resources that they contain.

It sees itself as a forum with multiple roles:

- a forum for guidance through the linking-up of all the groups of players involved in the region
- a forum where all ideas and reflections lead to decisions by the authorities involved in environmental and forest matters in Central Africa
- a forum for consultation and exchanges of experiences open to all those involved in the forest sector with a view to equitable and sustainable management of forest ecosystems in Central Africa

CEFDHAC has initiated and supports various networks, such as the Network of Parliamentarians for the sustainable management of Forest Ecosystems in Central Africa (REPAR), created in Libreville in 2002. The objectives of this network are to enable parliamentarians in the region to share their respective national legislative experiences in the management of forest ecosystems, to deliberate on common themes, to encourage consideration for the interests of local communities in the preparation of legislative texts relating to the environment, to contribute through concerted legislative action to the safeguarding and sustainable management of the forest ecosystems of Central Africa and to make the CEFDHAC Member States aware of the need to apply international conventions on the environment. REPAR plans in November 2006 to convene in Yaoundé (Cameroon) the second international conference on the involvement of parliamentarians in sustainable management of the forest ecosystems of Central Africa.

To find out more: <http://iucn.org/places/brac/programme/cefdhac/cefdhac.htm#brazzaville>

Sources: UICN-BRAC (2006) and CEFDHAC (2006).

influences of trends in international thinking (privatization, decentralization, equitable revenue-sharing, etc.) and national approaches, can cause administrations to move away from the mentality of a 'forest State', and instead of managing the forest territory as a whole, administrations become then more concerned with the definition of rules and standards, supervision, penalties, and even technical support in specific circumstances (Karsenty, 2005). While there are now provisions for the delegation of management to rural communities – such as in Cameroon, Gabon and the Republic of Congo – community forests are often slow to establish or may encounter numerous dif-

Box 7.4. RAPAC (*Réseau des aires protégées d'Afrique centrale*)

Created in May 2000 in Yaoundé, within the context of the institutionalization of the ECOFAC program, RAPAC is a regional association that brings together the agencies in charge of protected area management in seven Central African countries. Each member of RAPAC is appointed by his corresponding Ministry. RAPAC is a technical body that specializes in the management of protected areas. Its main objective is to promote conservation and the rational management of the natural resources of Central Africa, particularly through the management of protected areas in its member countries. Seven countries are currently associated with RAPAC: Cameroon, CAR, the Republic of Congo, Gabon, Equatorial Guinea, São Tomé & Príncipe and Chad.

At present there are eight protected areas affected by RAPAC:

- Dja Faunal Reserve (Cameroon)
- Odzala National Park (Republic of Congo)
- Lopé Faunal Reserve (Gabon)
- Monte Alén National Park (Equatorial Guinea)
- Ngotto Forest (CAR), the future National Park of Mbaéré-Bodingué
- the protected area covered by the 'village hunting areas' development project (CAR)
- Obo Nature Park (São Tomé & Príncipe)
- Zakouma National Park (Chad)

Any administration in charge of protected areas in the region and any protected area itself may join RAPAC. Research and/or training institutions, environmental NGOs and private operators concerned with the management of natural resources can also become RAPAC members.

By gathering effectively managed protected areas into a network, RAPAC hopes to enhance the results achieved, create synergies and promote the efficient allocation of funding earmarked for the management of protected areas. Their objective is to make RAPAC a technical tool that uses an overview of initiatives pertaining to the management of protected areas in Central Africa to help develop a regional strategy.

To find out more: <http://www.rapac.org/Presentation.htm>

Source: RAPAC (2006).

faculties in becoming established.

In the case of protected areas, management often remains in the hands of State agencies; it is rarely delegated, except to sport-hunting companies. In truth, even if joint management or the transfer of management becomes an unavoidable political objective, making it a reality remains far behind the declared intentions. In an institutional landscape marked by a diverse set of stakeholders, numerous standards, official or unofficial, and multiple layers of management, the agents responsible for protected areas, often supported by international NGOs, adopt various attitudes and strategies more or less beneficial for the management of protected areas. These attitudes include: a

determination to apply the official standards at the risk of conflict with the other parties concerned; the use of standards to defend particular interests; or the use of the official standards and the agent's position to build social capital to the benefit of his own professional goals (Nguingui, 2004). At the regional level, a recently formed body bringing together representatives of the administrations of several countries, RAPAC, has as its objective to promote the development and good management of protected areas in the region (Box 7.4).

Public or parapublic organizations

In some countries, management of protected areas is entrusted to a public organization with management independence. Such is the case in the DRC, with the ICCN (*Institut congolais pour la conservation de la nature*) and in Equatorial Guinea, with the INAP (*Institut national des aires protégées*). In Gabon, the CNPN (*Conseil national des parcs nationaux*) is a special structure, a coordinating agency that is directly attached to the Presidency and includes all the Ministers immediately or more indirectly concerned with management of national parks. This agency guides policies and strategies, but does not have the means to handle the management of the parks. However, a bill is currently being prepared for the creation of a 'national parks agency'.

In Cameroon, all aspects relating to forest management and silviculture are dealt with by ANAFOR (Agence nationale de développement des forêts), formerly ONADEF (*Office national de développement des forêts*). Among other public or parapublic organizations are the national mapping institutes, SNBG (*Société nationale des bois du Gabon*) which has exclusive rights to market okoume and ozigo, and forest plantations or agro-industrial companies that may have a major impact on forests. In Gabon and Cameroon, some of these bodies have been privatized (Hévégab-Gabon, Hévécam-Cameroon, for example).

Private industrialists

Industrial loggers are also included in this group of 'managers', because of both their primary role logging industrial timber and the increasingly important role they must play in ensuring the survival of the forest ecosystems (Cassagne *et al.*, 2004). The logging sector is one of the motors of the national economies of the countries of Central Africa. The last fifteen years have seen great changes in this sector, with logging activities spreading to even the most remote forests,

the switch of the majority of timber sales from Europe to Asia and the growing numbers of Asian companies moving into the region.

As in many cases (NGOs, rural populations, etc.), this category comprises a wide variety of operators, including companies harvesting timber in the forest, operators involved in its processing and dealers solely concerned with international trade. There are also small domestic companies and firms belonging to large international groups active in other socioeconomic sectors that each have their own objectives and practices more or less in keeping with the principles of sustainable exploitation of forest resources (Bikié *et al.*, 2000; Colomb *et al.*, 2000; Forests Monitor, 2001; Gami & Doumenge, 2001; Christy *et al.*, 2003; Ruiz Perez *et al.*, 2005). Finally, a whole section of forest exploitation is carried out, to various degrees of legality, by small operators working on a non-industrial scale. This is the case in Cameroon with the development of the rattan cane sector or the market for the *Gnetum africanum* plant (sold in neighboring Nigeria). These activities develop in the informal economy without any legal exploitation standards to ensure sustainable management of the resource.

Some of these stakeholders are grouped together in national associations: APMEC (*Associação dos pequenos e médios empresários de Cabinda*, Angola), GFBC (*Groupement de la filière bois au Cameroun*), AEFNA (*Association des exploitants forestiers nationaux du Cameroun*), UNICONGO (Congo), SYNFOGA (*Syndicat des producteurs et industriels du bois du Gabon*), and FEC (*Fédération des entreprises du Congo*, DRC). By joining together, players provide States with valid interlocutors and can also more easily participate in discussions on important aspects related to the management of harvested forests.

In terms of surface area, the major portion of forest concessions and permits are in the hands of large industrial groups of European origin (Danzer, Rougier, Timber, Thanry, Wijma, etc.) or, more recently, Asian origin (Man Fai Tai, Rimbunan Hijau, Taman Industries, etc.). To get established the latter have either created new companies or taken over old companies with European capital (for example Vicwood, a company dominated by Hong Kong Chinese interests bought out the Cameroonian subsidiaries of Thanry, a company with French capital; Forests Monitor, 2001). These large Asian groups, operating in the form of a network, moved into Central Africa in large numbers in the space of just a few years. Whatever the cultural origin of the networks (Asian, Lebanese or Italian), the

performances achieved appear to be the result of speed, mobility of capital, a very flexible structure of non-contractual groups or associations of companies, a vision of logging on a world scale and incorporation in large financial networks extending beyond the forestry sector (Roda & Mabiala, 2005).

Some of these large groups exist through subsidiaries in various countries. They operate at the local level (logging sites), where they are often the only rural development player or are regarded as such by the rural populations, and are formally represented in the capital of the country (since the subsidiaries do not always bear the name of the parent structure). For instance, Thanry has a subsidiary in Gabon - CEB (*Compagnie équatoriale des bois*), simultaneously timber is represented by CIB (*Congolaise industrielle des bois*) in northern Republic of Congo, etc. As the forestry sector is generally one of the largest employers in countries of the region and as a source of significant foreign exchange, all these big groups have considerable socioeconomic weight. They also have national and even international political connections.

Some of these companies are active in international forest forums, particularly through the IFIA, an association bringing together the biggest European forestry companies (Box 7.5). Some of these companies have adopted a code of professional ethics for sustainable management of forest concessions that was developed by the IFIA with the support of CEFDHAC. They are also involved in setting up management plans and more sustainable harvesting plans (as is the case of CEB, Leroy-Gabon or Rougier in Gabon, CIB in northern Republic of Congo, etc.). Other companies have gone further by joining in the forest certification process, but it should be noted that generally the world of industrial logging in Central Africa still lacks transparency and suffers from numerous privileges favoring illegal or 'mining-type' logging.

Private artisans

Within the organized private sectors, we have identified three types of stakeholders who have an important role: backers/sponsors (usually from the urban elite), middlemen and transport operators, and producers. In actual fact, the term 'producers' covers a wide diversity of players: chainsaw owners and other individual timber producers; charcoal makers; hunters (either locals or outsiders); farmers and gatherers of non-timber forest products (NTFP), including plants and animals for medical-magic purposes, etc.

Box 7.5. Interafrican Forest Industries Association (IFIA)

Founded in 1996, IFIA brings together, through various associations, approximately 300 forestry companies operating in Africa. In the Congo Basin, its members are present in Cabinda (Angola; APMEC), Cameroon (GFBC and AEFNA), CAR, the Republic of Congo (UNICONGO), Gabon (SYNFOGA) and DRC (FEC). IFIA is made up of forestry companies belonging to big international groups such as Danzer (IFO in the Republic of Congo; SIFORCO in DRC), Sonae through Isoroy/Plysol (Leroy Gabon), Rougier (SFID in Cameroon, Mokabi in the Republic of Congo and Rougier in Gabon), Thanry International (CEB in Gabon), tt Timber (CIB in the Republic of Congo; GIB in Gabon), Wijma (Wijma Douala in Cameroon), etc., as well as medium-sized companies operating within a single country (Likouala Timber in the Republic of Congo, Panagiotis Marelis in Cameroon, SBL in Gabon, SODEFOR in DRC, etc.).

IFIA's has numerous objectives:

- to make an active contribution to the economic and social development of the host countries by exploiting the forest resource in a sustainable manner
- to support a communication and information network linked to the interests of its members and other professionals
- to represent the industry's interests at the international level
- to promote sustainable exploitation of the forests
- to promote better governance and professional ethics among administrative, industrial and commercial partners
- to be active in the economic and social sectors of countries where its members are established through, for example, the promotion of local industrialization, job creation, staff training, the development of social infrastructures, etc.

To find out more: about IFIA (<http://www.ifiasite.com/index.php?rub=Présentation&langue=fr>), the Danzer Group (<http://www.danzer.de/fr/02/02.html>), the Sonae groups (<http://www.sonae-industria-tafisa.com/fra/index.htm>), Isoroy (<http://www.isoroy.fr/pages/index.htm>) and Plysol (<http://www.plysol.fr/>), the Rougier Group (<http://www.rougier.fr/>), the tt Timber Group (http://www.tt-timber.com/servlet/control/wtk_page/PublicSite@fr/wtk_invoker/PublicSiteMenu/menuid/21105/) and Wijma (<http://www.wijma.com/english/home/index.asp>).

Source: IFIA (2006).

Consulting firms

We will deal more specifically with consulting firms in the section on consultants, even though some of them can be directly involved in management operations at times, more or less replacing state operators if the latter relinquish the task. Such was the case, for example, with the implementation, by Agreco, of the ECOFAC program (Conservation and Rational Utilization of the Forest Ecosystems of Central Africa) in support of protected areas in the region. In another area, the company SGS (*Société générale de surveillance*, of which SGS-Forestry forms a part) is standing in for Cameroonian or Congolese administrations to monitor the timber trade.

Trade unions

Workers are generally affiliated with recognized trade unions in their own countries. Some trade unions such as SYNFOGA in Gabon have already been mentioned above, in the section on the private forest sector. In the DRC, the FEC brings together various socioeconomic sectors, with forestry and timber professionals representing only a part.

Non-governmental organizations (NGOs)

NGOs also fall more specifically within the group of support-advice players. However, some of them, national or international NGOs with field projects, can be directly involved in management actions (for example WWF - Worldwide Fund for Nature or WCS - the Wildlife Conservation Society). NGOs may serve to make up for certain deficiencies in State services. Some national organizations directly involved in conservation and sustainable local exploitation of forests have gathered together within a network going beyond the confines of the Congo Basin, the RAAF (*Réseau africain d'action forestière*; CEFDHAC, 2006). At present, NGOs like WCS are intervening effectively in Gabon, the Republic of Congo and DRC in the management of protected areas and the development of ecotourism. With their external financing, these NGOs play a part in strengthening local skills by training young cadres in the conservation of natural resources.

Local Populations

In this category we place a particular emphasis on forest populations, be they Bantus or Pygmies. These rural populations live in the forests and are entirely, or at least largely, dependent on forest resources for their survival. This is not the case with the administrations, a number of private forestry operators or politico-administrative officials holding forest permits as insurance for their retirement or the loss of their job. Harvesting forest products or clearing the forest for agriculture provide forest populations with an income enabling them to meet their daily needs (food, health, education, habitat, rituals, etc.).

Among the Bantus, special mention must be made of the phenomenon of 'elites', because even though they may live a long way from the forests they retain considerable power over local decisions about the forests. The elite may be a son of the village who has become a member of parliament, Minister or major State administrator at

the national level. At the local (village) level, the elite may be the village schoolteacher, nurse, etc. The village or provincial elites act as links between the population and the 'grande élite' living in the city. Generally, no important decision involving the village may be taken without the opinion of the elites living in the city.

The rural populations are considered here from the angle of local users of natural resources: village communities using their land for subsistence or commercial purposes and outsiders. The latter subset is involved in profit-making exploitation with a structured organization in networks: bushmeat in all countries; rattan in Cameroon and Gabon; *Gnetum* or Koko in CAR, etc. These are examples of the city-forest interface.

Although still in its early stages, forest management is now moving towards greater involvement of the local populations (management in partnership). This involvement usually takes place in one of two ways: the initiative can come from the population or the administration. In this context, the role of the elites must not be forgotten or minimized. The Lossi Gorilla Sanctuary in the Republic of Congo is one such an example, while additional examples exist in Cameroon.

The processes of management relocation, or management in partnership, encourage populations to structure themselves into organized groups which can be made officially responsible for the management of resources. These groups can contribute towards the regulation of land use for subsistence and commercial exploitation purposes and the establishment of controls on outside populations involved in commercial exploitation (hunting, gathering, agriculture). However, kinship relations (clan, lineage) and marriage alliances can make collective decisions approved by the administration difficult to apply because of the cultural obligations of acceptance and sharing that come with these alliances.

The creation of community or communal forests, as provided for in Cameroon, is inevitably complicated by this phenomenon. This is even more true when the associative culture to which governmental processes turn (sometimes through NGOs), to enable the appointment of representatives of the community and limit membership of this community to people physically present on the territory in question at a given moment, do not form part of the traditional culture of forest peoples. Setting controls on the use of resources in a given territory must therefore involve the identification of, and organizational support to, interest groups (hunters, gatherers, gold-panners, farmers, etc.).

Other examples of attempts to give official status to the collective regulation of land management come from the Congo and are within the context creating and managing protected areas. The *Association des enfants des terres de Lossi* (AETL), for example, was at the center of the creation of the first community-initiated protected area on the basis of customary law - the Lossi Gorilla Sanctuary. These examples remain tenuous because local players remain susceptible to the influence of elites, politicians and/or private operators.

Interesting case studies involving the inclusion of indigenous communities in the management of natural resources and the defense of their rights come from southwest Cameroon. In Cameroon, local NGOs CED (*Centre pour l'environnement et le développement*) and PS (Planet Survey), backed by an international NGO FPP (Forest People Project), were able to help Bagyeli Pygmies obtain citizenship, land and participation in meetings of the multi-partner platform set up for their promotion. Over the last few years, some minority groups, traditionally with little presence in regional debates, have set up regional networks enabling them to prepare common positions, make their voices heard and act in a more coordinated manner: the *Réseau des femmes africaines pour le développement durable* (REFADD) (Box 7.6) and the *Réseau des populations autochtones et locales pour la gestion durable des écosystèmes forestiers d'Afrique centrale* (REPALEAC), set up within the framework of CEFDHAC.

Consultancies

Consultants have important technical, scientific and practical knowledge on conservation and the sustainable exploitation of forests within a changing world context. They play a key role in the definition of laws and regulations, in support of the political stakeholders, and in the implementation of these texts, in support of managers. Dialogue and the construction of common frameworks should drive the support provided by these actors.

Public organizations

Some international organizations, particularly within the United Nations system, play an important role in international debates on forests and are also involved at the national level in defining forest policies and strategies. Examples are the FAO (Forestry Department of the United Nations Food and Agriculture Organization)

and the UNDP (United Nations Development Programme), along with the WCMC (World Conservation Monitoring Center).

The world secretariats and national representatives of some international conventions also play a 'watchdog' role, but may also play a role in providing technical and financial support for the fulfillment of the commitments entered into by the various States. Apart from the Convention

on Biological Diversity (CBD), the Convention on Climate Change, the Convention to Combat Desertification and the International Convention on Trade in Endangered Species (CITES), this is particularly true in the cases of the Ramsar Convention and the World Heritage Convention. The secretariats of the latter two Conventions are housed in the IUCN and UNESCO (United Nations Organization for Education, Science and Culture); the IUCN provides scientific and technical support to both of them. CITES is advised by the IUCN and all the associated specialist groups (African elephant, primates, etc.) and is widely supported by an international trade monitoring network (Traffic) that was created on the initiative of IUCN and WWF (Worldwide Fund for Nature).

At the national level, the technical departments of the Ministries responsible for applying the legal texts and managing forests also play an assistance/advisory role among political stakeholders in the preparation of these same texts. With some recent developments, particularly those associated with making local communities responsible for forest management, these departments tend to move away from a managerial role towards one of technical assistance/advice, monitoring and evaluation and disciplinary measures.

The semi-public organizations include, for example GTZ (*Deutsche Gesellschaft für Technische Zusammenarbeit*), a company created by the German government to help apply the country's cooperation policy. As such, GTZ is more of a support organization than a funding agency.

Private companies and consulting firms

The main role of these groups is to support local stakeholders and train them in the sustainable management of resources. Unfortunately, they often carry out the work for which they are contracted themselves without providing sufficient training for the development of local skills and transferring their activities to nationals. This is a problem that must be resolved if Central Africans are to assume for themselves the sustainable management of their countries' resources.

These players generally have international headquarters well away from the region (Europe and Canada, in particular), but occasionally set up regional representations or subsidiaries. This is the case with ONF International (*Office national des forêts*), which teamed with Luso Consult (Sylvafrica, with headquarters in Libreville, Gabon) to create a subsidiary in central Africa aimed at logging companies and the implemen-

Box 7.6. REFADD (*Réseau des femmes africaines pour le développement durable*)

Created in June 1998 in Bata, Equatorial Guinea, on the occasion of the second CEFDHAC, REFADD is a network of primarily women's NGOs working in the field of sustainable management of natural resources. The REFADD member countries are: Burundi, Cameroon, CAR, the Republic of Congo, Gabon, Equatorial Guinea, DRC and Rwanda.

REFADD has set itself the task of 'promoting the effective participation of African women in sustainable development through their involvement in programs for the sustainable management of natural resources and biodiversity conservation in Central Africa'.

REFADD has outlined the specific objectives of the network:

- to identify strategies that favor the participation of NGOs (mostly women's) in the formulation, implementation and monitoring of national and regional sustainable development programs
- to make humanity aware of the determinant role that women can play in the sustainable management of natural resources
- to promote the strengthening of the capacities of NGOs through training and information with a view to the participation of local populations in general, and women in particular, in the decision-making process on questions connected with sustainable development
- to improve communications, dialogue and synergies among NGOs and the players involved in the sustainable management of natural resources in Central Africa
- to reconcile conservation needs with development through the promotion of alternative activities and the strengthening of the capacities of the members (financial, technical and institutional support)
- to develop strategies to seek sustainable financing
- to share the lessons learned at national, sub regional, regional and international levels

Representatives of the network regularly participate in regional and international processes related to the environment and forests. The network has set up various micro-projects to combat poverty and to promote biodiversity conservation: optimum use of non-timber forest products (Cameroon), mushroom growing (Burundi), breeding of greater cane rats (Cameroon), conservation of the Mukura forest reserve (Rwanda), obtaining micro-credits for women (Republic of Congo), training of peasants in agroforestry (Bas-Congo, DRC), fauna management and action to combat illegal logging in forest concessions (various countries).

Sources: REFADD (2006) and CEFDHAC (2006).

tation of their management plans. For similar purposes, we also find consulting firms working essentially from their base (FRM – Forêts, Ressources, Management in France, for example) or, on the contrary, installed in the region (Terea, in Gabon, for instance).

In the environment sector, consulting firms sometimes form partnerships with other institutions, notably semi-public organizations or NGOs. These temporary associations or partnerships are common within the implementation framework of large scale, integrated projects that require diverse expertise and significant financial resources.

Non-governmental organizations

There are several international NGOs working in Central Africa. They have their headquarters in the major industrialized countries of Europe or America. Even though the link between conservation and local development is increasingly integrated in the policies and projects of these organizations, the entry point for their actions is either biodiversity conservation (CI, IUCN, WCS, WRI, WWF, etc.) or the protection and promotion of the development of forest populations (RAN – Rainforest Action Network, Survival International, FPP - Forest People Program, etc.).

Development or humanitarian NGOs have also been working for many years in Central Africa, where they support the populations, small NGOs and local associations. Some of the numerous NGOs present or active in the region that are more or less directly concerned with forest and the environment include: *Association française des volontaires du progrès* (AFVP), *Amis de la terre*, CARE-Congo in DRC, SNV (*Stichting Nederlandse Vrijwilligers*), etc.

The extreme variability of these organizations, in institutional terms (organizations of volunteers, professional NGOs, denominational associations, etc.), in terms of objectives (humanitarian, support for local development, support for the development of human skills, etc.) and in terms of activities merits a more detailed analysis than is possible to conduct within this report (Redford *et al.*, 2003; Olivier, 2004). Some of the big international NGOs have regional or national representations (IUCN-BRAC, WCS, WWF-CARPO, etc.), while others only assign personnel to field projects or work in the form of field missions.

To complicate this landscape even further, some NGOs are not individual entities but rather loose collections whose various parts can

act in the region either in a coordinated manner or otherwise. Such is the case for the ‘nebulous’ World Wide Fund for Nature, with WWF-US, WWF-Belgique, WWF-Netherlands and WWF-International, all working directly or supporting projects in the region. The IUCN is also a unique case because it is both a non-governmental organization and a governmental organization, which has some of the States in the region as members. It is also the reference international organization for everything concerning protected areas and endangered species. Its activities are coordinated in Central Africa by the *Bureau régional de l’Afrique centrale* (BRAC), based in Yaoundé.

These large organizations are present from the level of world or regional political debates right through to the management of conservation-development projects in the field (WWF Minkébé project in Gabon; WWF Campo Ma’an project in Cameroon, for example).

At times, some of these NGOs may team up for varying periods of time in order to implement common projects, sometimes in a partnership with other institutional players. Such is the case with WWF and the IUCN, which have collaborated to set up the Traffic network in support of CITES and the monitoring of international trade in biodiversity, including that of timber. Likewise, several large NGOs (AWF, CARE, CI, WCS, WRI, WWF, etc.) have joined forces with American federal agencies (USFWS, USDA-FS, etc.) for implementation of the CARPE program; CARPE is the financing channel for the US government under the CBFP.

Another rather hybrid actor that should be mentioned is the International Technical Timber Association (ATIBT), which is concerned with the development and sustainability of the tropical timber sector. It supports the private logging sector and plays a role in offering advice or transferring information to private players. ATIBT brings together stakeholders from various international organizations, research institutions, training institutions and the private sector.

While national development NGOs have been present in some countries for several decades (Cameroon and DRC in particular), national environmental NGOs have only developed since the Rio Conference in 1992. Without going into all these NGOs in detail, it should be noted that most of them do not really operate as NGOs because they do not have the necessary financial means (subscriptions too low or not collected). However, in recent years some national or local NGOs have established growing reputations for their commitment and conscientiousness. In some countries

they are becoming credible and active partners, either in political debates or in the field.

Most of the national or local NGOs that are genuinely committed to conservation and sustainable development are supported by international NGOs or regional projects. In such cases, they are required to apply the policies of these large NGOs that provide the funds. They are often NGOs concerned with environmental education and public awareness (*Les Amis du Pangolin in Gabon; l'Alliance nationale pour la nature* (ANN) in the Republic of Congo; Planet Survey and the CED in Cameroon), but may also be involved in ecotourism and monitoring turtles (ASF – *Aventure sans frontières*, in Gabon). These NGOs sometimes carry out activities in the field, but can also play a technical assistance/advisory role. Some local NGOs have made it their specialty to support self-help organizations at the grassroots level (PIL – *Promotion des initiatives locales*, Kivu, DRC; Planet Survey – Project Promo Bagveli within the Department of the Ocean in southeast Cameroon) or to promote the transfer of information and education (BEST – *Bureau d'études scientifiques et techniques*, Kivu, DRC).

Networks

We have already presented a few networks: REPAR, RAPAC and REFADD, but it is worthwhile returning to this concept, given the strong interest in this flexible institutional form which enables the stakeholders in each country to be brought together and regional synergies to be developed among the groups of stakeholders concerned (CEFDHAC, 2006).

Apart from the networks that have already been mentioned, it is worth mentioning the Tropical Trees Network (supported by the Silva association), which has set up national groups in various countries in the region. Its objective is the exchange and dissemination of practical information on the use and management of natural resources in dry and humid tropical areas, mainly in Africa. The collaborative management network, created by an IUCN-GTZ project, aims to link up people working on projects implementing collaborative management initiatives in protected areas in Central Africa. This network has led to the establishment of an additional platform by linking up the teachers in forestry schools in the region.

Research Institutions

Research institutions are financially dependent on a main funding agency, public body, NGO or private entity. This dependence weighs heavily on the type of research carried out and also on the efficiency of the institutions. The public institutions of Central Africa are generally inefficient, although this is less true in Cameroon than in the other countries. They often lack financial and human resources and are largely dependent on external financing and cooperation. To help resolve this problem, the FORINFO project, financed by France, aims to obtain financing for research and training scholarships and supports the research networks in the region.

A summary of the main national public research institutions is given in Table 7.1. The research carried out at these centers and/or institutes is basic or applied research, although primarily the latter. In addition to these institutions, some Ministries also have their own research units, as is the case with the CNRF (*Centre national de la recherche forestière*) in the Republic of Congo. Some institutions have research stations in the field (Ipassa-Makokou, an IRET station in Gabon (Figure 7.3); Lwiro and Irangi, CRSN stations in Kivu, DRC) or manage permanent experimentation sites (Mbaïki, Boukouko, La Lolé in CAR, Oyan in Gabon, Ngoua 2 in the Republic of Congo, etc.).

At the international level, the specialist research center run by CGIAR (Consultative Group on International Agricultural Research), CIFOR (Center for International Forestry Research), is active in the Basin with a regional office in Yaoundé, Cameroon. This body carries out forest research within a multidisciplinary framework and in partnership with local institutions. The other CGIAR centers that should be mentioned here are: the World Agroforestry Center (ICRAF), the International Plant Genetic Resources Institute (IPGRI) and the International Institute of Tropical Agriculture (IITA).

Apart from these international centers, additional public research centers and institutes have a mission to work in and collaborate with tropical countries. Such is the case with CIRAD (*Centre international de recherche agronomique pour le développement*), IRD (*Institut de recherche pour le développement*), MNHN (*Muséum national d'histoire naturelle*) in France, Kew Gardens (Great Britain) and centers in Belgium and Missouri (United States), etc. Certain Western universities also work in collaboration with the countries of the region (University of Montpellier

or Bordeaux in France, for example). Some of these institutions have regional or national representations (CIRAD, IRD, etc.), while others collaborate with the national institutions via research field trips of different durations, joint supervision of thesis writers, etc.

Various networks of researchers and research institutions have been set up in recent years: CORAF-forest, FORNESSA (Network for forest research in Sub-Saharan Africa) and AFORNET, for example. The development of forest research in Sub-Saharan Africa is also supported by the Special Program for the Developing Countries of IUFRO, the International Union of Forest Research Organizations (IUFRO-SPDC), and through a network of European researchers, the ETFRN (European Tropical Forest Research Network), which includes people working in Europe and from the African continent on matters relating to tropical forests.

Training

Teachers and instructors play a fundamental role in training younger generations to meet current and future needs in human skills. The main players in this field are the institutions in the public sector: the universities and forestry and environmental colleges at national or regional levels (Table 7.2). Most universities have departments dedicated to forest or agro-forestry sciences. The only really regional institution is the *Ecole régionale post-universitaire en aménagement intégré des forêts tropicales* (ERAIFT), based in Kinshasa

Table 7.1: Public research institutions in Central Africa.

Country	Institutions and centers for forest research
Cameroon	IRAD (Institute of Agricultural Research for Development)
	IRMPM (<i>Institut de recherches médicales et d'étude des plantes médicinales</i>)
	IRGM (<i>Institut de recherche géologique et minière</i>)
Republic of Congo Public research is carried out in 15 research establishments, of which 10 are under the supervision of the <i>Délégation Générale à la recherche scientifique et technologique</i> (DGRST)	CRFL (<i>Centre de recherche forestière du littoral</i>)
	CRFO (<i>Centre de recherche forestière d'Ouessou</i>)
	CRHM (<i>Centre de recherche hydrobiologique de Mossaka</i>)
	GERDIB (<i>Groupe d'étude et de recherche sur la diversité biologique</i>)
	STARDI (<i>Station de recherche biologique et forestière de Dimonika</i>)
	CERVE (<i>Centre d'étude sur les ressources végétales</i>)
	CRAL (<i>Centre de recherche agronomique de Loudima</i>)
	CERGECE (<i>Centre de recherche géographique et de production cartographique</i>)
	CRESSH (<i>Centre d'étude et de recherche en sciences sociales et humaines</i>)
	CRCRT (<i>Centre de recherche sur la conservation et la restauration des terres</i>)
Gabon Research is under the supervision of the Ministry of Higher Education, Research and Technological Innovation. Research is coordinated by the <i>Centre national de recherche scientifique et technologique</i> (CENAREST), which groups together the five aforementioned centers.	IRAF (<i>Institut de recherche agronomique et forestière</i>)
	IPHAMETRA (<i>Institut de pharmacopée et médecine traditionnelle</i>)
	IRET (<i>Institut de recherche en écologie tropicale</i>)
	IRSH (<i>Institut de recherche en sciences sociales</i>)
	IRT (<i>Institut de recherche technologique</i>)
DRC INERA has officially been given a mandate to coordinate all applied agronomic research, including forest research, for which it does not have any resources. Among the research centers, CRSN-Lwiro is the one with the best forest research facilities. Apart from the main universities, there are also services or establishments that carry out some forest research as a supplement to their main mission.	INERA (<i>Institut national pour l'étude et la recherche agronomique</i>)
	CRSN-Lwiro (<i>Centre de recherche en sciences naturelles de Lwiro</i>)
	CREM-Mabali (<i>Centre de recherche en écologie et foresterie de Mabali</i>)
	University of Kinshasa
	University of Kisangani
	ICCN (<i>Institut congolais de conservation de la nature</i>)

Source: Doumenge et al. (2001).



Figure 7.3. The IRET station at Makokou (Gabon).

(DRC), which trains higher education students in the fields of the environment and the management of natural resources. Others, such as the *Ecole de Faune de Garoua* or CRESA Forêt-Bois in Cameroon (*Centre régional d'enseignement spécialisé en agriculture – Forêt-Bois*), are nationally managed even though they take in and train students from other countries.

Several of these institutions got together a few years ago to form a regional network, RIFFEAC, which facilitates exchanges and inter-institutional cooperation. Several institutions are directly supported by projects financed through international funding agencies (support project for ENEF-Cap Estérias and ERAIFT, financed by the European Union).

Technical and practical training is also provided by other operators in the private sector or civil society. The ECOFAC program, also funded by the EU, has set up a training center in Cameroon for managers of protected areas. This center has a regional vocation. NGOs such as WCS train and participate in the training of field technicians and personnel (field botanists, guards for protected areas, for example). As for the national NGOs, they tend to concentrate on environmental education programs and/or training in the field of rural development, as opposed to the forest sector.

While private companies may be concerned with research, they have generally invested little, if anything, in the region. Forest research is financed and even directly guided by NGOs such as WCS, an American NGO specializing in scientific research to support the conservation of biodiversity.

Funding agencies, financial institutions, and private funders

Although they do not always have the appropriate technical abilities, funding agencies and other financial institutions play a key role in the orientation of forest management. This is particularly true in the case of large financial institutions such as the World Bank or the IMF (International Monetary Fund).

Multilateral funding agencies

These funding agencies intervene within the framework of multilateral cooperation. Several are linked to the United Nations system. A non-exhaustive list includes: the World Bank, IMF, ADB, FAO, UNDP, UNESCO, the European Union, etc. While some of these agencies manage their own funds ('primary' funding agencies), others have limited resources and thus channel funds from elsewhere ('secondary' funding agencies). This is the case with FAO and ITTO (International Tropical Timber Organization). Other sources of financing exist through the establishment of international funds, in particular the Global Environment Facility (GEF), administered by the World Bank, UNDP and UNEP.

Bilateral and national funding agencies

Within the context of bilateral cooperation in the forest sector, the following agencies should be mentioned: the European Union, which has financed, and continues to finance, numerous actions such as the ECOFAC program; *Ministère français des affaires étrangères* (MAE), *Agence française de développement* (AFD) and PROPARGO, France; the United States Agency for International Development (USAID), which is currently contributing to the CBFP via CARPE; Department For International Development (DFID), United Kingdom; Canadian International Development Agency (ACDI); DANIDA, Denmark; etc.

Funding is primarily in the form of grants, although certain bodies can make loans, either to States or to the private sector (for example the AFD and PROPARGO). Other funding mechanisms exist, involving bilateral funding agencies in particular, but they remain little, or not at all, used (debt-for-nature swaps, Trust Funds, etc.). It should also be noted that France has set up the *Fonds français pour l'environnement mondial* (FFEM), which provides support in the form of grants for activities involving conservation or

the sustainable exploitation of biodiversity and is complementary to the activities of the above-mentioned GEF.

In this region, the Ministries in charge of forests are key Ministries for the development of these countries. These Ministries are of strategic importance because they generate and manage their own funds generated by the exploitation of forest products, essentially timber. The Republic of Congo has set up a forest fund that reinvests the taxes collected into the Ministry's operations, specifically into facilities and bonuses for forest managers. While funding for forest management is fairly substantial, this is not the case for the conservation (management of protected areas), research, and training sectors, despite the fact that these sectors are important to the futures of these countries.

Private funders

Within this category are the large logging groups and oil or pharmaceutical companies who have financed – or potentially could finance – research or training activities in support of their own activities or for the development of external projects. In southern Republic of Congo, for example, the oil companies BP (British Petroleum) and Chevron have financed a number of studies which have allowed a conservation-development project to be set up in the Conkouati Reserve (studies financed by the oil companies, project financed by the GEF). In Gabon, Shell has financed the macro-propagation of cuttings to rehabilitate sites degraded by oil exploration and exploitation, as well as biodiversity inventories in the Gamba complex of protected areas.

Table 7.2. Training in the forest sector in Central Africa.

Country	Training institutions
Region	ERAIFT (<i>Ecole régionale post-universitaire en aménagement intégré des forêts tropicales</i>)
Cameroon	University of Dschang and CRESA-Forêt-Bois (<i>Centre régional d'enseignement spécialisé en agriculture – Forêt-Bois</i>)
	University of Yaoundé I
	University of Douala (Faculty of Sciences)
	University of Ngaoundéré
	<i>Ecole de faune de Garoua</i>
	ENEF-Mbalmayo (<i>Ecole nationale des eaux et forêts de Mbalmayo</i>)
Central African Republic	ISDR (<i>Institut supérieur de développement rural</i>)
Republic of Congo	Marien Nguabi University: - Faculty of Sciences, - Faculty of Arts and Social Studies (Geography Department), - <i>Institut de développement rural</i> (IDR), mainly the department of forestry techniques.
	<i>École normale supérieure</i> (ENS)
	ENEF-Mossendjo (<i>Ecole nationale des eaux et forêts de Mossendjo</i>)
Gabon	Omar Bongo University: - Geography Department, - <i>Laboratoire universitaire des traditions orales</i> (LUTO).
	USTM (<i>Université des sciences et techniques de Masuku</i>)
	ENEF-Cap Estérias (<i>Ecole nationale des eaux et forêts du Cap Estérias</i>)
DRC	University of Kinshasa: - Faculty of Science, - Faculty of Agronomic Sciences, - Faculty of Social Sciences, - Faculty of Pharmacy.
	University of Kisangani: - Faculty of Science, - Faculty of Agronomic Sciences, - Faculty of Social Sciences, - <i>Centre universitaire de Bukavu</i> .
	IFA (<i>Institut facultaire d'agronomie</i>)

Conclusion

This chapter reviews the diversity of the stakeholders in the forest sector of the Congo Basin and highlights the pre-eminent role of state institutions in decision-making and forest management.

This diversity has an influence on management issues because the stakeholders' interests are often divergent. Given this situation, emphasis should be placed on the important role played by COMIFAC to ensure that the interests of the different players converge towards responsible and sustainable management of the natural resources of Central Africa. Some of the players, such as Greenpeace, Forest People Program and Rainforest, intervene to remind others of the importance of taking into consideration indigenous peoples in their natural resource management policies.

While the private industrial sector is increasingly emerging as a legal or de facto manager of forests under concession, the involvement of national NGOs and rural populations remains minimal. The main reasons for this reality are their low degree of organization (even though this is improving); their weak influence and low capacity (for example, to counterbalance the influence of the private industrial sector or certain international NGOs); and continuing poor skills (although these are emerging). Relationships of power and influence among all these players are complex and do not always lead to the sustainable management of resources. The private sector generally gives priority to economic profitability rather than the sustainable management of the resource. This trend is being minimized at present, thanks to the support of certain international NGOs which are putting pressure on governments.

One of the key elements necessary to allow the region's populations to take their development into their own hands is the training of young experts in forestry and the environment. This must be made a priority if sustainable management of the forests of the Congo Basin is to be guaranteed for present and future generations. In particular, it is necessary to strengthen RIFFEAC by updating the programs in colleges, encouraging exchanges of experiences among teachers/researchers in forestry colleges or universities and promoting closer relations between scientists, trainers and the labor market.

Certain difficulties associated with communications among stakeholders and the identification of appropriate partners when setting up projects, along with the often skewed distribution of infor-

mation among certain actors (concerning the sustainable management of forests and mutual awareness of stakeholders), could be partly resolved by the creation of a database on the players in the forest sector. This database should include profiles of institutions and a notation of appropriate contacts. It should be accessible via the Internet and should also provide links to the websites of the institutions in question.

As indicated at the beginning of this chapter, it was not our intention to develop an exhaustive analysis of the stakeholders in the forest sector, of their roles, interests or activities and of how they work. This needs to be done in the future, but such an analysis will require a more complete set of information than is currently available. The creation of a database, as suggested, would allow an exhaustive review of the stakeholders in the forest sector of the Congo Basin to be carried out on a regular basis. This '**observatory of institutions**' would make it possible to follow the development of the activities of a particular institution or, more generally, to follow the changes in the roles played by the various categories of stakeholders in management of the forests. This would also allow some institutions, both national and international (Ministries in charge of forests, ATO, national NGOs, etc.), to become more familiar with each other and provide greater clarity of the regional institutional landscape.

This type of observatory could also be designed to serve as an '**observatory of skills**', addressing the following questions: who does what and in which domain within the countries of the Congo Basin? The work started in 2002 by the FORAFRI project and ADIE to create a database of individual skills in forestry and environmental research in the region could be used as a basis for this latter aspect of database development.

8. A Comparison of Forestry Legislation and Regulations in the Six Forest Countries of Central Africa¹

Land status

In all the countries of the subregion, forests are governed by what is known as the '*régime de domanialité*' (literally the 'domanial regime') which essentially means State ownership of the forests. Several countries make a clear distinction between the 'public domain' and the 'private domain', with some countries having a specific category entitled the 'national domain', which generally corresponds to a category defined by default.

The domanial regime and ownership

The 'public domain' is generally distinguished from the 'private domain' by the fact that the goods in the public domain are for everyone's use, like roads or airports, whereas those in the private domain are owned by a public entity (State, community, etc.); consequently, the forests owned by public entities, such as the State, generally form part of the private domain of these entities, even though some legislators class them as being in the 'public domain' (see DRC). The other distinguishing criterion stems from the nature of the law applicable to property: administrative law for the public domain, common, or private law for the private domain.

In certain cases in Africa (Cameroon) there exists a third category: the **national domain**. The national domain is a collective asset held by the

State, for which private appropriation is possible under certain conditions. However in Cameroon, the creation of a national domain was seen as an exercise in nationalization of land hitherto held according to customary law. The privilege of redistribution of land in the national domain, which is conferred upon the State explicitly or implicitly (as in Cameroon), partly justifies this perception. Jurists agree that it is difficult to talk about State ownership of land in the national domain. The texts use ambiguous expressions within an administrative vocabulary, such as State 'control' over this land.

Legal frameworks for the distribution of forested land

Cameroon

The legal framework for the classification of land in Cameroon (Table 8.1) uses the distinction 'permanent domain versus non-permanent domain', which is the equivalent of the categories 'classified domain' and 'protected domain' used in other African countries. It is recognized that the local authorities have the possibility of including forests among their private assets. The legislator has chosen to place community forests in the national domain, in other words in the category of non-permanent forests. Private forestry is possible. As noted by M. Kamto (2001), '*it is possible legally to acquire ownership of a part of the national*

¹ This chapter was written by A. Karsenty.

Table 8.1. Legal framework of land tenure in Cameroon.

Purpose of land – as defined by the overall land-use planning objectives	PERMANENT FOREST DOMAIN (forests classified or awaiting classification)		NON-PERMANENT FORESTS (referred to as 'agro forestry band' in the zoning plan)	
	DOMANIAL FORESTS	COMMUNAL FORESTS	COMMUNITY FORESTS	OTHER FORESTS
Administrative designation				
Legal status	(State-owned, private domain)	(private domain of the municipality)	(Part of the national domain)	(national domain, privately owned forests)
Allocation	production forests, protected forests, etc.	production forests, protected forests, etc.	Defined by a management agreement for a period of 15 years between the village and the forestry department	Areas assigned for use (private forests) or awaiting assignment (registration for the benefit of individuals or communities)

domain in the first category by planting forests: a person having developed a portion of the national domain in the form of a forest plantation may become the owner if he obtains a permanent concession on this portion. However it should be noted that Article 15 of Order 74-1 establishing the land tenure system constitutes an obstacle to direct access to ownership of forests in the national domain by persons and legal entities under private law (forestry companies, for example), in so far as these forests form part of the second category the national domain, i.e. 'land free of all effective occupancy'. These persons can only be concessionaries thereof'.

Republic of Congo

A particular conception of the public domain can be clearly seen in the system adopted by the Republic of Congo (Table 8.2). In the legal tradition inspired by French law, the public domain cannot be transferred, as opposed to in the private domain, but private plantations may be established as a result of actions carried out in areas belonging in the public domain. This is equivalent to relinquishing it to a private person, since even unplanted trees become the property of the operator². In Cameroon, the legislator has provided for a specific category (the national domain) to overcome this difficulty. In the absence of this legal facility, the Congolese legislator admits that at least part of the forest resources in the public domain can be relinquished and lead to the establishment of private plantations.

Within the context of the subregion, two Articles (36 and 37) are particularly interesting

and innovative: the planter acquires exclusive, transmissible use of land (under *jus tertii*), but not ownership of the land. This right ceases if the land is abandoned or cleared. Here we have a provision that potentially creates a framework for encouraging private/farmer plantations.

Gabon

In Gabon dissimilarity with the Cameroonian Code concerns classified forests ('forêts classées'): since Act 1/82 of 22 July 2002, the so-called Waters and Forests Orientation Act, classification has been used for preservation purposes and not, as was the case previously, production (Table 8.3). Furthermore, classification brings them into the State-owned public domain (and not the private domain, as was the case until then). It is the protected 'domanial' forests, containing production areas, which constitute the State-owned private domain.

With Act 016/01, the distinction between private domain/public domains is no longer mentioned. Article 13 merely states that 'any forest forms part of the national domain and is the exclusive property of the State'.

These provisions raise the following issues:


- The affirmation of the State's 'exclusive' ownership of all forests, natural or artificial (the text does not make any distinction in this respect), leaves no place for the development of **private forestry**, which could be suitable for the development of forest plantations by individuals, companies or even communities.
- The code refers to implementation texts de-

² Art. 36: Any person, of Congolese or foreign nationality, or legal entity under Congolese law that plants forest trees on land within the non-permanent forest domain acquires exclusive use of the planted land and ownership of the trees thereon, subject to:

- *jus tertii*,
- the number of trees planted exceeding that of trees not resulting from planting,
- the limits of the planted land being clearly established.

Art. 37: The rights acquired through application of the provisions of Article 36 above are transmissible, in accordance with the law. They cease with clearing of the land, abandonment or perishing of the stand (...)

Table 8.2. Legal framework of land tenure in the Republic of Congo.

National Forest Domain					
State-owned Forest Domain (*)				Forest domain of private persons	
Permanent forest Domain			Non-Permanent Forest Domain (public domain, unclassified protected forests)	Private Plantations	Private forests
Private domain of the State (must be classified)	Private domain of local or territorial authorities (classification, plantation or transfer)	Private domain of public entities	Public domain	<div style="text-align: center;">  (... which can come from the public domain) </div>	

(*) 'Falling within the competence of the State', Art. 4. The legislator carefully avoids talking about State ownership, i.e. he has a conception of domaniality closer to the idea of the collective heritage of the Congolese and consistent with the idea that individuals may create property rights through certain forms of development (here planting).

fining the conditions for the registration of production forests (texts which, as far as we know, have not yet been drafted). Presumably it is only after this registration that forestry concessions will acquire a firm legal status and the State-owned private domain will be legally established over the forest areas concerned (unless under Gabonese land tenure law brings the private domain under the registration system, as was the case during the colonial period).

- This institutional framework does not take account the possibility of public institutions other than the State being able to have exclusive ownership of a private domain, particularly rural **local authorities** which could be called upon to manage forests in their immediate surroundings.

Democratic Republic of Congo

DRC has adopted a distinction between classified forests and protected forests, with the former corresponding to the objectives of conservation and not logging (Table 8.4).

Based on the land tenure law, which derives from land concessions, the forestry law has adopted the forestry concession as an exclusive means of access to forest resources. It will no doubt be necessary to define several categories of concessions depending on whether they are granted within the future permanent forest domain or outside of it, and whether, in each case, the appropriate management instrument is defined (management plan for concessions in the permanent forest domain, simple management plan³ for community forests and concessions granted in the non-permanent domain).

Central African Republic

CAR has not defined sufficient categories to establish a meaningful legal framework. The fundamental distinction is that between a State-owned forest domain and a community or privately owned domain. The State-owned domain must be established through classification. Plantations created by private individuals on land belonging to them, in accordance with the regulations, become their property. However, subsequent clearing of the land is only possible with the authorization of the administration. According to the code (Art. 53): 'A forest belongs to a territorial community when it is the subject of a classification decree on behalf of this community or when it has been reforested and managed by the latter'.

As in DRC, the definition of forests is very wide (Art. 2: 'all areas covered by vegetation for-

Table 8.3. Legal framework of land tenure in Gabon.

Purpose of land – as defined by the overall land-use planning objectives	PERMANENT FOREST DOMAIN		RURAL FOREST DOMAIN	
	Administrative designation	CLASSIFIED DOMANIAL FORESTS	REGISTERED DOMANIAL PRODUCTION FORESTS	FUTURE COMMUNITY FORESTS
Legal status (according to Act 1/82)	Public domain	State-owned private domain	State-owned private domain	State-owned private domain
Allocation	Protection forest Recreational forest Reforestation zones Production forests, sensitive or adjacent to the rural forest domain	Production forest Including forests conceded as CFAD or PFA	Production (through the community forest regime)	Freely negotiated permit for clear felling Areas awaiting assignment or conversion

mations are called forests'). This implies that the forest regime is applied to a very extensive area.

Equatorial Guinea

The legal framework is outlined in Table 8.5.

Overall summary

Forests are largely public property in Central Africa. Several laws allow the establishment of private forests, generally through planting, except in DRC where natural forests situated on land concessions are recognized as the property of the land concessionaries. In practice, private forestry is virtually non-existent. Four countries (Cameroon, Equatorial Guinea, Gabon and DRC) have adopted legal provisions permitting community forestry, with community forests established in Cameroon and Equatorial Guinea. But only Cameroon has provided for the possibility of the local authorities (here, the municipalities) having a private forest domain. Finally, the real legal status is not always in step with the legislators' intentions: the establishment of a permanent forest domain involves the effective classification of forests or an equivalent formal legal

³ These simple management plans would be based on a few fundamental rules such as the minimum felling diameter according to species.

Table 8.4. Legal framework of land tenure in the DRC.

Ecological definition	FORESTS		
Use	Conservation (target 15% of national territory)	Permanent and non-permanent exploitation	Permanent exploitation
Domanial status	PUBLIC DOMAIN	STATE-OWNED PRIVATE DOMAIN	STATE-OWNED PRIVATE DOMAIN
Legal classification	CLASSIFIED FORESTS	PROTECTED FORESTS	PERMANENT PRODUCTION FORESTS
Type of exploitation	Limited to research activities	Traditional (by virtue of rights of use) Community forestry concessions	Forestry concessions
Main management instrument	Management plan	Management plan for forestry concessions	Management plan for forestry concessions
Responsibility for management	State	Operator	Operator Community under administrative supervision
Customary rights of use	Restricted	Recognized	Discontinued

instrument to place specific forest areas in the intended category. Only Cameroon has begun a thorough classification process for the forests in the southern part of the country.

There is a duality between ‘modern’ law and the customary laws, which largely govern social relationships and everyday practices regarding access to land in all the countries of the subregion. The link between land tenure law, land access practices as governed by customary law and forest laws constitutes a legal and institutional challenge that these countries will have to address.

Access to forest resources

Access to resources is achieved through different systems, the best known being that of the forest concession, which is a form of private management of public property. To combat illegal logging, the governments have substantially reduced the number of permits based on volume, which often led to fraud by systematically exceeding the permitted volumes. These types of permits are also vehicles for tax fraud (avoiding surface area taxes) or for getting around quotas imposed on conces-

Table 8.5. Legal framework of land tenure in Equatorial Guinea.

Purpose of land – as defined by the overall land-use planning objectives	<i>Dominio de Producción Forestal</i> (Forest production domain)			<i>Dominio de Conservación o Protección</i> (Conservation and protection domain)	
Administrative designation	<i>Bosques Nacionales</i> (National Forests)	<i>Bosques Comunes</i> (Community Forests)	<i>Parcelas Forestales</i> (Wooded Plots)	<i>Áreas Protegidas</i> (Protected Areas)	<i>Bosques de Protección</i> (Protection Forests)
Allocation	Production of construction timber through concessions system	Multiple uses by village communities	Production of construction timber through authorizations	Conservation, research, etc.	

sions (processing or species quotas). However this policy puts artisanal and other small-scale operators in a precarious position, and often results in them turning to the informal logging sector and straying outside the law.

In 1999, Cameroon suspended the different existing permits by volume (personal authorizations to fell 30 m³, timber recovery authorizations allowing operators to remove logs that they find 'abandoned' in the forest, auctions, timber salvage felling, etc.), although some permits were still issued locally by the authorities in the non-permanent domain⁴. This suspension has since been lifted. In Gabon, permits by volume essentially concern the freely negotiated permit, by which Gabonese citizens are allowed to fell up to 50 trees. The administration admits that it is very difficult to check whether this number is respected (OIBT, 2005). Abolition of the 'construction timber permit' in the Republic of Congo brought protests from small-scale operators. In the Republic of Congo there are also permits for logging plantation timber (State-owned plantations). The forestry code in CAR allows 'special logging permits' to be issued for a maximum area of 10 ha.

Logging permits based on surface area

The period for which permits are issued (Table 8.6) varies from 15 years renewable (Cameroon and Equatorial Guinea) to 99 years (CAR). Ideally, the duration of permits should be close to the duration of the rotation period, but the renewal clause nevertheless gives the investor a certain level of security.

Allocation methods

Forestry permits are granted on a discretionary basis by the administrations according to different criteria, such as investment projects, the foreseen social impact of activities, or presence in the country. The exception is in Cameroon, where an **award mechanism** was introduced in 1996 for both concessions and the sale of felling rights. It is a two-stage process:

- The pre-selection phase is when possible forestry offenses attributable to the applicants are examined, technical abilities are presented and solvency is assessed. The elimination mark is 65 out of 100.
- The second phase involves the examination of technical and financial offers received. The technical note counts for 30% and the financial offer (which corresponds to the amount

Table 8.6. Different types of logging permits in Central Africa

	Large surface area	Limited surface area	Other categories
Cameroon	Concessions	Sale of felling rights (≤ 2,500 ha)	Communal forests Community forests (≤ 5,000 ha)
Gabon	Forestry Concessions under Sustainable Management (CFAD)	Associated permits (PA) (≤ 150,000ha when associated with CFAD, ≤ 50,000 ha when managed by the holder)	
Republic of Congo	Management and processing agreements (CAT), Industrial processing agreements (CTI)		
DRC	Concessions		Community concessions
CAR	Logging and management permits		
Equatorial Guinea	<i>Contratos de Arrendamiento por Aprovechamiento Forestal</i> (Rental contracts for use of the forest)		<i>Bosques comunales</i> (Community forests)

proposed by the tenderer through the annual forestry fee - RFA - based on the area conceded) counts for 70%. The financial offer is announced in public and the results declared immediately after the total number of points is calculated. The successful tenderer must place a bank guarantee with a banking establishment corresponding to one year's RFA payment. He has the right to give up the concession within a certain period, in which case it goes to the tenderer who came in second place. The whole process is monitored by an independent observer appointed by the government. The observer provides his opinion on the procedures and reports to the government and various institutions on how the operations were conducted.

The forestry code of DRC indicates that concessions must be awarded through a tendering process, although freely negotiated agreements are still possible 'on an exceptional' basis (Art. 83 and 86). A decree laying down the details of the award procedure is in preparation; it is based on

⁴ If these permits, officially suspended, are still being issued by decentralised ministerial structures, it is because the agents, whose basic pay is insufficient, benefit financially from their being issued; a release from MINEF from 14-9-2000 states that for 'sales by auction' 75% of the revenue goes to the State with 25% being paid to agents via a special fund.

the Cameroonian mechanism. In the meantime, there is a moratorium on the awarding of new concessions, introduced by a decree of 14 May 2002, but it has not been fully observed. In May 2005 CAR adopted an award mechanism similar to that of Cameroon, with a different weighting (40% for the technical offer, 60% for the financial offer), which must be applied in cases of concessions being re-awarded following withdrawal or bankruptcy (Decree 011/MEFCPET/CAB/SG of 20 May 2005).

Permits reserved for domestic operators

Apart from permits by volume, the legislation reserves some zones or categories of surface area permits for nationals. This is the case in Gabon, for 'first zone' permits (areas along the coast) and for associated forestry permits (PFA). In Cameroon, some of the forest management units (UFA) put out to tender are reserved for domestic operators. This has not always been the case, as invitations to tender between 2000 and 2001 were open to all applicants. As for sales of felling rights, those which are issued for the permanent domain are reserved for nationals (Art. 44-2), but not those for the national domain (Art. 53). However, few or no felling rights are issued for the permanent domain and in 2005 the government reserved quotas of felling rights for Cameroonian nationals for the national domain.

The permits reserved for nationals are often subcontracted or 'leased' to foreign operators who possess the logging resources that domestic operators, few of whom are real professionals, often lack. The major drawback to this form of subcontracting is that it breaks the chain of responsibilities in forest management and, since the 'lessee' can change, it does not favor the development of a long term vision. With the exception of a few rare cases, reserving surface area permits for nationals has not really succeeded in developing a class of domestic entrepreneurs in Cameroon.

The role of local populations

Community and communal forests

Local populations can benefit from community forests in Cameroon, Equatorial Guinea, Gabon and DRC. In Cameroon, 67 community forests have been established since 1997 (out of 180 applications received), amounting to some 240,000 ha (GFW, 2005). It appears this number is set to rise to over 80 forests by the end of 2005. Since 2002, communities have had a **right of first refusal** on future sales of felling rights in the

national domain. In CAR, although the forestry code does not mention this possibility, a pilot project has been initiated for the establishment of 6 community forests. In Gabon, the government envisages establishing community forests within the framework of pilot projects (OIBT, 2005). The forest code in DRC indicates that communities can benefit from forest concessions on forested land 'held by virtue of customary law' (Art. 22) within the protected domain, but no community concession has been established to date. However while in Cameroon only artisanal logging has been authorized theoretically in community forests since 2001, the forestry code in DRC stipulates that logging in community concessions can be entrusted, by contract, to a artisanal operator (Art. 112) or a 'third party' through a logging contract (Art. 113-3).

In Cameroon, a ceiling of 5,000 ha has been placed on the surface area of community forests and these forests must have a simple management plan validated by the administration; in DRC, as of yet no implementing text has fixed a ceiling on the area of community concessions. In Cameroon, the local populations should also benefit from logging in communal forests through fees paid to the municipality by the holder of the permit.

Rights of use

The populations retain their rights of use in forests designated for logging, with the explicit exclusion of agriculture in DRC. But these rights of use can be restricted in permanent forests by specific regulatory texts. Article 25 of the Gabonese Code states 'The texts on the classification of a forest or management plans for a production forest must provide for a sufficient area within which the resident populations can exercise their customary rights of use'. Hunting rights are regulated by ad hoc texts. Article 42 of the Congolese code specifies: 'The rights of use are reserved for the satisfaction of the personal needs of their beneficiaries. The products deriving therefrom may not be the subject of commercial sales'. But this type of provision is rarely observed anywhere in the country.

Local allocation of tax revenue

In Cameroon, the local populations adjacent to concessions receive 10% of the annual forestry fee (RFA), which is based on the surface area of the concession and determined by the award mechanism. The funds are paid by the municipality to a management committee set up within

each beneficiary community. A recent study refers to the difficulties that the beneficiary villages have in receiving all the amounts due to them from the municipalities (Ngoumou Mbarga, 2005). The municipalities in Cameroon receive 40% of the RFA from concessions and sales of felling rights located in the municipality's territory⁵. This represents just over 5.5 billion FCFA annually. In the CAR, 30% of the felling tax is allocated to the local authorities and 25% of the reforestation tax (Art. 58 of the 1998 Finance Act), which represents about 1.5 billion FCFA in theory.

In Gabon, the general conditions of certain logging deeds for large concessions provide for the payment of 1,000 FCFA per m³ of felled timber to the resident populations. A territorial scale of distribution for the *'finages'* (area of influence of each village) has been defined for the allocation of these fees. The administration could extend this provision in the general conditions to all concessions in the near future. In the Republic of Congo, 50% of the surface area tax goes into a special fund created at the Treasury for regional development.

General conditions

A large proportion of transfers of funds and payments in kind for the benefit of the local populations are achieved through the general conditions (*'cahier des charges'*) system. These general conditions contain various clauses providing for social transfers or initiatives of a socioeconomic nature chargeable to the concessionaries. The planned beneficiaries are not only village communities but also sometimes neighboring public communities (administrative entities) or even local administrative authorities and the forestry department. In the Republic of Congo, the transfers made through the general conditions system have become substantial (Karsenty and Pierre, 2005)⁶. In DRC, there are no fixed conditions yet, but informal transfers in cash or in kind for the benefit of the local populations and local authorities are frequent and negotiated (or imposed) on a case-by-case basis.

Forest management systems

Forest management is compulsory for industrial logging permits. The forestry laws are steadily incorporating technical elements such as the choice of species, minimum dimensions, different inventory protocols and the implementation of management plans. The laws and regulations often contain provisions indicating principles for

fixing minimum felling diameters (MFDs), the rotation duration or inventory standards. Gabonese law is particularly precise on these matters. But in order to be really operational, and to enable the administrations to assess the management plans proposed to them, these principles must be completed according to specific technical management standards. These national management standards or directives are available in Cameroon and in CAR. In Gabon, they are available to the players involved but still have to be made official through a decree.

In these three countries, the need for flexibility on the part of operators is taken into account by keeping the cutting units (*'assiette de coupe'*) open for 2 or 3 years in order to allow them to adapt to commercial or technical uncertainties. On the other hand, it is not possible to open up more than one cutting unit a year: thus 'retrospective' flexibility is possible, but cannot be accompanied by 'prospective' flexibility where the logging activities get ahead of the planned rotation cycle.

The national standards or directives also allow managers to define different 'management' MFDs (DME-A) from the 'legal' MFDs (DME-L). But while the DME-A can be higher than the DME-L, they cannot be lower. This is not because of forestry concerns, but in order to limit the risks of offenses occurring in a context where the traceability of timber remains difficult.

The extent to which biodiversity is taken into account in logging concessions is often limited to little more than action to combat poaching in the concession, an aspect negotiated during the preparation of the general conditions. While management plans classically provide for a series of protection zones, they are still frequently limited to areas that can not be logged, such as steep slopes, rocks or marshes. Very few concessions have incorporated genuine ecological zoning or have agreed to protect biodiversity in actual production areas.

Centralized management or delegation of functions?

Two approaches appear to coexist as regards implementation of management plans. On the one hand, given their new forest codes, the Republic of Congo and CAR appear to have opted for a centralized operational method with the State ensuring implementation of the plans. The Cameroonian law has also followed this approach, however, one of the implementing decrees has opened the way for the delegation of this function to companies. Poor quality plans prepared by

⁵ When a logging deed covers several municipalities, each of them receives a separate check, the amount of which is calculated according to the surface area of the forest concerned.

⁶ Concessionaries ask for the level of transfers indicated in the general conditions to be adjusted according to the amount of the forest tax that is paid, which varies from country to country. With the general increase in tax pressure in recent years, economic operators are demanding strict limits on the scope of transfers and other initiatives. So far this has not succeeded in the Republic of Congo.

the public body ONADEF convinced companies that it was in their interests to perform this function themselves, often entrusting this task to specialized consultancies. In the Republic of Congo, the shortage of trained personnel and the obvious lack of financial capacities within the administration in charge of forests led to the choice of delegated management⁷. The only exception has been CAR, due to the relatively limited surface area to be managed (3 million ha), shared among six concessionaries, and the creation of a management unit supported by a project financed by AFD. This unit prepares the management plans of forestry companies, involving them in the preparation of the different stages, while working to take into account their choices and strategies. In other countries (except for DRC where the process is only just beginning), many companies have recruited forest managers to create in-house management units working alone or with the support of specialized consultancies. The **internalization** and **appropriation** of forestry management is a process that companies must go through.

Effectiveness of legislations on forest management systems

Application of forest management planning rules and provisions varies from country to country and even within the same country. Little information is available on fulfillment of management obligations by concessionaires in Equatorial Guinea, and the absence of a detailed reference to this subject in the official documents available leads us to suppose that these provisions are only followed to a limited extent. In DRC, there is a notable shortage of applicable regulatory texts on the subject of forest management, although this does not prevent large companies from preparing their own management plans with a view to certification. A similar situation exists in the Republic of Congo, where several large companies in the north of the country have prepared, and one of them is implementing, a management plan despite the absence of national standards. However, a number of companies, in the north and especially in the south, have not adopted this approach.

Cameroon and Gabon are in contrasting situations, with some concessionaries involved in the management process, while many logging companies or simple permit holders, remain completely outside the process, for financial or other reasons.

In CAR, the situation is more uniform because of the decision to set up a national management

unit. However, genuine appropriation of forest management by beneficiary companies must still be demonstrated (which raises the question as to what the situation would be if the project came to a halt).

The legislations provide for penalties going as far as withdrawal of the permit for non-compliant holders. In Gabon, withdrawal is envisaged for numerous permit holders – mostly ‘associated permits’ held by individuals rather than genuine forestry companies – who have not started any forest management work (and who are often in arrears with payment of their taxes). The end of 2005 was to be a landmark date for the government’s decision (OIBT, 2005).

A particular problem is posed by the ineffectiveness of the compulsory simple management plans for community forests in Cameroon. They are rarely observed and for some operators this category of forest has become a way of extracting illegally cut timber or avoiding payment of certain taxes.

Taxation and pricing systems

While the other countries – apart from DRC – have not followed Cameroon in adopting the tendering principle, they are all set on reforming their systems of forest taxation, generally in the direction of an increase in tax pressure.

Increase in the cost of access through the surface area fee

In Cameroon, the tendering mechanism led to the annual forestry fee, based on surface area, rising to an average of 2,724 FCFA/ha on concessions up to 2004. However, the latest allocation process in 2005 resulted in much lower offers, with the average offer from tenderers amounting to 1,355 FCFA/ha. On sales of felling rights, the average offer accepted was 8,265 FCFA/ha in 2005, also well down on the average of 26,000 FCFA before the latest allocation process.

In Gabon in 2002, the government proposed an annual surface area forestry tax of 1,000 FCFA. This measure was to have been applied at the beginning of 2003, but in the face of strong reactions, a rate of 600 FCFA was decided on, with only 300 FCFA for companies that had finalized their management plans. This was a transitional measure, as indicated in the Forestry Policy Letter (*Lettre de Politique Forestière*) of 2004.

In the Republic of Congo, the government introduced a surface area tax of 350 FCFA per ha for the northern zone and 500 FCFA for the

⁷ In *delegated management*, the State entrusts functions of a general interest to a third party: an individual, a local authority, a local community or a private public company. In this case, delegation is accompanied by precise commitments, generally in the form of terms and conditions setting out the rights and obligations of the entity to which the functions are delegated. Delegated management is contractual, unlike devolution and decentralization.

southern zone. At the same time, it raised felling and export taxes substantially, which brought a fierce reaction from operators. Agreements were reached in May 2003 that reduced the different taxes by about 20%.

In DRC, where there are some very large concessions (with low logging intensities) of 2 and 3 million hectares, the government has undertaken a tax reform which will see the surface area tax increase in stages until 2007 (from \$0.10 to \$0.50 per ha) in return for a reduction in incidental taxation and the abolition of excessive levies on the sector by state owned companies. In this country, where potentially productive forests covers more than 55 million hectares, forest taxation in 2002 brought in less than 2 million dollars for the State. Since the implementation of new tax measures, over 4 million hectares held by companies that did not have the capacity to exploit them have returned to the public domain. There is also a tax on annual cutting units, which contributes to the Forest Fund budget.

In CAR, the 'annual rent' (surface area tax) rose successively from 125 FCFA/ha (before 1998) to 300 FCFA (between 1998 and 2003) and then to 500 FCFA per ha in mid-2003. A surtax of 500 FCFA should be applied as from 2007 for companies that have still not signed a provisional management agreement with the Ministry of Water and Forests.

These surface area taxes apply to the whole area of the concession, including the non-productive areas. With the development of management plans defining the production runs, it is only now possible to levy the tax on these, to the exclusion of other production runs. DRC has introduced this principle in its new tax system.

Other taxes

All the countries heavily tax exports of logs, with the dual objective of tax generating revenue and providing an incentive for local timber processing. Some countries have introduced surtax mechanisms: in Cameroon, it is a fixed surtax on exported logs (in addition to an exit tax of 17.5% of the FOB value); in the Republic of Congo, there is a progressive surtax on exported logs above the authorized maximum quota of 15% per concession. The taxable value is calculated on the basis of FOB values determined by the administration, but it generally poorly reflects variations in prices due to an insufficient frequency of audits and a lack of information on markets. CAR and DRC⁸ have adopted a FOT (Free on Truck) or EXW (Ex-Works) basis for calculating export

taxes, deducting an average transport cost per m³ from the FOB value. The other countries modify the level of these taxes by dividing up the territory into 3 or 4 zones reflecting the degree of remoteness. But in all cases, fine zoning that reflects real transport costs rather than simply distance would be necessary in order to achieve a better balance of logging operations over the territory. It would also help to combat 'skimming' – selection of highest value specimens only - in forests where access is difficult.

Processed products are taxed less or are even tax exempt, as in Gabon. In Cameroon, a tax is levied on rough lumber entering the factory, in order to exercise better control over flows of processed timber and to encourage savings in materials. The Republic of Congo differentiates the level of export tax according to the degree of processing.

Felling taxes are based on the FOB value of the species, on a market price listing well below the FOB price, in CAR, or on a 'bracket' value (purchase price for okoume from operators set by the SNBG) in Gabon. In DRC, lower rates have been introduced for the main species being promoted, tola (*Gossweilerodendron balsamiferum*). Felling taxes are pre-calculated and prepaid in the Republic of Congo on the basis of annual felling authorizations. This ensures good tax collection, but discourages risk-taking as regards diversification of the species that are logged (since only species that can be marketed will be exploited). In the other countries, the felling tax is less well controlled and collected. However, it plays a structuring role as regards controls in the field (one of the reasons for controls in the forest being to check that felled trees have indeed been taxed). Furthermore, the possibility of varying the rates according to species allows the felling tax to be used as an incentive, although this potential has yet to be fully explored.

Allocation of taxes and fees

The principle of a single budget structure is progressing slowly. While it is well applied in Cameroon, where most of the revenue passes through the Treasury before being reallocated to the institutions in charge of forest management, the DRC still works with pre-allocated taxes – particularly for the Forestry Fund. The Republic of Congo has even taken a step backwards after trying in 2003 to work on the principle of a single fund structure and subsequent reallocation of the necessary sums to the forest administration institutions. Faced with a situation where it had

⁸ In DRC, only for calculation of the reforestation tax paid on exports, which fuels the forestry fund and, in principle, for the felling tax.

become extremely difficult to obtain reallocation of the agreed upon sums, once they had been paid to the Treasury, the Ministry in charge of forests once again took over the collection of forest taxes (surface area and felling taxes) in 2004. However, a decree (No 7702 of 5 December 2005) re-established the principle of a Single Treasury (*'unicité de caisse'* – a system where all public sector finance, whether central or local, is handled by a single national Treasury). This stipulates that checks are to be made out in the name of the Director of the Treasury from a special account and that reallocation to the Forestry Fund of part of this revenue, up to the full amount of the Forestry Fund (as decided by Parliament and fixed by the annual Finance Act), is to be by standing order.

Overall analysis

With the introduction of the tendering mechanism in Cameroon, the price for access to the resource was largely fixed by the interplay of competition and no longer by administrative decisions. Moreover, publicity for the process helped to increase transparency in a sensitive field. Nevertheless, the majority of the established profession has never really accepted this principle of an RFA fixed through a tendering process. The heterogeneity of the forests under concession (frequency and distribution of species, quality and unproductive areas) is not always well estimated by the current types of surveys or large-scale reconnaissance inventories. Also public information is so limited that tenderers are never able to have access to the same level of information. The ability to adapt to a resource which is different from that expected depends on several factors (capital available, accessible markets, industrial capacities, etc.) and the operators themselves are not always able to control these. They do not have perfect information, they have relatively limited forecasting abilities and they may make mistakes in their evaluations. This increases risk-taking by companies when it comes to tendering, especially as the fee proposed for the duration of the contract is fixed whereas the price of timber varies considerably from year to year⁹.

The changeover from 'exit' taxation (taxes concentrated on exports) to more balanced taxation between the upstream and downstream ends of the sector is criticized by some in the private sector who consider that the surface area fee represents a fixed cost whereas the logging business is unpredictable and timber prices are unstable. However, the introduction of surface area taxes seems inevitable in these countries that are pursu-

ing the objective of drastically reducing exports of logs in favor of industrialization. In so far as tax revenue was essentially based on these exports, it is necessary to accept that the center of gravity of tax collection must be shifted¹⁰. However in Africa, the uneven distribution of information between companies and administrative departments is such that it cannot be left to a corporation tax to 'collect the economic rent' from the exploitation of a natural resource. As for felling taxes, these are more often subject to massive fraud as the rate increases.

A review of the impacts of tax reforms is necessary. This could lead to improvements in the existing mechanisms by introducing, among other things, greater flexibility (adaptation to the fluctuation in prices and to transport costs) and incentives (promotion of secondary species), especially as over the last couple of years the sector has been hit by increases in the price of diesel (around 30%) and in international freight charges in 2004 (from \$25 to peaks of \$60-80 for a 40-foot container), but has not been able to pass on these increases in the price of the timber sold.

⁹ On the other hand, the Cameroonian government has not provided a mechanism for index-linking to the rate of inflation, which has been 2-2.5% a year on average in Cameroon since 2000.

¹⁰ Transferring taxes to exports of processed products (sawn timber, etc.) would run counter to the widely shared objectives for the development of the timber industry.

Regulation of trade in forest products and timber processing

The legislation in these countries reflects a common desire to promote local timber processing, but the means of achieving this objective differ. Since 1999, Cameroon has banned exports of logs of numerous species with a high commercial value, with the exception of two secondary species (so-called 'promotion' species), Ayous (*Triplochyton scleroxylon*), which is the main species harvested, and Azobé (*Lophira alata*). However, logging of these two species is subject to a surtax and, since 2002, export authorizations.

In the Republic of Congo, the forestry code (Art. 48) indicates that 'products from natural or planted forests must be processed in the Republic of Congo' and that 'first-stage processing of timber shall be close to the felling site'. A transitional provision allows operators to export, with a ministerial authorization, 15% of their production in the form of logs. Subsequent texts have introduced a progressive surtax for exports above this threshold and this is effectively applied.

The Gabonese code is less demanding: it indicates that 'the level of processing of local production must rise to a level of 75% during the decade following the date of promulgation of this Act' (Art. 227). In DRC, the code specifies that only the holders of a processing unit may export logs 'for a maximum period of 10 years' after logging begins and 'subject to a quota not exceeding 30% of production' (Art. 109). In Equatorial Guinea, operators must process 60% of their harvest. In CAR, the forestry code requires holders of permits for 3 or more years to process 60% of their production. This was raised to 77% by a recent Finance Act. In none of these 3 countries are the regulatory measures really applied.

It should also be noted that in Gabon there is a measure prohibiting exports of Longhi (*Gambeya africana*) as logs, which indirectly benefits the slicing company using this species¹¹.

SNBG monopoly on Okoume (*Aucoumea klaineana*) in Gabon

Okoume, the main species produced in Gabon, and Ozigo (*Dacryodes buettneri*) were for a long time the subject of a log export monopoly for SNBG (*Société nationale des bois du Gabon*), which used to buy the logs from foresters and allowed them production quotas (with a guarantee of purchase). Processed logs were not covered by

this mechanism. The government decided to do away with this SNBG export monopoly on the first of January 2006.

Overall analysis

The imposition of identical compulsory processing quotas for each operator is a relatively effective measure (if it is applied uniformly to all concessionaries) from a quantitative point of view (volume processed). However, it is a much less effective measure from an economic point of view because (i) it does not take into account the comparative advantages of each company in timber processing (some are more efficient than others) and thus may lead to loss of potential value and (ii) it hinders the necessary movement towards specialization among concessionaries, which is intended to lead to the creation of large-scale processing units benefiting from economies of scale¹² and procuring part of their supplies from concessionaries that are more concerned with sustainable logging.

The formula of an annual *national quota* to be distributed among the different operators seems to be a more appropriate option from the point of view of economic efficacy; however, it does pose the problem of the distribution of this overall quota among potential exporters. The three allocation possibilities are (i) free distribution of export entitlements (either equally or weighted in accordance with particular technical criteria), (ii) selling them at a price fixed administratively or (iii) auctioning of export entitlements, which would then replace export taxes.

Means of Application

The degree of application of legislation varies considerably from country to country and according to the different laws and regulations, with some, as we have seen, being less well applied than others. The human resources at the disposal of the Ministries in charge of forests are fairly limited with more at the central level than in the provinces. Even when human resources are deployed in the forest areas, the agents are generally confronted with a limited number, or total absence of, vehicles (such as in DRC) and fuel to enable them to carry out their checks. Consequently in most cases agents are dependent on transport provided by the forestry operators, who are the subjects of the controls¹³.

- In Cameroon, the Ministry of the Environment and Forests (MINEF) had a staff of 1,800; the government decided to

¹¹ By guaranteeing it a purchasing monopoly on this species.

¹² Even though it is also desirable to have a collection of small and medium-sized companies specializing in different production segments.

¹³ This situation has been mentioned for the Republic of Congo (REM, 2005) and DRC (Cirad, 2003).

split this Ministry into two entities of about 900 people each: one dedicated to forests and fauna (MINFOF) and the other to the environment. This staff is ageing and recruitment restrictions in public services, linked to the adjustment process, cannot guarantee that this number can be maintained. Moreover, a recent study (I&D, 2001) indicated that 82% of personnel were in the regional centers, but only 28% in forestry posts (480 people). For the eastern province, where the great forests are located, the ratio was 176,000 ha of harvestable forest per agent. The MINEF budget (with its 1,800 agents) was around 14 billion FCFA per year at the beginning of the 2000s, 75% from external financing (projects implemented by MINEF). The institutional audit (I&D, 2001) noted that *'...a relationship of dependence has become established between agent and operator. The latter often 'helps' the agent to make it to the end of the month or to deal with a difficult situation (illness, return to school, etc.), in exchange for the agent not being too fussy about regulations being ignored'*. As regards equipment, information collected by GFW going back to early in the 2000s mentions five 4 x 4 vehicles and 28 motorcycles for all five forest provinces. This is very low and constitutes a major constraint to the efficiency of agents (I&D, 2002).

- In Gabon, the total staff of the Ministry of Forests, Fisheries and the Environment numbers 781. The Directorate-General for Forestry Economics had a staff of 281 in 2003, at least half of whom were based at headquarters. In the year 2000, the ratio of agents assigned to controls/areas allocated to logging was 1 per 86,400 ha according to GFW data (2000).
- In the Republic of Congo, a study (REM, 2005) indicated that 60% of agents were concentrated in the central services and only a hundred or so were in the control brigades, which corresponds to one agent to supervise 100,000 ha of harvestable forests. The average salary of these agents is around 30,000 FCFA a month (excluding bonuses).
- In CAR, the Ministry in charge of forests has about 350 agents (FOSA-FAO national prospective report, 2001), with a high concentration at the local level.
- In DRC, the Ministry in charge of forests is grossly under-equipped, with the provincial delegations having virtually no resources and agents entirely dependent on economic operators for their travel and even for their subsistence.
- No data is available for Equatorial Guinea.

The low salaries and the lack of material and human resources are a common situation in these countries. Lack of motivation among agents is a common phenomenon, particularly in categories B and C (middle management, technical agents) in the field (Pousse E. & F., 2006). The agents are frequently dependent on the economic operators, but it should also be emphasized that the incentive systems (in the form of direct or retroactive bonuses) for penalized offenses encourages agents to penalize in order to make a transaction; a system which gives the administration a preponderant role to the detriment of legal proceedings. Consequently, **there is a risk of offenses not being penalized as a function of their gravity with respect to environmental management considerations, but rather as a function of how advantageous the transaction is for the agent.**

In recent years, there have been two parallel phenomena encouraged by funding agencies:

- The use of independent observers for controls in the field, whose role is to carry out joint control missions with the forestry administration to be followed up by published reports. This task was entrusted to the NGO Global Witness in Cameroon in the early 2000s and in 2005 the NGO Resources Extraction Monitoring (REM) carried out a feasibility study at the request of the Congolese government in the Republic of Congo. It is also important to mention the role of Global Forest Watch (GFW). GFW is attached to WRI, has offices in the subregion and prepares interactive maps centered on the utilization of forests, presumed illegal logging and other useful data.
- A move towards the privatization of control systems, firstly at the level of timber exports and increasingly in forestry controls in the field. These tasks are entrusted to specialized private companies (SGS-Forestry) and controls are being split up between the administrative structure and the private structure.

Thus, one of the sovereign powers – that of controls – is being 'delegated' increasingly to private companies, although without losing the traditional administrative structures carrying out the same tasks. Is this partial 'duplication' of public tasks by the private sector a viable solution? It is at the very least an expensive solution for those being controlled, even those that are in order. Dual checks cost money (additional export tax) and time (twice as much for 'paperwork' and other time-consuming chores). The alternative would be a thorough reform of the administrative system to make it more efficient or the introduc-

tion of criteria for management, remuneration, penalties and advancement (drawing on examples from the private sector) in the administration's control units (special corps). These control units would operate autonomously, but there would be a strong incentive for administration agents to join this corps and, in the event of poor performance, they would run the risk of their returning to the normal administrative system.

Summary and prospects for harmonization

The legislations of the countries of Central Africa have been renewed over the last ten years. Many factors now allow advances to be made towards sustainable forest management.

The forestry codes contain numerous similar clauses regarding management plans, for example, but remain somewhat dissimilar on many issues. The question of the status of forests is largely influenced by the juridical traditions of each country and the link-up with national land tenure laws. According to good legal logic, classification should be regarded as a prerequisite for management because it sets the geographical limits of the forest that is conceded. Uncertainty as to the limits gives rise to problems of a fiscal nature (concessionaries pay for an area which will perhaps be reduced in size) and of a technical nature (basis for the management plan). Cameroon has fallen behind in the classification of forests, but has prepared a land use plan for forested land which allows the players to be closely involved in both the short and long term. Other countries such as Gabon, the Republic of Congo and CAR, which are planning classified forests, will also be faced with this problem. All these countries will have to formulate land use plans based on zoning proposals that will strengthen the rule of law, which is often more theoretical than real when it comes to the legal status of land.

Community forestry has become well established in Cameroon and Equatorial Guinea but has yet to be implemented in Gabon or DRC. Forestry codes in CAR do not cover it, but a pilot project aims to fill this gap. Nothing has been announced in the Republic of Congo. Only Cameroon has explicitly provided for forests belonging to the local authorities. While the guidelines for forest management are common to all the countries, only Cameroon, CAR and Gabon have produced operational national standards. DRC and Equatorial Guinea have made little progress towards effective forest management, in spite of the stipulations of their national laws.

As regards industrialization, while the objectives for the development of local processing may converge, the means applied are not the same; the guidelines of the Gabonese code exist side by side with the partial ban on exporting logs in force in Cameroon or the substantial financial penalties on non-quota exports in the Republic of Congo. Cameroon stands out for its competitive tendering mechanism whereas elsewhere the allocation of permits remains largely discretionary.

Forest taxation systems have moved closer together with the recent waves of reforms, marked in particular by the introduction or strengthening of the surface area tax system and the increase in tax pressure. However, they remain different in terms of tax levels and structures, with a greater burden at the upstream end of the sector in Cameroon and downstream (exports) in Equatorial Guinea, Gabon and CAR. Few incentives are contained in the tax systems in force, other than lighter taxation for processed products. Gabon is halving the surface area tax for managed permits, while CAR and, to a lesser degree, Cameroon and DRC are partly adjusting export taxes according to transport costs. DRC has introduced interesting provisions favoring the promotion of abundant secondary species, cutting by half certain taxes on Tola (*Gossweilerodendron balsamiferum*) and perhaps on other secondary species in the near future.

One of the weaknesses of the legislations is the **absence of clear and secure frameworks for small-scale logging and processing**. These constitute a popular and growing economic activity meeting real needs that can not be met by the more export oriented industrial companies¹⁴. To combat illegal logging, the governments have cancelled or suspended permits by volume, which were often diverted from their intended use, but which allowed small-scale sawmills to operate within a regulatory framework. Many of these players are thus 'criminalized' and continue to operate in the informal economy; this leads to a loss of control by the authorities over entire areas of this activity, whose impact on forest resources can be significant, and causes permanent legal insecurity for these economic players. Furthermore, in the absence of clearly established property laws relating to forest resources in farmers' fields (wood plots, fallow fields) situated in areas of non-permanent forest, supplies to small-scale sawmills cannot be organized on the basis of contractual agreements with farmers in forest areas (whereas such agreements would encourage the latter to plant trees and conserve wooded resources on their land).

¹⁴ *Estimations for Cameroon (Plouvier et al., 2002) and DRC (Djire, 2003) suggest that the volume of logs harvested by these activities surpasses a million m³ for each of these countries.*

The application of laws also varies considerably from country to country and in terms of the clauses. Management obligations apply to all concessions, but not all the latter have a management plan (far from it in fact). It is true that there have been long delays between passing of the laws and the appearance of the implementing texts, and national management standards only exist in three of the six countries. The fact remains that governments hesitate to apply their laws; the decision by Gabon to grant a tax discount to companies doing no more than complying with the law by developing a management plan may seem surprising, but clearly shows that social and political considerations act as brakes when it comes to applying dissuasive measures, such of cancellation of a logging contract for noncompliance with the law. **The paradox is that this lax approach on a key issue exists side by side with extremely particular provisions whereby the administration penalizes operators for not rigorously following the felling plan in the cutting units** (felling a legally harvestable species not initially provided for in the plan) **without there being any clear benefit in terms of sustainable management.** Mention should also be made of the influence of the system of transactions connected with 'disputes', which allows agents to collect a substantial percentage (25% in Cameroon and 30% in the Republic of Congo, according to their respective codes) that goes to the Forestry Fund, which is often the source of additional bonuses for agents. This practice enables the forestry administration to benefit considerably from fines collected on a transaction whereby once the transaction has been requested no further legal action is taken (*'sollicité, éteint l'action publique'*; Art. 146 – 2 of the Cameroonian code). This results in regulatory systems that are sometimes unnecessarily complex and a host of preliminary authorizations that generate more opportunities for offenses. An alternative concept for this juridical/regulatory mechanism would be to allow the field operators greater leeway by clearly defining the range of prohibited activities (proven risk to the environment or to health) and considering all the others to be legal.

The question of the subregional harmonization of legislations and policies

On the seventh of June 2004, the government representatives of the countries of Central Africa adopted a convergence plan aimed at harmonizing their policies. Several themes were addressed, including policies and taxation, with the objective of developing 'forest management standards [which are] compatible'; ensuring that 'the different taxation systems are harmonized and compatible with the requirements of sustainable management of forests'; and carrying out environmental impact studies 'before any major intervention in forests'. The plan provides for numerous comparative studies, a subregional consultation forum and the centralization of information at COMIFAC. The cost of the component 'harmonization of policies and taxation' was estimated at over 14 billion FCFA for the period 2004-2006 and 56 million dollars for the ten-year period 2004-2013. Financial resources are a limiting factor for the implementation of this plan and at the Summit of Heads of State in January 2005 in Brazzaville the idea of a financing mechanism based on 'the levying of a tax on revenue from all exported forest and wildlife products'¹⁵ was adopted. The percentages collected would go into a subregional fund that would finance COMIFAC. This mechanism 'would free the member countries of the constraints connected with the annual payment of equal contributions to COMIFAC'. However, this formula can be interpreted in two ways: (1) the allocation to this fund of a fraction of the taxes that already exist or (2) the creation of a new tax (like the levies introduced in Cameroon, CAR and the Republic of Congo to finance the structure - private or mixed - for controls on exported forest products). The latter solution would exacerbate the existing tax pressure on companies.

The question of harmonization of policies or the 'compatibility' of standards remains ambiguous, in so far as the content of these terms has not been politically and technically explained. As regards management standards, the forest management models adopted by companies are based on the same principles: selective logging with natural regeneration, possibly assisted, and similar rotation durations (between 25 and 30 years) on plots whose areas are determined as a function of their potential for sustained harvesting. The inevitable spread of certification in the subregion is going to bring management practices closer together, from both the forestry and social points

¹⁵ *Putting in place an independent financing mechanism for COMIFAC. (Working document from February 2005).*

of view. Because it was instigated by forest companies and private management or certification structures, convergence is thus already well under way. Its development should be based on the need to take more explicit account of ecological criteria resulting from forestry research.

From the social angle, whether it be redistribution mechanisms (through provisions in the 'general conditions' documents), locally appropriated taxation, community forests or local authority forests, convergence is slower and is encountering institutional differences that extend beyond the strict framework of the forestry sector (extent and means of decentralization). To these must be added the specific local political agendas and different governance methods of the countries concerned.

As far as taxation is concerned, the points of convergence can be easily identified, both as regards tax pressure per m³ of timber (weighted by average transport costs, which vary from one country to another) and as regards the taxation structure (distribution between upstream and downstream ends, tax base). The beginnings of convergence can be clearly seen in the direction of the reforms carried out over the last ten years, often influenced by the World Bank. However there are still tangible differences and the subject of taxation, where governments are the least inclined to abandon what they consider to be their sovereign attributes, will continue to be a sensitive topic in the national political debate.

Export and import policies for forestry products have moved closer together, but the methods differ with some countries being more inclined to use a ban on exports of logs and others favoring tax incentives. The question of the free movement of goods within the CEMAC area will constitute a significant test for the five member countries (DRC forms part of SADEC): according to this common market treaty, no export duties will be paid on logs produced in a country or on other forestry products intended to be consumed or used as raw materials. Article 179 of the Forestry Code of the Republic of Congo stipulates that: '... the holders of logging contracts must supply, as a priority, extracted timber to industries installed on the national territory' whereas the community logic dictates that the relevant distinction should be between the CEMAC area and outside. However, it is hard to imagine the countries looking kindly upon industries in one CEMAC nation obtaining their supplies of logs from another country in the CEMAC region, thus creating industrial employment on the other side of the border. Clearly this is a significant constraint to integration and the

distribution of labor at the community level.

Harmonization of legislation should be a means to simplify certain elements in the laws and regulations and to accent rules that are really important from the point of view of sustainable management of forest resources and the associated social aspects. This would make it possible to adapt the legislation to the capacity of the State and society in order to actually implement them. It would also reduce any ambiguities that may lie in their interpretation and would streamline 'adjustment' procedures to reduce the risks of arbitrary application of clauses that are too strict. This would reassure the different players in the sector and encourage long term commitment.

Legislative and Institutional Aspects	Cameroon	Gabon	Republic of Congo	Democratic Republic of Congo	Central African Republic	Equatorial Guinea
<i>Date of forestry law</i>	1994	2001	2000	2002	2000	1997
<i>Land Use Zoning Plan</i>	Yes, in the southern part of the country	In progress of preparation	No	First tests in progress	Planned	Land classification map published in 1999 by the CUREF project and validated
<i>Permanent Forest Domain (legally established, not established)</i>	38 classified UFAs (as of 30 June 2005), process in progress for 57 others	No (few classified forests)	No, classification of forests is planned	'Permanent production' forests are planned	No (no classified forests)	No
<i>Regime for allocation of concessions (mutually negotiated agreement/invitation to tender/invitation to tender with financial component)</i>	Invitation to tender, with technical pre-selection, then technical offers (30%) and financial offers (70%)	Mutually negotiated agreement, 45% of areas are on 'lease'	In theory: invitation to tender. Technical criteria such as industrialization project. No 'financial offer' component	Moratorium on new allocations pending the development of a tendering procedure combining technical and financial criteria	Since May 2005: invitation to tender as in Cameroon, but 40% for technical criteria and 60% for financial criteria	Mutually negotiated agreement
<i>Duration of concessions</i>	15 years, renewable once	Renewable rotation (generally 30 years)	15 or 25 years renewable	25 years	For the life of the company	15 years renewable
<i>Management obligation</i>	Yes. A management plan must be prepared during the 3-year provisional agreement, but several provisional agreements have passed the specified 3 years	Yes (partly applied). Surtax for non-application	Yes. Process progressing in the north, but non-application in the south	Yes (since new code). Will take several years	Yes. Only country where plans are implemented jointly by a public structure (PARPAF project) and the concessionaries.	Yes (not applied)
<i>National management standards</i>	Since 2002: Decree 222/A/MINEF of 25 May 2002	Since 2003, pending official confirmation by decree	No, but operational directives	No	Technically validated and applied since 2001. Regulatory text in course	No
<i>Proportion of logs required to be processed in country</i>	Local processing of 100% for category 1 species and logging authority subject to payment of surtax for category 2 and 3 species. Annual export quotas provided for – but not applied – for some species (Ayous and Azobé)	No legal restriction, but objective of stepping up local processing.	On a 'transitional basis': 85% of the production of each company; rule not uniformly applied. Complete prohibition provided for in the code. Progressive surtax above 15% of logs exported.	70% of the production of each company since the new code. Difficult to apply in the short term.	60% by the permit holder (code of 2000) The 2000 Finance Act raised this threshold to 77%	Only 60% local processing required, below which exporters pay a tax penalty. Seems to be rarely applied.
<i>Areas under management</i>	48 UFAs (i.e. 42 concessions) have a management plan validated by the administration, representing a total area of over 3 million ha	Process started on 6.5 million ha	Two plans completed and awaiting approval; Process started for 5.5 million ha	3 companies have started work leading to management plans (total of 677 million ha)	A management unit (PARPAF project) is preparing the plans for the country's 6 concessionaries. 2.8 million ha in process	Pilot management inventory for a concession of 50,000 ha through the CUREF project
<i>Concessions with certification</i>	1 ESC certified concession (December 2005). FSC certification process in course for 2 concessions	2 concessions certified according to the Dutch 'Keurhout' system, 2 ISO 14000 certified companies	1 concession certified according to the Dutch 'Keurhout' system. FSC certification process in course for the same company	0	Certification process Origin & Legality Standard (OLB-EUROCERTIFOR) in course for 1 concession	0
<i>Ceiling on areas that can be accumulated</i>	200,000 ha per company (several large groups hold over 200,000 ha and up to 600,000)	600,000 ha, but 3 companies alone own 700,000 ha	No ceiling	500,000 ha (except for acquired rights, some groups or companies have almost 3 million ha)	No ceiling	50,000 ha (a Malaysian company, Shimmer International, holds about 500,000 ha)
<i>Community or local forestry</i>	Community forests (5,000 ha max.): 59 approved, 225,615 ha Communal forests (one to date): 16,250 ha, but planned for over 600,000 ha (UFA applied for by municipalities)	Community forests provided for in the 2001 Act. Nothing concrete to date	Nothing provided for	Recognized 'Local community forests'. No ceiling on area. Decree to come with detailed rules. The 'decentralized entities' will also be able to obtain forests	6 pilot community forests (backed by project) but nothing provided for in the present code; a draft is in course	'Communal forest' where the State recognizes a right of permanent use for the rural communities

Table 8.7. Comparison of forestry legislations across Central Africa.

Taxation	Cameroon	Gabon	Republic of Congo	Democratic Republic of Congo	Central African Republic	Equatorial Guinea
<i>Estimated average tax pressure per m³ of product (FCFA/m³)</i>	30,000 (exported Ayous logs), i.e. 28.5% of FOB 36,500/m ³ sawn timber, i.e. 14% of FOB	About 26,000 for exported logs (28% of FOB) on a managed permit, 27,000 on an unmanaged permit (29% of FOB). Veneers: from 12,700 (managed permit), i.e. 5.4% of FOB, to 14,400 (unmanaged), i.e. 6.1% of FOB Sawn timber: from 19,700 to 22,800	From 21,618 (South) to 23,137 (North) or 11.6% to 14.6% for a 'panier export' (exported goods) FOB value per zone Sapelli export logs North: 19,300 to 34,350 (according to surtax) Okoume export logs South: 18,240 to 29,800 27,200/m ³ sawn sapelli	39 \$/m ³ (2004), i.e. 14.4% of the FOB value of a 'panier export' (exported goods) comprising 70% export logs and 30% sawn timber 33.8 \$/m ³ exported sapelli, i.e. between 12% and 19% of FOB 41.7 \$/m ³ sawn sapelli, i.e. 8-10% of FOB	About 26,500 for exported sapelli logs (i.e. 17.6% of FOB) and 34,900/m ³ of sawn timber, i.e. 11.8% of FOB	41,000/m ³ of exported okoume logs, i.e. 39% of FOB 31,000/m ³ of veneer (about 15%)
<i>Amount of surface area tax (concessions)</i>	Minimum: 1,000 FCFA/ha Average recorded since 1996: about 2,700 FCFA/ha	600 FCFA/ha in 2000 300 FCFA/ha only for companies engaged in the management process	350 FCFA/ha (North) 500 FCFA/ha (South) Discount of 20% on average to account for surface area that is actually exploitable.	0.0014 \$/ha up to 2002 0.067\$/ha in 2003 0.10 \$/ha in 2004 0.20 \$/ha in 2005 0.50\$/ha in 2007 Tax in annual logging permits: \$2 in 2004, \$10 in 2005	500 FCFA/ha/year	Between 2,500 and 3,000 FCFA/ha according to area
<i>Felling tax</i>	2.5% of FOB LM minus 20%	3%, 5% or 9% (depending on the zone) of an administrative price of the 'bracket value' type	3% FOB LM value	1.25% of Ex-Works value (EXW: FOB minus average transport cost of \$50 or \$80)	7% of administrative value (FOB LM minus 40%)	80% of the 'standing value' (defined as worth 8% of FOB)
<i>Exit duties on logs</i>	17.5% FOB value + surtax according to species	17% of FOB value	From 8.5 to 10%, according to zone (4) with an administrative FOB value fairly close to real prices	6% administrative value (fairly far removed from real prices) + 4% of EXW value (FOB minus average transport cost) as reforestation tax	10.5% FOT value (reduced FOB) + reforestation tax: 11% of administrative value	30% of official FOB value
<i>Exit duties on processed products</i>	Replaced by a tax on logs entering the factory (2.25% FOB on incoming logs)	No	From 0.5% to 4.5% of an administrative FOB value - poorly reflecting real prices	In 2005 (planned): 1% non-dried timber, 0% dried In 2006 (planned): 2% non-dried timber	4.5% FOT value for certain species only	10% of official FOB value
<i>Incentives or other specific measures</i>	None	Reduced surface area tax for managed permits No export taxes on processed products	Surface area tax on estimated surface that is actually exploitable	Surface area tax on production runs only (after management). Reforestation and felling tax lower for remote areas (EXW). Export taxes reduced by 50% for promotion species (tola, etc.) No export taxes on dried sawn timber	Surface area tax on estimated surface area that is actually exploitable. Export taxes lower for more remote areas	None
<i>Revenue for Treasury and Forestry Fund (in billions of FCFA)</i>	25 (2000-2001)	19.8 (2001)	12 (2003)	\$2 million (2002) (about 1.2 billion FCFA)	8.335 (2001)	Not available

Table 8.8. Comparison of forestry taxation in the countries of Central Africa.

9. Central African Forest Cover and Cover Change Mapping¹

Introduction

Mapping Central African vegetation began in the 1930's following the completion of the first botanical and ecological studies. These mapping efforts were based on aerial photography interpretations coupled with numerous ground-based observations. National and regional maps were mainly derived from the compilation of local studies, resulting in compatibility problems such as the matching of contiguous map edges. The UNESCO/AEFTAT/UNSO (White, 1983) potential vegetation map of Africa is the result of a long effort to mosaic existing maps and standardize existing documents with local experts. The vegetation map of Africa produced by the *Institut de la carte internationale de la végétation* is also based on the compilation of information existing at the national level, and on the interpretation of Landsat mosaics for transition zones.

For the past ten years, Central African vegetation maps, and forest cover changes estimates, have been primarily derived from satellite imagery, which provides undeniable benefits: simultaneous data acquisition over very large areas, repeated acquisition (for a better monitoring of seasonal and inter-annual ecosystem evolution), better geographic accuracy, and observations in wavelengths beyond the visible range (increase of thematic information). These innovative projects have demonstrated not only the possibilities for improving vegetation mapping, but also revealed limitations that need to be taken into consideration when mapping Central Africa.

- In particular, the quasi-permanent **cloud coverage** over numerous areas of the Basin (Atlantic Coast, South Congo) poses difficulties for accurate mapping. There are two options to overcome cloud coverage: daily acquisition of coarse resolution optical data (SPOT VEGETATION, MERIS, MODIS) or radar observation (ERS, JERS, Radarsat) that are not affected by cloud coverage.
- **Coverage** of the region from high-resolution polar orbiting sensors is rare.
- Another limitation is the absence of a **permanent receiving station** in the region. Mobile receiving stations, portable acquisition systems, and on-board recorders can provide potential solutions to this problem (Box 9.1).
- Difficult access to the field due to limited in-

frastructure impedes validation efforts.

- **Vegetation seasonal effects** require the use of systems with high temporal acquisition frequency (optical systems with coarse spatial resolution).

Forest Cover Mapping

Data and Methods

The most reliable maps for an objective assessment of Central Africa forest cover are derived from moderate (250m, e.g. MODIS) and coarse (1 km, e.g., SPOT) spatial resolution optical satellite data.

Each operational satellite system has advantages and disadvantages for discrimination of forest types. The main parameters to consider are wavelength (for example, observations in the mid-infrared portion of the spectrum—1.6 μm —will provide better indication of vegetation water content), spatial resolution (in particular for areas of human disturbance and areas of high landscape heterogeneity), and observation frequency (in the case of seasonal vegetative cover types or in areas with persistent cloud cover). However, the class definitions of thematic classes for maps derived from satellite imagery are essentially based upon physiognomic-structural vegetation traits, which leads to simplified legends when compared to other, more detailed floristic maps.

Recent technological advances have led to improvements in the spatial resolution, number and range of observable wavelengths (from the visible to radar), and acquisition frequency (for instance using satellite constellations) of satellite-based observations.

Vegetation mapping efforts have evolved from a 4km spatial resolution in the mid-eighties, to, currently, more precise 250m maps that better capture thematic and spatial detail.

For an initial survey of the forest zone of Central Africa, we performed a synthesis of two maps, one produced from SPOT VEGETATION imagery (GLC2000-Joint Research Center), and the other produced from MODIS data (University of Maryland and South Dakota State University). These maps were combined to produce a consolidated map based on the analysis of the strengths and limitations of both products. Topographic information was used to discrimi-

¹ This chapter was written by M. Hansen, D. Devers, Ph. Mayaux, P. Defourny, and G. Duveiller.

nate between altitudinal forest classes in the forest domain.

A more precise thematic map of the Democratic Republic of Congo has just been produced by the *Université catholique de Louvain* (UCL) (Box 9.2), derived from SPOT VEGETATION imagery, but this map does not cover the whole region and was not included in the regional synthesis.

The following vegetation classes were used:

- Dense humid coastal forest (includes evergreen and semi-deciduous formations with an elevation below 300m)
- Mid altitude dense humid forest (300-1000 m elevation)
- Submontane dense humid forest (1000-1600 m elevation)
- Montane dense humid forest (>1600 m elevation)
- Swamp forest and mangroves
- Secondary forest and rural complex
- Dry dense forest and miombo
- Forest – savannah mosaic
- Woodland and parkland savannah
- Shrubland
- Grassland and bare soil
- Swamp grassland

Map Description

The coastal dense forest is found in the western part of Cameroon, in the mainland part of Equatorial Guinea, and in the coastal area of Gabon west of Lambaréné. Mid-altitude dense forest covers the major portion of the Congo Basin from mid-Gabon to Kivu. Submontane forests occur on the edges of the Basin and in several forest blocks, such as on the Chaillu or the Belinga massifs, and feature high biodiversity. Two small mountain forest blocks exist in the Albertine Rift and in the foothills of Mount Cameroon. The central part of the Congo Basin, straddling both Congos, is covered by one of the world's largest inundated tropical forests.

The transition between the forest domain and savannah is relatively abrupt, in the North as well as in the South. This transition zone features marked disturbance and the presence of derived secondary savannah formations. Gallery forests of variable width stand in the Sudanian and Zambezi savannahs. Gallery forests present similar physiognomic characteristics to the dense forest, but cannot be classed in the same category, since they do not have the same ecological function nor the same economic value.

Within the Central African forest block the presence of areas of forest degradation varies from

one region to another. Analysis of these degraded areas provides useful information about land cover change dynamics. In the central part of Cameroon and in Equatorial Guinea, anthropogenic factors have affected large areas, especially in high population density zones. For instance, around Yaoundé, existing forest blocks are continually exploited and persist only in areas not suitable for agriculture.

In eastern Cameroon, CAR, Gabon, and the Republic of Congo, forest fragmentation is much less visible on regional maps. This is due to lower population pressure and consequently less agricultural activity. Forest exploitation in this region, largely selective logging, is not visible at the spatial resolution of either the SPOT or the MODIS sensors.

In the Democratic Republic of Congo, the forest is traversed by a dense road network, dating from the colonial area. The roads are bordered by rural complexes that include villages, food-producing areas, industrial plantations, and fallow areas. During the colonial period, villages were relocated to these transportation corridors, and even if the roads are no longer functional, the villages have remained in place. Degradation along road networks is continually expanding and these networks are the primary spatial indicator of future degradation.

Derived Forest Areas

Two major sources of error affect forest cover statistics derived from coarse and moderate spatial resolution satellite maps: unavoidable classification errors and spatial aggregation, which tends to underestimate finer spatial scale features, especially for maps at 1 km resolution.

The areas of disagreement between the GLC2000 and MODIS maps are found largely in the western area of the forest zone. Around Yaoundé, in Equatorial Guinea, and in the Chaillu Mountains in southern Congo, large forested areas are classified as dense forest by GLC2000 and as rural complex by MODIS. The latter classification is closer to reality.

In Gabon, small rural complex areas randomly appear in the MODIS map and correspond probably to artifacts linked to high cloud coverage.

In CAR, gallery forests identified as dense forest have been reclassified in a special class because they do not have the same ecological and economic roles as dense forest. Gallery forests cover about two million hectares.

In the Democratic Republic of Congo the two maps largely concur with differences attributable

Table 9.1. Forested areas in 1000 ha. Humid tropical forest areas derived from MODIS and GLC2000 maps and from the Global Forest Resources Assessment for the year 2005 (FAO, 2006). FAO estimates originate from harmonized national statistics.

	Forested areas derived from MODIS (1999-2002) and GLC2000 maps	World forest status in 2005 (FAO)
Cameroon	19,639	21,245
CAR	6,250	22,755
Republic of Congo	22,263	22,471
Equatorial Guinea	1,900	1,632
Gabon	22,069	21,775
DRC	108,339	133,610
Central Africa	180,460	223,488

to the different spatial resolution of the SPOT and MODIS sensors.

Compared to FAO (Table 9.1), the main differences are noted in countries that have large areas of wooded savannahs, which are assessed as forest by the FAO (>10% of canopy cover). This is the case of DRC (+23%) and especially of CAR (+264%).

When dense forest is disaggregated by topography and hydrography (Table 9.2), we note that 80% of the forests are located between 300 and 1000 m of altitude, while coastal forests and inundated/swamp forest each comprise about 7% of the forested area. Submontane and montane forests represent only 3.6% of the forested area.

Forest Cover Change

Forest cover change measurements need to take into account the spatial characteristics of change processes in Central Africa and the challenges of acquiring data over humid tropical forests, which are under quasi-permanent cloud cover (Box 9.3).

- Zones of deforestation are relatively small, and their measurement requires data at an appropriately fine spatial scale.
- Forest blocks, in other words 'deforestable' areas, are extensive, but deforestation is not uniformly distributed in time and in space. Change is a distinctly non-random process.
- The time scale of measurement needs to be adapted to the processes and to the spatial distribution of deforestation (Box 9.4).

Table 9.2: Distribution in % by dense humid forest type.

	Coastal forest (0-300m)	Intermediary forest (300-1000m)	Submontane forest (1000-1600m)	Montane forest (>1600m)	Inundated forest and mangroves
Cameroon	14.7%	82.8%	1.5%	0.3%	0.6%
CAR	-	99.6%	0.3%	-	-
Republic of Congo	9.0%	71.1%	-	-	20.0%
Equatorial Guinea	23.3%	76.4%	0.3%	-	-
Gabon	32.6%	66.7%	-	-	0.7%
DRC	0.7%	85.5%	4.4%	1.3%	8.0%
Central Africa	7.5%	81.5%	2.8%	0.8%	7.4%

It is not currently possible to measure forest cover change annually at fine spatial resolutions. With existing data sets, and improved sampling methods, it is possible to update forest cover change dynamics for most of the Basin in 5 to 10 year intervals.

Continental Deforestation Estimates

Remote sensing tools are perfectly adapted to measure deforestation in large and inaccessible areas such as Central Africa. Several strategies have been developed in the past to measure in a precise manner deforestation at the global or continental scale: random sampling (FAO-FRA 1990) or systematic sampling (FAO-FRA 2000) of high spatial resolution imagery, an exhaustive coverage with high resolution optical data (Landsat Pathfinder), and detection of zones of rapid change ('hot spots') with coarse spatial resolution data in combination with expert opinion and use of higher resolution imagery to measure deforestation in these zones (TREES).

According to expert analysis and developed models, the major sites of deforestation are in southern Cameroon and in DRC. High population growth, concentrated in cities like Douala, Yaoundé and Ebolowa, has increased agricultural pressure. Forest access is facilitated by the construction of logging roads by logging companies. In DRC deforestation is concentrated along the road network; the principal cause is the demand for food products in the big cities of the region (Kinshasa, Kananga, Mbuji-Mayi, Lubumbashi, Kisangani, Brazzaville and Bangui).

In areas of higher population density, along existing road networks that are relatively well-connected to urban areas, change is driven by local farmers. In the interior, logging companies, exploiting concessions attributed by the government, open networks of primary and secondary roads that fragment the canopy cover. When the urban demand for food products (cassava, bananas, maize, bushmeat, etc.) is great, people settle along those openings and start trading such products, which results in the colonization of primary forests. If the demographic pressure is low, forest trails can close up in only a few years.

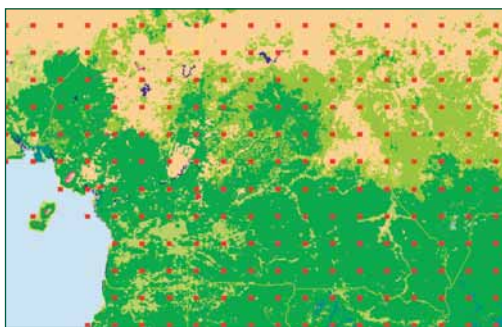


Figure 9.1: Theoretical statistical scheme for the northeastern sector of Central Africa showing the grid used to calculate deforestation and degradation (Source: JRC).

National and Local Deforestation Estimates

Methods

The above mentioned strategies, developed for the most part at the end of the nineties, did not provide national scale deforestation rates, nor did they provide reliable regional scale deforestation rates due to inadequate sampling.

More recently, teams have opted for two different approaches allowing finer measurement of forest cover change: an exhaustive ('wall-to-wall') deforestation mapping of the areas of interest (work in progress at the University of Maryland and South Dakota State University for CARPE in the landscapes— Box 9.5), and a finer sampling scheme of smaller units (Figure 9.1) for which the results have become recently available (Joint Research Center and *Université catholique de Louvain*).

The statistical scheme applied in the JRC/UCL study is a systematic grid sampling of $\frac{1}{2}$ square degrees. Units of observation are 10 by 10 km subsets from Landsat images from the years 1990 and 2000 (± 2 years), which gives an approximate sampling density of 4%. FAO proposes to use this statistical scheme to compute its future global estimates.

National Estimates

The JRC/UCL sampling scheme provides estimates for deforestation with each country. Within all the observation units (10 by 10 km subsets), only images over the forest domain are analyzed. Cloud coverage poses a major problem in the coastal region. As a result only 20 to 30 % of the units can be analyzed in Gabon and Equatorial Guinea. A review of all available images shows that close to 60% of the images do not show any forest cover change between 1990 and 2000. Table 9.3 details the parameters for each country.

The adopted statistical scheme and image availability constraints permit derivation of forest change estimates for relatively large units, such

as countries or landscapes. Regional estimates, as well as first national estimates, have been produced based on the 374 samples. National estimates will be more precise for countries that have many observation units (DRC, Republic of Congo, Cameroon) than for other countries. In the latter case, a higher density of samples should allow for results with the same precision.

Table 9.4 details national estimates of gross deforestation rate, net deforestation rate (=gross deforestation – reforestation), and net degradation rate (transition from dense forest to degraded forest through small canopy openings). The last line of the table refers to FAO estimates. The deforestation rate of Central African countries is estimated at 0.19%/year, with 0.10%/year degradation. The table shows that deforestation is higher in DRC and in Cameroon—recognizing the weak reliability of estimates for Equatorial Guinea. It is worth mentioning that these estimates are prelim-

inary figures and that they will be fine tuned, notably by including confidence intervals. FAO estimates come from statistics provided by national services, which are often based on old estimates or on expert opinions. It is therefore not surprising that they differ from our estimates, which are based on a more homogeneous method. The case of Cameroon clearly indicates this fact.

These estimates could be sensibly improved in a second phase using co-variables, such as road presence, village or the percentage of secondary forests - variables that could be measured on the total population and not only on the samples. Spatial statistical techniques will be used to produce consolidated statistics in the near future.

Landscapes estimates

Deforestation estimates could also be produced for sufficiently large landscapes and for landscapes where cloud cover is low. Table 9.5 synthesizes observation parameters and estimates per landscape. It should be noted that landscapes close to the Atlantic Coast (Lopé, Gamba, Monte Alén) have fewer samples and thus do not allow for accurate estimates. A combined estimate for all the landscapes can nonetheless be proposed to answer the following question: Is deforestation lower within the landscapes or outside of the landscapes? For the 1990-2000 period, this gives us an indication of the threat level with which the landscapes were confronted at the time of their selection. The results are quite clear: the deforestation rates observed within the landscapes (0.078%/year) is less than half of the deforestation rate observed for the region. The only landscape that has a relatively high deforestation rate is Maiko-Tayna-Kahuzi Biega (close to 0.3 %/year).

Forest change has been mapped exhaustively for three landscapes from high resolution satellite data for the same time interval by UMD/SDSU researchers using a wall-to-wall methodology. For Maringa-Lopori-Wamba the estimates are close to the estimates derived from the JRC/UCL methodology (close to 0.1 %/year), while they diverge quite clearly for Salonga (0.074% and 0.038%/year).

Table 9.3: Parameters of analyzed samples.

Country	Theoretical number of samples	Number of samples analyzed	Number of samples with change	% of samples analyzed	% of samples with change
Cameroon	63	29	8	46.0	27.6
CAR	16	12	4	75.0	33.3
DRC	338	266	129	78.7	48.5
Republic of Congo	80	47	13	58.8	27.7
Equatorial Guinea	9	2	1	22.2	50.0
Gabon	63	18	5	28.6	27.8
Central Africa	569	374	160	65.7	42.8

Table 9.4: National annual rate estimates of gross and net deforestation and net degradation for the time interval from 1990 to 2000, based on the JRC/UCL sampling method. FAO estimates are included for comparison. The regional estimates are corrected as a function of the number of subsets actually analyzed in each country. The negative signs represent canopy cover reduction.

	Cameroon	CAR	DRC	Equatorial Guinea	Republic of Congo	Gabon	Central Africa
Gross Deforestation	-0.28%	-0.15%	-0.33%	-0.35%	-0.12%	-0.16%	-0.27%
Net Deforestation	-0.19%	-0.07%	-0.26%	0.41%	-0.03%	-0.12%	-0.19%
Net Degradation	-0.02%	-0.02%	-0.15%	0.52%	-0.01%	-0.09%	-0.10%
FAO Deforestation	-0.90%	-0.10%	-0.40%	-0.60%	-0.10%	0.05%	-0.36%

Conclusions

Satellite remote sensing is an efficient tool to map and monitor vegetation in Central Africa. Nonetheless, in order to maximize its efficiency, a number of conditions have to be met:

- A multidisciplinary approach should be adopted by deforestation monitoring teams, including remote sensing specialists, foresters, ecologists and social scientists.
- Deforestation monitoring should be built on a multi-sensor, multi-scale strategy, which combines remotely sensed data (optical or radar) with ancillary data sources (Box 9.6).
- There is a need for improved and meaningful dialogue between field projects and earth observation-based mapping projects. Field projects can provide the definition of user needs and product validation, while earth observation based projects can provide a wider context for field observations.
- Ongoing collaborations between African and non-African institutions should increase technology transfer to build in-country mapping capabilities.

Box 9.1: Data availability

Remote sensing data is critical for policy makers, environmental managers, and scientists interested in understanding land cover and land use change at the local, national, and regional scale. Satellite imagery is also critical for forestry decision support systems.

Until recently, Landsat, given its low cost and unrestricted license use, has been the workhorse for high resolution (20-30 m) forest cover mapping of Central Africa. Unfortunately, on April 2003 the failure of the Landsat 7 ETM+ scan line corrector resulted in data gaps outside of the central portion of acquired images, seriously compromising data quality for land cover monitoring.

Given this failure, there is an urgent need to explore how the ensuing data gap might be filled at a reasonable cost with alternative sources of data in order to meet the needs for operational decision-making. Possible alternative sources of data include Landsat 5 TM, ASTER, SPOT HRVIR, IRS, CBERS or DMC data. However, none of these data sources are optimal, due to the absence of long term continuity, the excessive cost for large area mapping, or the absence of a receiving station or ground segment. Moreover, since the various data sets have different characteristics, it cannot be assumed that products will be comparable.

The participants to the State of the Forest meeting, held in Kinshasa in March 2006 highlighted the lack of current remotely sensed data for ongoing forest monitoring in the region. The concluding report of that meeting recommends engaging space agencies – such as ESA, NASA, JAXA, CNES – to improve continuity and access to high resolution satellite data. Improved data access policies would allow for a true forest monitoring capability.

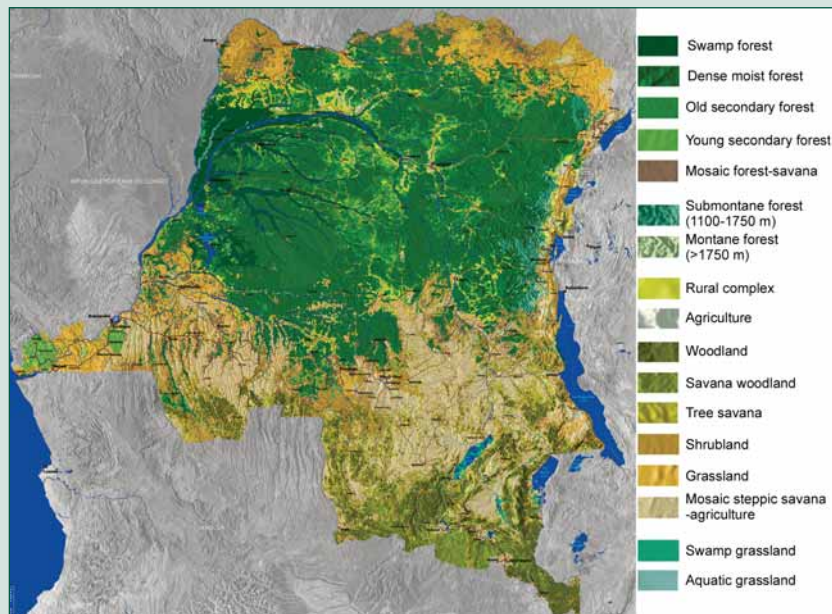
As the science of earth observation monitoring has matured, the providers of the data necessary to make monitoring a reality have not kept pace with the science. In the short term a solution to the current data gap should be pursued. Such an effort would involve the acquisition and compositing of appropriate imagery to generate a mid-decadal data set. This would not only respond to the recommendation of the majority of the stakeholders interested in forest monitoring in the Congo Basin - COMIFAC, National Governments, donors, NGOs, private sectors, observers - but would also respond to the draft Strategic Plans for Global Earth Observation System of Systems (GEOSS), of which CBFP government partners are signatories.

Table 9.5: Landscape annual deforestation rates as estimated for the time interval from 1990 to 2000. The estimate for the entirety of the landscapes is corrected as a function of the number of subsets actually analyzed in each landscape. The negative signs represent canopy cover reduction.

Landscape	Percentage of analyzed subsets	Number of analyzed subsets	Sampling Method (JRC-UCL)				Exhaustive coverage (CARPE-UMD-SDSU)
			Number of subsets with change	Gross deforestation	Net deforestation	Net degradation	
Sangha Tri-National	31.2	5	1	-	-	-	-0.042%
Dja-Minkébé-Odzala (Tridom)	61.3	27	6	-0.079%	-0.003%	0.069%	
Ituri-Epulu-Aru	81.8	9	6	-0.209%	-0.117%	-0.141%	
Monte Alén-Monts de Cristal	36.3	4	1	-	-	-	
Maiko-Tayna-Kahuzi-Biega	73.1	19	8	-0.450%	-0.294%	-0.128%	
Lopé-Chaillu-Louesse	16.7	2	0	-	-	-	
Salonga-Lukenie-Sankuru	80	32	11	-0.114%	-0.074%	-0.040%	-0.038%
Léconi-Batéké-Léfini	33.3	2	0	-	-	-	
Gamba-Mayumba-Conkouati	12.5	1	0	-	-	-	
Lake Télé-Lake Tumba	66.7	30	10	-0.176%	-0.073%	-0.097%	
Maringa-Lopori-Wamba	85	17	5	-0.115%	-0.100%	-0.190%	-0.098%
Total	61.9	148	48	-0.171%	-0.078%	-0.062%	

Box 9.2. A new map of the forests of the Democratic Republic of Congo

This new land use map of the Democratic Republic of Congo produced by the *Université catholique de Louvain* (Belgium) in collaboration with the Joint Research Center (JRC) underlines the impact of the human activities that are widely scattered all over the African forest ecosystems. In total, 17 vegetation types have been identified by ecologists using seasonal information from satellite images acquired in 2000. This map is derived from a temporal series of SPOT VEGETATION images at 1 km resolution. It is the most up-to-date available map giving detailed information for the whole country. The estimated forest area is 1,120,340 sq. km, and represents 47.4 % of the country's territory. Four forest types are categorized: dense humid forest, edaphic forest, old secondary forest and recent secondary forest. These estimates are very close to those obtained by the FAO-Africover project.



Box 9.3. Indicators and factors of deforestation

Some indicators derived from satellite imagery or from geographic information systems enable the detection or prediction of zones of rapid changes.

Forest Fragmentation

Forest cover fragmentation measured using coarse resolution maps is generally superior inside hot spots than outside. However, some highly fragmented regions, such as the Batéké Plateau or the Ogooué Estuary do not correspond to any hot spot zone because their fragmentation is linked to oro-hydrographic or edaphic causes. In order to use forest fragmentation as an indicator of deforestation, we need to discriminate between natural and anthropogenic phenomena.

Transport Network

The road network is a fundamental indicator if we want to predict where deforestation will occur in the future. Two parameters are important: location and status of roads and trails. Location of roads is more easily accomplished than assessing their status. Also the forest trail and track locations, which are often the first axis of forest fragmentation, need to be collected from development projects and logging companies.

Navigable rivers also play an important role in the transport of people and goods, particularly in the central part of the Basin. Unfortunately, there are major gaps in existing river network databases.

Vegetation Fires

Vegetation fires detected by satellite are not useful indicators of deforestation in Central Africa, contrary to the situation prevailing in Brazil. First, clouds very often cover forest zones and impede regular image acquisitions (only a few high resolution images per year). Secondly, forest fires occur frequently in secondary forest zones because they are part of the slash-and-burn agricultural system. These fires, limited by the clearing capacity of one person, are often too small to be detected by satellites. Fires lit by new migrants for forest colonization are very different. They are found mainly in southern Cameroon, colonized by the Bamileke.

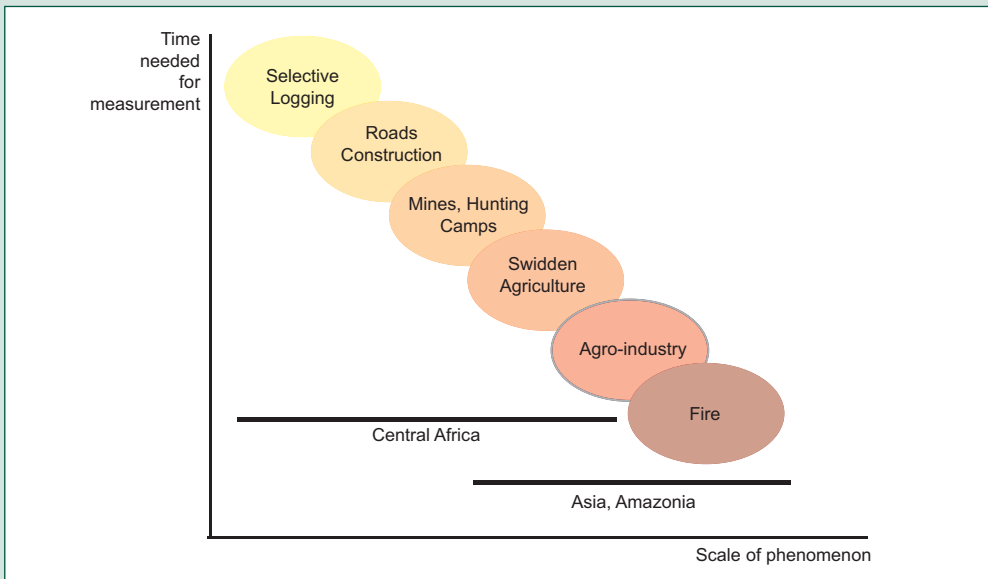
Demographic Growth

In Central Africa, population growth is a significant driver of deforestation. Cities like Yaoundé, Kinshasa or Libreville have developed considerably during the 1970s and the 1980s. The population structure (urban and rural) can have a considerable impact on the different deforestation processes. An increase of rural population leads to a reduction of fallow period, and can lead to soil degradation. Often this happens in secondary forest zones, but when pressure is too high, primary forests blocks can be threatened as well. Fallow periods can thus be a good indicator of demographic pressure. An increase in urban population increases the demand for food products and creates a market in neighboring zones. In that case, the urban population impact on deforestation depends on the accessibility, and by consequence quality, of the transportation network. The poor reliability of demographic data in Central Africa is a major handicap for the implementation of reliable models. Some national censuses date back to the 1970s, while Gabon has population data for 1996. When modeling population dynamics, attention must be paid to the suspect quality of population data. For example, a simplistic model that establishes a linear relationship between population and deforestation should be treated with skepticism. At the initial stage, a population increase can provoke intense forest degradation, but with time the intensification of production techniques reduces the negative impact of population. It is important to be able to estimate the carrying capacity of the different ecosystems concerned.

Logging Concessions

While it is generally acknowledged that excessive logging exploitation has dramatically reduced forest cover in West Africa, the situation is more complex in Central Africa. With sustainable management conditions, logging companies do not represent a major deforestation risk. They generally exploit only a few commercial species without substantially reducing canopy cover. For example, the extraction of 1 to 2 trees per ha reduces the forest cover by 10% (see chapter on commercial forestry). On the other hand, logging exploitation opens new logging trails and roads, increasing access to the forest. It would be interesting to study the impact of new trail construction in correspondence with deforestation measures in ensuing years in the same zone. In that regard, logging concessions maps are of a prime importance for deforestation modeling.

Box 9.4: Time scale to measure change



The method to measure forest cover changes depends largely on the scale and range. If changes occur over very large areas in short time periods (due to fires for example), changes can be detected using sensors with a high frequency acquisition, but with a lower spatial resolution. On the other hand, if changes are small and incremental (selective logging, swidden agriculture), changes can only be detected with precise imagery, even if the acquisition frequency is lower.

Box 9.5: Forest cover change mapping in the Landscapes

The production of a large number of Landsat mosaics allows for the precise mapping of forest cover change in the CBFP landscapes (University of Maryland and South Dakota State University). An example for the Maringa-Lopori-Wamba Landscape is shown below. The primary objective of the project is to create spatially explicit basin-wide maps of forest cover change. By doing so, forest change attributes such as fragmentation can be analyzed over time and correlated with existing *in situ* data sets. This is not possible with a sampling scheme.

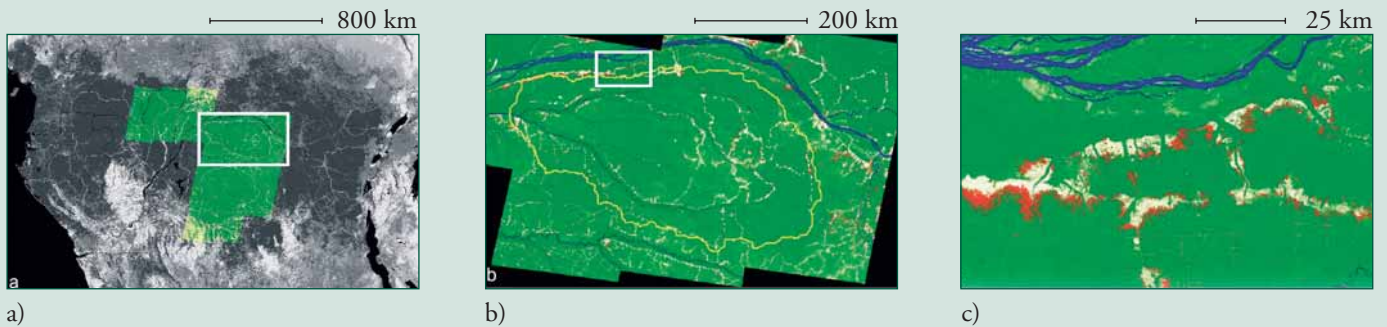


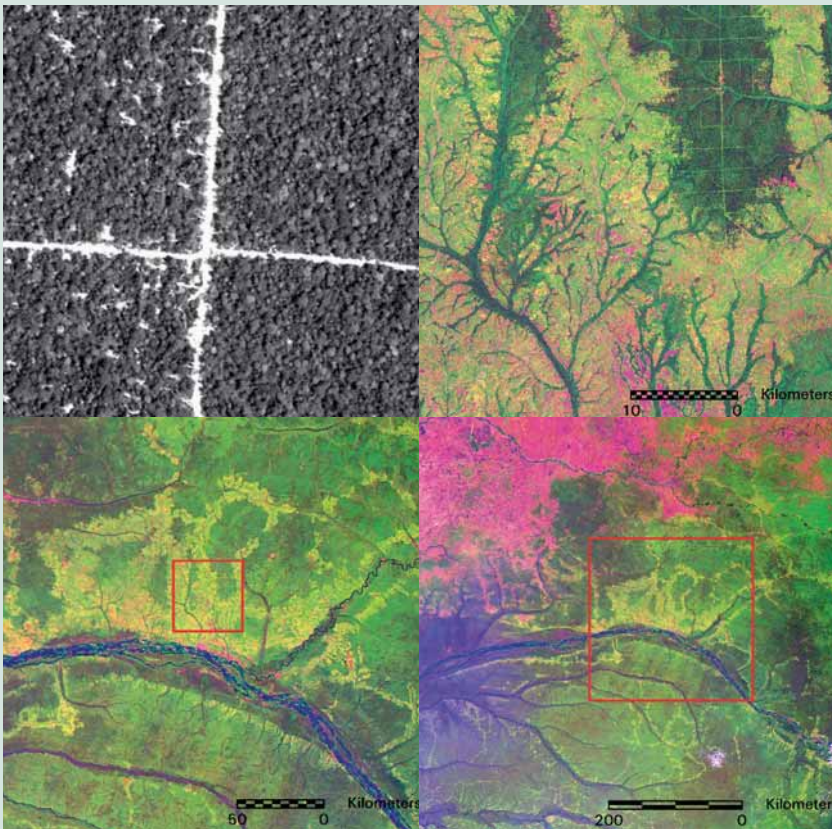
Figure a: Processed high-resolution forest probability and change estimates for the Congo Basin, 1990-2000.

Figure b: High-resolution change map for the Maringa-Lopori-Wamba Landscape (in yellow outline).

Figure c: Full-resolution zoom of change map for the northern edge of the Landscape.

Box 9.6. Spatial resolution and repeatability

One of the fundamental parameters of satellite imagery is the spatial resolution, which is defined by the size of the elements (pixels) constituting the image. We class optical satellite data into 4 major categories based on resolution: very high resolution (Ikonos, SPOT 5: 1-5 m), high resolution (SPOT HRV, Landsat, ASTER: 15-30 m), moderate resolution (MODIS, MERIS: 250-300 m), and coarse resolution (SPOT VEGETATION, AVHRR, Meteosat: 1-4 km). The spatial resolution is usually inversely correlated to the width of the field of view and the data acquisition frequency. Data from different sensors, which have complementary characteristics, can be combined to monitor deforestation: continuous monitoring at coarse resolution, change detection every 2-3 years at moderate resolution, fine measurements every ten years at high resolution. Data at very high resolution make it possible to distinguish individual trees, but cannot be used to measure deforestation given the high costs of acquiring such data.



Satellite Data: SPOT 5 (2.5 m, upper left), Landsat (30 m, upper right), MODIS (250 m, lower left) and SPOT VEGETATION (1 km, lower right).

10. Importance, Constraints and Prevailing Trends of the Timber Sector in the Six Forest Countries of Central Africa¹

Synopsis²

The contribution of the timber sector to the economic activity of the six forest countries of Central Africa (Cameroon, Republic of Congo, Gabon, Equatorial Guinea, CAR and DRC) tends to vary, but on the whole it is of major importance because of the tax revenue it brings in, its share of exports and the jobs it generates, particularly through the creation of centers of activity in regions far removed from established infrastructure and populated areas. The contribution of the timber sector to GDP is difficult to assess and differs substantially from country to country: Cameroon 6%, Republic of Congo 2%, Gabon 3-4%, Equatorial Guinea 6%, CAR 10% to 13%, and DRC 0.7%.

The intensity of timber extraction varies considerably and depends on the country's forest structure as well as other available resources, the country's raw materials (especially oil) and agricultural production. Equatorial Guinea is the country where the pressure from logging is greatest, with a forestry industry largely dependent on Asian interests and a total absence of sustainable management. At the other end of the spectrum, DRC is characterized by a very low level of timber extraction relative to the available forest area and maintains a firm commitment to the process of sustainable forest management.

The timber industry in the six countries is essentially organized around processing and the export of products. For historical reasons, Europe has long been the main destination for timber exports from Central Africa. This trend began to change in 1994 as a result of two factors: (i) the devaluation of the CFA franc, which improved the competitiveness of the timber sector and boosted investments, and (ii) the surge in Asian demand, associated with Malaysia's 1993 ban on all exports of logs and the sharp fall in forest resources throughout the region. This measure also led Asian companies to invest in certain countries of Central Africa as they moved in to compete with European operators.

The rate of processing is directly linked to the level of industrialization, which remains low in the region, except in Cameroon where there is a partial ban on the export of logs. In Equatorial Guinea, it has declined considerably over the last 10 years. Gabon remains the leading exporter of

logs in Africa, although the processing industry there has only recently begun to develop. In DRC, and to a lesser degree CAR and the Republic of Congo, the level of logging activity operates well below its potential due to repeated conflicts, which have effectively served as a brake on the development of this sector.

Domestic markets are largely supplied by the informal sector, which is often the only source of supply for rough lumber that is accessible at affordable prices and at the local level. The volumes of timber passing through this sector could be higher than those processed by the formal sector, with very little possibility of controls on the volumes intended for export. In DRC, a country undergoing reconstruction and with a very large population, industrial companies in the formal sector are concerned more with the domestic market, due to its strong development potential and the very high associated demand (production of plywood intended solely for the domestic market).

The future development of the timber sectors in the countries of Central Africa is closely linked to their ability to find solutions to the following problems:

- 1) Promoting further timber processing, which is currently limited by numerous constraints:*** major difficulties in supplying the log-processing units; the poor condition of equipment; inadequate transport infrastructure and poor services; political instability and social conflicts; the absence of or failure to implement any concerted and coherent national strategies for the development of the forestry industry; lack of appropriate mechanisms for the financing of a more intensive processing industry; strategies of multinational corporations based on intra-firm transfers (except in DRC, where timber companies tend to be family affairs with a target clientele in Europe); lack of skilled personnel with experience in planning, management of further processing and marketing of products; tight domestic markets for processed products and imports from foreign countries (*OAB, 2004: Promotion de la transformation plus poussée des bois tropicaux en Afrique*).

¹ This chapter was written by J. Gérard.

² This synopsis is organized at a national scale to highlight the particular characteristics of each country. The information provided is the result of an analysis of recent publications and reports, and takes into account the indicators defined at the validation meeting held on November 3-4, 2005 in Kinshasa.

- 2) ***Establishing satisfactory economic and fiscal conditions to secure the sustainable operation of companies*** and ensure that they have growth prospects within a context favorable for their expansion.
- 3) ***Making better use of the timber produced and processed at each stage in the production system***, from rough lumber (logs) on logging sites to the proportion of processed products which do not meet the current criteria of international demand.
- 4) ***Increasing the output of first-stage processing companies***: this output remains low, primarily due to the specifications imposed by the export market (long lengths, fixed dimensions, FAS quality for sawn timber); an increase in output is conditional on the feasibility of further developing timber processing.
- 5) ***Developing the processing and marketing of little-used species, within the context of sustainable management***: at present, logging companies undertaking sustainable forest management are required to use these species to economically optimize the exploitation of their concessions; the inventories carried out make it possible to determine precisely the availability and exploitability of this timber; downstream of the sector, second-stage processing companies in the north, particularly sectors consuming large volumes (exterior woodwork), are seeking to secure their supplies and guarantee their source.

At the end of 2005, 9.2 million hectares of forestry concessions in the Congo Basin had sustainable management plans that were either finalized or in the process of finalization (drafted, submitted or in course of approval). A sustainable management plan, the starting point for genuine sustainable forest management, must reconcile the objectives of the interdependent aspects of sustainable forest management: production of timber and non-timber forest products, environmental considerations and social concerns. It is the first tool for securing and planning sources for the processing units.

The objective of 'timber production', on which the financial viability and implementation of these sustainable management plans are directly dependent, is conditional on the possibility of broadening the range of timber extracted by moving away from the conventional framework in which logging was structured around a limited

number of flagship species. For logging companies involved in sustainable forest management, logging little-used species for marketing addresses two requirements:

- the need to optimize the use of areas already being logged by making the best possible use of unexploited species
- the need to limit the pressure on flagship species in accordance with the objectives defined in their management plans

At present, harvesting, processing and marketing these so-called secondary species is an essential condition to ensure continuity and to contribute to the extension of the sustainable management plans of logging companies in Central Africa.

Cameroon

Since 1986, exports of timber and derived products (particularly plywood panels) have played a growing role in Cameroon's economy. This growth was concurrent with the fall in prices of exported raw materials (coffee, cocoa, etc.). The forestry sector, which contributes some 6% to GDP, currently generates around 45,000 jobs, half of which are in the informal economy. The adoption of the forest code in 1994 and the partial halt to exports of logs in 1999 paved the way for the rapid industrialization of the sector. Cameroon has the most highly developed processing industry in the subregion. In 2003, exports of timber and derived products, second only to petroleum products, represented 16% of all exports (around 380 million dollars).

Construction timber production was estimated at 2.45 million m³ per year in 2004, of which 1.5 million m³ was from the permanent forest domain, 50,000 m³ was from community forests and 100,000 m³ was from reforested areas. Currently, 300 species are marketable, but only sixty or so are logged regularly. Six species are heavily logged in relatively large quantities: obeche, sapele, ekki, iroko, tali and frake.

Industrial fabric and timber processing

Since the partial halt to log exports in 1999 (23 species in 2004³), Cameroon's forest economy has essentially been based on processing, because of the added value and number of jobs generated in both urban and rural areas.

Timber processing units, primarily geared towards first-stage processing, are typically situated in industrial 'free zones' or in urban environments (with easy access to the port of Douala) and are

³ African mahogany, assamela, aniegre, bete, dibetou, bosse, bubinga, makore, white azfelia, red azfelia, fromager, ilomba, iroko, longhi, moabi, movingui, ovengkol, padauk, pao rosa, sapele, sipo, wenge, zingana

usually outfitted with second-hand equipment bought and reconditioned in Europe.

A study by CERNA, carried out between 1994 and 1998, on the industrialization of the timber sector in Cameroon reported 66 factories in operation; a more recent inventory by MINEF (2001) listed 75 units in operation:

- 68 sawmills (with or without dryer and with or without integrated joinery workshop)
- 5 cutting/plywood factories
- 2 slicing factories

The maximum processing capacity is estimated at 2.8 million m³ for an annual production of 2.45 million m³.

The four leading companies in terms of processing capacity are: SFID (*Société forestière de la Doumé*, Rougier Group, 240,000 m³), SFH (*Société forestière Hazim*, with Lebanese interests, 165,000 m³), ALPICAM (Italian company, 110,000 m³) and SIBAF (*Société industrielle des bois africains*, 100,000 m³). Recently, the Cameroonian subsidiary of Interwood was sold to Jean Khoury, HFC (*Hassan Forestière Campo*, subsidiary of the Bolloré Group) was liquidated and SEBC (*Société d'exploitation des bois du Cameroun*) and SAB (*Société africaine des bois*), both subsidiaries of the Thanry Group, were sold to Vicwood (Chinese Group). The other active companies are Lebanese (Cocam, SABM), Italian (Ecam Placage, Vasco Legne Group), Belgian (Decolvenaere), Greek (Etablissements Karayannis), Dutch (Wijma, GWZ Group), Malaysian or Cameroonian.

Second-stage processing, which is growing appreciably in Cameroon, is being carried out by three types of companies:

- 1) *industrial companies*: several have integrated with sawmills and as a result their production of precut timber, profiled timber (flooring, internal trim) and moldings is largely exported. The existence of these integrated companies is a relatively recent development and is evidence of the industrialization efforts that were started in 1998. Integration is concerned with securing supplies and the development of waste recovery in order to increase the companies' yields. The concept of integration, does not favor the development of the domestic sawn timber market.
- 2) *Second-stage processing SMEs and furniture factories*: there are relatively few of them. These companies produce medium to top of the line furniture for a local well-off clientele. They were established in the 1980s to meet the demand for furniture designed for administration or public buildings. Some of these

companies are currently experiencing difficulties due to a shortage of timber of guaranteed origin and competition from numerous small scale local companies.

- 3) *Small scale local companies*: these are more numerous and they tend to be located in city centers, where they use rudimentary equipment to produce furniture and other internal fittings for the domestic and regional markets (Gabon, Equatorial Guinea, etc.). Most of these craftsmen operate within the informal economy.

In addition to these three types of companies, there has been a recent increase in companies that plane down timber to specific dimensions for export, using wood that has come from legal or illegal small-scale sawing operations (chain saws or other mobile saws).

Production

Production of logs (Table 10.1) has been relatively stable over the last three years, while domestic consumption has increased in keeping with the regular increase in sawn timber production, one of the objectives of introducing the new forest code. These data reveal a drop in domestic consumption of sawn timber. This substantial and unexpected reduction can be explained by multiple factors:

- a reduction in supply from processing companies, which prefer to export their products at more advantageous prices than those on the domestic market
- a possible reduction in activity in the building and furniture sectors, the two main consumers of construction timber, linked to a fall in purchasing power
- the difference being covered by informal supplies, for which there are no formal records

Exports

Over the last five years, the ban on exports of logs of certain species has had a strong influence on the timber sector in Cameroon (Table 10.2). These exports have decreased substantially while the domestic industry has grown. Today, less than 7% of logs harvested in Cameroon are exported unprocessed. The activity at the port of Douala is centered on exports of logs from the Republic of Congo and CAR.

Obeche and frake represent 81% of exported logs (Table 10.3). Obeche exports have remained stable while those of frake have fallen sharply because the price of this species has become uncompetitive. Like ekki, it is increasingly being processed locally. Eyong, tali and lati are well behind these two flagship species, while all the other species account for only 5% of the total volume exported.

Italy is the main importer of logs from Cameroon, importing more than 40% of the country's exports (Table 10.4), followed by China (25%) and France (9%).

With 685,000 m³ of cut timber exported in 2004, Cameroon remains one of the leading processors in Africa. The two main species concerned are still obeche and sapele, which represent about a half of all timber exports. Exports of white azfelia (*Azfelia pachyloba*) and iroko increased considerably in 2004; along with tali and ekki, they represent 30% of total exports. The remaining 20% are exports of around 50 other species in the form of cut timber.

European countries, mainly Spain and Italy, are still the largest consumers of cut timber, importing 80% of Cameroon's production; China's share is increasing constantly, but the targeted markets remain transactional at the moment. The 50,000 m³ of plywood exported is mainly consumed by Italy, the Republic of Congo and Senegal (30%, 19% and 17% respectively). Exported veneer (23,000 m³), mainly obeche (80%), goes almost exclusively to Italy.

x1,000m ³		Logs	Sawn timber	Veneer	Plywood
Production	2002	2,150	652	53	42
	2003	2,530	658	47	39
	2004	2,375	710	53	50*
Domestic consumption	2002	1,725	221	30	27
	2003	2,146	178	20	27
	2004	2,234	25	38	3

Source: ITTO

* ITTO estimates or adjustments

Table 10.1. Main production statistics for Cameroon.

Development priorities

At present, the main destination for timber from Cameroon is Europe; Cameroon has thus started implementing the European Union's FLEGT process, which is concerned with Forest Law Enforcement, Governance and Trade, to combat illegal logging. Cameroon can play a key role in the enforcement of forest laws and governance in the sector and could become a leader among the producing countries of the Congo Basin. At the same time, individual companies are committing to certification and, at the end of 2005, one forestry company obtained FSC certification⁴.

Promotion and technical support should be supported in order to promote industrial and local small scale SMEs involved in second-stage processing and encourage integration of the informal economy.

Main bibliographical sources

Ambassade de France au Cameroun, 2005; Ambassade de France au Cameroun, 2003; ATIBT, 2005; BEAC, 2005; BEAC-CEMAC, 2005; Carret, 1999; Carret *et al.*, 2002a; Carret *et al.*, 2002b; Carret *et al.*, 2002c; FAO, 2002; Koffi, 2005; Langbour, 2005; MEF, 2004; OAB, 2004; OIBT, 2004.

⁴ WIJMA DOUALA obtained the FSC certificate (EUROCERTIFOR – BVQI) for the management of the *unité forestière d'aménagement* UFA 09 021 and thus became the first FSC-certified logging company in Central Africa.

Table 10.2. Main export statistics for Cameroon.

x1,000m ³		Logs	Sawn timber	Veneer	Plywood
Exports	2002	425*	432	27	15
	2003	385* (191**)	480 (890**)	27	12
	2004	141*	685*	23*	50*

Source: ITTO

*: ITTO estimates or adjustments **: source ATIBT

Table 10.3. Volumes of logs exported from Cameroon in 2004, for the five main species (> 1,000m³).

Species	Volume (m ³)	Main destinations
Obeche	80,894	Italy, China
Frake	33,510	Italy, France
Eyong	9,747	China, Turkey
Tali	6,994	Spain
Lati	2,479	China, Italy

Source: ATIBT

Table 10.4. Volumes of cut timber exported from Cameroon in 2004, for the 10 main species (> 14,000m³).

Species	Volume (m ³)	Main destinations
Obeche	184,975	Italy, Spain
Sapele	143,050	China, Spain
Iroko	96,429	Ireland, Spain
Tali	39,445	Spain
Ekki	38,846	Netherlands, Belgium
White azfelia	31,932	Italy, Portugal
Frake	20,483	Italy, Senegal
Kosipo	16,750	Morocco, Saudi Arabia
Movingui	16,087	France, Belgium
Sipo	14,202	Belgium, United Kingdom

Source: ATIBT

Republic of Congo

Until 1972, timber was the country's primary resource and represented over half of all exports. It was then overtaken by oil. Recent economic revival programs in the Republic of Congo have placed the emphasis on developing the timber processing sector, confirming that the forest sector in general is an important factor for the creation of added value and jobs.

About 90% of the 22.5 million hectares of Congolese forest (over 60% of national territory) are allocated to production, with 11.4 million hectares in concessions. The ligneous potential is estimated at over 150 million m³: 130 million in the forests in the north of the Republic of Congo, rich in Meliaceae, obeche, limba and various other species that are to be promoted, 20 million in the forests of the south, especially rich in okoume and limba. The annual potential, without compromising the forest's regeneration capacity, is estimated at 2 million m³.

To this natural potential must be added

73,000 hectares of plantations of eucalyptus, pine and limba, representing a standing volume of 4 million m³.

Industrial fabric and timber processing

The timber industry is still very much focused on primary processing (sawing then peeling and slicing). Two-thirds of the 33 first-stage processing companies listed are sawing companies, nine of them with a capacity of over 50,000 m³ (Table 10.5).

The leading four companies in terms of concession and sawing capacity are: CIB (*Congolaise industrielle des bois*, a subsidiary of the tt Timber group⁵, 100,000 + 220,000 m³ logs), IFO (*Industrie forestière de Ouesso*, a subsidiary of the German group Danzer, 110,000 m³ logs), Mokabi SA (Rougier group, 80,000 m³ logs) and Likouala Timber (company with capital of French origin, 85,000 m³). The other companies are Congolese (11 companies, 59% of concessions), European (two French, one Portuguese and one Italian-French, 15% of concessions), Malaysian and Chinese (7 companies, 21% of concessions). The level of foreign involvement in the Congolese timber-processing sector is around 85%.

The level of primary processing among industrialists (proportion of timber harvested and then processed into finished or semi-finished products) is between 50% and 90%. For sawing, the average material yield is around 30-35%, but could reach 40% if there was access to the local market, and even more if there was effective promotion of off-cuts (non-standard dimensions of cut wood). In peeling, yields are around 50%.

Forestry companies with first-stage processing tools are essentially export oriented. The domestic sawn-timber market is supplied by (i) industrial units and (ii) small-scale sawyers who obtain their supplies legally or illegally from forest patches and gallery forests in urban peripheries or from areas richer in commercial species. Extraction by small-scale sawyers has increased with the reduction in log traffic on the Congo River and the associated difficulties that small-scale sawyers have in obtaining logs recovered from rafts. For instance, it is thought that 94% of supplies on the Pointe-Noire market come from small pit sawyers. These sawmills play an important social role and supply the local market with sawn timber at accessible prices.

Second-stage processing is still limited to a few semi-industrial joinery units and a host of small informal companies close to the big centers. In the Pointe-Noire region, the rate of second-stage

⁵ At the beginning of 2006, tt Timber was taken over by the Danish group DLH (Dalhoff Larsen & Horneman), which has thus consolidated its position in the tropical timber international market, widened its source of supply in sustainably managed forests and strengthened its possibilities of supplies of ecocertified tropical timber.

processing (volumes reprocessed compared to volumes having undergone first-stage processing) is estimated at less than 2%. Three forestry companies export reprocessed products (Trabec, CIB and IFO). However, the trend is towards vertical integration with consolidation of the first-stage processing infrastructures.

Production

Production of logs in 2004 was 1.3 million m³, of which 50% was exported (Table 10.6). The country's first-stage processing capacity is between 1.1 and 1.2 million m³, with the possibility of processing about 90% of domestic production (the purpose of the legislative and fiscal measures taken by the Congolese government is to encourage local companies to step up their local processing rate to 85% over a given period).

Production of sapele and sipo in northern Republic of Congo is influenced by the implementation of management plans, which are encouraging companies to diversify their species and therefore reduce the volumes of the main species used.

Production of pine and eucalyptus logs (Table 10.7) from plantations stopped for a while due to changes in the shareholder structure of ECO SA in July 2001. Activities resumed in the second half of 2005 following the takeover of ECO by a South African group (see paragraph on *Recent developments*).

Exports

In 2004 exports of logs and square-edged timber (Table 10.8) benefited from the opening up of new concessions in the north of the Republic of Congo and continued activity in the Mayumbe region, particularly for okoume. China buys over a half of exported logs and a significant proportion of sawn timber, mainly sapele. Europe is the second leading destination for this timber.

Okoume accounts for some 50% of log exports, followed by sapele (26%), which is the leading species exported in the form of sawn timber (64%), followed for this product by sipo and iroko, which each represent about 6.5% of exports (Table 10.9).

Table 10.5. Capacity of companies in the Republic of Congo.

Activity	Number of companies	Capacity (C) (x 1,000 m ³ logs)	Total capacity
Sawing	23 of which	3 with C ≥ 100; 6 with 50 ≤ C ≤ 100 4 with 10 ≤ C ≤ 50; 7 with 5 ≤ C ≤ 10 3 with 5 ≤ C	≈ 940,000 m ³
Peeling	5	15; 27; 36; 65 (x 2)	≈ 210,000 m ³
Slicing	2	15; 7	≈ 22,000 m ³
Plywood	3	12 (x 2); 15	≈ 30,000 m ³

Table 10.6. Main production statistics for the Republic of Congo.

x1,000m ³	Logs	Sawn timber	Veneer	Plywood
Production				
2002	1,179	230*	22	4
2003	1,350 (1283*)	167	26	4
2004	1,300	350	32	6*
Domestic consumption				
2002	724	33**	4	0
2003	672	5**	14	0
2004	650	100	4	1

Source: ITTO

*ITTO estimates or adjustments
** consumption figures to be treated with caution in view of ITTO estimates on associated production levels

Table 10.7. Production of eucalyptus logs in the Republic of Congo.

Production	2000	2001	2002	2003	2004	2005
Eucalyptus logs (x 1,000 t)	531	319	83	61	-	18*

Source: BEAC

*: SGS

Table 10.8. Main export statistics for the Republic of Congo.

x1,000m ³	Logs	Sawn timber	Veneer	Plywood
Exports				
2002	445* (641**)	197* (127**)	18	4
2003	610* (712**)	335* (133**)	13* (15**)	3
2004	650* (844**)	250* (143**)	28* (9**)	6

Sources: ITTO/ATIBT

*ITTO estimate ** source: ATIBT

Table 10.9. Volumes of the 10 main species exported from the Republic of Congo in 2004.

Species	Logs (m ³)	Veneer (m ³)	Sawn timber (m ³)	Finished products (m ³)
Okoume	416,116	8600	446	0
Sapele	221,216	0	91,070	879
Sipo	42,840	0	9,520	195
Iroko	39,560	0	9,099	0
Bilinga	22,004	0	746	391
Bosse	15,422	0	4,348	10
Agba	13,237	0	2,493	0
Tiama	11,051	0	1,773	187
Obeche	?	0	6,951	3,305
African star apple	8,158	0	225	0

Source: ATIBT

Recent trends in the forest sector and forestry industries

The activity of forestry companies during the first half of 2005, compared to the same period in the previous year, was characterized by a reduction in both felling and exports. This reduction in activity can be ascribed to two factors:

- recurrent problems in transporting logs to the port of Douala for companies based in the north of the country and maritime transport from Pointe-Noire in the south
- stricter application, by the Ministry of Forest Economy, of the new forest code fixing at 15% the proportion of log production for export

By the end of the first half of the year, compared to the previous year, the amount of okoume and secondary timber species that had been felled was down by 10% and 19% respectively. Exports of okoume and secondary timber species were lower by 15% and 27% respectively.

During the first half of 2005, compared to the previous year, activity in the timber industry saw contrasting developments. Production and foreign sales of sawn timber fell by 57% and 35% respectively. On the other hand, production and foreign sales of veneer increased by 39% and 34% respectively with the resumption of activities at the peeling factories in Pointe-Noire by Man Fai Tai and Taman Industries.

Activities in the eucalyptus sector have resumed in the Republic of Congo, with the creation of EFC (*Eucalyptus Fibres Congo*), a company under Congolese law and a subsidiary of the South African firm Chartwell Carbon Technologies, which has taken over the activities

of the now defunct state-run company ECO-S.A. In return for payment of a forest tax, EFC will work the 42,000 hectares of eucalyptus forest in the Kouilou department.

Development priorities

Development of the Congolese timber sector will require finding the means to:

- create satisfactory economic and fiscal conditions to secure the sustainable operation of companies and assure them of growth prospects within a favorable environment
- improve road, rail and waterway infrastructures
- make better use of the timber produced and processed at each stage in the production process, from rough-sawn lumber (logs) in the logging areas to processed products, which do not meet the current criteria of international demand
- improve yields in first-stage processing companies (at present around 35% on average in sawing operations and 50% in peeling) in line with the specifications required by the export market (large lengths, fixed dimensions, FAS quality for sawn timber); this increase in yields is directly linked to further timber processing
- integrate and redeploy the activities of small-scale sawyers (pit sawyers) who supply most of the local market and improve their yields

Main bibliographical sources

Ambassade de France au Cameroun, 2005; Ampollo A.N., 2005; ATIBT, 2005; BEAC, 2005; BEAC-CEMAC, 2005; FAO, 2002; MEF, 2005; OAB, 2004; OIBT, 2004; Walsch Lebel P. *et al*, 2003.

Gabon

The timber sector is the leading private employer in the country (over 20% of the working population), but its contribution to GDP is low, between 3% and 4%, due to the size of the extractive industries. From an economic standpoint, up until it was overtaken by oil in the 1970s, the forest sector represented the country's main source of wealth. The forest sector is still a key sector because of its potential and because of the possibilities it offers for diversification at a time when the oil industry is expected to start declining.

Of the 22 million hectares of forests, 12 million are allocated in the form of concessions to logging companies. By 2004, approximately

5 million hectares were involved in some form of the management process: management plans were either approved or in the process of approval for around three million hectares and provisional management-logging-processing agreements (= CPAET) were drawn up for two million hectares. The area involved in the management process today surpasses six million hectares, with all individual concessions exceeding 100,000 ha. Action is also being taken to enable small concessions to gain access to sustainable management procedures.

In 2004, the breakdown of industrial permits according to type of holder was as follows: Gabonese (42.5%), French (31.5%), Malaysian (9.1%), Libyan (5.1%), Italian (2.8%), Lebanese (1.3%), and others (7%).

The functioning of the Gabonese timber sector has been greatly influenced by the introduction of the Forest Code, law No 16/2001 of 31 December 2001, whose objective is the sustainable management of forests by combining forest management, industrialization of the sector and the conservation of ecosystems.

Industrial fabric and processing

According to different estimates, the rate of local processing is between 18% and 25%. A recent survey conducted by the Ministry in charge of forests identified 56 industrial units (Table 10.10), of which 41 are for sawing, 9 for peeling, 2 for slicing and 4 for plywood manufacturing. The most recent sawing unit was set up by the Rougier Group in Franceville for processing okoume (target capacity: 1,400 m³ a month).

Asian interests, particularly Malaysian and Chinese, are increasingly present in the sector, even though French interests still constitute the vast majority.

The forestry companies are:

- large groups involved in processing and marketing in Europe, such as Rougier-Gabon, CEB (*Compagnie équatoriale des bois*) / Thanry, Leroy-Gabon (subsidiary of Isoroy of the Portuguese group SONAE), GIB (*Gabonaise industrielle des bois* - tt Timber International AG), CBG (*Compagnie des bois du Gabon*), the Italian company CoraWood, etc.
- smaller companies, sometimes family businesses, such as Lutexfo/Soforga, SHM (*Société de la Haute-Mondah*), SBL (*Société des bois de Lastoursville*), Comexfo (*Commerce exploitation forestière*), GEB (*Gabon export bois*), SGBF (*Société gabonaise Bescos et fils*), etc.

Table 10.10. Number of first-stage processing units in Gabon.

	Sawing	Peeling	Plywood	Slicing
French	17	6	1	
Malaysian	5	1		1
Gabonese	7		1	
Lebanese	4		1	
Italian	2	1	1	
Canadian	1			1
Chinese	2			
Others	3*	1**		

Source: MEFEPNN

*: 1 Malian, 1 Portuguese, 1 Spanish **: Moroccan

Companies controlled by Gabonese capital are often smaller: IFK (Franco-Gabonese group Sogafric), SEEF (*Société équatoriale d'exploitation forestière*) and Nzé Ekomié. Malaysian companies control over three million hectares, most notably Bordamur, a subsidiary of the Rimbunan Hijau group, and SFM (*Société forestière de Makokou*), a subsidiary of the Winnerpac group. The Indian company Olam is the fourth largest exporter of okoume.

Local processing of okoume timber (peeling, sawing, veneer) has grown recently and French companies (Rougier, Leroy, Thanry, Thébault) have invested heavily in this field.

While the tax on exports of tropical logs has been increased from 15% to 20% in order to reduce exports of logs, the other three categories of processed products - sawn timber, veneer and plywood - are not subject to any export tax, so as to encourage domestic processing and the export of processed products.

The domestic market for first-stage processing products is largely supplied by the informal sector, which is competitive and can offer acceptable price levels locally. Bush sawyers in the countryside around Libreville and sea-front sawyers supply virtually all the capital's market.

Second-stage processing is underdeveloped and comprises: a few joinery and cabinet-making units with small-scale structures.

Production

Table 10.11 details the main production statistics for Gabon. Apart from okoume, the flagship species in Gabon, and a few other key species, such as padauk, moabi and kevazingo, production of some hitherto unused species such as okan, bahia and gombe is beginning to increase.

Table 10.11. Main production statistics for Gabon.

x1,000m ³		Logs	Sawn timber	Veneer	Plywood
Production (imports)	2002	3,615	176	71	98
	2003	3,563	231	140*	101
	2004	3,700*	300*	140*	140*
Domestic consumption	2002	1,687	88	26	33
	2003	1,846	108	6	10
	2004	1,700	51	6	27

Source: ITTO

*: ITTO estimate or adjustment

- the system for marketing okoume and ozigo via the SNBG, which threatens the competitiveness of companies because of the high transaction cost and also hinders commercial adaptability through its administrative setup in which timber is purchased at fixed prices and then resold on fluctuating markets

Together, these three factors have led to a reduction of over 10% in exports of logs and about 25% for okoume. While Asia remains the leading buyer of Gabonese logs with 52% of volume, its relative share has fallen since 2003 due to the

Table 10.12. Main export statistics for Gabon.

x1,000m ³		Logs, of which	Okoume logs	Sawn timber	Veneer	Plywood
Exports	2002	1,928 (1921**)	1,233* (64% of total)	89	55	67
	2003	1,717 (1694**)	1,100** (65% of total)	124	141	103
	2004	2,000* (1517**)	829** (55% of total)	250	140*	125

Source: ITTO

*: ITTO estimate or adjustment **: ATIBT

Promotion of little used species remains a priority for the forest department and more particularly forestry companies under sustainable management, which must optimize extraction in their concessions. Likewise, making use of secondary qualities of okoume, not used for peeling, is a major aim of these companies.

Okoume is still the most common species processed as sawn timber, with almost all production by sawing units in the formal sector being exported. A survey conducted in 2004-2005, among the 15 units known to produce sawn okoume timber, estimated a monthly production of between 13,000 and 16,000 m³ for this species. Okoume production from the informal sector, traditionally used at the local level for light construction work, is estimated at three to five times more than that of the formal sector.

Exports

Gabon is the region's leading exporter of logs, mainly okoume, and the third largest exporter within the ITTO (Table 10.12).

In 2004, the fall in exports of logs from Gabon was linked to:

- the effect of the value of the US dollar, particularly on the behavior of Asian buyers
- an increase in the proportion of timber processed locally, accredited to the introduction of management plans and increased industrialization

forementioned reasons. The log exporting sector has undergone a succession of crises since 1998, as a result of: the way in which the sector is organized; taxation which holds back competitiveness; transport problems; and competition from countries with cheaper labor and lower taxation such as the Republic of Congo, Equatorial Guinea and Indonesia.

Although okoume remains the most important species (Table 10.13), the timber species being exported as logs are diversifying now that management plans have become operational, as well as because certain other countries (notably Cameroon) bans the export of certain species as logs. These species include: moabi, bosse, iroko, douka, mahogany, sapele, sipo and niangon.

Although okoume is used and exported above all for peeling and the manufacture of plywood, it is also the leading species exported in the form of sawn timber (Table 10.14).

Recent trends in the forest sector and forestry industries

The timber sector had a favorable first six months in 2005. In fact, production of logs of all species combined rose by 4.7% compared to the same period in the previous year. This production is dominated by secondary timber species. There was also a change in the trend for okoume; which historically accounted for most Gabonese production, but is now being supplemented by sec-

ondary species. Production of secondary species increased by 22% between June 2004 and June 2005, while production of okoume declined by around 11% over the same period.

Operators in the sector are still concerned about the decision by authorities to end the monopoly of the *Société Nationale des Bois du Gabon*; a decision which is to come into effect as of the first of January 2006.

In the first six months of 2005, sales of logs and cut timber rose by 21% and 10.5% respectively. The trend in exports of logs is in line with the overall situation in the sector, whose export volumes rose by 25%.

Main bibliographical sources

Ambassade de France au Cameroun, 2005; ATIBT, 2005; Avomo Diong, 1999; BEAC, 2005; BEAC-CEMAC, 2005; Cassagne & Chevalier, 2005; Christy *et al*, 2003; FAO, 2001; Gérard, 2005a; Mabiala, 2004; Mabika, 2003; OAB, 2004; OIBT, 2004.

Equatorial Guinea

In 1995, timber production in Equatorial Guinea represented over 20% of GDP and 42% of exports. By 2004, it accounted for only 4% of trade and 6% of GDP, due to the reduction in forestry production and, more significantly, the growth in oil production. Forest currently covers 78% of the area of Equatorial Guinea (2.2 million hectares out of 2.8 million). Most logging is carried out within the continental part of the country, where 1.4 million hectares of forest (two thirds) are logged by some sixty concessionaries.

Industrial fabric and timber processing

The proportion of forestry production processed locally is still small and is less than 10% of total production on average.

The main companies among the twenty or so currently operating in the logging and processing sector are essentially Southeast Asian or Spanish: Anisok Mongola (of Spanish origin, now part of Shimmer), Chilbo (North Korean company), Efusila and Exfosa (under Spanish management but also part of Shimmer), Matroguisa and Safi S.L. (Spanish company based in Valencia), Shimmer International (subsidiary of the Malaysian international group Rimbunan Hijau and world leader in forestry production both for logs and for sawn timber), Sijifo International (Chinese company), Sinosa, Sitsa and Sofmal (Lebanese company whose activities are focused entirely on logging), Sofoge (Lebanese company, activities uncertain) and Somagui Forestal.

Of these companies, six or seven, all south Asian, have peeling units to manufacture veneer: Anisok Mongola, Chilbo, Exfosa (although this company's peeling activity would appear to have ceased during 2004), Safi, Shimmer, Sijifo and Somagui Forestal.

Peeling

The manufacturing of cut veneer is the primary activity in timber processing. Veneers (mainly okoume followed by ilomba and aiele) are intended solely for export. Domestic consumption of veneer is virtually nonexistent and the country has no plywood manufacturing units. In 2004, Shimmer International opened a new peeling factory in Mongomo, with a predicted processing capacity of 50,000 m³ of okoume logs a year. Following the recent wave of takeovers, current veneer production in Equatorial Guinea depends exclusively on Asian interests.

Table 10.13. Volumes of the 9 main species of logs (>26,000 m³) exported from Gabon in 2004.

Species	Volume (m ³)
Okoume	829,000
Padauk	107,200
Moabi	62,400
Kevazingo	51,300
Bahia	41,200
Ekki	32,700
Beli	30,400
Agba	26,300
Movingui	26,100

Sources: ATIBT

Table 10.14. Volumes of the 9 main species of cut timber (>850 m³) exported from Gabon in 2003.

Species	Volume (m ³)
Okoume	68,570
Ekki	32,490
Dibetou	11,610
Bahia	5,010
Moabi	3,290
Douka	2,110
Mahogany	2,070
Movingui	2,070
Padouk	860

Source: MEFEPNN

Sawing

Except for a few small processing units which survive by meeting domestic market requirements (two units in Bata), the domestic market and the small demand for export are supplied by unregulated sawing activities (using chainsaws). This activity involves several hundred operators, although it is still impossible to quantify the actual quantities of timber sawn. This timber is collected and size-graded in small planing units set up on very rudimentary sites near to the source of supply; there are eight sites of this kind around Bata.

Second-stage processing

The second-stage timber processing sector is made up of small companies, usually with a small-scale structure. These companies only supply the local market. They are small and their activity is too limited to imagine opening them up for export markets.

Production

Equatorial Guinea's forestry production increased until 1999, reaching a record volume of about 800,000 m³, after which it has been in steady decline (Table 10.15). Officially, this decline is attributed to the progressive application of the forest law of 1997, which is aimed at preventing overexploitation and favoring the sustainable management of timber resources. The authorities planned a progressive reduction of 10% a year to return to the fixed level of 450,000 m³ which, according to the FAO, is the annual limit that must not be exceeded if the sustainability of the resource is to be ensured. In actuality, most operators within the timber sector in Equatorial Guinea attribute this decline in production to the depletion of forest resources, whose life expectancy is seen by many as being very short (just a few years). Equatorial Guinea is one of the countries in the Central Africa region where the decline in forest production has been greatest.

Okoume is still the most important species in Equatorial Guinea, representing about 80% of

total production, followed by ilomba, tali, ekki, okan and andoung.

Exports

Almost all forest production is exported, mainly in the form of logs, with a small portion in the form of veneer and a tiny fraction as sawn timber (Table 10.16).

Shimmer is the leading exporter of logs and veneer: 70% and 40% of exports respectively. In the first half of 2004, China was Equatorial Guinea's leading customer for logs, taking 68% of the country's exports, followed by the three Mediterranean countries of France, Portugal and Spain. Spain was the leading importer of veneer, 46% of exports, followed by France, Portugal, and then China. Spain is the only country that buys sawn timber. This sawn timber essentially comes from informal activities, including chain-sawing and finishing in highly opportunistic planing units; it is sought after for its very low price and for the species processed, particularly iroko (Table 10.17).

Development priorities

The forest sector in Equatorial Guinea is in serious difficulties and is causing a great deal of concern among most stakeholders, including local and outside observers. This decline must be viewed in correlation with the expansion of oil production, particularly over the last six years.

The limited opportunity for foreign investment in the timber industry in Equatorial Guinea, due to legal and fiscal insecurities and the difficulties associated with working in this sector, are merely adding to this trend.

However, some local second-stage processing companies (general joinery and associated activities), which are supplying only the domestic market, have started to develop. These growing activities are evidence of the desire on the part of company heads to break out of their small-scale business structures and move up to a semi-industrial or industrial level.

Main bibliographical sources

Ambassade de France au Cameroun, 2005; Ambassade de France au Cameroun, 2003; Banque de France, 2003; BEAC, 2005; BEAC-CEMAC, 2005; FAO, 2002; Gérard, 2005b; Palmer, 2004; Roitman & Roso, 2003.

Table 10.15. Production trend in Equatorial Guinea.

Year	1999	2000	2001	2002	2003	2004 estim.	2005 forecast
Production (x 1,000 m ³)	776.1	714.9	669.9	531.5	528.5	513.5	513.5

Sources: OCIPF (Oficina de Control, Información y Protección de las Especies Forestales) and BEAC; Equatorial Guinea is not a member of ITTO, which therefore does not have any statistics on the country

Central African Republic

CAR has 3.6 million hectares of productive tropical forest in the southwest of the country, comprising about 5% of the national territory. The volumes harvested range from 500,000 to 700,000 m³ a year. The forest sector is the country's highest performing economic sector and it plays an important role as a lever for the national economy. With over 4,000 direct jobs and several thousand indirect jobs, it is the country's leading employer. Its contribution to CAR's tax revenue is significant and direct forest taxes and fees amount to 10 billion FCFA per year. The sector's economic output represents 50% of exports, based on value, and from 10% to 13% of GDP. Timber is the country's second leading export, after diamonds.

The sector was rationalized in 2003, and permits were redistributed after undergoing reviews and the removal of dishonest operators. The forest industry escaped material damage (destruction or pillaging) during the politico-military events of 2002-2003. Presently, the primary difficulties are associated with the road transport of logs for export; transport costs, journey times and insecurity push up timber prices. Logging is carried out by ten companies holding permits for a total surface area of 3.5 million hectares and a total exploitable area of 3 million hectares. By mid-2005, six forestry companies had started preparing management plans for their forest concessions: SEFCA (707,000 ha), SCAD (435,000 ha), SCAF (269,000 ha), VICA (299,000 ha), SESAM (392,000 ha) and Thanry (228,000 ha).

Industrial fabric and processing

Decree No 91/018 of 2 February 1991 establishing the mechanism for the allocation of concessions (granting of licenses) was revised in 2004. The forestry companies are now obliged to justify the creation of production and processing units. In 2003, the forestry industry had eleven industrial units, most of them made up of simple sawing lines (with no dryer or industrial joinery units) with two exceptions: SCAD, which also has a plywood production line and SSB, which has a peeling and slicing line, however, only its sawing equipment is operational. The units are spread out over the forest area as follows: four in Lobaye (two IFB, two SCAD), six in Sangha-Mbaéré (two SESAM, two SEFCA, one Thanry-Centrafrrique and one SBB) and one in Mambéré-Kadéi (SOFOKAD).

Table 10.16. Main export statistics for Equatorial Guinea.

	2001	2002	2003	1 st half of 2004
Export of logs (m ³)	589,355	519,858	438,293	108,077
Export of sawn timber (m ³)	3,030	4,285	1,056	364
Export of veneer (m ³)	28,403	13,103	26,287	15,851
Value of exports (x 1,000 CFA)	38,790	33,270	33,382	-

Source: OCIEPF

SCAD manufactures semi-finished products (parquets, friezes, moldings, and broomsticks) via its associate company Dameca.

Domestic timber consumption, which represents a substantial volume, can be broken down by its numerous uses. The timber is collected directly from the forest in the form of deadwood or by felling standing timber, or it is bought on the local sawn-timber market. For villages near to sawmills, timber which is not of commercial quality is given away by these companies for private or collective use. Construction timber prices on the domestic market in CAR are very high and act as an obstacle to the development of small processing industries and craftsmen.

Production

Given the granting of three major permits to new concessionaries and the prospect that the exchange rate for the dollar would return to a more reasonable level, the department of water and for-

Table 10.17. Exports according to species from the first half of 2004 in Equatorial Guinea.

Species	Logs (m ³)	Veneer (m ³)	Sawn timber (m ³)
Okoume	34,192	10,290	30
Tali	7,333		
Ekki	6,403		
Padouk	2,003		
Eyong	1,322		
Izombe	318		
Iroko	100		310
Ilomba	-	3,856	
Miscellaneous	56,406	1,705	24
Total	108,077	15,851	364

Source: ASEMAR SA (shipping agency in charge of almost all tropical timber exports)

Table 10.18. Main production statistics for the Central African Republic.

x1,000 m ³		Logs	Sawn timber	Veneer	Plywood
Production	2002	664	97	-	2
	2003	516	69	-	2
	2004	570	107	-	1*
Domestic consumption	2002	333	20	-	1
	2003	293	11	-	1
	2004	376	50	-	-

Source: ITTO

*: estimate or adjustment

ests forecasted a growth in the industrial production sector for 2004, returning it to the 2002 level (Table 10.18). However, the data for 2004 show that these forecasts did not materialize and production remains below the country's potential.

The logs and sawn timber being marketed primarily consist of the following species: sapele, obeche, sipo, kosipo, iroko and aniegre.

Exports

The appreciable fall in log exports between 2002 and 2003 continued in 2004, when a decline of around 13% was recorded (Table 10.19). This apparently cyclical decline was due to the country's political situation (troubles linked to the overthrow of the government in March 2003) and to the fact that the Department of Water and Forests was taking over a sector in which a number of irregularities had been observed concerning the allocation of special permits. It is not surprising that the emergency measures introduced in April 2003 by the Minister of Water and Forests to rationalize the sector (return of permits to the public domain, temporary ban on logging and timber exports, etc.) resulted in the sector's decline. Sustainable management of the forests also disrupted the rhythm of operations.

To these political factors must be added an economic factor: the fall in the value of the dollar in the last quarter of 2004 severely affected the

competitiveness of free zone Central African timber. Finally, in 2004, the prices of tropical timbers suffered a number of blows, with the price of sapele logs for export dropping 10% to 15%.

The downward trend in sawn timber exports that began in 2003 continued in 2004. This decline is directly linked to the sharp fall in the value of the dollar, which affected the competitiveness of sawn timber from Central Africa to the benefit of Asian sawn timber, particularly that from Malaysia, within the traditional export markets for Central African timber.

In 2004, approximately 20 species were exported in the form of logs; the first two account for 60% of the total volume exported, while the first five represent 91% of the total volume exported (Table 10.20).

The two leading exporters of logs (SEFCA and SOFOKAD) account for 49% of the total volume exported; the first five exporters (the two above-mentioned companies plus Thanry, IFB and SOTRAC) account for 77% of the total.

China is the leading buyer of logs (31.4%), followed by Italy (16.3%), Spain (15.9%), France (10.9%), Germany (10.7%) and Portugal (6.1%). The other importing countries of note (with less than 5%) are Turkey, Japan and Finland.

Sapele represents over 80% of exports in the form of sawn timber, with iroko a distant second with 13.6% of exports (Table 10.20). The first five species represent 98.5% of the total volume exported in the form of sawn timber.

The two leading exporters of sawn timber (SEFCA and the Thanry-VICWOOD Group) account for 63% of the total exported and the first five exporters (the two aforementioned companies plus IFB, SESAM and SBB) represent 95% of the total exported.

Spain is the leading buyer of sawn timber (28.4%), followed by China (18.9%), Belgium (17.6%), and the United Kingdom (10.3%). The other importing countries of significance (with less than 5%) are Morocco, France, Ireland and Italy.

Table 10.19. Main export statistics for the Central African Republic.

x1,000 m ³		Logs	Sawn timber	Veneer	Plywood
Exports	2002	331 (343**)	77 (56**)	-	1
	2003	223 (232**)	58 (50**)	-	1
	2004	194 (195**)	57 (44**)	-	1

Source: ITTO

** ATIBT data

Development priorities

In 2003 the Minister of Water, Forests, Hunting and Fisheries convened a wide ranging ministerial review in order to meet the national transitional government's expectations for stabilizing all sectors of the CAR economy, including the timber sector. The subsectoral forest commission was given the task of conducting an analysis of the current situation and proposing solutions to revive the industry. Several proposals were made concerning the development of the timber sector and the domestic market, including:

- drawing up and adopting industrialization standards for the processing sector
- facilitating access to bank loans through preferential rates for large investors
- studies on the domestic timber market to strike a better balance between supply and demand
- introducing incentives for the creation of sales depots throughout the country
- easing the taxes on sales of construction timber for the domestic market
- developing local marketing channels for timber
- setting up training courses

All of these proposals are still valid.

Main bibliographical sources

Ambassade de France au Cameroun, 2004; Ambassade de France au Cameroun, 2005; BEAC, 2005; BEAC-CEMAC, 2005; Commission du sous-secteur forêt, 2003; Liabastre, 2005; OAB, 2004; OIBT, 2002; OIBT, 2004.

Democratic Republic of Congo

Although DRC houses the second largest tropical forest in the world, some 130 million hectares that have barely been touched, the timber sector in DRC has suffered and is still suffering from a number of major problems: production structures are in very poor condition, slow means of transporting production, political troubles and wars, poor forests and high harvesting costs. The contribution of the timber sector to the country's GDP was estimated at 0.7 % in 2004 and although it remains low, it is now growing.

Following the promulgation of the forest code in 2002, the area under concession has fallen from 45 million hectares to about 20 million hectares. The present concessions are being converted to

Table 10.20. Volumes of logs and sawn timber exported from the Central African Republic in 2004, according to species.

Species	Logs (m ³)	Sawn timber (m ³)
Obeche	60,919	
Sapele	57,366	34,879
Aniegre	24,114	726
Iroko	23,156	5,921
Sipo	11,109	678
Azfelia	6,610	
Longhi	5,095	
Mahogany		547
Kosipo		431
Others	6,371	201

Source: T. Liabastre in la Lettre de l'ATIBT

a new type of contract; an operation that is being carried out in the presence of independent observers. Until 2004, the concessions were not involved in any management process; most of them remained closed because of insecurities. In 2005, five companies joined the conversion process, accounting for a surface area of over 6 million hectares. Additional companies are preparing to follow suit.

In 2004, in consultation with all the players involved in the forest-timber sector, the World Bank commissioned an economic review to support the revival of the forest sector's activities and to formulate recommendations for the development of the timber sector and sustainable management of DRC forests. The findings of this review were embodied in Interdepartmental Decree No 010 of 17 March 2004.

Industrial fabric and processing

The forest sector in DRC has suffered from years of war; it is now undergoing reconstruction. Among the sixty or so forestry companies registered with the directorate-general for forests, only twenty are listed as having resumed their activities. Only half of these companies would really seem to be in a position to start up again; these ten companies control two thirds of the approximate 400,000 m³ of theoretical production capacity (Table 10.21).

Second-stage processing, to supply the national market, is in the hands of small firms, many of them in the informal economy, and also industrial companies, with activities focused on the manu-

Table 10.21. Capacity of first-stage timber processing companies in DRC.

Activity	Number of companies	Capacity (C) (x 1,000 m ³)	Total Capacity
Sawing	17* of which:	1 with C ≥ 100; 6 with >10 to ≤ 20 C; 7 with C ≤ 10	≈ 281,000 m ³
Sawing, peeling	2	10; 15	≈ 25,000 m ³
Sawing, peeling, slicing	1	60	≈ 60,000 m ³
Peeling	1	10	≈ 10,000 m ³
Slicing	1	20	≈ 20,000 m ³

Source: Roda et al, for DGF

*: 3 for which no capacity data is available

Table 10.22. Main production statistics for DRC.

x1,000m ³		Logs	Sawn timber	Veneer	Plywood
Production*	2002	105*	35*	1*	1*
	2003	90*	15*	1*	1*
	2004	90*	15*	1*	1*
Domestic consumption	2002	75*	6	1	1
	2003	32	1	0	1
	2004	32	1	0	1

Source: ITTO

*: ITTO estimate or adjustment

facturing of finished products (parquet, pre-cut timber), mainly for export.

Production

Production in the formal sector has always been low relative to the immense size of the resource and in comparison with other producing countries in the subregion. Of the six Central African countries, DRC has the lowest rate of forest production (Table 10.22). Production never topped 400,000 m³ (DGF-Simon) to 500,000 m³ (FRFC-Karsenty) during the decade preceding the war. In 2004, it dropped below 100,000 m³, with more than half being exported, mostly in the form of logs. In 2005, production is estimated to have been around 250,000 m³.

With regard to forest companies restarting after the interruptions caused by the war, most worksites have yet to reach their production targets for the first year. Production often remains below 2,000 m³ a month or under 20,000 m³ a year.

A key portion of production in the country is carried out by the informal sector for the domestic market. Pit sawmills, whose workforce increased considerably between 1996 and 2000, offer more competitive prices, even though the quality-price ratio is equal to what the formal sector can offer. The market in Kinshasa and the other big cities is also supplied by industrial companies. The precise quantities produced by the informal sector are unknown, but appear considerable and could be as high as those produced by the formal sector. Plywood production is basically intended for the domestic market.

Exports

The exports mentioned concern only the formal sector and remain limited, despite a substantial increase in 2005 (Table 10.23). Exports from the informal sector are not quantifiable, but could constitute a higher volume than those from the formal sector. There seem to be two main outlets for timber from the informal economy: one to the west, in the direction of Angola, and one to the east, in the direction of Uganda, Kenya, Zambia, and Tanzania. The outlet in the east is supplied by logging that has developed in Ituri and Kivu. These exports go towards financing imports of consumer goods for populations in the east of the country.

The particularly difficult conditions for freight in DRC are an additional constraint that restricts export possibilities and influences the sector's commercial strategies. Destinations are limited, departure times are few and far between and costs are high. For conventional shipments the only destination is Europe. There are only three charter firms, whose operating procedures are restrictive: frequent stops at other ports in the subregion, transshipments, etc.

Destinations for the shipment of containers are more numerous, but the associated costs are high.

Development priorities

The factors limiting the sector's development possibilities are freight costs, costs connected to reinvestment, overall transportation costs and the extremely high human population pressures in certain regions.

Consequently, the main action objectives are:

- making provincial activities and river traffic secure

Table 10.23. Main export statistics for DRC.

x1,000 m ³		Logs	Sawn timber	Veneer	Plywood
Exports	2002	30*	29	-	-
	2003	58 (37**)	14 (16**)	1	-
	2004	58*	14	1	-

Source: ITTO

*: ITTO estimate or adjustment ** ATIBT data

- improving port infrastructures and rehabilitating the Kinshasa-Matadi rail link
- zoning forest areas to determine land use priorities
- establishing a reliable power supply, particularly in Kinshasa
- improving information and education of the population
- abolishing forms of incidental taxation where no services are supplied in return

DRC is a country undergoing reconstruction whose growing demand for materials, especially timber, is being supported by a revival of its industrial production sector and substantial growth of its timber sector.

Main bibliographical sources

Ambassade de France au Cameroun, 2005; FAO, 2002; Lumbwe Gwaadigo, 2000; Makombo Monga Mawawi, 2004; OAB, 2004; OIBT, 2004; Roda *et al.*, 2003.



Figure 10.1. Floating logs on the Congo River in DRC.

11. The Environmental Dimension of Industrial Logging¹

With areas under concessions often being much larger than the neighboring protected areas, logging in Central Africa can be a potential instrument for conservation of the environment or one of the causes of environmental damage and loss of biodiversity. These diametrically opposed trajectories fuel the ongoing controversy between supporters of the management of tropical forests, as a means of conserving them, and champions of protection, pure and simple. These two options, however, can be complementary and it is time to move beyond the traditional sterile debates between conservationists and those in favor of sustainable management. Conservation is obviously essential, but logging that is compatible with maintaining and renewing resources, and makes optimum use of tropical forests, can also contribute to their protection from conversion into alternative uses. This ‘sustainable’ logging necessitates greater consideration for environmental factors in the management of production forests (Table 11.1).

Tropical forest logging

The evolution of forestry concepts

While Southeast Asia leads the tropical timber export industry, logging originated in Africa with the first exports of mahogany from West Africa to England in 1672. In Central Africa logging for a few high value species (ebony, padauk, etc.) continued relatively extensively for about three centuries, however, the tropical forest of Central Africa really became the loggers’ green gold in the 1950s. The 1950s brought the arrival of new machinery (crawler tractors and logging trucks), which substantially increased the profitability of timber logging and made it possible to work further away from the coasts and major watercourses.

During the years 1950 to 1970, the forest was seen as capital allowing an endless production of timber. Most of its users regarded it as a simple source of income and foreign exchange. Growing environmental awareness at a global scale, marked by the Stockholm Conference in 1972, led to growing recognition of nature conservation as a fundamental factor for human development. The increase in the rate of species disappearance gave rise to conservation biology in the 1980s. At the same time, the perception of forests changed from simple capital in the form of land and timber to that of a complex and multifunctional living environment. This concept gave tangible form to the principle of sustainable forest management (although the principle had been around since the beginning of the 20th century), aimed at meeting current needs without compromising future needs. Then in 1992 at the Rio Conference, Agenda 21 defined non-restrictive forestry principles for the sustainable management of forestry resources: triggering a shift from the classic technical concept of ‘sustained timber production’ to the current socially-based concept of sustainable forest management, which takes into account the numerous uses and users of forests. This change in concept was accompanied by a growing sensitivity on the part of society to the environmental impacts of logging in tropical forests. However, the respective expectations of societies in the North and the South vis-à-vis tropical forests are different, sometimes even contradictory (Gullison *et al.*,

¹ This chapter is taken from a collective work co-produced by CIFOR, the Autonomous University of Madrid and ITTO, financed by ITTO, to be published at the end of 2006: ‘La gestion durable des concessions forestières dans le Bassin du Congo’ by R. Nasi, J.-C. Nguingui & D. Ezzine de Blass (Eds.). We would like to thank the International Tropical Timber Organization, which authorized the use of this work for the 2006 report on the State of the Forest.

What is the logging situation in Central Africa? What environmental impacts does it have? How are these environmental aspects taken into account in practice? What progress can be made to achieve forestry management, certification and logging with a reduced impact? These are the questions that this chapter will attempt to address.

Table 11.1. Trends in the management of production forests.

Old concept: sustained yield	Recent concept: Sustainable management
Forest = productive capital	Forest = complex multifunctional living environment
What must be preserved in the long term: the volume harvested is equal to annual production	What must be preserved: the ecological functions (therefore both plant and animal biodiversity), as well as the economic and social functions
Concern for a balance in age classes for timber species	Concern for overall balance of the environment; no irreversible measures
	Application of the precautionary principle

2001; Lugo 1999; Smouts, 2001), and the idea of being able to conserve the biodiversity of tropical forests through sustainable forestry practices is rejected by a sector of the conservation community (Vincent, 1992; Howard *et al.*, 1996; Rice *et al.*, 1997, 1998a and b; Bowles *et al.*, 1998).

Area affected by logging

Why then worry about improving logging activities by implementing techniques with a reduced environmental impact?

Quite simply because the industrial or communal exploitation of the tropical forests of Central Africa will continue, regardless of what the environmental lobbies may have to say, and the forest area under concession is much greater than the forest area contained in protected areas (Table 11.2).

At present, the area under protection (unfortunately often a somewhat theoretical notion) represents about 16% of the area of dense forest, while the area allocated to forestry concessions as of 2004 represented 36% of the area of dense forest.

Sustainable logging of production forests, therefore, provides an additional opportunity to that offered by protected areas to maintain forests and biodiversity (Lugo, 1999; Whitmore, 1999) in Central Africa. To attain this objective it is essential to ensure that the logging causes the least possible damage to the environment.

Characterization of forest logging in Central Africa

In Central Africa, logging is by and large very selective (Table 11.3). It concerns a limited set of commercial species and very few individual trees are harvested (between 0.5 and 3) per unit area (Ruiz Perez *et al.*, 2004). In legal texts, the individual trees that can be harvested are defined by a minimum felling diameter (MFD). There is no such limit to the number of individual trees that can be harvested per hectare, even if the natural distribution of commercial species means that the number of individual trees that can be felled is low.

Irrelevant of a concessionaire's commitment to a particular management approach, logging in a forest requires the construction of infrastructure: camps, road networks, timber storage areas, tracks, etc. The road network includes main roads and secondary roads which are used by trucks to carry wood away from timber storage areas in the forest.

Logging also leads to considerable human activity in the forest. To begin, there are prospecting and concession demarcation teams who travel throughout the forest block, followed by the civil engineering teams and their machines, who establish the main road network and camps. Once the minimum infrastructure is in place, an inventory team goes through the forest to determine and locate the harvesting potential. Inventory activities vary in intensity depending on whether the logger proceeds by selection 'on sight', without any prior planning (simple inventory or harvesting inventory, with varying degrees of efficiency), or develops a management plan (management and harvesting inventories carried out according to strict standards and with rigorous controls). Inventory teams are followed by cutting and extraction teams, which cut down the designated trees and transfer the trunks to temporary storage areas. Once there, additional teams cut them and load them onto trucks for transport to timber yards at factories or ports.

Table 11.2. Areas (ha) of production forests and protected areas in Central Africa.

	Cameroon	Gabon	Republic of Congo	DRC	CAR	Equatorial Guinea	Total
Area of country ^(a)	46,540,000	25,767,000	34,150,000	226,705,000	62,298,000	2,805,000	398,265,000
Area of dense forest ^(b)	19,639,000	22,069,000	22,263,000	108,339,000	8,227,000	1,843,000	182,380,000
Production forest							
'Large dense <i>terra firma</i> rainforests' ^(c)	12,000,000	17,000,000	13,000,000	90,000,000	3,500,000	1,500,000	137,000,000
Surface allocated in 2004 ^(d)	5,400,000	13,600,000	10,000,000	16,000,000	3,000,000	1,400,000	49,400,000
Protected areas ^(e)							
Category I (Full nature reserve)	0	15,000	0	270,000	86,000	51,500	422,500
Category II (National Park)	1,748,312	2,910,285	2,247,542	8,544,000	3,102,000	303,000	18,855,139
Category IV (Area managed for habitat or species)	1,053,583	20,000	1,042,500	1,438,425	1,493,000	197,500	5,245,008
Category VI (Protected areas of managed natural resources)	425,466	1,010,000	528,960	5,889,225	336,000	0	8,189,651

(a) FAO, 2005

(b) Mayaux *et al.*, 2004

(c) FRM, 2003

(d) FRM, 2003; MINEF planning document Cameroon 2004; Karsenty direct survey for DRC

(e) Vande weghe, 2004

Table 11.3: Species logged and productivity.

Country (Concession)	Number of species logged	% of 5 main species	Average productivity (m ³ /ha)
Cameroon (5)	12-35	65-100	4-7
CAR (global)	20	91	3-4
Republic of Congo (7)	8-30	75-100	4-11
DRC (5)	11-21	75-100	3-7
Gabon (4)	25-30	± 90	± 6

Source: Ruiz Perez et al. 2004

Environmental impacts of logging

The above mentioned operations cannot be carried out without causing some degree of disturbance. To reduce the negative impacts of logging on the environment, it is necessary to understand the nature of these impacts and, above all, to determine those practices which can be modified in order to minimize overall damage.

A distinction can be made between the direct and indirect impacts of logging. In addition, some impacts are unavoidable and must be mitigated, whereas others are avoidable and should be eliminated (Table 11.4). The destruction of a certain number of trees and other forms of life is indisputably a direct and unavoidable consequence of logging. It is impossible to construct a road or fell a tree without some damage. Hunting and the sale of bushmeat by employees of logging

companies are not essential to the harvesting and marketing of timber. They constitute indirect and potentially avoidable consequences.

Direct impacts of logging

Creation of infrastructure

The creation of infrastructure implies complete and permanent destruction (for the duration of the concession) of the affected vegetation cover. Different data published in the literature show that camps and industrial installations (such as sawmills) commonly take up between 0.03% and 0.1% of the surface area of the forest (Estève, 1983; Lumet *et al.*, 1993; Durrieu de Madron *et al.*, 1998).

The area occupied by road infrastructure varies according to the topography, road widths and the distribution and number of harvestable trees. The values found in the literature typically vary between 1% and 2% of forest cover destroyed (Estève, 1983; Durrieu de Madron *et al.*, 1998, 2000).

Inadequate construction or maintenance of road systems can have a direct effect on the environment (Dykstra & Heinrich, 1996) by:

- obstructing the flow of certain watercourses and building dams (often sources of plant pathogens or causes of plant mortality) upstream of infrastructure
- increasing sedimentation of watercourses, which can have serious consequences for water supply and quality
- causing significant soil erosion
- increasing the risk of landslides on steep gradients, along with the repercussions that this can have on infrastructure, watercourses and modes of land use
- substantially modifying vegetation and fauna along the main routes (Malcolm & Ray, 2000)

The presence of a road network, even well designed, also has the indirect effect of fragmentation of the forest block to varying degrees (see following section).

Table 11.4: Environmental impacts of logging.

Impacts	Direct impacts	Consequences
Unavoidable	Damage in the residual stand	Increase in the local density of the human population
	Noise, various disturbances	Loss of nutrients
		Fragmentation
Avoidable	Soil erosion and pollution of watercourses	Increased access to isolated forests
	Reduction of regeneration capacity, loss of genetic diversity	Increased deforestation
		Increase in hunting
		Increased risk of fire
		Propagation of exotic species

Logging

Once the access roads have been constructed, the operations connected with felling and removing logs to the timber yards will also destroy or damage parts of the vegetation. The extent of this damage is directly linked to the tree-felling intensity (Fig. 11.1) and the precision of various operations, but it is impossible to carry out logging without damage to the residual stand.

In Central Africa, legal logging removes about one tree per hectare. Opening up trails for inventories entails cutting plants at their base. Felling of trees causes varying degrees of damage to other trees. Opening up the skid tracks and the skidding itself lead to the death of a large number of seedlings, young plants and undergrowth. Skidding can also inflict injuries at the base of large trees. Opening up timber storage areas requires clearing strips in the forest. However, at the average removal rate of one tree per hectare, these impacts concern only small areas: 1-2% of the total area for secondary roads and timber storage and 2-4% for skid trails.

All teams working in the forest commonly make a lot of noise and disturb fauna, especially when using motors. This impact is in addition to the fact that personnel often take advantage of their stay in the forest to lay traps, hunt with guns or collect small slow-moving animal species. Although there is a lack of rigorous studies (see Larkin, 1996 and Radle n.d. on the effects of noise on wildlife), it is probable that disturbances related to human presence and noise cause little damage to wildlife, as long as they have the means to move away from the areas of disturbance.

As long as adequate management procedures are applied, logging is not a highly polluting activity (unlike the extraction of petroleum or certain ores). Poor management of industrial waste (fuels, oils, used parts) or human waste (see following section) can, however, be a direct cause of damage to the environment.

Indirect impacts and consequences

At present, logging in Central Africa is generally carried out in remote and often undeveloped areas with few inhabitants. The arrival of a logging company, with its associated resources, in these isolated and undeveloped areas often attracts large numbers of immigrants in search of better living conditions. This immigration from surrounding villages, combined with company employees and their families, leads to a rapid and substantial local increase in the density of sedentary populations.

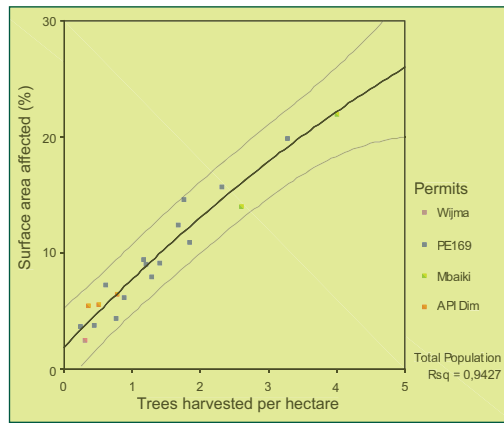


Figure 11.1: Percentage of forest area disturbed according to the number of trees harvested

Source: modified from Durrieu de Madron et al., 2000.

Pokola in North Congo is a striking example of this phenomenon: a small village of fewer than 300 habitants in the 1970s, the installation of the CIB's main camp changed Pokola into a town of 13,000 by 2003; a town equipped with better infrastructure than the regional capital (Ouessou). CIB employs 2,000 people in Pokola, giving a ratio of 6.5 habitants per employee. Such human concentrations in the forest quickly become local sources of pollution (household waste, excrement) and can perpetuate the propagation of exotic species and the overexploitation of forest resources (commercial hunting, fishing, deforestation).

Impact on the conservation of nutrient cycles

In the dense forests of the tropics, most nutrients are stored in trees and soil is of poor quality, serving primarily as a medium for the conversion of dead matter into living plants.

Traditional forestry activities do not lead to the movement of appreciable quantities of organic matter or nutrients. The large scale of logging activities makes it tempting to think that very large quantities of matter are removed, however, in reality the quantities removed are small, particularly if good practices are followed. The volume extracted – less than 10 m³ per ha – is small relative to the total biomass, which is over 500 m³ per ha. Logs rejected after felling, and the tree crowns left *in situ* after separation from the trunk, return to the forest and represent a volume comparable to that extracted. The tree crowns are particularly valuable because they consist of the youngest parts of the tree (leaves and branches), which are also the richest in nutrients. These nutrients are released slowly and can be taken up by the vegetation. This process is in contrast to the case of slash and burn agriculture, which releases nutrients too quickly for efficient absorption.

Impacts on plant diversity

Forests relatively close to inhabited areas are used to gather fruit, other secondary foods, medicinal plants, building materials and/or material for other uses. The removal of these products is normally within limits that do not endanger the survival of species, but when there is strong external demand, over harvesting can occur. While the unfortunate disappearance of a rare species is always a risk, the threat of causing the extinction of a plant species in an area where properly conducted logging operations are being carried out is very low. From an ecological point of view, logging does not lead to any major modification of the system.

However, logging does have two negative effects that tend to run counter to sustainable production. Extracting specific species tends to modify imperceptibly the floristic composition of the forest and in some cases this modification can favor non-commercial species to the detriment of species being extracted. Moreover, the systematic selection of the finest examples of specific species has the perverse effect of reducing the genetic diversity of the harvested species and selecting for the least commercially attractive specimens. The elimination of seed-bearers also severely compromises regeneration. In the case of illegal logging, with the indiscriminate felling of the largest number of trees, there is a greater possibility of substantially reducing both commercial and non-commercial species.

Impact on fauna

Opening up the necessary roads and trails for logging causes fragmentation of the forests and facilitates access by local or outside populations to areas that are often home to abundant and relatively 'naïve' wildlife species. In what become densely populated areas, subsistence or commercial hunting quickly reaches unsustainable levels. In areas that have been recently opened up, hunters can easily find large prey because the fauna is still very abundant and diverse. These areas should be given special consideration as regards conservation (Auzel & Wilkie, 2000; Auzel, 2001). If the areas have been accessed by hunters for a long time, they have generally passed through an 'extinction filter' and only the most 'resistant' species, rodents and small antelopes, will have survived (Cowlshaw *et al.* 2004).

According to Robinson *et al.* (1999), logging appears to be the primary cause of the non-sustainability of hunting in tropical forests. The presence of logging activities drastically changes the prevalent hunting conditions by facilitating

access to the forest and offering commercial outlets for what were originally subsistence activities. Auzel and Wilkie (2000) observe that in northern Congo the employees of concessions hunt more than villagers and that, in general, employees and villagers living along the roadside hunt more than villagers living in areas further away. For a general review of the effects of hunting and their associations with logging, it is worth referring to Fimbel *et al.* (2001) or Robinson and Bennett (2000).

Impact on plant cover: fragmentation

Another consequence of logging is the increased fragmentation of the ecosystem. The roads, tracks and tree-fall gaps create discontinuities that can create problems for wildlife. The reaction of wildlife to fragmentation varies. For instance, main roads may represent impassable obstacles for certain arboreal species or those with low mobility, while the secondary vegetation which develops at the edge of the road may attract a number of large herbivores (elephants, buffaloes, large antelopes) which profit from the abundant source of food. However, in edge areas there is also a higher risk of being hunted. In the absence of any hunting pressure, a certain level of fragmentation appears to increase the animal biomass (Tutin *et al.*, 1997). Another study (Tweheyo *et al.*, 2004) showed that logged areas of the forest and the forest edge provide approximately 76% of the diet of chimpanzees; these are also the areas with the greatest human interference. Studies in Neotropical forests have revealed that hunting and fragmentation act in synergy, with the effects of one compounding the effects of the other (Peres, 2001).

Apart from facilitating hunting, the fragmentation of forests increases their vulnerability to fire. Although this phenomenon is less prevalent in Central Africa than in Indonesia, the extensive fires in Côte d'Ivoire in 1982-83 clearly showed that fragmented forests are more vulnerable to fire than intact forests (Bertault, 1992). Van Nieustaat and Sheil (2005) showed that in Indonesia most trees destroyed by fire were already killed by drought. Therefore, it seems that there is a fairly strong relationship between fragmentation, drought and fire. This relationship probably contributed to the major fires of 1982-1983 in Côte d'Ivoire.

Although the evidence is rare in Central Africa, fragmentation and greater access to forests also increases the risks associated with the invasion and dissemination of animal or plant pests. The increased presence of domestic animals (dogs, cats, livestock) around human concentrations can

increase the chances of disease transmission between domestic and wild animals. Furthermore, some exotic and/or ornamental plants introduced in camps or villages could turn into invading species that favor the changes in forest cover and microclimate due to fragmentation. Examples of this phenomenon appear to be fairly rare in Central Africa, but infestations of *Chromolaena odorata* (Figure 11.2) have been noted at the edges of practically all forests in the Congo Basin. This light-craving species forms a dense thicket of 1 to 2 meters high in open spaces. *Chromolaena* rarely reach felling gaps as these gaps are isolated from the roads and paths by a curtain of forest, however, few woody plants can penetrate *Chromolaena* thickets and, according to observations in Côte d'Ivoire, transition into tree cover is very slow. Observations in post-harvest fallows demonstrate that these thickets do not give way to woody plants until many years later.

Impact on soil and water

The most obvious impact associated with harvesting activities is the compaction of soil that can affect water movement. This risk is particularly high with clayey soils. It cannot be avoided when the permanent road infrastructure is created, but must be minimized when opening up temporary paths and skid trails.

A second risk is the disappearance of the humus layer. Generally, soils in tropical rainforests are not very rich in humus: there is only a slight development of color with depth, and even the surface layer is red. The aforementioned compaction is visible on wheel tracks from skid trails, which also expose a mixture of materials from the top few centimeters. These disadvantages can be minimized by stopping logging when the soil is wet.

In conclusion, it is clear that the indirect impacts, often subtler and less spectacular than logging itself, present a greater danger for the survival of the forest than the felling of a few trees.

How to reduce the environmental impacts of logging?

Low-impact logging (LIL)

For approximately the last ten years, low-impact logging (LIL) has been widely presented as one of the most important advances in sustainable forest management. Most recent publications on the subject seem to concur about the existence of a number of practices that can reduce appreciably the negative environmental impacts of tropical logging (Ong & Kleine 1995; Pinard *et al.* 1995; Putz *et al.* 2000; Fimbel *et al.* 2001). There also seems to be a general consensus on the fact that LIL as currently advocated, essentially a series of recommendations relating to advanced planning, forestry management and civil engineering, is not necessarily a panacea and is probably insufficient to guarantee environmental sustainability (Sist *et al.* 2003a). For example, its beneficial effects, such as the reduction of damage to the residual stand, quickly disappear in cases with excessive harvesting intensity or particular spatial distributions of harvested species (Sist *et al.*, 2003b) or become debatable if the harvested species are light-demanding species that require large openings in the canopy in order to regenerate (Fredericksen & Putz 2003; Sist & Brown, 2004).

In Central Africa, the few large-scale studies that have been carried out (Durrieu de Madron *et al.*, 1998; Parren 1998; Jonkers, 2000) show that the adoption of rational harvesting practices (planning of road networks and trails, undertaking careful logging inventories, removing buttresses before felling, etc.) allow productivity per hectare to be increased, while reducing damage to the stand. Other classic recommendations in LIL manuals, on the other hand, seem ineffective (directional felling) in reducing damage or pose a threat to biodiversity (removing lianas).

In conclusion, the adoption (or rediscovery) of good harvesting practices by operators should allow the impact per cubic meter to be reduced considerably. In certain conditions, other measures recommended in LIL could also be of some use. This is conditional on there being a genuine operational plan that really does incorporate these practices and controls offtake.



Figure 11.2. *Chromolaena odorata* is an aster of Asian origin.

Ecocertification

For fifteen years, various ecocertification systems (Forest Stewardship Council, Pan European Forest Certification, CSA International, Sustainable Forest Initiative, etc.) have been developing with the common objective of having good forest management practices labeled by a third party. Whichever the system, these are market instruments intended to improve current practices based on the assumption that 'ecosensitive' consumers will prefer to buy an ecocertified product. In return, producers wishing to retain this sensitive market will improve their practices in order to obtain certification. However, the applicable markets only exist in Europe and North America and represent only a very small portion of the world's consumption of tropical timber (Roda 2000).

Proof of this can be seen in the very low level of growth of ecocertification in tropical and subtropical forests (Table 11.5). The latter, although forming some 50% of the world's forest areas, only represent about 17% of certified forests around the world under the FSC label (the most widespread in the world). In Central Africa, the situation is even simpler: only one FSC certificate has been issued so far, although a few companies have recently embarked on this process. This imbalance is probably due to the opportunity cost of ecocertification, which is higher for tropical forests than for temperate or boreal forests (which already have a long history of rational management).

Additional limitations of certification relate to product quality, compliance with sizing standards and the reliability of supplies, all points on which Western (and therefore sensitive) markets are very strict. As ecocertified products are rarely cheaper than non-certified products, their market is highly competitive. Even if consumers are prepared to pay more for a product in exchange for a 'good forest management' label, this does not mean that they are prepared to pay more for products of lower quality. In terms of most forestry products, the two critical components of Western markets, be they ecosensitive or not, are the demand for a certain level of product standardization and the demand for a high level of reliability in the regularity and volume of supplies. These requirements relate to the organization and performances of industrial sectors and have no direct relationship with 'good or bad' forest management (Roda 2001).

In conclusion, certification certainly offers opportunities for improving current forestry practices in Central Africa in order to make them more environment-friendly, but these opportunities have yet to be seized and certification alone, without forest management, will certainly have only a limited impact.

Forest management

In Central Africa, an approach to forest management has been emerging in recent years based on the concept of integrated management. In this approach, an industrial partner is involved in the management of the forest allocated to him right from the management conception stage. This approach is backed by a French cooperation (Ministry of Foreign Affairs, for institutional aspects; *Agence Française de Développement*, for the financing of facilities and industries; *Fonds Français pour l'Environnement Mondial*, for biodiversity considerations) and thus far approximately 15 million hectares of dense rainforests are already under or being brought under management (Nasi & Forni, 2003).

This concept of integrated management runs counter to the extraction practices still applied by the majority of operators (no real planning of logging operations, removal of a small number of species, repeatedly logging patches, rapid exploitation over very large areas, etc.). Forests to be managed are large in size (several hundred thousand hectares) and current forestry practices are limited to logging. Operators are tempered by a genuine concern to take into account forest dynamics (mortality, growth, regeneration, damage

Table 11.5. Areas of FSC certified forests. Note: in February 2006, 1,445,758 ha were ISO 14001 certified in Gabon, 41,965 ha were FSC certified in Cameroon, and 1,727,788 were Keurhout certified in Gabon.

FSC certified areas	Non-tropical	Tropical subtropical	Total
Asia	639,676	194,699	834,375
Southern Africa	-	1,854,190	
Central Africa	-	0	
West Africa	-	0	
East Africa	-	36,825	
Africa (total)	-	1,891,015	1,891,015
America	12,959,840	6,616,567	19,576,407
Europe	30,383,543	-	30,383,543
Oceania	630,373	591,842	1,222,215
Total	44,613,432	9,294,123	53,907,555

Source: FSC 2005, modified

to the stand) and aim for sustainability of the resource to be exploited. More and more frequently biodiversity is being included in management systems. There are now numerous examples of management plans that are not just plans for felling timber, but instead plans that incorporate mammal populations or even, in the case of the most sophisticated plans, refuges of plant and animal biodiversity. Consequently, there are increasing numbers of industrial companies adopting this approach with the help of international NGOs or specialized consultants (Tutin & Nasi, 2001).

Unfortunately, this approach currently applies only to industrial operators and not small, medium-sized or community operations, although these represent an appreciable part of the region's production.

Conclusion: where are we?

Seeking ecologically sustainable forest management involves constantly searching for a better understanding of nature and the means to use it more efficiently. The most effective way is through the widespread establishment and application of genuine forest management. However, for this approach to respond effectively to concerns for ecological stability, the following areas will have to be developed over the next few years:

The incorporation of biodiversity implies so-called low-impact logging techniques (LIL). While LIL has demonstrated its effectiveness in a tropical environment, it is founded on considerations related to civil engineering and forestry and includes few or no ecological considerations, in contrast to practices in northern countries (NBF, 1992). However, researchers in numerous disciplines believe their work can potentially improve logging practices. Knowledge on the vulnerability of forest taxa is much more widespread than is commonly thought or applied (Martini *et al.*, 1994). A synthesis of this knowledge and its implications for biodiversity in LIL, would likely be more useful than specific studies on the impact of logging, which are classically found in the literature (Sheil & van Heist, 2000).

Changes in current forestry practices that are based on a universally applied rule: the minimum felling diameter (MFD). Originally defined in accordance with the technical capacities of the sawmill industry, current MFDs do not take into account the ecological and forestry considerations of the concerned species. Blind application of MFDs leads to excessive logging intensities or compromises the maintenance of rare or slowly regenerating species. In the long term, this can

have serious consequences for the floristic diversity of the ecosystem. Using MFD as the only constraint would therefore appear to be insufficient, and forestry must include new standards to ensure the sustainability of the ecosystem (Sist *et al.*, 2003a and b).

Optimizing canopy gaps: Logging causes gaps whose size, spatial distribution and frequency may vary substantially. To date, there is no official recommendation on how to optimize the number and size of gaps, as a function of forest ecology. It would be interesting to know which logging approaches would favor the regeneration of the largest number of species and, therefore, greater floristic variety, as suggested by the theory of intermediate levels of disturbance (Sheil & Burslem, 2003; Wright, 2002). In other words, can particular logging conditions serve as a motor of floristic diversity?

It is also necessary to address the sustainability problems posed by legal or illegal hunting associated with logging. To comprehensively consider this question, it is necessary to look beyond pure prohibition or solely repressive measures. Solutions must be sought by fostering a greater awareness on the part of governments and industrialists and by the genuine integration of the faunal resources in management processes.

12. Monte Alén-Monts de Cristal Landscape

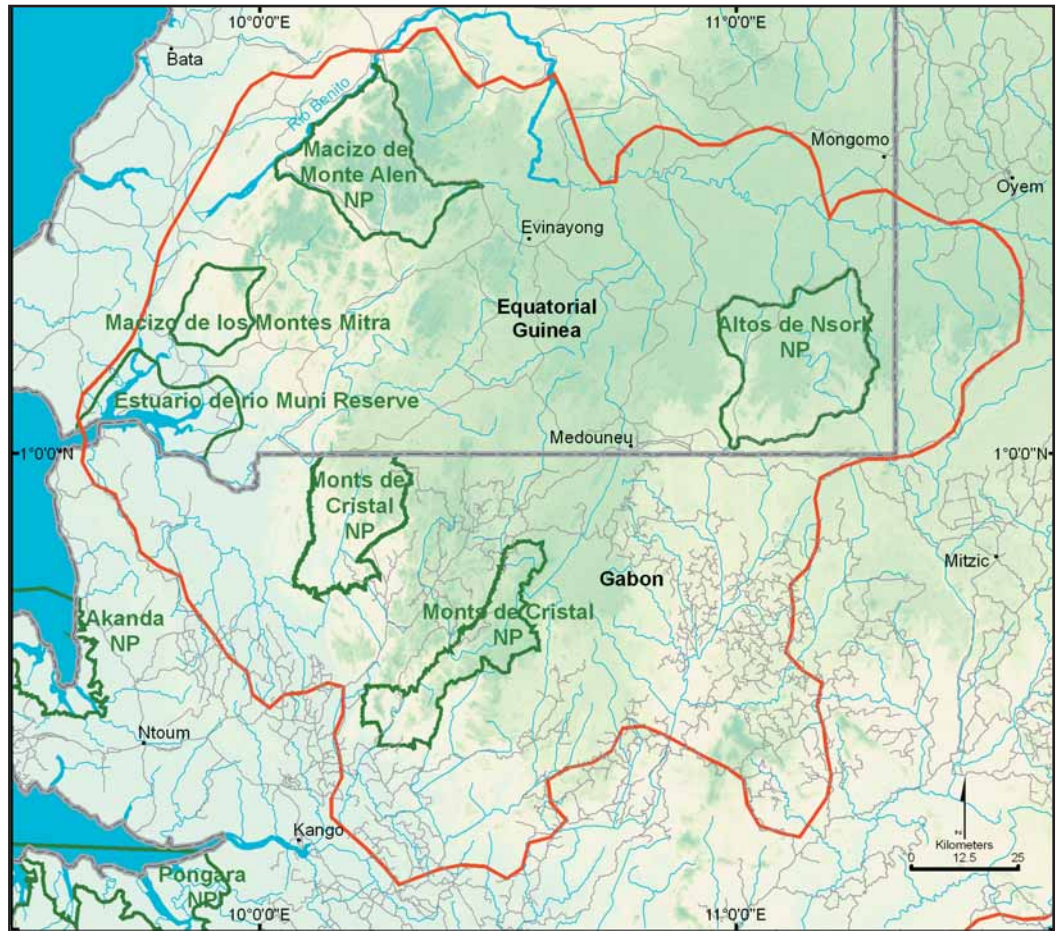


Figure 12.1. Map of Monte Alén-Monts de Cristal Landscape (Sources: CARPE, JRC, SRTM, WCS-Gabon).

The Landscape in brief

Coordinates: 1°53'35"N – 0°5'38"N; 9°37'2"E – 11°36'3"E

Area: 26,747 km²

Elevation: 300-1,250 m

Terrestrial ecoregion: Atlantic Congolese forests ecoregion

Aquatic ecoregions: Central West equatorial coastal ecoregion
Southwest equatorial coastal ecoregion

Protected areas:

Monte Alén National Park, 200,000 ha, 1988/2000, Equatorial Guinea

Altos de Nsork National Park, 40,000 ha, 2000, Equatorial Guinea

Monts de Cristal National Park, 120,000 ha, 2002, Gabon

Rio Muni Estuary Reserve, 70,000 ha, 2000, Equatorial Guinea

Piedra Nzas Natural Monument, 19,000 ha, 2000, Equatorial Guinea

Location and area

The Monte Alén-Monts de Cristal Landscape covers the south and southeast of Equatorial Guinea and the northwest of Gabon (Figure 12.1). It has an area of approximately 26,747 km², of which about half is located in Equatorial Guinea and half in Gabon. In Equatorial Guinea, it includes the Monte Alén and Altos de Nsork national parks, as well as the Rio Muni Estuary Reserve and the Piedra Nzas Natural Monument. In Gabon, it comprises the two sections of Monts de Cristal National Park.

Physical environment

Relief and altitude

The Landscape occupies a rugged area of plateaus and mountain chains mainly situated at an altitude of 300 m to 650 m to the northeast of the coastal sedimentary basin of Gabon (Figure 12.2). In Equatorial Guinea, the highest peak is formed by Monte Mitra, which rises to 1,250 m and is

the culminating point of the Niefang chain which runs from the southwest to the northeast. Monte Alén is slightly lower. To the east of this chain is a peneplain with a smoother relief at an average altitude of 650 m and with a landscape studded with granite inselbergs such as that of Piedra Nzas (700 m). In Gabon, the relief forms alignments running from the northeast to the southwest. The highest point is Mont Mbilan (800 m).

Geology and soils

The vast majority of rocks in the Landscape are Archean. In Gabon, the 3.2 billion years old non-differentiated gneisses are dominant, but there are also formations of amphibolites, aged 2.9-3.2 billion years, and ultramafic intrusions, 2.7-2.8 billion years old. In Equatorial Guinea and the Medouneu region, the dominant rocks are calco-alkaline granite aged 2.9 billion years.

Hydrology

In Equatorial Guinea, the Landscape is drained by the Mitemele, Laña and Wele rivers, which run to the estuaries of Rio Muni and Rio Mbini, two very important features of the coastal marine ecosystems in the Gulf of Guinea. These estuaries contain the coral reefs of the islands of Corisco and Elobey. The south of the Landscape includes humid areas that form the heads of the Komo River, which empties into the Gabon Estuary. In Gabon, the Landscape is drained by four watercourses that flow towards the southeast. The Mbé and the Komo form part of the basin of the Gabon Estuary. The Adouré and the Noya turn west and then northwest before ending in the Muni Estuary.

Climate

Across the Landscape, annual rainfall varies between 2,000 mm in the east to 2,800 mm in the west. There is a dry season of three months that runs from July to September, but its effects are considerably attenuated by the fact that a good part of the Landscape is then shrouded in low clouds. Not only does the whole region have high rainfall, but the humid winds from the Atlantic and the clouds that drift into the western flank of the mountains maintain a high level of humidity, especially in the dry season when the clouds are very low. These special conditions existed during the glacial eras. They were perhaps even more marked at that time due to the fact that the surface temperatures in the Gulf of Guinea were



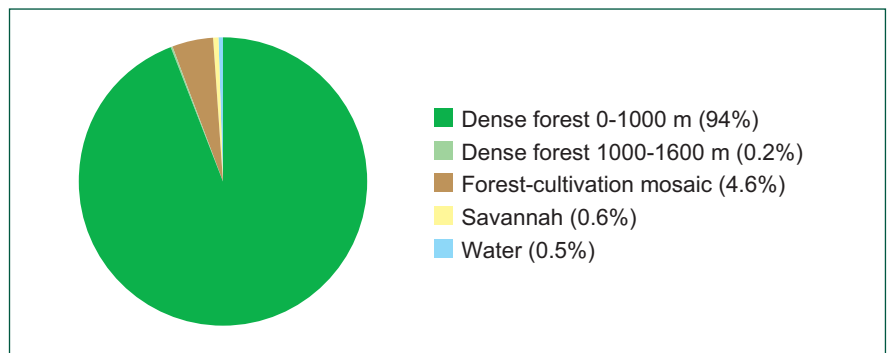
Figure 12.2. Mountains in the Tchimbélé region.

lower and stratiform clouds were more frequent. The mountains in this Landscape have thus been able to maintain large forest formations and represent a forest refuge.

Vegetation

The dominant vegetation is terra firma forest (Figure 12.3) of which 15-18%, in Gabon at least, has been modified by agriculture. Near the estuaries of the Rio Muni and the Komo, there are stretches of swamp forest (<1%) and an abandoned plantation of 500 ha of okoume can be found just to the south of the Seni section of the Monts de Cristal National Park. These forests are a part of the Atlantic coast forests and the caesalpinaceae forests, which form more or less parallel chains along the coast of the Gulf of Guinea. The domi-

Figure 12.3. Main vegetation types (Source: JRC).



nant tree families are Burseraceae, Euphorbiaceae and Leguminosae-Caesalpinioideae. Above 650 m, the forest formations show submontane influences and, on high peaks or slopes exposed to the clouds of the Atlantic, there are cloud forests recognizable by their abundant epiphytes. The inselbergs also have a very particular vegetation, with meadows of *Afrotrilepis pilosa* and thickets very rich in epiphytes.

As part of an ancient Pleistocene refuge, the forests have maintained a very high level of species richness and numerous endemic species. The flora includes over 3,000 species of which a hundred or so are endemic to the Atlantic coastal region of Lower Guinea. The montane species found in Equatorial Guinea include *Podocarpus* spp. On the inselbergs, *Elaeophorbia grandifolia* and *Polyscias aequatoguineensis* have been found. In the Gabonese section, there are some species with a very limited distribution, particularly *Bikinia durandii*, a Caesalpinioideae, and *Marquesia excelsa*, the only Dipterocarpaceae in Africa, which is endemic to Gabon.

Recent studies suggest that the forests of the Monts de Cristal constitute the richest forest formations in Central Africa, from the point of view of both alpha and beta diversity, and the second richest in the world following a site in Ecuador¹. In addition, the 'hot spots' are not the same for different groups or families of plants. Among the families that are exceptionally well represented are Acanthaceae, Melastomataceae, Balsaminaceae, Orchidaceae (Figure 12.4) and Begoniaceae (Figure 12.5). The forests of Monte Mitra are also exceptionally rich with an average of 107 plant species with a stem of over 1cm in diameter, per hectare.

Fauna

Mammals

The forests in the Landscape contain most of the mammals typically found in the forests of western Central Africa, notably the forest elephant *Loxodonta africana cyclotis*, the buffalo *Syncerus caffer*, the giant pangolin *Manis gigantea*, the water chevrotain *Hyemoschus aquaticus*, six species of duiker, de gorilla *Gorilla gorilla*, the chimpanzee *Pan troglodytes*, the mandrill *Mandrillus sphinx*, the black colobus *Colobus satanas*, the Ogooué talapoin monkey *Miopithecus ogoouensis*, the leopard *Panthera pardus* and the golden cat *Felis aurata*. The aardvark *Orycteropus afer* has also been reported. In the lower parts of Equatorial Guinea, the white-collared mangabey *Cercocebus torquatus*

and the hippopotamus *Hippopotamus amphibious* have been found. It is important to mention that on the fringe of the Landscape – but still within the same forest block – manatees (*Trichechus senegalensis*) live in the Komo and Abanga rivers (comm. ENEF-WWF).

Birds

There is no comprehensive list of birds for the Landscape, but 267 species have been recorded in Monte Alén National Park and 340 in the Monts de Cristal region. Among the species endemic to Lower Guinea are the Cameroonian picatharte *Picathartes oreas*, Verreaux's Batis *Batis minima*, the forest swallow *Hirundo fuliginosa* and Rachel's malimbe *Malimbus racheliae*. In the Equatorial Guinea section, three montane species have been found that have not yet been observed in the Gabonese section: the pink-footed puff-back *Dryoscopus angolensis*, the grey cuckooshrike *Coracina caesia* and the black-capped woodland warbler *Phylloscopus herberti* (Fishpool & Evans, 2001).

Herpetofauna

The reptiles are still poorly known, but their fauna appears rich and representative of the forests of the region. It includes the forest crocodile *Osteolaemus tetraspis*, the false gavial *Crocodylus cataphractus*, the forest tortoise *Kinixys erosa*, the ornate monitor *Varanus ornatus* and the African python *Python sebae*. In the Gabonese section, 48 species have been counted so far, but the total number of species is probably around 65 (Pauwels, pers. comm.).

As concerns amphibians in Gabon, species have been found that are associated with forest waterfalls; several of these species were only known from western Cameroon and one is a new species for science. In the Equatorial Guinea section, three threatened species have been found: *Bufo superciliaris*, the largest toad in Africa, *Conraua goliath*, the largest frog in the world, and *Trichobatrachus robustus*, a hairy frog.

Invertebrates

The invertebrate fauna is very poorly known, but preliminary prospecting in Gabon has revealed butterfly species that were considered endemic to western Cameroon, particularly *Cymothoe haimodi* and species with localized distributions, like *Euphaedra limbourgi*, *E. brevis*, *E. dargei*, *E. dargeana*, *E. adolffrederickii*, *Euriphene minkoi*,

¹ On five sample plots of 1 ha, an average of 97 woody species with a diameter of over 10 cm were recorded; the richest sites in Cameroon have between 73 and 93 woody species (Thomas, 2004).

Euryphura euthalioides and *Euryphura nobilis* (G. Vande weghe, in prep.).

Humans in the Landscape

Density and distribution

The average population density is 16-18 inhabitants/km² in Equatorial Guinea and 0.6 inhabitants/km² in Gabon. In Gabon, the populations are concentrated along the Medouneu road and in the departmental capital where some 3,000 inhabitants reside. Cocobeach and Kango are situated just outside the Landscape and Libreville is less than 100 km away. These population centers are major destinations for bushmeat from the west and south of the Landscape. In Equatorial Guinea, the recent development of petroleum extraction has instigated large-scale migration to the towns of Bata and Malabo, as well as Evinayong (10,000 inhabitants), which is situated within the Landscape. Despite the significant urbanization of populations, immigrants to urban areas maintain contact with the rural areas and there are still important economic, family and cultural links between new urban populations and rural populations. In some remote areas, whole villages have been abandoned and fields recolonized by the forest.

Ethnic groups

The dominant ethnic group in the mountain areas of the Landscape is the Fang group. Ndowe live in the coastal basin in Equatorial Guinea and small populations of Beyele Pygmies remain in the Altos de Nsork region.

Activities

In both Gabon and Equatorial Guinea, human populations depend on subsistence agriculture and hunting. Cultivation is itinerant and is usually established in old secondary forests or abandoned coffee plantations. Any surplus of agricultural products is sold along the roadsides or, less frequently, transported to towns. In the Gabonese section of the Landscape, there are 40-50 professional hunters, ten of whom are elephant hunters. In Medouneu, 400-500 people are employed by the government. In the periphery of the Landscape, commercial hunting for bushmeat is a very important activity along the Ndjolé-Lalara road (recently tarred).

Land use

Forest concessions cover 65% of the Landscape, protected areas 18% (27% in Equatorial Guinea), and crops 3% (Figure 12.6). In Gabon, two hydroelectric dams have been constructed in the Mbé Valley to supply Libreville, the capital of the country.

Logging

In Gabon, most of the Landscape is covered by forest concessions and 'family felling rights'. Logging began in the 1970s and old maps show a dense network of logging roads, most of which are no longer useable because they have been overtaken by the forest and the bridges have collapsed. At present, logging takes place in the south and east of the Mbé sector. Very recently, it has also begun in the northeast. However, the most intense logging used to be in the west of this sector, but it stopped in 2004 because it was no longer profitable. Logging continues in the lower regions in the south of the Seni sector. The concessions are worked by French, Asian and Franco-Gabonese companies (NBG, TLP, Afrique Verte, SGG, SEEF, Rougier, BSG).

In Equatorial Guinea, timber was the main source of foreign exchange before oil was discovered in 1995. The volume harvested rose from 50,000 m³ in 1980 to 790,000 m³ in 1999, although maximum sustainable production had been officially estimated at 400,000 m³ and legal small-scale production was set at 450,000 m³. The main species harvested was okoume and 85% of production was exported as logs to Asia. With oil revenue, the pressure on the forest eased, but unregulated and unsupervised logging continues. Companies are taxed on the basis of the logs arriving at the port of export; consequently, companies have no interest in reducing the impact of their logging and the government is deprived of revenue that could finance monitoring. Most of the Landscape outside of the protected areas is divided up into concessions, but many are inactive. Recently, the President of the Republic ordered the creation of a permanent national forest domain of 500,000-600,000 ha where logging would be supervised. This measure could ensure the interconnectivity of the protected areas.

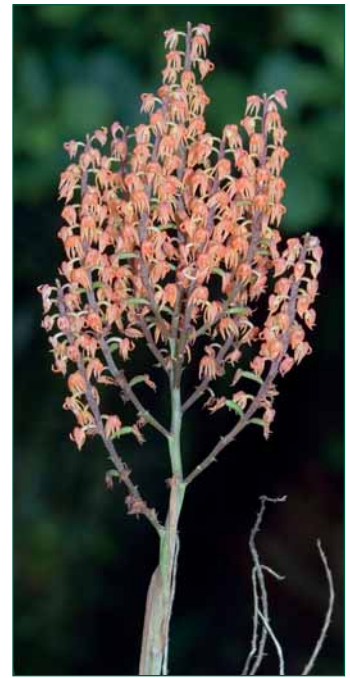


Figure 12.4. Among the Orchidaceae, the genus *Polystachya* is particularly well diversified.



Figure 12.5. Among the Begoniaceae are many land plants as well as epiphytes.

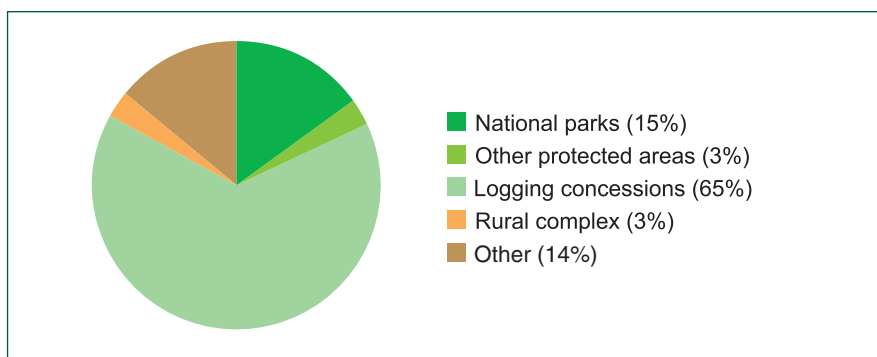


Figure 12.6. Main land use types.

Reasons for the identification of the Landscape

- (1) This Landscape was chosen for its extraordinary biodiversity, linked to the climatic conditions, and because it contains an ancient Pleistocene refuge.
- (2) The Equatorial Guinea section was considered important for bird conservation (Fishpool & Evans, 2001).
- (3) The human population density is relatively low, especially in Gabon.
- (4) The forests are still fairly well conserved.

Conservation

History

In Equatorial Guinea, Monte Alén National Park was created in 1988 and benefited from the support of the ECOFAC program which began in 1992. In 1997, a forest law was passed providing for the creation of a vast network of protected areas. In March 2000, following the Yaoundé Declaration and the CUREF program proposals, 13 protected areas were created, four of them in the Landscape: Monte Alén National Park, Altos de Nsork National Park, Piedra Nzas National Monument and Rio Muni Nature Reserve. The CUREF program ended in 2002 and its activities were handed over to the *Instituto de Desarrollo Forestal* (INDEFOR), created to manage the country's forests and protected areas. The ECOFAC program was suspended in 2004 and is set to resume in 2007. Very recently, following a COMIFAC meeting, the national forest domain was created and a good part of it lies within the Landscape. The aim of the forest domain is to 'let the forests rest' after a recent phase of intense logging. However, the creation of this forest domain has not yet been approved by Parliament.

In Gabon, the value of the region was recognized by conservation botanists well before it was added to the list of priority conservation sites by the IUCN in 1990. The creation of Monts de Cristal National Park in 2002 was a result of this recognition. It is composed of two blocks of 600 km² (Seni sector and Mbé sector) that cover 10% of the surface area of the Landscape in Gabon.

Players

In Gabon:

- CNPN, MEFEPNN, WCS and WWF are the principal conservation players.
- The Smithsonian Institution, the Missouri Botanical Garden, the University of Wageningen and the national herbarium (CENAREST) are engaged in research.
- The Gabonese Water and Energy Company (SEEG) runs the hydroelectric dams.
- The main industrial logging companies are: NBG, TLP, Afrique Verte, SGG, SEEF, Rougier, and BSG.

In Equatorial Guinea:

- INDEFOR, the University of Acalá, the Missouri Botanical Garden, Imperial College, the University of Wageningen, Boston College and the Smithsonian Institution are involved in research.

Direct threats

(1) Hunting and bushmeat trade

In both Equatorial Guinea and Gabon, hunting for bushmeat represents the main threat to biodiversity. In Equatorial Guinea, the consumption of bushmeat has risen considerably in the last few years. This increase is the result of an increase in the purchasing power of the urban populations following the development of oil extraction. Regulations are not observed and even protected animals are openly sold in the markets.

(2) Ivory trade

In Gabon, elephant hunters continue to operate, but they are as equally concerned with elephant meat as ivory. As in many other regions of Central Africa, they are supported by local elites.

(3) Industrial logging

In Equatorial Guinea, despite a recent slowdown, logging continues to be unsustainable and there is ongoing degradation. In Gabon, there is pressure to restart logging in the buffer zones of national parks due to the fact that laws and

regulations on the management of these areas do not yet exist. However, small companies operating in the Landscape, with the exception of SEEF, are not in a position to practice reduced-impact sustainable management. Chinese and Malaysian companies, in particular, operate in a destructive manner². Unlike other companies, they harvest timber of lower value and leave behind highly impoverished forests. In general, industrial logging causes much more damage in mountainous areas than on flat ground. Submontane forests and cloud forests are more sensitive to any opening-up of their canopy; the penetration of light into the undergrowth transforms the microclimate, which may become unsuitable for very sensitive plants, such as begonias.

(4) *Small-scale mining*

In a few places in the Gabonese part of the Landscape there are gold panners who disturb streams, aggravate erosion, intensify sedimentation and spend a lot of time hunting.

(5) *Industrial mining*

It is also possible that in the southern part of the Landscape platinum mining may start over a strip of 85 km, of which 75 km are in the Mbé sector of Monts de Cristal National Park or in the 5 km buffer zone. Initial prospecting has already been carried out and more advanced prospecting will take place over the next few years to determine the economic feasibility of this mining activity. If the results are positive, partial declassification of the national park could be foreseen, with compensatory classification of other forests with the same area. In this scenario, the richest forests of Central Africa would be 'replaced' by poorer forests. Logging could also have adverse effects on the hydrological system in the region and could impact hydroelectric supplies of electricity to Libreville by affecting the operation of turbines and increasing erosion and sedimentation in dams.

Indirect threats

(1) *Weak institutions*

In Equatorial Guinea, INDEFOR has little influence within the government, including within its own Ministry, and does not have the financial means to carry out its tasks. Consequently, the concessions are not monitored, the guards responsible for supervising the protected areas are ineffective and laws are ignored because of a lack of professionally qualified personnel. The few existing personnel have little training, remain isolated and are poorly paid.

(2) *Ad hoc development*

In Equatorial Guinea, the government has started repairing and extending the road system, while logging companies are constructing their own roads. The number of vehicles has risen substantially. These activities enormously increase accessibility to the forests and facilitate poaching.

State of the vegetation

There is little concrete data suitable for evaluating and quantifying the impacts of human activities on forests. However, in general, the forests are a mosaic of degraded and intact formations, where intact formations are protected by their inaccessibility. The national parks of Monte Alén, Altos de Nsork and Monts de Cristal still have considerable expanses of primary forests. In Equatorial Guinea, the composition of the forests in the coastal basin has been modified by the excessive logging of okoume, but these changes are not irreversible and these forests can still recover a good portion of their biodiversity. The forests in the interior of the country have been minimally logged and those in Altos de Nsork National Park are intact.

State of the fauna

No species in the Landscape has been eliminated locally, but population densities are very low, especially in Gabon. Recent inventories show that the northern block of Monts de Cristal National Park is particularly 'empty' of large fauna³. The Mbé sector of Monts de Cristal National Park is nevertheless part of a large area of forest stretching as far as Ndjolé, Mitzic and Medouneu. The interior of the Abanga forests (15,000 km²) contains high densities of large mammals and most notably elephants (SEEF, CFAD Haut-Abanga de Rougier). The elephants move between the forests of the Tridom and the forests of Abanga.

² These companies often work on very steep slopes where they carve out roads and cause serious erosion.

³ Inventories to be completed later with a report in preparation.

Financing of conservation

In Equatorial Guinea and Gabon, only one protected area is certain of financing in the short term (<2 years).

Environmental education and capacity building

In Gabon, WCS runs an environmental program in villages on the periphery of Lopé National Park that includes actions targeted at schoolchildren and informal meetings for adults. An apiculture project and a vegetable garden for children have been launched to promote the sustainable management of natural resources on communal land.

Management and governance in the field of renewable natural resources

(1) At the Landscape level

In Equatorial Guinea, the CUREF project (European Commission) has developed a land pre-classification map covering an area of about 20,000 km², which has yet to be validated by the government.

(2) In protected areas

Throughout the Landscape, with the exception of Monte Alén National Park, management of protected areas is still in its early stages. In Gabon, Monts de Cristal National Park is managed by CNPN with the support of WCS. All the protected areas have legally defined limits.

(3) In the extractive zones

In Gabon, the forests outside the village sectors are the responsibility of the Ministry of the Forest Economy. In the eastern and southern part of the Abanga forests, WWF is working in collaboration with the Ministry of Forest Economy and with loggers to improve the management of fauna in this forest network; a cooperative agreement is being prepared between the Ministry, Rougier Gabon and WWF. This agreement centers on the conservation of fauna in the Rougier CFAD of 'Haut-Abanga' (288,626 ha). Socioeconomic surveys have been carried out along the Medouneu-Sam, Lalara-Ndjolé and Ndjolé-Bifoun-Oyan axis. A network of old forest tracks in the Oyan-Bifoun-Ndjolé area provides access to poachers.

(4) In rural areas

No actions have been initiated.

Monitoring of natural resources

In Gabon, basic demographic, socioeconomic, resource use, human pressure, and biological data were collected in 2004 and 2005. These efforts involved national and international institutions and covered almost the entire Landscape. An exhaustive report is being drawn up to support management and local and regional monitoring activities. These surveys were an initial reconnaissance exercise to assess the prevailing conditions and in no case constitute exhaustive inventories. A more comprehensive monitoring program will be proposed on the basis of the data obtained and will be used to measure changes over the course of time. Unfortunately, such monitoring is expensive and budgetary constraints make it impossible in the near future.

To monitor forest dynamics, five one hectare plots were identified and all woody species with a diameter of over 1 cm or 10 cm were recorded. This work was made possible through collaboration between the national herbarium of Gabon, the Smithsonian Institution and the Missouri Botanical Garden (Thomas, 2004).

In Equatorial Guinea, capacities are being developed through a promising collaboration between INDEFOR, IUBioma (the national biodiversity institute), the University of Acalá, the Missouri Botanical Garden, Imperial College and Conservation International. IUBioma and INDEFOR are developing a national research and monitoring plan which will include the Landscape.

13. Gamba-Mayumba-Conkouati Landscape



Figure 13.1. Map of Gamba-Mayumba-Conkouati Landscape (Sources: CARPE, JRC, SRTM, WCS-Gabon).

Location and area

The Gamba-Mayumba-Conkouati Landscape is transnational and centered on the Loango, Moukalaba-Doudou and Mayumba national parks in Gabon, and Conkouati-Douli National Park in the Republic of Congo (Figure 13.1). Lying between the national parks in Gabon is a set of hunting areas - Ngové-Ndongo, Moukalaba, Sette Cama and Iguéla - plus the Ouanga Plain Wildlife Reserve. The Landscape extends over a total area of 34,258 km², of which approximately 75% lies in Gabon and 25% lies in the Republic of Congo, and stretches along the southwestern coast of Gabon and the western coast of the Republic of Congo. Mayumba and Conkouati-Douli national parks extend back 15 km and 22 km from the beach respectively, covering an area of 80,000 hectares in Gabon and 120,000 hectares in the Republic of Congo.

The Landscape in brief

Coordinates: 1°36'26"S – 4°26'26"S; 9°15'48"E – 12°24'28"E

Area: 34,258 km²

Elevation: 0-840 m

Land ecoregions:

Congolese Atlantic forests ecoregion

Southwestern forest-savannah mosaic ecoregion

Aquatic ecoregion:

Southernmost western equatorial coastal ecoregion

Protected areas:

Loango National Park *, 153,581 hectares, 2002, Gabon

Moukalaba-Doudou National Park *, 502,805 hectares, 2002, Gabon

Mayumba National Park, 80,000 hectares, 2002, Gabon

Conkouati-Douli National Park, 505,000 hectares, 1980/1999, Republic of Congo

Ngové-Ndongo Hunting Area*, 1956, Gabon

Moukalaba Hunting Area *, 20,000 hectares, 1962, Gabon

Iguéla Hunting Area *, 1962, Gabon

Ouanga Plain Wildlife Reserve *, 1962, Gabon

(*) protected areas located in the Gamba Protected Areas Complex



Figure 13.2. Along the coast of Loango National Park are several small cliffs, rich in cretaceous fossils.

Physical environment

Relief and altitude

The relief is quite varied, consisting of beaches and low dunes stretching along the Atlantic Ocean, coastal plains and low undulating plateaus of the coastal sedimentary basin, and the Monts Doudou Mountain Range in Moukalaba-Doudou National Park, which rises to over 800 meters and is a flank of the Mayombe Range. The Monts Kouboula Mountain Range in the Republic of Congo rises to over 800 meters. Mayumba National Park in Gabon and the nearby Conkouati-Douli National Park in the Republic of Congo each include a 60 km long, narrow strip of beaches and lowland areas between the ocean and lagoons. The terrain is flat, but near the Congolese border it gives way

Figure 13.3. The flood plains of the Ngové River in Loango National Park.



to low rising hills behind the beach, intersected by small lagoons and mangroves. The marine sections have a depth of 50 meters at their deepest, and the sea bottoms are sandy with scattered low-lying rocky outcrops (dolerites and gabbros) visible on the coastline.

Geology and soils

The Landscape comprises three geological entities. Most of it belongs to the coastal sedimentary basin, which narrows from 80-100 km wide in the north to only 10-20 km wide south of Mayumba. This basin is formed of sedimentary rocks from the Cretaceous-Tertiary period, resulting in heavily leached and poor sandy to sandy-clay soil. The entire coastline of older layers is covered by cirque series sand sheets of the Pliocene epoch. On the coast, in particular at Milango Point in Loango National Park, marine erosion has exposed rocks rich in marine fossils (fish, ammonites) dating from the second half of the Cretaceous period (Figure 13.2). Monts Doudou Mountain Range is composed of granite and compound gneisses of the lower Proterozoic, 2.2-2.5 billion years old, which result in ferruginous soils. Nyanga-Moukalaba Basin chiefly consists of 500-700 million year old Upper Proterozoic calcareous or dolomitic sedimentary rocks. The Landscape's present relief comes from the coastal basin land emergence caused by the uplift of the western margin of Central Africa during the Tertiary period.

Hydrology

The water system consists of the Nyanga River, the Ndogo, Ngové and Banio lagoons in Gabon, the Ngongo, the Conkouati Lagoon and the Noumbi River in the Republic of Congo. The Nyanga is Gabon's second largest river in terms of flow and drains a 22,500 km² basin, of which 80% is located in the country. The Banio Lagoon divides Mayumba National Park from the hinterland. It is over 70 km long and runs parallel to the coast. The three large lagoons are supplied by rivers that drain the coastal basin and have a permanent outlet. Some of these rivers are surrounded by vast flood plains (Figure 13.3). In the Republic of Congo, the Ngongo River supplies the Tchibinda, Tchivoka, Tchimpa and Manzimanouvou lakes, all of which supply significant volumes of fresh water to the Conkouati Lagoon, creating highly fluctuating levels of salinity. The Noumbi is the third largest river of the Republic of Congo after the Congo and Kouilou rivers. The coastline

is dotted with countless small lagoons that discharge into the sea during the rainy season. In the dry season, their outlet is blocked by a sand bar. Paradoxically, the level of these lagoons is highest towards the end of the dry season¹.

Climate

Annual rainfall averages from approximately 1,800 mm in the north of the Landscape to under 1,500 mm in the Moukalaba and Nyanga valleys. The dry season extends from June to September, but January-February represents a period of lower rainfall. During the dry season, low stratiform clouds, driven by the Atlantic winds, reduce solar radiation and lower the temperature by an average of 3°C, causing a sharp decrease in evaporation.

Vegetation

The Gamba-Mayumba-Conkouati Landscape is probably the most diverse of all Landscapes in Central Africa (Figure 13.4). The coastline vegetation consists of a succession of stands composed of sand-binding vegetation such as *Ipomea pescaprae*, coastal pastures of grasses and sedge, coastal thickets of *Dalbergia ecastaphyllum*, *Hibiscus tiliaceus*, *Phoenix reclinata* and *Hyphaene guineensis*² and the coastal sclerophyllous forest containing *Chrysobalanus*, *Manilkara* and *Fegimanra* (Figure 13.5). Further inland, there is a spreading mosaic of forest stands composed of pioneer forests, containing *Aucoumea klaineana* and *Sacoglottis gabonensis* of different ages, and mature stands, which are more diversified in *Aucoumea*, *Desbordesia glaucescens*, *Dacryodes buettneri*, *Tetraberlinia moreliana*, *Monopetalanthus pellegrini*, *Tessmannia africana*, *Odyndyca gabonensis*, *Lophira alata*, *Klainedoxa gabonensis* and *Librevillea klainei*. In addition, the Moukalaba Basin contains *Dialium pachyphyllum*, *Toubaouate brevipaniculata*, *Autranella congolensis* and *Dacryodes heterotricha*. Monts Doudou Mountain Range is clad in dense forests, which above 650 meters show submontane affinities. Cloud forests are found on the highest summits and peaks exposed to Atlantic winds. In the lower regions, terra firma forests are interspersed with raffia palm-groves and vast expanses of swamp or floodplain forests of *Alstonia congensis*, *Anthocleista vogelii*, *Anthostema aubryanum*, *Hallea ciliata*, *Syzygium sp.*, *Xylopa sp.*, *Lecomtedoxa biraudii* and *Gilbertiodendron unijugum*.

The forests are also interspersed with open, permanent or semi-permanent marshes, in particular papyrus swamps, and grass savannahs. In the coastal basin, the latter belong to three specific

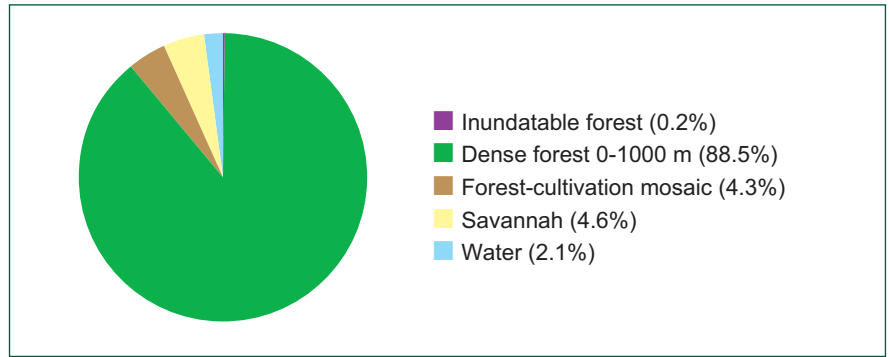


Figure 13.4. Main vegetation types (Source: JRC).

types: periodically flooded savannahs in the lowest-lying lagoon areas, steppe savannahs on white sand, and savannahs with denser herbaceous cover on sandy clay soil. In several spots, especially in Loango National Park, steppe savannahs are being colonized by thickets of *Chrysobalanus*. In the Nyanga and Moukalaba valleys, the savannahs consist of tall grasses and include a shrub stratum with *Nauclea latifolia*, *Bridelia ferruginea* and *Crossopteryx febrifuga*.

The low, periodically flooded savannahs are dotted by semi-permanent ponds with *Nymphaea* and *Utricularia*. The lagoon mouths are home to mangroves with *Rhizophora* and *Avicennia*, as well as relatively brackish floodplain grasslands.

The region's flora was little-known, but specimens collected over the past ten years by the University of Wageningen, the Missouri Botanical Garden, CENAREST and the national herbarium have considerably expanded the knowledge base³. A study of the orchid family revealed the presence of 73 species⁴. In the Monts Doudou Mountain Range, 991 species have been collected from 2,459 herbarium samples, including 5 endemic species and 9 restricted-range species⁵. Overall, 11% of species appear to be endemic to the biogeographic area, and the richest areas are situated at the medium and high altitudes. These findings support the theory that Monts Doudou Mountain Range was a forest refuge in the Pleistocene era. In the Republic of Congo, over 2,500 plant species have been recorded in Conkouati-Douli National Park and its surrounding environments.

Fauna

Mammals

At least 89 species of mammals inhabit the Landscape. Significant species include the forest elephant *Loxodonta africana cyclotis* (Figure 13.6), the buffalo *Syncerus caffer*, the hippopotamus *Hippopotamus amphibius*, the lowland gorilla *Gorilla gorilla*, the chimpanzee *Pan troglodytes*, the

¹These small lagoons are particularly important for populations of Nile crocodiles *Crocodylus niloticus*.

²The shrub *Tabernaemontana iboga*, of the dogbane family, widely used in Gabon in certain traditional rites for its hallucinogenic properties, is extremely abundant in these coastal thickets, which probably represent its original environment.

³At least 30 new plant species of the *Commitheca*, *Begonia* and *Impatiens* genera have been discovered, as well as a giant tree, *Xanthocercis rabiensis*, in the Rabi region (Hallé & Louis, 1989). More recently, detailed studies of 75 plots throughout the Gamba Complex have yielded information on 7,305 plants (Campbell *et al.*, 2006).

⁴Including 20 terrestrial and 53 epiphytic species; 3 species are new to science and still require description (Stewart & Droissart).

⁵The species endemic to the Monts Doudou Mountain Range or southwestern Gabon are: *Adhatoda le-testui* (Acanthaceae), *Anthonota trunciflora*, *Cynometra nyangensis* and *Isomacrolobium conchyliophorum* (Caesalpinioidea), *Begonia dewildei* and *B. gabonensis* (Begoniaceae), *Calpocalyx brevifolius* (Mimosaceae), *Commitheca letestuana* and *Tarenna jolinonii* (Rubiaceae), *Trichoscypha gambana* (Anacardiaceae), *Costus nudicaulis* (Costaceae), *Dichapetalum sp. nov.* (Dichapetalaceae), *Impatiens floretii* (Balsaminaceae) and *Trichostephanus gabonensis* (Flacourtiaceae).

Figure 13.5. Coastal thickets with *Fegimanra africana*.



black colobus monkey *Colobus satanas* and the collared mangabey *Cercocebus torquatus* (Figure 13.7), the Ogooué talapoin monkey *Miopithecus ogoouensis*, the mandrill *Mandrillus sphinx*, seven species of duikers, including the white-legged Ogilby's duiker *Cephalophus ogilbyi crusalbum*, and the defassa waterbuck *Cobus ellipsiprymnus*, the most important waterbuck in Gabon and probably the only one in the Republic of Congo. In April 2000, four species of bush babies (*Galago* sp.⁶, *Euoticus elegantulus*, *Galagoides thomasi* and *Galagoides demidoffi*) as well as Bosman's potto *Perodicticus potto* (Bearder, 2000) were identified around Gamba. The side-striped jackal *Canis adustus* is found in all savannahs, while the manatee *Trichechus senegalensis*⁷ inhabits the lagoons and some rivers of both Gabon and the Republic of Congo.

Little research has been done on marine mammals, but a total of 17 species of cetaceans have been observed (Box 13.1) and 10 other species may be present, based on their known distribu-

tion (Findlay *et al.*, 2004). Most common are the humpback whale *Megaptera novaeangliae*, the common or saddle-backed dolphin *Delphinus delphis*, the bottlenose dolphin *Tursiops truncatus* and the Atlantic hump-backed dolphin *Souza teuszii*. The latter is a rare species, but it has been observed in great numbers in the southern part of Mayumba National Park. The Cape fur seal *Arctocephalus pusillus* has also been found on the beach (Thibault 1999a, Thibault, 1999b).

Twelve species of *Muridae* and 9 species of *Soricidae* have been collected in the Monts Doudou Mountain Range (Nicolas *et al.*, 2004). None of these represent mountain species.

Birds

In terms of bird life, Sargeant (1993) has inventoried 380 species in the Gamba region. The most recent inventory of bird life inhabiting the Gamba Protected Areas Complex lists nearly 500 species (Christy, pers. comm.). Christy and Goodman (2004) noted 230 species, including 161 typically forest species in the Monts Doudou Mountain Range, which is also home to little-known birds such as the African green ibis *Bostrychia olivacea*, the Bates' swift *Apus batesi*, the Angola pitta *Pitta angolensis*, the forest swallow *Hirundo fuliginosa* and notably the grey-necked rockfowl *Picathartes oreas*⁸. Two hundred bird species have been inventoried in Loango National Park. They include the loango slender-billed weaver *Ploceus subpersonatus*, a known coastal species ranging from Gabon to Angola. No inventory has been done in the Mayumba region, but it appears to be a major stopover site for Palearctic terns (*Sterna hirundo*, *S. paradisea* and *S. sandvicensis*) and the Damara tern *S. balaenarum*, an endangered species from southern Africa. Steppe savannahs in both the Republic of Congo and Gabon are nesting sites for the African river martin *Pseudochelidon eurys-*

⁶ A new, previously unrecognized species closely related to *Galago alleni* and *G. gabonensis*. The latter is found only in northern Gabon and southern Cameroon. All three were undifferentiated until recently and taxonomised as *G. alleni* generally.

⁷ This manatee population is the only one in the Republic of Congo.

⁸ The discovery of *Picathartes oreas* at 600 meters of altitude in the Monts Doudou Mountain Range considerably extended the south-westward distribution of this species.



Figure 13.6. Elephants in coastal vegetation.



Figure 13.7. The collared mangabey *Cercocebus torquatus*.

tomima and the rosy bee-eater *Merops malimbicus*. The *Hyphaene* coastal thickets are home to the rufous-tailed palmthrush *Cichladusa ruficauda*. Thickets in both the Republic of Congo and Gabon are inhabited by a Zambebian species, the black-backed barbet *Lybius minor*, while the wet coastal plains are also home to the saddle-billed stork *Ephippiorhynchus senegalensis*.

Herpetofauna

A total of 86 reptile species are known in the Gamba Complex: 11 chelonians⁹, 3 crocodilians, 2 amphisbaenians, 22 lacertilians (Figure 13.8) and 48 ophidians including 30 Colubridae (Pauwels *et al.*, 2006). Seven species are on the IUCN Red List: the four sea turtles (*Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea* and *Dermochelys coriacea*), the turtle *Kinixys erosa*, and the crocodiles *Crocodylus cataphractus* and *Osteolaemus tetraspis*. The Nile crocodile *Crocodylus niloticus* is plentiful in lagoons and at sea. This important population is probably the last in Gabon.

Fifty-four species of amphibians have been found in the Monts Doudou Mountain Range - a relatively high abundance of species for an African site. They include 6 species new to Gabon; the *Hemisus* and *Kassina* genera were also previously unrecorded at this site (Burger *et al.*, 2004). Sixty-six species of amphibians have been found in the Gamba Complex as a whole (Burger *et al.*, 2006).

Ichthyofauna

Sixty-seven fish species have been found in the Rabi region (Mamoneke *et al.*, 2006), while in the Ndogo Lagoon more than 68 fish species belonging to 34 families have been inventoried (WWE, 1998). A rapid census of the Conkouati Lagoon in the Republic of Congo identified 55 species belonging to 31 families (Mamonekene, 2005). Industrial fishing, in practice since 1989, may have impacted these findings. In January and February 1989, a Norwegian team sampled a total of 354 marine species along the Gabonese coast between Pointe-Noire and Port-Gentil (Bianchi, 1992). An inventory is being done in Mayumba. Panga Bay, opposite the town of Mayumba, appears to be a major shark nursery and could be a significant feeding area for the manta ray *Manta birostris*.

Box 13.1: Marine mammals

Seventeen species of marine mammals have been recorded in Gabonese waters and ten other species are known to inhabit the Gulf of Guinea ecosystem or are expected to be found in the region based on their world distribution. This list includes seven species of large cetaceans (baleen or toothed whales). The whales are present in the area during the Antarctic winter and include populations that migrate between their warm or tropical water winter breeding quarters and their Antarctic or sub-Antarctic summer feeding quarters. Humpback whales are present from June to October, and the entire continental shelf area (up to a depth of 200 m) is critically important to the calving, nursing and mating of this species. There is little information on the distribution and abundance of other Cetacea in Gabonese waters, but Gabon's entire inshore area, near the beaches, is critically important for the Atlantic hump-backed dolphin (Findlay *et al.*, 2004).

Baleen whales

Humpback whale *Megaptera novaeangliae*
Blue whale *Balaenoptera musculus*
Fin whale *Balaenoptera physalis*
Sei whale *Balaenoptera borealis*
Bryde's whale *Balaenoptera edeni*
Southern Right Whale *Eubalaena australis*

Toothed whales

Sperm whale *Physeter macrocephalus*
Killer whale *Orcinus orca*
False killer whale *Pseudorca crassidens*
Melon-headed whale *Peponocephala electra*
Short-finned pilot whale *Globicephala macrorhynchus*
Risso's dolphin *Grampus griseus*
Rough-toothed dolphin *Steno bredanensis*
Bottlenose dolphin *Tursiops truncatus*
Long-beaked common dolphin *Delphinus capensis*
Common dolphin *Delphinus delphis*
Atlantic hump-backed dolphin *Sousa teuszii*

Invertebrates

Data on invertebrates have been collected in the Monts Doudou Mountain Range for three groups of hymenoptera: ants, ichneumons and chaclid wasps, a group of small wasps that breed in figs, the fruit of *Ficus*¹⁰. The Smithsonian Institution's work has recorded over 1,500 morpho-species in Loango National Park.

⁹ Monitoring of 5.75 km of beach during the 2002-2003 egg-laying season found 607 traces of leatherback turtles with clutches and 71 traces of olive Ridley turtles, but no trace of the other two species which had previously been found (Billes *et al.*, 2006).

¹⁰ For the Formicidae (ants), 310 species belonging to 56 genera were found - the greatest number of species ever found in Africa (Fisher, 2005). Thirty species of Chalcidoidea (chaclid wasps) were found, 28 of them new for Gabon (van Noort, 2004b). Among the Ichneumonidae (ichneumons), 112 species were found; only 28 species had been recorded previously in Gabon (van Noort, 2004a).



Figure 13.8. *The chameleon Chamaeleo dilepis.*

Humans in the Landscape

Southern Gabon has essentially been populated over the past 300 years by Bantu populations from the south. These migrations are due in part to the upheavals created by contact with Europeans¹¹, but also because of the increase in certain populations in the interior of the continent.

Density and distribution

The estimated population in the Gabonese section of the Landscape is 15,000, with an average density of 0.5 inhabitants/km². These populations are grouped into three population centers with little communication between them: the Iguéla sector in the northwest; the Mourindi sector in the east; and the Ndogo Lagoon region, with Gamba and Mayonami, in the center. The Gamba Protected Areas Complex has a population of 9,500 people distributed between forty-odd villages. The largest of these is the town is Gamba, with a population of 7,500. Gamba developed around the Shell Gabon facility and its population includes both Gabonese and foreigners. Rural population density (2,300 inhabitants) is 0.2 inhabitants/km². The over-55 age group accounts for 29% of the population; fewer than 30% belong to the under-15 age group and the over-15 population is 59% female. These statistics reflect rural migration towards development centers, which has left several villages abandoned since the 1960s. The Landscape's second-largest town is Mayumba with 2,980 inhabitants.

The Congolese portion of the Landscape has a low population density - approximately 5,900 people are distributed between 25 villages in and around the national park. The total population size and distribution changes as industrial forest exploitation companies come and go. Between 1964 and 1984, the rural population of Kouilou (including Conkouati) was halved and, in 1990, the estimated density was 2.8 inhabitants/km². The population living in the vicinity of the national park in 1996 was half of that of 2005 (Paris, 1996; WCS, 2005). Migration towards Pointe-Noire has slackened in the last decade.

Within 40 km of the Landscape's borders there are four towns (Pointe-Noire, Dolisie, Loudima and Makabana) whose populations benefit from the Landscape's resources. Pointe-Noire, the economic capital of the Republic of Congo, has a population of close to a million inhabitants and is linked to Brazzaville by the railway, several daily flights and a road unfit for traffic. Railways and

aircraft are key means for transporting bushmeat away from the Landscape for sale in Brazzaville.

Ethnic groups

In Gabon, the ethnic groups of the coastal basin, from Rembo Ndogo to the Atlantic Ocean, are the Vili, Lumbu and Ngové. Those of the Moukalaba and Nyanga river basins are the Punu, Varama and Vungu. These ethnic groups belong to the Punu-Eshira group and originate in the Congo (Raponda-Walker & Sillans, 1995). At present, the Ngové mainly speak Nkomi, which is a Myene language. The ethnic groups form autonomous subdivisions - clans - that occupy a common territory and abide by the same traditions and taboos. Clan affiliation is established through matrilineal descent. The clan concept and its associated traditions are disappearing through acculturation, which is particularly marked in the Ndogo Lagoon region because of the town of Gamba.

The dominant ethnic groups in the Republic of Congo are the Vili and Lumbu. The Vili are coastal people who have been settled in the Conkouati region since the 13th century. The Lumbu are forest people from the Mayombe Mountains who moved into the Conkouati region within the past 100 years. Together with other ethnic groups, they were imported to construct the Pointe-Noire-Brazzaville railway, and more recently for industrial logging (Hecketsweiler & Mokoko Ikonga, 1991).

Social organization

Administratively, the Gabonese portion of the Landscape straddles three provinces: Ogooué-Maritime, Ngounié, and Nyanga. Each province is administered by a governor. Departments are run by a prefect and a departmental council. The prefect, assigned by the Interior Ministry and supervised by the provincial governor, is in charge of departmental administrative services. The prefect also oversees the budgets of the different central government agencies, the departmental council and the local town hall. The departmental council, composed of a leader, deputy leaders and councilors, is involved in infrastructure development, improving living conditions and forwarding local people's complaints to higher authorities. At the departmental level, deputies represent the population at the National Assembly. Each department is divided into cantons. The hierarchical organization of the local authority structure into canton, settlement and village leaders, a legacy of the co-

¹¹ The first exchanges between the Vili Kingdom of Loango and the Portuguese and Dutch date back to at least 1570. Trade originally centered around copper, ivory, raffia and redwood and then, as of the 17th century, slaves. The slave trade expanded rapidly under the English and then the French who founded the first European establishments. After the Congress of Vienna and the abolition of slave trafficking south of the equator (1836), trade declined despite persistent illegal trafficking. After 1883, European exploitation changed from a barter-based system to a colonial model of concessions. The establishment of French Equatorial Africa in 1910 led to a surge in economic activity and the development of forest exploitation (Blaney, 1998).

lonial period, is the framework within which the traditional forms of authority derived from customary law are exercised.

Activities

(1) Agriculture

As in the rest of Gabon, there is little tradition of agriculture in the Gabonese portion of the Landscape¹² (Figure 13.9). Farming is a predominantly female occupation. The women see to land clearing (June-July), sowing (September-November), weeding (December-February) and the selling of produce. Men take part in tree felling in the dry season. The main crops are cassava, plantains, corn, 'old' coco-yams (dasheen) and sugar cane. The per capita annual area under crop gives an indication of farming intensity: the Etimboué department has the highest value with 2,090 m²/person/year while elsewhere it ranges from 687 to 1,445 m²/person/year.

In rural areas, farming is primarily a subsistence activity. In Gamba, where 56% of urban families engage in agriculture (Blaney *et al.*, 1998), most production is sold to provide women with 'pin money' to supplement the head of household's income. Production from local agriculture still remains marginal in Gamba's overall supply. A relatively affluent, significant share of the population buys imported goods. In the surrounding Gamba region, agriculture is mainly reserved for indigenous ethnic groups; customary law restricts land tenure opportunities for immigrants, who form the bulk of Gamba's population. Landscape-wide, the pressure on natural environments by agriculture is minimal and is confined to populated areas.

Plantations are regularly devastated by elephants, which abound in the Gamba area. This is a problem throughout the Gamba Complex, and is the source of extreme discontent. The forest management agency, assisted by WWF, is supporting the installation of protection systems in the form of rope fences, to which empty drink cans filled with pebbles are attached in order to create noise.

(2) Fishing

Fishing is concentrated on the lagoons, lakes and main rivers, and is the main source of animal protein for lagoon and sea-side villages, as well as the towns of Gamba and Mayumba.

Recent studies have been done on fishing in the Ndogo Lagoon (Pinkston, 1997; Blaney *et al.*, 1998, Nteme Mba, 2001 and 2005). The gill net is the most common method used (85%

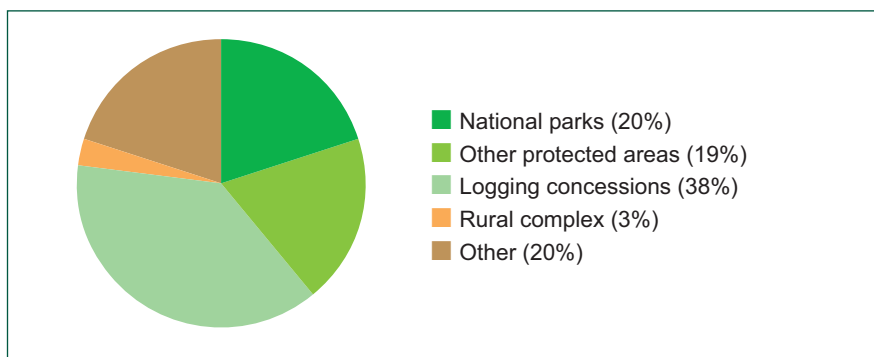


Figure 13.9. Land use types.

of fishermen), followed by seine nets (10%) and lines (3%). Apart from pot and barrier fishing in the dry season, both done by women, fishing is a male occupation carried out in paddled or powered dugout canoes. Approximately 40% of the lagoon fishermen are based in Gamba. The most common catches are 'tilapias' or carp, mullet, sea catfish, horse mackerels and sea-bream. April to September is the peak fishing season, but total catches do not satisfy local demand. With a total of 125 fishermen working the lagoon and Basse-Nyanga, the Gamba Complex's fishery resources are arguably under exploited. The traditional fishing business would therefore stand improvement. For this reason, the fishery management agency and WWF are helping fishing communities through capacity-building for the Ndougou department fishermen's association (APDN). A regular supply of fish to the towns could help cut the trade in poached bushmeat.

Fishing and the fish trade are the main activities in the town of Mayumba and the area around Mayumba National Park. In the villages surrounding the park, 90% of the population believes that fishing is 'very important' or 'essential'. Fresh water lagoon fishing is restricted to native Gabonese and prohibited to foreigners. Sea fishing is carried out only by West Africans, especially Beninese, who live in Mayumba. Overall, the resources are not being over-fished, and commercial trawlers pose a bigger threat.

(3) Game hunting and trade

Hunting is very widespread and goes well beyond the bounds of what is customarily allowed¹³. There is a profitable trade in game, with major flows to big town and city markets. Urban markets are supplied by well-equipped professional hunters taking advantage of the access routes opened up by the mining and oil companies. Since Waters and Forests (General Principles) Act No. 1/82 of 22 July 1982, this sector of activity, despite being given 'official status', has become illegal and equated to poaching. The Gabonese section of the

¹² Pre-colonization, hunting and gathering were the main means of subsistence. An agricultural development policy notwithstanding, only 10% of the population engage in farming. Twenty-five percent of the population's needs are met by food imports. The growth of a mining-based economy has been a major factor in the decline of Gabonese agriculture. Between 1961 and 1975, Gabon's 'area under crop' shrank by 32% while the number of farming households aged 50 and over rose from 30 to 52%. The appeal of urban jobs prompted a youth exodus to the towns, leaving the oldest family members to work the land.

¹³ Hunting is a very deep rooted tradition in Gabon. Country wide, it is the main source of animal protein, ahead of fishing and livestock production, which contributes only 5% of total requirements. So great is the sociocultural value of game to both rural and urban populations that no alternative solution has so far succeeded in limiting hunting and the associated game trade (Pfeffer, 1996). People are willing to pay premium prices to satisfy their food preferences, despite how hard it is to make a living.

Landscape is no exception to the rule. Some areas accessible via the old and new forest and oil roads in the Gamba Complex are a source of supply for the meat trade to Omboué, Port-Gentil, Mandji, Lambaréné and Libreville. Despite the presence of three teams of Ministry of Water and Forests wildlife rangers, quotas are being exceeded, protected species are being slaughtered and the hunting season periods are being breached. Spot checks on the Gamba, Tchibanga and Omboué markets over the past ten years clearly demonstrate the role that the Gamba Complex plays as a wildlife reserve for local hunters. The most populous species are duikers, water chevrotain, bushpigs, brush-tailed porcupines, crocodiles and mangabeys.

There are no villages or permanent encampments within Mayumba National Park boundaries, but they abound in the buffer zone. Three small encampments and two fishing villages located near the park's boundaries are used as bases for poaching. The villagers traditionally used the coastal margin to collect salt and turtle eggs. Salt collection is no longer economically viable, but there is fierce opposition to the ban on collecting turtle eggs. This ban and the crackdown on poaching are the main points of contention between the national park authorities and the villagers.

In the Republic of Congo, the Vili are traditionally fishermen, whereas the Loumbou are hunter-gatherers. Farming, fishing and hunting, along with public administration, are the main economic activities, and most of the population still depends on locally obtained naturally occurring resources. Shifting cultivation (cassava, bananas and corn) is practiced by women; fishing and hunting are carried out by men. Hunting is less important than fishing. Minor activities include the collection of firewood, marantaceae leaves for cassava preparation, mushrooms and other forest produce¹⁴.

(4) Gold panning

This is a rapidly expanding activity in the Republic of Congo: in 1996, it employed 40 people; in 2005, about 1,000, over 99% of whom are illegal immigrants from DRC. In this same area, the economic value of conservation is not negligible: the park employs 45 people full-time, and 20 for at least 7 months of the year for the monitoring and protection of sea turtles.

Development and public services

The exploitation of oil has provided a considerable development stimulus to the Gabonese

section of the Landscape, particularly in the Gamba region. The situation is very different in the Congolese section of the Landscape. Public service provisioning is lacking: there are only 5 health clinics, 15 primary schools and 2 secondary schools. Families who can afford it, send their children to Pointe-Noire or Brazzaville, but many children do not attend school because their parents cannot afford it. The regional capital, Nzambi, has a police station and national security station, but the police have no working radio, equipment or facilities. Nzambi is separated from the town of Pointe-Noire by the Noubi River and the Conkouati Lagoon, which can be crossed only by dilapidated ferries. For a civil servant to be posted to Nzambi is equivalent to a punishment. As a result, Conkouati often inherits 'disgraced' civil servants to represent the 'security' authorities.

Eighty percent of the water supply to villages in the Gabonese section of the Landscape comes from upwellings: streams and rivers. Very few villages have a well or power generating units. Health care services barely meet villages' needs: only 14.3% of localities in the Gamba Complex have a public health clinic staffed by qualified personnel¹⁵. Patients are often transported to one of Gamba's three medical facilities: a hospital and two private clinics. Villages with a school (40% of villages in the Gamba Complex) manage to support a population of children aged 6-14, and therefore retain families. Villages without a school do not.

The town of Gamba (meaning 'fog' in the Vili language and named after the lagoon on whose shores it lies) did not grow out of any indigenous settlement in the Landscape. In the 1960s, no one lived where Gamba now stands. The city was built from scratch by Shell Gabon when the first wells of the Gamba-Ivinga deposit came on line in 1963. Shell's employees were settled in Gamba with their families. Oil production and its accompanying economic development attracted a sizeable population. The town grew very rapidly from 1965 to 1974, despite its isolated position in the middle of inhospitable wetlands. General supply stores were created in 1966, and a primary school in 1969. By 1977, Gamba had a hospital, a cultural center, an outpost of Gabon's power and water company (SEEG), a police station, airport and post office. The secondary school was opened in 1983. Having become the departmental capital in 1966, Gamba was briefly (1970-74) assigned the status of an autonomous district by a government decision that curtailed the conflicts of interests between the Ogooué-Maritime and Nyanga provinces, which were trying to claim the 'oil

¹⁴ A family living in the area around the national park earns an average annual income of approximately 800,000 CFA francs from fishing and 200,000 CFA francs from agriculture. The total value of catch/produce harvested in the immediate periphery of the park is estimated at 250 million CFA francs per year.

¹⁵ Although it must be said that the localities are so small and scattered that it would be hard to deliver educational and health care services to them all.

city' as part of their territory. Gamba now has 3 health centers and 6 schools (4 primary and 2 secondary). Ndougou department, which includes Gamba and 13 villages distributed between three cantons, has 14 schools, 16 health centers and 13 communal TV/radio viewing and listening centers. The coming on line of Rabi in 1986 brought a new influx of labor, but the trend is now reversing as Shell Gabon gradually pulls out and the first big layoffs are made.

In the Gabonese section of the Landscape, telephone access is restricted to the urban centers of Gamba, Mayumba and Tchibanga, which have unreliable landline networks, but also mobile phone operators (Celtel and Libertis). Gamba and Tchibanga also have a cybercafe.

The main highways in the Gabonese section of the Landscape are laterite roads, sporadically maintained by the provincial public works department. Only the three towns have tarmac roads, maintained by the town councils. There is no road link between the Congolese and Gabonese parts of the Landscape. The town of Gamba is also very cut off from the outside world and only accessible by a sandy track, seasonally flooded over approximately 80 km and crossed by 2 ferries. The only way to the town of Mayumba is across the Banio Lagoon on the ferry operated by the public works department.

Logging

Four logging companies currently operate in the Gabonese section of the Gamba-Conkouati Landscape. In order of size, they are: *Compagnie des bois du Gabon* (CBG), Idriss Plantation Holdings Gabon (IPHG), *Société d'exploitation et d'aménagement forestier* (SEAF) and *Transformation et exploitation forestière* (TEF). Only CBG has two publicly approved forest working concessions (CFAD): one for 350,000 hectares in the north of the Landscape and one for 190,000 hectares close to Mayumba. The other forest companies operate under family felling operations or temporary operating licenses.

CBG's Mandji CFAD is in the northeastern tip of the Gamba Complex, north of Moukalaba-Doudou National Park. The company's management plan was approved by the forestry economy ministry in December 2004 and put into operation in January 2005. Despite its efforts, the company is finding it hard to implement the wildlife component of the management plan. Due to these difficulties, it began discussions with WWF (Gamba Project) in early 2005. These discussions resulted in WWF being given support by

the French Global Environment Facility (FFEM) under the CAWHFI program to provide technical support to the administration and CBG in implementing the wildlife management plan. The plan is that WWF will interface between the ministry for the forestry economy, the national park management authorities, the operating company and local communities.

In the Republic of Congo, the Landscape includes 4 large concessions (UFA): Pointe-Noire, Niari-Kimongo, Kayes and Kibango. At least 8 companies have operated in the Landscape since 1980, including in what is currently the national park. These areas were working concessions up until the war in 1997. Insecurity and the collapse of transport systems subsequently brought exploitation to a halt. In 1999, after the national park was created, the Asian company *My Fai Tai* started up operations in the Landscape and the national park. Despite national park status, this logging is still going on today over an area of 916,000 hectares. It has had serious consequences for the Landscape: it has changed the human population distribution, population processes, socioeconomic factors, and the composition and structure of forests; it has also left roads and skid trails everywhere. The impact on the national park is dramatic.

Oil extraction

Oil deposits in Gabon have been known since 1928, but they were not exploited prior to 1957. The oil industry developed rapidly in the 1960s and 1970s following the discovery of extensive reserves in the Sette Cama hunting reserve and offshore from Port-Gentil. Shell commenced explorations in the Gamba Complex in 1960 in the guise of *Compagnie Shell de recherches et d'exploitation du Gabon* (COSREG). In August 1963, COSREG found oil near Gamba, then in Ivinga. The Gamba-Ivinga oilfield was producing 50,000 barrels per day in the 1970s, but this fell to 7,000 barrels per day in 2001. As early as 1985, known Gabonese reserves had decreased, and production had fallen to 150,000 barrels per day. The effects of this decrease were compounded by falling oil prices. The discovery of the Rabi deposits in 1985 was providential, therefore, increasing production by 77%. Rabi was the biggest onshore oil field in sub-Saharan Africa, and came fully on line in 1987, achieving an output of 240,000 barrels per day in 1997 (60% of Gabonese production). In 2003, Shell Gabon's total output was 69,000 barrels per day.

Other onshore exploitations in the Gamba

Complex include Atora (Total Gabon), in production since 2001 (15,000 barrels per day), Echira, Moukouti and Niango (Perenco). The Bendé gas reserves (Shell) power Shell and the Gamba power company's (SEEG) turbines. Current exploration licenses in the Complex include those of Lotus (Sinopec), Eketamba (Transworld) and Nziembou-Dhighe (Perenco). Other companies present are operating individually or in joint ventures. They include Amerada Hess, Broken Hill Petroleum, Devon Energy, Energy Africa, Eni, Marathon, PanAfrican Energy, Petrofields, Petronas, Pioneer Natural Resources, Sasol Petroleum International, Vaalco and Vanco. The crude oil is shipped to the Gamba and Cap Lopez terminals.

Tourism

Despite its potentials, Gabon had remained virtually unknown as a tourist destination; however, recent years have seen the emergence of ecotourism schemes, especially around Petit Loango Reserve, now Loango National Park. Four lodges or tourist camps are now operational. The Iguéla area has Loango Lodge, operated by *Société de conservation et de développement* (SCD), with satellite camps at Akaka, Tassi, Pointe Sainte-Catherine and Petit Loango, as well as Ngavilo Lodge. SCD operates under the guise of Operation Loango and supports research through WCS, Apenheul and the Max Planck Institute. In Sette Cama, Africa Tours Operators (ATO) runs the Camp Missala Lodge and Sette Cama Safaris. The Ndougou departmental council runs a holiday lodge at Sette Cama in association with the village and technical and financial support from the European Union's Protected Areas Development Program (PSVAP). Shell Gabon runs a small private lodge at the southern end of the national park. A guide service and tourist reception center have been set up at the southern tip of the park with PSVAP support, and contracted out to the local NGO, Ibonga.

Tourist activities in the Loango National Park currently include sport fishing and photographic safaris from the four lodges established in the north and south of the park. The provision of tourist facilities and products make Loango National Park one of the primary destinations in Gabon and the whole of forested Central Africa.

Reasons for the identification of the Landscape

- (1) The Gamba region was identified as critical to conservation in Central Africa as long ago as 1990 (Wilks, 1990), partly for its unrivalled diversity.
- (2) The Gamba Complex has been identified as an important birdlife conservation area (Fishpool & Evans, 2001).
- (3) The Monts Doudou Mountain Range is a Pleistocene era forest refuge whose protection was called for in 1990 by the IUCN (Wilks, 1990), because of its tremendous botanical significance¹⁶ and the recent discovery of the white-legged Ogilby's duiker *Cephalophus ogilbyi crusalbum*¹⁷.
- (4) Unlike other lagoon systems in the Gulf of Guinea, the Gamba-Mayumba-Conkouati Landscape lagoons lie in an area of very low human population density, which helps preserves the integrity of their ecosystems. The large lagoons, as well as the countless small lagoons, are critically important to the development of commercially significant fish populations; not only in the lagoon waters, but also the contiguous inshore waters.
- (5) The Landscape is important for its near-intact large mammal populations.
- (6) Mayumba National Park is contiguous with Conkouati National Park in the Republic of Congo and both make up a transnational zone of 120 km of protected beaches comprising one of the world's two most important leatherback turtle egg-laying sites.

Conservation

History

Gabon's 250,000 hectare Ngové-Ndongo Hunting Area, and its 50,000 hectare Petit Loango National Park were created in 1956. The 700,000 hectare Sette Cama Wildlife Utilization Area was classified in 1962. The Ngové-Ndongo Hunting Area remained unchanged, but the Petit Loango National Park became the Iguéla-Petit Loango Wildlife Reserve and its area increased to 80,000 hectares. Three new entities - the 20,000 hectare Ouanga Plain Wildlife Reserve, the 200,000 hectare Sette Cama Hunting Area, and the 150,000 hectare Iguéla Hunting Area - were also added to the Sette Cama area. In 1966, the Iguéla-Petit Loango Wildlife Reserve became the Petit Loango Wildlife Reserve with a reduced area of 50,000 hectares, and the Iguéla Hunting Reserve was in-

¹⁶ Two endemic species of begonias - *Begonia dewildei* and *B. floretii* - had been just found there.

¹⁷ This form endemic to Gabon was discovered only in 1978, and at the time so little was known of its distribution that the Monts Doudou mountain range was thought to be essential to its conservation (Christy *et al.*, 2003).

creased to 180,000 hectares. In 1971, the areas remained unchanged, but the complex was split into three sectors: Iguéla, Sette Cama and Ouanga. The Moukalaba-Dougoua Wildlife Utilization Area was created in 1962 out of the Moukalaba-Dougoua Wildlife Reserve (80,000 hectares) and the Moukalaba Hunting Area (20,000 hectares). The 332,000 hectare Monts Doudou Mountain Range Wildlife Utilization Area was classified in 1998. The contiguous collection of protected areas has become known as the Gamba Protected Areas Complex, in which WWF has become the partner of the Ministry for Water and Forests. Loango, Moukalaba-Doudou and Mayumba national parks were the last to be created, in August 2002.

In the Republic of Congo, Conkouati Reserve was created in 1980 over a land area of 300,000 hectares. For a decade, it was under the sole management of the Ministry for Water and Forests and suffered from a lack of human and financial resources. In 1989, much of it was given over to industrial logging, reducing the reserve to 144,000 hectares. In 1994, the Republic of Congo secured GEF/PROGECAP funding to support a number of conservation-related activities in the reserve, while the IUCN was commissioned to provide technical assistance to the Congolese government. At the end of the GEF/PROGECAP program in the late 1990s, WCS became the MEFE's partner in the Landscape. In 1999, the wildlife reserve became the 505,000 hectare Conkouati-Douli National Park (approximately 25% of it marine) by Executive Order No. 99-136^{bis}.

Players

In Gabon:

- Natural resource management is the responsibility of the MEFEPNN, acting through the provincial water, forests and fisheries inspectorates in Tchibanga, the water and forest cantons in Mayumba, Ndindi and Mandji, the fisheries brigades in Mayumba and Gamba, and the wildlife brigades in Mourindi, Sette Cama and Iguéla.
- Protected areas are managed by the CNPN and the MEFEPNN's wildlife and hunting department.
- WWF (since 1989) and WCS (since 2002) are the main international NGOs supporting conservation.
- CI, ASF, the *Association des pêcheurs du département de Ndougou* (APDN), the *Comité de réflexion pour l'après-pétrole* (CRAP), Ibonga-ACPE (Association for Environmental

Knowledge and Protection), Nyanga-Tours and various European Union-funded programs (Cybertracker Monitoring Program, the '*Espèces Phares*' critical species program, the Kudu and Protomac programs) provide more case-specific support or are concentrating their work on particular aspects of management.

- The oil companies Shell Gabon and Total Gabon operate in the protected areas between Loango and Moukalaba-Doudou national parks to recognized environmental standards. Shell Gabon also supports the work done by the Smithsonian Institution and the Ndougou Department of Sustainable Development Support Program (PADDN). The PADDN program is also supported by the Shell Foundation and run by a steering committee that includes the National Employment Office (ONE), Omar Bongo University (UOB), the Expansion and Development Fund for Small and Medium-sized Enterprises (FODEX), the local authorities, Shell and WWF.
- The National Scientific and Technological Research Center (CENAREST), the national herbarium, the University of Wageningen, the University of Kyoto, the Smithsonian Institution and the Max Planck Institute are conducting research.
- Operation Loango (SCD) is working to develop tourism in the northern part of Loango National Park.
- The European Commission's Protected Areas Development Program (PSVAP) is active in the Gamba Complex.

In the Republic of Congo:

- The Ministry for Forestry Economics and the Environment (MEFE), formerly MEF, has had field operations in place since the Conkouati Wildlife Reserve was created in May 1980. There have been a conservation officer and assistant conservation officer since 2000.
- The NGO *Habitat Environnement et Liberté des Primates* (HELP) secured Ministry for Forestry Economics (MEF) authorization to establish a chimpanzee sanctuary on four islands in the Conkouati Wildlife Reserve in 1991.
- In 2000, WCS signed a draft agreement for management of the Conkouati-Douli National Park in partnership with the MEFE.

Direct threats

(1) *Hunting*

Illegal hunting is the main threat in both Gabon and the Republic of Congo.

(2) *Logging*

Non-sustainable logging is prevalent throughout the Landscape in Gabon, and even 'accidentally' overflows into the Gamba Complex. Instances of unlawful transnational logging have been recorded. Illegal logging is found in the very heart of the national park in the Republic of Congo.

(3) *Industrial fishing*

Illegal industrial fishing practiced by national and foreign trawlers is a major threat to marine biodiversity. Neither the Gabonese nor Congolese governments have the policing and enforcement resources to counter this threat. Trawlers regularly ply the no-fishing zone within 6 nautical miles of the beach. In the Republic of Congo, trawlers have even dynamited rock clusters, endangering the survival of local communities who largely depend on fishing for their subsistence, threatening resource sustainability, destroying bottom-dwelling communities and posing a serious threat to sea turtles from capture in nets. Indirectly, the decrease in fish supplies to local markets may increase pressure on land resources, in particular through an increase in hunting.

(4) *Traditional fishing*

Illicit lagoon fishing, practiced mainly by foreign fishermen, is a serious threat to lagoon ecosystems, as traditional methods have been replaced by new and potentially less sustainable techniques¹⁸ introduced by fishermen from West Africa, who are established and fishing illegally in the region, often under the protection of local political authorities. The main danger comes from the widespread use of nets in lagoons, especially banned monofilament nets, and the blocking of tidal waterways preventing any exchange of fish between ecosystem components.

(5) *Sport fishing*

In areas where codes of practice are not followed, this may also represent a threat: the regular catching of very large mature fish is not sustainable and threatens populations with regards to both population dynamics and genetics.

(6) *Oil exploration*

On and offshore oil exploration, including in the protected areas, constitutes a significant threat:

- Wells, roads and pipelines cover dozens of square kilometers, generate access and fragment habitats.
- Waste and/or accidental spillages are polluting. There are many offshore oil rigs, drowned springs and pipelines lying very close to the Landscape limits. So far, accidental pollution has not caused massive damage, but the threat of a major oil slick cannot be ruled out.
- The long term effects of low-level but constant petroleum hydrocarbon pollution are not yet known, but could be more significant than assumed.
- Human populations have been introduced into previously uninhabited habitats.
- Seismic studies have a negative impact on the whale population, especially on humpback whales during the breeding season.
- The declining output from old production licenses means that oil permits worked by large international companies with recognized environmental standards are transferred to small opportunistic operators. This threatens the medium and long term quality of environmental management systems.
- The decline in the oil business could also prompt many unemployed workers to join in the exploitation of wild resources, especially through hunting, as evidenced since the late 1980s¹⁹. It is therefore important to involve the oil companies in the planning and zoning of protected areas as part of their withdrawal strategy.

One deeply disturbing fact is that Loango National Park is included in the 'Lotus' exploration license - previously 'LT 2000' - recently sold to the Chinese oil company Sinopec. Likewise, the western part of Moukalaba-Doudou National Park straddles an exploration license.

It must, however, be acknowledged that Shell Gabon and Total Gabon have done much to support natural resource management and limit their environmental impact. Shell Gabon is not only ISO-14001 certified, but is developing its biodiversity action plan with scientific support from the Smithsonian Institution. In preparation for the post-oil era in the Gamba Complex, Shell Gabon and the Shell Foundation have also initiated the 'After Oil Development Support Program for the Ndougou Department' aimed at framing a development approach up to 2015 through a

¹⁸ Non-sustainable practises also include the capture of large numbers of immature sharks.

¹⁹ Commercial hunting began in the Loango National Park area in the late 1980s when the oil companies started to shed jobs. Hunters then came from Port-Gentil.

participatory process including local leaders and other players. At the same time, they are supporting small enterprise development.

(7) *Sea turtle egg collection*

This 'traditional' activity is not sustainable and is threatening these already vulnerable populations (Box 13.2).

(8) *Mining activities*

Gold panning destroys freshwater aquatic ecosystems and diminishes water quality. But over 1,000 gold panners are operating within the boundaries of Conkouati-Douli National Park. The Milingui zone iron deposit, towards the southern part of Moukalaba-Doudou National Park, could be worked in the future.

(9) *Pollution*

The beaches of southwest Gabon are badly polluted by waste from the Republic of Congo, DRC and Angola. Many lost logs wash up along the shores and represent a danger to sea turtles (Figure 13.10).

Indirect threats

(1) *Lack of managerial know-how*

The lack of an efficient management system, and a shortage of human, technical and financial resources, is a constant threat. In Gabon, the Gamba Complex is currently managed by the MEFEPNN, but the CNPN, created by presidential order in 2002, has general oversight of the development of the national parks network. In the Gamba Complex, two park wardens have been appointed for Loango National Park and Moukalaba-Doudou National Park, but the MEFEPNN seriously lacks the human, financial and technical resources to deal with inadequate, poorly-maintained facilities and equipment. Roles and responsibilities must be clarified, especially in the protected area located between the two national parks, which is what prompted WWF to initiate a study in December 2003 to come up with a new zoning and management methods for the Gamba Complex (Blom & Geerling, 2004). Park staff must be appointed, trained and equipped. Buffer zone management must also be clarified. A similar situation exists in the Republic of Congo.

(2) *Lack of transboundary coordination*

The lack of protected status for areas abutting Conkouati-Douli National Park in Gabon poses an indirect threat to the integrity of the national park in the Republic of Congo. Expelling

gold panners, illegal hunters and fishermen from Conkouati-Douli National Park has only moved the problem elsewhere. Some of those expelled have relocated close to Mayumba National Park and its buffer zone. A Landscape technical management committee was set up in 2005 to step up transnational collaboration. Two transnational meetings have been held so far between the wardens of the four national parks in the Landscape with representatives of the Gabon MEFEPNN, WCS and WWF to map out strategies for working together on coast surveillance, industrial fishing, oil pollution monitoring, sea turtle monitoring and the exchange of information on other illegal transnational activities like poaching and logging.

State of the vegetation

In Gabon, most of the Gamba Complex forests have been logged at least once in recent decades. This activity has left disused access tracks, facilities, deserted villages and stumps *in situ*. But logging has had limited impacts on forest ecosystems, due to the selective logging method which focused only on a few commercially valuable species, chiefly okoume. Logging notwithstanding, the forests are still in good condition and vast tracts of primeval forests remain. Illegal logging has caused serious damage to the national park in the Republic of Congo.

State of the fauna

Gabon's terrestrial wildlife is abundant and no species is in immediate danger. There are concerns about the manatee, however, which despite being legally protected is still being poached. The Banio and Ndogo lagoon aquatic resources are currently being assessed by the MEFEPNN, WCS and WWF. There is evidence that the Banio Lagoon is suffering from overfishing; the Ndogo Lagoon seems less endangered. As regards saltwater fishing, local fishermen complain of a sharp drop in catches, for which they blame industrial trawlers near or in their fishing areas. Targeted studies are essential to assess stocks of particular species, such as sharks. Controlling industrial fishing in the Mayumba and Iguéla zones, and in the future in Sette Cama and Nyanga, could substantially ease the pressure on fishery resources, but control of traditional fishing is also essential.

Recent estimates by WCS and MEFE in the Republic of Congo show a sharp decline in large mammal populations in the *My Fai Tai* concession.

Box 13.2: Sea turtle conservation

The conservation of sea turtles is the top priority in the Mayumba portion of the Landscape. The Pacific leatherback turtle population has declined by 90% over the past 20 years as a result of fishing, damage to beaches and egg collection. Atlantic turtles are now exposed to the same threats, but their populations remain relatively strong. This means it is essential to protect all egg-laying beaches, especially those in the Mayumba region where nest density is among the world's highest. Research is also starting to identify offshore sites that are important for successful conservation.



Figure 13.10. The lost logs on the beaches of the Gamba Complex of Protected Areas are a permanent threat to the marine turtles.

Management and governance in the field of renewable natural resources

(1) At the Landscape level

In 1995, WWF produced a first framework plan for the Gamba Complex, which was updated in 2001 and 2002. To catalyze this coordinated management strategy, the WWF Gamba project drew up and distributed a working paper to a number of key players at the end of April 2003. This document sets out a draft strategic management framework with proposals on key strategies and the different players' roles and responsibilities, on the basis of a comprehensive SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis. One of the most pressing needs is to review the status of the Complex's different protected areas, other than the two national parks. These include hunting areas and wildlife reserves that overlay oil exploration and extraction licenses, village territories and community farming, hunting and fishing lands, as well as the town of Gamba. As a result of consultations initiated by WWF in December 2003, recommendations on zoning, protected area management methods and future management structures were written and produced in April 2004 (Blom & Geerling, 2004).

In Iguéla and Mayumba, permanent monitoring camps have been set up along the coast to feed back information on illegal fishing activities, especially by industrial trawlers. An information system generates reports on illegal fishing and can launch boat operations using small crafts stationed in Iguéla and Mayumba to control or prevent contraventions. These measures will be strengthened by creating posts between the Landscape's northern and southern points²⁰. National park

staff work closely with MEFEPNN personnel, which strengthens mutual collaboration and support. The fisheries department lacks the technical and budgetary resources to police the fishing zones, but a partnership with the national parks and NGOs could help resolve this shortcoming.

Oil extraction is still taking place in the coastal waters of the national park in the Republic of Congo, even though prohibited by law. In 2005, new seismic prospecting took place unbeknown to the national park authorities²¹.

(2) In the national parks

In Gabon,

- CNPN has appointed four conservation officers, assigned to Mayumba, Tchibanga, Gamba/Sette Cama and Omboué/Iguéla. Total staff assigned to management and monitoring of protected areas is 0.76/1000 km² (Annex 1).
- Bases for developing management plans have been worked out for the national parks, and a first management plan has been developed for Loango National Park. It will be finalized in 2006.
- Substantial support is expected under a GEF program run by the World Bank and approved in May 2005²².
- Delimitation in Loango and Moukalaba-Doudou national parks is almost completed.
- Wildlife brigades have been set up in Iguéla and Sette Cama for Loango National Park and in Mourindi for Moukalaba-Doudou National Park. Surveillance stations have been built at Panga and Digoudou on the edges of Moukalaba-Doudou National Park.
- A total of 9 sworn agents, including the 3 park wardens supported by forty rangers and ecoguides paid for by government or NGOs and tourism operators, are responsible for running the Complex.
- In Loango National Park, cleaning up the waste littering beaches boosted the coastline's attractiveness and enabled a database of all the waste collected to be compiled, as the basis for an international waste pollution campaign.
- In the Mayumba region, NGOs and conservation officers are working to persuade MEFEPNN personnel to enforce forestry laws in the Landscape.

²⁰ These actions are vital to preserve fish stocks in Gabon and are in the immediate interest of the country's human populations who consume large quantities of fish as their main source of protein; agriculture and livestock production are under developed.

²¹ The company that carried out the explorations paid fishermen not to fish for a month.

²² This US \$10 million, 5-year program will swing into action only after Gabon has passed a new law on the national parks, and once the national parks agency - an MEFEPNN-supervised semi-public agency for the management of the national parks - takes shape.

In the Republic of Congo:

- Conkouati-Douli National Park has minimal facilities, which were substantially upgraded in 2005²³. The plan for 2006-2007 is to build visitor and researcher accommodations.
- When the national park was created in 1999, it was divided into ten areas with five different protected statuses: two fully-protected zones, two partially protected zones (former forest exploitations), two multiple use zones (ongoing forest exploitations), three sustainable development zones and a marine zone known as the 'marine extension'. These zones were ill-defined both geographically and in terms of authorized activities, and the legal bases of management remain unclear. The illegal presence of an industrial logging company in a fully-protected zone in the middle of the national park prevents any effective management. To address this zoning issue, WCS in partnership with the Conkouati park warden and assistant warden, developed clear rules and regulations, and a new development plan that divides the park into two zones with clearly-defined natural boundaries: (1) a fully-protected land and marine zone in which no human settlement is permitted; (2) a sustainable development zone in which the sustainable, controlled exploitation of natural resources by park residents will be permitted.
- Despite these problems, the MEFE warden, helped by 22 rangers, tries to enforce the laws. In 2005, a checkpoint was set up in Yanika to stem the bushmeat flow to Pointe-Noire. This checkpoint proved highly effective²⁴, and a second checkpoint has been set up at Youbi on the Gabon road²⁵. Within the park boundaries, anti-poaching patrols concentrated on clearing the park of traps²⁶.
- In 2004, WCS submitted a report to the government on the impact of industrial logging in Conkouati-Douli National Park and called for it to be banned from the park, but it still continues at the time of this writing²⁷.

(3) *In extraction zones*

A sport fishing company has set up in the Mayumba National Park buffer zone in Gabon, which might also in the near future consider starting up legal sport hunting for elephants and other large mammals. Efforts are being made to see that any such activity stays within strict quotas and that operating and monitoring procedures are established and complied with.

The forests situated outside the national park in the Republic of Congo are all included in con-

cessions, but there is no policing of wildlife management or even logging activities.

(4) *In rural areas*

- Mayumba National Park personnel and local fishermen are jointly studying sustainable salt-water and freshwater fishing. It is a highly participatory process using the PARFISH methodology developed by the United Kingdom's Department for International Development. The first meetings have been held and an initial period of basic data collection has been completed to draw up a long term follow-up program. The outcomes will be used to guide fishermen towards the adoption of the sustainable management measures suggested by the project.
- A study is also taking place on sustainable oyster fishing at Mayumba. The idea is to form a co-operative and find lucrative markets for the exploitation of a quality product, to avoid over-fishing and enable stock control.

Monitoring renewable natural resources and their management

A wide range of environmentally and socio-economically related activities are taking place. A large body of information is starting to materialize, but there is no harmonized Landscape-wide database as yet.

(1) *Fisheries monitoring*

Traditional fishing is a major economic activity for many villages, including Gamba and Mayumba, but the ecosystem's productive capacity is unknown and is certainly affected by industrial fishing. Therefore, fishermen must be given supportive guidance, their rights or obligations must be clearly defined, no-fishing zones must be delimited and catch monitoring introduced. Fisheries monitoring is also being set up in Mayumba, and the government department responsible for fisheries has shown a keen interest in the program. Should the early results be conclusive, the PARFISH method could be given official status across all Gabonese fisheries.

Inshore waters surveillance equipment and methods are being tested out in Iguéla and Mayumba. It is hoped that the surveillance network will be extended by NGOs and national parks managers, including Conkouati-Douli National Park in the Republic of Congo, as well as the MEFEPN's fisheries department. A new project supporting the fisheries sector and backed by the African Development Bank (ADB) is in

²³ These facilities include headquarters with 3 houses, 2 offices, a volunteer house, 2 stores, a generator room, a small port, a small boathouse, a sea-going boat, a garage and a workshop.

²⁴ 129 animals were confiscated in the first week of January, compared to just 8 in December 2005.

²⁵ 497 animals were confiscated from bushmeat traffickers in its first week of operation.

²⁶ More than 20,000 neck snares were removed and destroyed between January and December 2005.

²⁷ The company was fined 11 million CFA francs (US \$20 000) in 2005 for operating in the middle of the park's fully-protected zone. This is a paltry sum relative to the damage done.

its development period in Gabon, as part of the Forests and Environment Sector Program (PSFE). Building the institutional capacity for inshore waters surveillance through setting up forward surveillance bases and bringing high speed motorboats into service is planned for the Landscape's coastal zones. In Loango National Park, an ocean-going vessel - the Gemini - is already in service to support surveillance of illegally operating trawlers.

(2) Monitoring oil extraction

Standards and the practical implementation of standards have been considerably strengthened over the past two decades, albeit to different extents between the different companies. The standards applied by oil companies and their suppliers are mainly dictated by their sensitivity to international public attention, which is in turn determined by the company's size, the scale of its international presence, and the culture of its headquarter's country. In the case of large companies like Shell and Total, natural and human environmental aspects are addressed by health, safety and environmental management plans. Shell Gabon is ISO 14001 certified. But these procedures were not introduced when oil operations first came on line 40 years ago and they continue to be a work in progress. Where the Gamba area is concerned, the legacy of past practices is still visible as 'black spots'. A program has been implemented to deal with them.

In Mayumba, a coastal oil pollution monitoring system was initiated by WCS and is in the process of being given official status. Procedures have been developed to standardize surveillance and reporting for monthly or spot checks along beaches. Past oil slicks have received little attention and many surely went unnoticed. This failing has probably held back the development and introduction of a binding code for offshore oil exploitation similar to that in Europe or the United States. Therefore, standardized monitoring of beaches will not only enable rapid responses to major pollution incidents, but it will also force some companies to change their strategies for security/safety and reducing environmental impacts.

(3) Sea turtle monitoring

The study of sea turtles, commenced six years ago in Mayumba by ASE, *Gabon Environnement*, ECOFAC/Protomac and WCS, is ongoing. A research program has been conducted on the Gamba beaches by Ibonga, ENEF, Biotopic, the University of Glasgow, Protomac/Kudu and

WWF since 2002. Turtles in the north of Loango National Park have been monitored since 2003 by a team of Gabonese researchers from WCS. Two specialized aquatic ecology researchers are monitoring sea turtles in the Republic of Congo, aided by 20 temporary assistants.

The activities carried out by all these partners include using transmitters for the satellite tracking of females' movements during and after the egg-laying period, studies on turtle population genetics, studies on turtle health and monitoring breeding success. Standardized counts at seven points in the Landscape in both Gabon and the Republic of Congo are added to national and regional databases, and the exchange of data on tagged turtles gives a better understanding of their migration patterns.

Proposed new activities include a project to put NGO observers on selected trawlers to collect data on accidental turtle captures and a future workshop on trawlers' use of Turtle Excluder Devices (TED), to reduce accidental captures. Finally, regular boat-borne operations in the Mayumba region will be carried out to study turtle migrations, egg-laying sites and offshore abundance.

(4) Great ape monitoring

The first great ape studies were done in Loango National Park by the University of Kyoto in 1995. In 2004 and 2005, the Max Planck Institute in collaboration with WWF conducted a study of chimpanzee and gorilla densities and spatial distributions in Moukalaba-Doudou National Park. The data are currently being analyzed by the Max Planck Institute. In Loango National Park, another team from the Max Planck Institute has been studying gorillas since 2005 in order to habituate them to tourism. In Doussala, in the east of Moukalaba-Doudou National Park, the University of Kyoto has been running a gorilla habituation program since 2001.

(5) Elephant monitoring

Satellite tracking of elephants in the Gamba Complex is being done by WCS, SCD and SI. The data are available on the CARPE website (CARPE Mapper). The plans are to fit three more collars in August 2006 in the Akaka swamplands on the edge of Loango National Park. Plans are being developed to study the use of the environment by forest elephants in Loango National Park and to set up a tracking program based on individual identification.

(6) *Cetacean monitoring*

The WCS Cetacean Research and Conservation Group has been studying the migrating population of humpback whales off the Landscape's coast since 1999. In collaboration with Operation Loango, in Iguéla, briefly in Gamba and more recently in Mayumba, the research efforts have been focused on studying the size and structure of the population that visit Gabonese waters from June to October. Methods used include systematically photographing fin and tail details for individual identification and skin sampling for genetic studies. Toxicological analyses have also been done to assess petroleum hydrocarbon levels in whales. In 2005, research out of Mayumba was able to individually identify 245 whales in 105 groups in 28 boat days. Other species identified on these outings were the common or saddle-backed dolphin, the bottlenose dolphin, the Atlantic hump-backed dolphin, the killer whale, the leatherback turtle and the olive Ridley sea-turtle, with occasional sightings of hawksbill turtles and green turtles. In 2006, research will be done out of three sites - Iguéla, Mayumba and Conkouati - which should yield vital information for whale conservation worldwide. New initiatives also include a study of the hump-backed dolphin, a rare and elusive species about which little is known. The findings of research on humpback whales have been submitted to the International Whaling Commission.

(7) *Research on crocodiles*

Research into the breeding and egg-laying of the African Dwarf Crocodile *Osteolaemus tetraspis* has been ongoing since 2004. In 2005, nine crocodiles were fitted with telemetric transmitter units to determine their territory.

(8) *Botanical monitoring*

Botanical research has been done in the Gamba Complex, particularly in the Monts Doudou Mountain Range area, for twenty-odd years by the Gabonese national herbarium, the Meise Botanical Garden (Belgium), the *Institut de Recherche en Ecologie Tropicale* (IRET - Tropical Ecology Research Institute), the Universities of Wageningen and Gembloux, and the NGOs Nature + and WWF. In early 2003, botanists from Gabon's national herbarium working in close collaboration with the Missouri Botanical Garden, the Royal Botanical Gardens in Edinburgh and WCS, took a botanical inventory of Loango National Park. Over 500 species have been identified to date. More in depth historical research into the park's vegetation began in 2005, focused

on the diversity, abundance and distribution of plants of the *Chrysobalanus* genus.

(9) *Monitoring large mammals and human presence*

The first inventories of large mammals in the Gamba Complex were done by WCS and WWF in 1997 and 1998 (Thibault *et al.*, 2001). In 2004, an expert from the Max Planck Institute (MPI) helped the CNPN, MEFEPN and WWF Gamba teams develop an environmental monitoring procedure based on an innovative combination of point and line transects. The procedure was tested in 2005. With support from an MPI expert, attempts are now being made to harmonize the monitoring approaches between WWF and WCS. Joint monitoring of Loango National Park is planned to start in 2006. Vital information on the socioeconomic dynamics of villages in the Gamba Complex area has been provided by studies done by WWF since 1998.

In the Republic of Congo, environmental research done to collect source data includes a study on vegetation and large mammal inventories. Using 2004 data, a new method was designed by WCS statisticians and successfully applied in November 2005 to yield excellent source data on large and small mammals. The elephant population was estimated at 0.2/km² or 772 (± 189) elephants for the entire park. The data also enabled mapping on the distribution of human impact, and the following species: elephant, gorilla, chimpanzee, buffalo, sitatunga, bushbuck, bushpig, blue duiker, red duiker, and brush-tailed porcupine. Socioeconomic studies were completed in May 2005. They include censuses in the villages around the park, the collection of demographic data, the collection of employment status data, and gender-specific socioeconomic studies. Thus far, data has been obtained from more than 5,900 people. The monitoring personnel consists of: 2 researchers specializing in aquatic environments, 2 in socioeconomics and 2 in ecology.

14. Lopé-Chaillu-Louesse Landscape

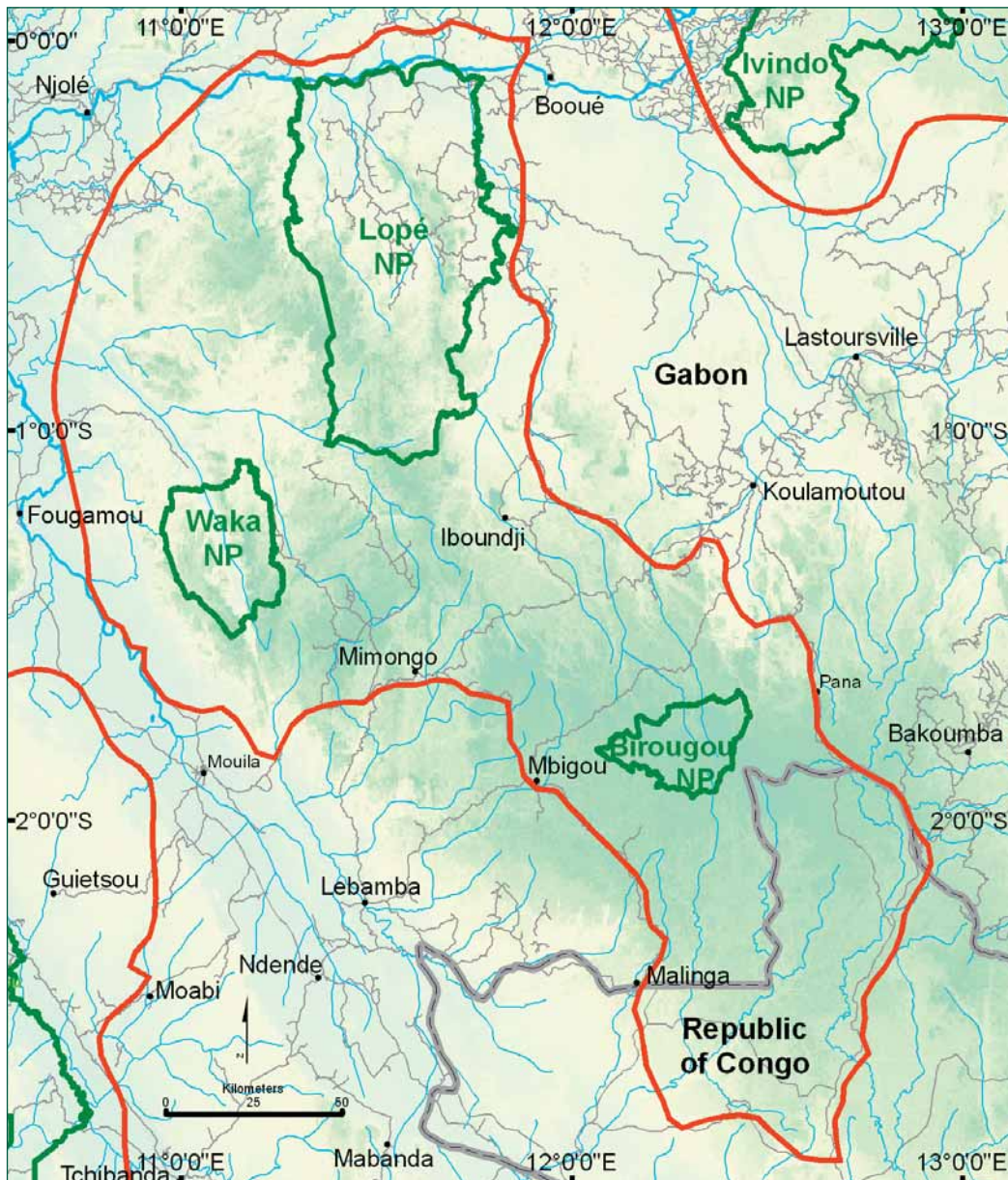


Figure 14.1. Map of Lopé-Chaillu-Louesse Landscape (Sources: CARPE, JRC, SRTM, WCS-Gabon).

¹ During the last glaciation of the Pleistocene the foothills of the Chaillu Massif seem to have been covered with savannahs and, contrary to the case in the Monts de Cristal, it is not certain that the highest areas were covered with dense continuous forests. Some people think that they were covered with a mosaic of plant environments and forest formations. Recent studies suggest, moreover, that even the forest galleries of Lopé National Park functioned as a refuge during the last glaciation for several species of Caesalpinioideae with very low colonization ability (Leal, 2004)

Location and area

The Lopé-Chaillu-Louesse Landscape covers 35,000 km² and extends over 275 km from north to south, from the center of Gabon to 50 km inside the Republic of Congo (Figure 14.1). It centers on the Chaillu Massif, a mountainous region that is assumed to have sheltered one of the forest refuges of the Pleistocene¹, explaining the presence of numerous endemic species. The Gabonese section of the Landscape includes Lopé, Waka and Birougou national parks.

The landscape in brief

Location: 0°2'52"N – 2°52'16"S; 10°40'25"E – 12°55'8"E

Area: 35,000 km²

Elevation: 100-1,000 m

Land ecoregions: Congolese forests ecoregion in the northwest
Atlantic Congolese forests ecoregion

Congolese forest-savannah mosaic ecoregion in the southwest

Aquatic ecoregion: Southwest equatorial coastal ecoregion

Protected areas: Lopé National Park, 497,000 ha, 1946/2002, Gabon

Waka National Park, 107,000 ha, 2002, Gabon

Birougou National Park, 69,000 ha, 2002, Gabon

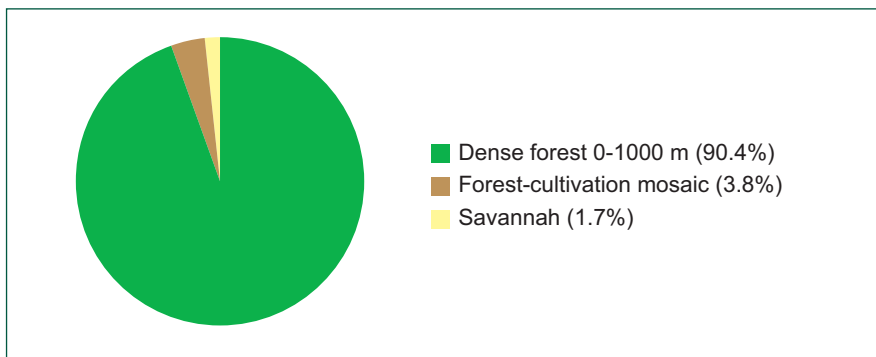


Figure 14.2. Main vegetation types (Source: JRC).



Figure 14.3. The forest-savannah mosaic in northern Lopé National Park.

Physical environment

Relief and altitude

The majority of the Landscape is made up of hills and mountains with a rather steep relief of between 100 m altitude at the Ogooué and 1,020 m at the summit of Mount Milondo (Figure 14.1). Nearly half the area of the Landscape is located above 600 m in altitude. With the Monts de Cristal in the north, the Chaillu Massif forms the ‘backbone’ of Gabon. In contrast to the Monts de Cristal, which are located only 100-120 km from the ocean, the Chaillu Massif is 300 km or more from the coast and is separated from the ocean by two intermediate ranges, the Doudou and Mayombe Mountain Range and the Ikoundou Range. These mountain ranges accumulate the clouds from the Atlantic and attenuate their effects.

Geology and soils

The Landscape is characterized by a complex geological structure. The major part of the northern half of the Landscape, including Lopé

and Waka national parks, rests on the volcano-sedimentary and cristallophyllian rocks of the Ogooué system, dating from the Later Proterozoic and aged 2 to 2.5 billion years. A narrow eastern band, along the Offoué River, rests on the volcano-sedimentary rocks of the Booué Basin, a subset of the Francevillien, also dating from the Later Proterozoic and 2-2.1 billion years old. The two systems are separated by archean rocks, 3.2 billion years old, which form a north-south band with a maximum width of twenty kilometers connecting the archean formations of the north and south of Gabon². In its northern part, at the height of the Lopé savannahs, the Landscape is characterized by the presence of isolated rocks made up of ultramafic formations of unknown age. The southern half of the Landscape, including the Chaillu Massif, chiefly rests on old undifferentiated archean gneiss that is 3.2 billion years old, interspersed with strands of granites and of calco-alkaline or alkaline granitoids that are 2.6 to 2.9 billion years old.

Hydrology

The Chaillu Massif and the north of the Landscape include the sources of the Lolo, Offoué, Ikoy and Ngounié, all rivers that belong to the Ogooué Basin. The south, between Mouila and Mimongo, belongs to the basin of the Nyanga and the Congolese section drains toward the Niari.

Climate

The annual average rainfall varies from 1,400-1,500 mm in the Lopé savannahs to 2,000-2,400 mm on the Chaillu Massif. The dry season lasts three months (June, July and August); the rainy season extends from September to May but it is interspersed with a season of less rainfall in January and February, which is extremely variable from one year to the next.

Vegetation

The Landscape includes three main zones (Figure 14.2):

- the area of savannahs of the middle Ogooué, interspersed with forest galleries (Figure 14.3)
- the mature forest area of the Chaillu Massif (Figure 14.4)
- the area of pioneer forests of okoume *Aucoumea klaineana* and the Marantaceae forests of the Lopé that extends over a distance of 50 km to the south of the Ogooué (Figure 14.5)

² The savannah area north of Lopé National Park rests on this archean ‘tongue’, while the Brazza Mountain Range belongs to the cristallophyllian system of the Ogooué.



Figure 14.4. Mature forests in Waka National Park, centered on the Ikobé River.

The majority of the information known about the vegetation comes from Lopé National Park (White & Abernethy, 1996) and its immediate environs, where more than 1,500 species belonging to 710 genera and 120 families have already been identified. With 52 genera and 138 species, the Rubiaceae represent the most diversified family. Other important families are the legumes, with the Caesalpinioideae and the Papilionoideae, the Poaceae and the Euphorbiaceae. Ferns are also very well represented. Several species are endemic to the Landscape: notably the trees *Dialium Lopénse* (Caesalpinioideae) and *Cola lizae* (Sterculiaceae), the Zingiberaceae *Aframomum sericeum* and several species of Begoniaceae.

Studies carried out in the northern part of the park have shown a complex mosaic of plant communities: 17 habitats in the forest and 6 in the savannah (White, 1992). The diversity of these habitats plays an important role in maintaining a large biomass and animal diversity because it offers an enormous choice of nutritive resources with varied phenologic and temporal patterns. This vegetal mosaic reflects the very dynamic history of the Lopé region with a transition from open herbaceous formations, frequently burned, through various colonizing forest formations, dominated by the pioneer species *Aucoumea*



Figure 14.5. Marantaceae forest in Lopé National Park.

klaineana and *Lophira alata*, toward mature old-growth forests with a closed canopy and a great diversity of tree species. In certain low areas of the Landscape, *Sacoglottis gabonensis* makes up monodominant formations, which are frequented by a large number of elephants during fructification³. On the other hand, the majority of the Landscape has probably been influenced for centuries by moving islands of itinerant cultures that have locally rejuvenated the forest formations.

Fauna

Mammals

The mammalian fauna includes nine species of diurnal primates and six species of nocturnal primates, including four species that are among the most endangered on the continent: the western lowland gorilla *Gorilla gorilla*, the chimpanzee *Pan troglodytes*, the black colobus *Colobus satanas* and the sun-tailed guenon *Cercopithecus solatus*, a species that is nearly endemic to the Landscape⁴. Ungulates are represented by thirteen species, including *Cephalophus ogilbyi crusalbum*, a form endemic to Gabon. There are a dozen carnivore species, the largest one being the leopard, which achieves very high densities in the northern part of Lopé National Park. In the north of the Landscape, the very large mammalian biomass (White, 1994) is dominated by the elephant, although other species are also represented by large populations, notably the gorilla, the chimpanzee, the *Syncerus caffer* buffalo, the bushpig *Potamochoerus porcus* and several species of primates, especially the mandrill *Mandrillus sphinx*⁵. Toward the south the mammalian biomass decreases, probably in relation to the low productivity of the dense forests in the mountainous terrain. In all, the Landscape con-

³ It has been estimated that all the elephants in a radius of 50 km are concentrated in these *Sacoglottis* forests (White, 1994).

⁴ This monkey was described in 1986 after being 'discovered' in 1984 in the forest of Abeilles, located just to the east of the Offoué. Subsequently, it was also found in Lopé National Park, to the west of the Offoué, and more recently around the sources of the Offoué in Birougou National Park.

⁵ The Landscape is at the center of the distribution of the mandrill which inhabits Lopé National Park in troops averaging 650. In the savannahs to the north, gatherings of more than 1,000 individuals have even been observed (Abernethy *et al.*, 2002).

tains 23 species that are considered endangered according to IUCN criteria (Annex C).

Birds

The avian fauna of the Landscape includes more than 400 species, 193 of them species typical of the Guinean-Congolese forests. Seventy-one species are residents of the savannah, in the forest galleries and copses in the north of the Landscape, which underlines the fact that the importance of these habitats is not limited to mammals. The forest avian fauna includes six species endemic to the forests of Lower Guinea: the grey-necked rockfowl *Picathartes oreas* and the forest swallow *Hirundo fuliginosa*, which depend on the rocks in the forest, the lesser bristlebill *Bleda notata*, the grey-headed puffback *Batis minima*, the black-necked wattle-eye *Dyaphorophya chalybea* and the Dja River scrub warbler *Bradypterus grandis*, a marsh species of Cyperaceae. In the forests around Birougou National Park, the pink-footed puffback *Dryoscopus angolensis*, a submontane or montane species, which has not been found elsewhere in Gabon, can be found (Christy, pers. comm.). This species had previously been observed in the Congolese part of the Landscape, along with another montane species, Crossley's ground thrush *Zoothera crossleyi* (Dowsett-Lemaire & Dowsett, 1991).

Herpetofauna

The reptiles and amphibians of the Landscape are not well known, but preliminary observations made in 2001 indicate a rich herpetofauna⁶: in 1995, *Leptodactylodon blanci*, a fast mountain stream frog, was described in the Lopé reserve; in 2001, the gecko *Hemidactylus kamdemtohami*, the burrowing snake *Letheobia pauwelsi* and the waterfall frog *Werneria iboundji* were described in Mount Iboundji, while the water snake *Hydraethiops laevis*, known only in Cameroon, has been found in the Chaillu Massif (Pauwels, pers. comm.).

Ichthyofauna

The majority of the Landscape is within the Ogooué Basin, which forms part of the southwest equatorial coastal ecoregion and houses more than 230 species of fish, 25% of which are endemic to the ecoregion. The Mormyridae and the Aplocheilidae are particularly diversified. The basins of the Nyanga and Niari form a transition with the basin of the Congo River, but the

Chaillu Massif has never really been investigated, and it is expected that numerous other small endemic species will be found in the mountain streams (Kamdem Toham *et al.*, 2003; Thieme *et al.*, 2005).

Invertebrates

The invertebrates are almost totally unknown, but a study of the social Hymenoptera of Gabon showed that the Chaillu Massif could be the region richest in species (Polly, pers. comm.). A preliminary inventory of the diurnal butterflies in the Lopé park (G. Vande weghe, in prep.) has so far revealed the existence of only 200 species, but these include two *Nymphalidae* with limited distributions (*Euphaedra dargei* and *Bebearia ore-mansi*) and one species new to science (*Bebearia Lopéensis*). A casual collection of Geometridae in 2000 led to the description of six new species in the *Zamarada* genus (Pierre-Baltus & Pierre, 2000).

Humans in the Landscape

Archaeology

The savannahs of the middle Ogooué have been inhabited for at least 400,000 years and archaeological excavations have revealed a nearly continuous set of artifacts going back 100,000 years and covering the entire Paleolithic, the Neolithic and the Iron Age (Oslisly, 1994, 1998, and 2001). However, between 1400 and 700 BP, the region was depopulated⁷. Around 700 BP, the valley of the middle Ogooué was repopulated by new populations, most probably coming from the northeast, whose descendants today are the Okandé. Following the introduction of American plants and the development of the slave trade and a barter economy in the 17th century, the populations gradually moved their villages closer to the Ogooué, which had become an important trade route. More recently, they have moved closer to the Trans-Gabon Railroad.

Density and distribution

According to CARPE data, the average density of the populations in 1990 in the Landscape was 2.8 inhabitants/km². This Landscape therefore has the second lowest population density among the Landscapes. Its populations are concentrated along the roads and the navigable watercourses. In the north, they are concentrated along the Ogooué and the railway line. In the south, they

⁶ During a short investigation of Mount Iboundji, at least three new species were found, which underlines the biological importance of the submontane habitats in the south of the Landscape (Pauwels, pers. comm.).

⁷ Radiocarbon dating shows an absence of human activity in a large part of Gabon and the Republic of Congo during this era (Oslisly, 1998 and 2001). The reasons are unknown.

are concentrated along the roads and certain pedestrian paths that cross the Landscape (above all the Mouila-Koulamoutou road, the Ndendé-Mbigou-Koulamoutou road and the Iboundji area). Between the two areas there is an enormous region with few inhabitants, where Waka National Park and the southern part of Lopé National Park extend. Koulamoutou, Mimongo and Mouila are the principal population centers in the south of Gabon, but they are located either just outside the Landscape or on its borders. All are major markets for bushmeat, as is Libreville, which is located at the end of the railway line. In the Republic of Congo, Mossendjo is located on the southern edge of the Landscape and Moyoko is the only other major population center located on the Franceville-Mossendjo road, the most important trade route between the two countries.

Ethnic groups

The Landscape is occupied by eight Bantu groups. The Okandé and the Tsogo group, comprised of the Simba, Povi and Apindji, are more or less related⁸. In addition one finds Makina, Akélé, Mbahouin, Saké and Massango. In certain areas, groups of Bongo Pygmies remain, some of whom maintain a traditional hunter-gatherer lifestyle⁹.

Activities

The primary traditional activities are subsistence agriculture, usually slash and burn, and hunting, but logging has become the most important activity over the last few decades. The construction of the Trans-Gabon Railroad in the 1970s triggered socio-economic development in the extreme north of the Landscape, with the creation of massive numbers of jobs and the construction of logistical base camps that later became the principal infrastructure of new and existing villages. This process was accompanied by the immigration of significant numbers of railroad workers, shopkeepers and hunters. With the end of work related to the railroads in the 1980s, the majority of these people lost their jobs. The more highly skilled left; the others remained in place without income or were hired by the logging industry. The establishment of the ECOFAC program in 1992 offered new employment opportunities¹⁰, but the interruption in the financing of this program once again increased unemployment. At present, the principal means of employment are logging, hunting and administrative tasks.

In the southern part of the Landscape, in Gabon and the Republic of Congo, the main ac-

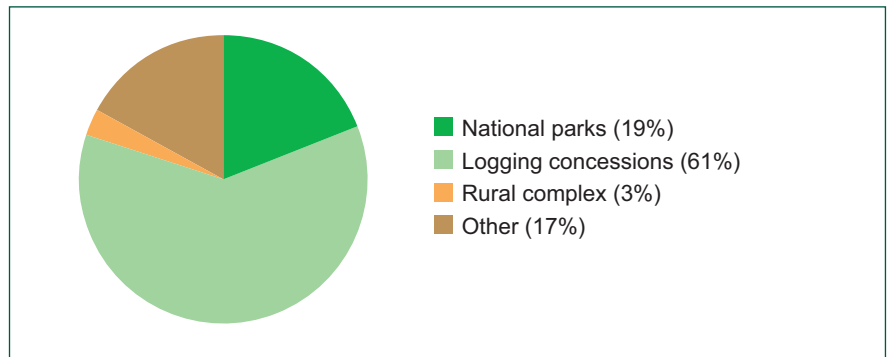


Figure 14.6. Land use types.

tivities remain agriculture, hunting and logging. The city of Mossendjo still houses the MEFE forestry school, but due to a lack of financing over the past fifteen years it hardly operates. The road that crosses the Landscape to the Republic of Congo can be traveled by 4x4 vehicles and serves as a commercial route to take agricultural products and bushmeat to the urbanized centers in the southern part of the country.

Land use

Around 61% of the area of the Landscape is occupied by logging concessions (Figure 14.6). The protected areas cover 666,300 ha, making up 19% of the Landscape.

Logging

In the Republic of Congo, a single concession, the UFA of Mossendjo, covers 1,170,000 ha and the entire Congolese part of the Landscape. It does not appear to be allocated at present. In Gabon, in 2004, the Landscape included 107 logging permits covering a total area of 1,934,888 ha. The average size of the permits was 18,000 ha. This difference necessitates very different approaches, both to the management of logging operations and to relations between operators and forest conservationists. In the Republic of Congo, conservationists have just one potential partner. In Gabon, they are confronted with a plethora of companies. These companies have different levels of skill, different levels of available financing, different length permits, and different objectives and interests as concerns the sustainability of the operations.

The relations between Leroy-Gabon and the Lopé reserve were extremely antagonistic up until 1997 after a very controversial FSC certification was withdrawn from the company at the beginning of the 1990s. Afterwards serious progress was made concerning sustainable operations. In 2001, Leroy-Gabon set up a protocol for manag-

⁸ This group could be considered endemic to Gabon and the Chaillu Massif represents its 'homeland'. It is very important culturally because of the fact that it seems to have taken up many elements of the culture of the Pygmies and because it has strongly influenced other ethnic groups in the country, many of which have adopted elements of the Tsogo culture (among others the Bwiti ritual).

⁹ All the Pygmies of the Chaillu Massif have base villages, usually in the region of Etéké-Massima, but they go away for long stays (up to six months) in the forest triangle: Sindara-Mimongo-South Lopé.

¹⁰ The program made a point of recruiting workers from the villages located around the national park, but the number never exceeded 50.

ing the fauna in its concession that limited hunting in the concession, the transport of hunters, the use of firearms and the trade in bushmeat. Unfortunately, the company seems to have given up its sustainable management program and lost its certification in March 2005. Later in the year the administration withdrew its approval of the management plan. One of the weaknesses for this company in terms of long term planning is the fact that it has changed ownership several times.

The company SBL¹¹, which operates between Lastoursville and Koulamoutou in the south of the Landscape, has terminated its management inventory, and its management plan, approved by the administration, is in the process of implementation. This company was selected by the Tropical Forestry Foundation (TFF) for the organization of a training program in reduced-impact logging (RIL) in which Form-International and WCS participated. The company SEEF also initiated the development of a management plan, but the company IFL, a company associated with SBL, which operates in the southwest of Waka National Park, has not yet initiated its management plan. The companies EGG, CFA and BSG—the latter operates in the BOFIGA concession which adjoins Lopé National Park—have also adopted a wait-and-see attitude insofar as development is concerned. However, Gabonese law stipulates that as of December 31, 2005 all companies will have to have implemented sustainable management. These companies are therefore in breach of the law and their operations have become illegal. They are probably counting on the ‘flexibility’ of the government.

The Malaysian company Rimbunan Hijau, the largest logging company in the world, operates to the southwest of Lopé National Park. It was established in Gabon after conducting aerial explorations and market studies. It was initially established in Lambaréné under the name of Bordamur, which has currently become the second largest forestry company in Gabon after Rougier. For the drafting of its management plan, Bordamur is working with the Sylvafrica office, whose principal shareholder is the French *Office national des forêts* (ONF).

All the companies cited have foreign roots and it is very difficult to generalize, since each company is a separate case with very different approaches and objectives.

Reasons for the identification of the Landscape

- (1) The Chaillu Massif forms the heart of a biogeographical subregion of Lower Guinea, has many endemic species and is considered one of the priority areas for conservation (WWF, 2006).
- (2) The pioneer forests of the north of the Landscape provide a habitat for densities of large mammals that are among the highest in tropical forests.
- (3) The Landscape includes three national parks (Lopé, Waka, Birougou) in Gabon.
- (4) Lopé National Park is an important site for the conservation of birds (Fishpool & Evans, 2001).
- (5) Outside of the protected areas there are very rich sites, such as Mount Iboundji, which provides habitat for endemic species of reptiles and amphibians.
- (6) In its northern part, the Landscape harbors an intact transition between open savannah and dense mature forest, making it possible to study the dynamics of this transition, which has played a fundamental role in the phenomena of speciation.
- (7) The Landscape houses the oldest vestiges of human occupation in western Central Africa¹² and a set of engravings on rock that is unique in Central Africa, making it possible to follow in detail the interactions between human beings and their environment over the course of the last 50,000 years.
- (8) There are significant opportunities for conservation:
 - a. Huge areas of the Landscape are very sparsely populated with humans and free of access routes.
 - b. Lopé National Park has been protected for a long time and Waka and Birougou national parks are well accepted by the surrounding populations.
 - c. The region of Lopé National Park is well known, especially through the existence of a research station on gorillas and chimpanzees.
 - d. Lopé National Park has benefited from support for more than fourteen years through the ECOFAC program (EU) first and later on WCS.
- (9) The opportunities for developing tourism are significant and tourist accommodation infrastructures already exist in Lopé and in Mikongo in Lopé National Park.

¹¹ This French company was established in Gabon in the 1980s after the prospects for industrial exploitation of forests in Côte d’Ivoire were sharply reduced.

¹² At Elarmekora, in the savannahs of the middle Ogooué, located on the border of the Landscape, worked stones dating from at least 400,000 years ago have been found. These stones are associated with the presence of a population of primitive *Homo sapiens*.

- (10) In the Congolese section of the Landscape there are opportunities for creating a protected area — in the process of being examined by MEFE and WCS — but the animal population densities are very low; the renovation of the forestry school of Mossendjo could, however, revitalize an indispensable Congolese institution and offer combined training in forestry management and fauna management. The Landscape could serve as a site for field training.
- (11) The majority of the Gabonese section of the Landscape has been only slightly logged and there are still major opportunities for implementing sustainable logging.

Conservation

History

Pursuant to a decree of 1944 governing hunting in French Equatorial Africa, in 1946 the partial hunting reserve of Lopé-Okanda, Okanda National Park and the complete nature reserve of Offoué were created. The borders of these protected areas were determined provisionally and definitive borders were never published (Christy *et al.*, 2003). In 1960, all the protected areas were transformed into areas for the rational exploitation of fauna and a decree of 1962 classified an area of rational exploitation of fauna in Offoué amounting to 500,000 ha, including the fauna reserve of Lopé-Okanda (350,000 ha) and the hunting domain of Lopé-Okanda (150,000 ha). A decree of April 1971 defined the sectors of tourist exploitation of fauna and introduced the name of 'Lopé-Okanda'. In 1982, a brigade for regulating fauna was set up in Lopé. A decree of 1996 divided the whole into a 'central core' of 167,018 ha classified as an integral reserve and a 'peripheral zone' of 369,000 ha where economic activities, especially hunting, could be organized by decree and where logging retained its rights. This decree had the objective of regulating the logging concessions granted starting in 1971 in the form of lots in the catchment area of the railroad (Christy *et al.*, 2003). A decree of November 1996 increased the central core to 240,000 ha. Finally, in 2002, the national park was created. Currently under discussion are the creation of a Mount Iboundji sanctuary and the creation of protection series in several logging concessions, like the reserve of Mount Mimongo set up by SBL.

Players

In Gabon:

- Conservation is managed by two governmental institutions: CNPN and MEFEPN, responsible outside the protected areas¹³.
- The ECOFAC program, financed by the European Commission, has developed conservation activities, including development of ecotourism with support for the hotel of Lopé, training of ecoguides, maintenance of infrastructure and connections with forestry companies. ECOFAC has also played an important part in the technical and administrative development of the national park, but is currently experiencing a break in financing while waiting for the start-up of their fourth stage 2006-2009. This interruption in financing has occurred in the past and has a very negative effect on the continuity of the program and the pursuit of conservation activities.
- Before the financing obtained within the framework of the CBFP, WCS was active at the level of the Landscape in the area of conservation-oriented research within the framework of the SEGC station. It set up basic research and applied research programs focused on large primates, in collaboration with CIRMF (*Centre International de Recherche Médicale de Franceville*). The scientific publications resulting from these research studies are among the most important in the area of forest ecology in Africa. Although these publications have contributed greatly to decision-making concerning conservation, WCS was not involved in the management of the protected area. WCS was, however, behind the creation of Waka and Birougou national parks.
- Since obtaining CBFP funds, WCS has played a more and more important role in the management of the Landscape and it is currently recognized as a partner of CNPN in the management of Waka and Birougou national parks. Its primary achievements are the delimitation of the three protected areas (nearly complete), the organization of meetings with the operators in the Landscape that have resulted in the drawing up of land use plans, ecological and socio-economic surveys, environmental education and setting up efforts to combat poaching throughout the Landscape.

In the Republic of Congo:

- The Landscape is managed by MEFE.

¹³ During a recent ministerial reshuffling, the management of national parks was placed under the responsibility of the Ministry of Forest Economy, but the creation of a semi-public institution is under way.



Figure 14.7. The leopard orchid *Anselia africana* is widespread but not common.

Direct threats

(1) Logging

A large part of the Landscape is covered by logging concessions. The high rainfall and the irregular terrain make logging difficult and cause significant erosion with sedimentation of the rivers and disruption of the aquatic ecosystems. Logging also opens up the canopy, increases the amount of sunshine on the underbrush and affects plants that require shade and constant humidity, such as the Begoniaceae, Balsaminaceae (Figure 14.7) and Orchidaceae, many species of which are not found elsewhere. On the other hand, logging involves the harvesting of species whose fruit are used by the local populations, in particular the moabi *Baillonella toxisperma*¹⁴, the ozigo *Dacryodes buettneri*, the amvut *Trichoscypha acuminata* and *T. abut*, as well as wild mango trees *Irvingia sp.*

Indirectly, logging opens up the forests to hunters. In the Bordamur concession, a primary logging road is under construction. It will pass less than 1 km from Waka National Park and will climb back toward the north parallel to Lopé National Park at a distance of 10-20 km from the edge of the park. It will bring Waka National Park directly in contact with the Ndjolé market. It will break the connection between the two national parks, end the isolation of the whole region, which is currently difficult to access, and require major support at the management level.

(2) Hunting for bushmeat

This represents a major threat throughout the Landscape and is facilitated by the proximity of markets such as those at Mouila and Koulamoutou, the construction of forest paths

and the presence of the railroad. Large mammals with a slow reproductive process are being hunted in a non-sustainable way and are becoming more and more rare near roads and residences. Hunting for ivory remains a problem and laws are not being applied. WCS's research studies have shown that hunters outside the concessions, more than those based in the villages, represent the major danger for the fauna. Therefore it is important to limit hunting in the concessions. Unfortunately, there is no consensus, even among conservation circles, on what must be given priority in the absence of data on the carrying capacity in the forest and the actual impact of hunting around base camps and felling sites. Many local communities in and around the Landscape still depend on forest resources, particularly bushmeat. In contrast to the more mobile commercial hunters, the villagers concentrate on areas close to home. This could lead to overhunting, but it also has the effect that villagers feel more concerned with the sustainability of their hunting. WCS's approach in the area of the management of renewable natural resources consists of applying advanced and participatory studies of the use of these resources, in particular hunting and agriculture.

(3) Epidemic diseases

The Landscape is at the edge of the region that has been affected by epidemics of Ebola during the last few decades. In 1997, this disease was found in a dead chimpanzee near the Lopé research station, but it did not spread as it did in the Minkébé region. Nonetheless it remains a potential major threat, as much for the great apes as for humans. It will continue to be monitored by the WCS Field Veterinary Program in collaboration with CIRMF.

(4) Invasive species

The savannahs of Lopé National park have been invaded by *Lantana camara*, a shrubby Verbenaceae originating in America, and the forests have been invaded locally by the ant *Wassmannia auropunctata*, also of American origin, which has a disastrous impact on the entomofauna¹⁵.

(5) Brush fires

In the savannahs of Lopé National Park, brush fires are frequent locally. They degrade the plant cover and reduce its nutritive capacity.

(6) Extraction of non-timber forest products

Many NTFPs are collected by the local populations, but in the majority of cases this use does

¹⁴ This tree, which is nearly endemic to Lower Guinea, has a very late maturation (not before 70-100 years), but produces fruits which are highly appreciated by the local populations for the oil that can be extracted.

¹⁵ This ant was introduced as a tool for biological control, but has now escaped and is out of control. Its colonies include satellite colonies that can replace the principal colonies in the event of destruction.

not endanger the species involved. The collection of 'bitter kola' *Garcinia kola* nonetheless has the effect of making this species rare¹⁶.

(7) Agriculture

The development of a nearly continuous strip of crops along the roads has intensified not only deforestation, but also fragmentation of the forests. Secondly, agriculture increases erosion and the disruption of aquatic ecosystems.

(8) Traditional mining activities

Panning for gold is practiced in the Etéké region between Waka and Lopé national parks. This causes serious disruption of aquatic ecosystems and a local increase in hunting pressure for bushmeat and ivory. Other mineral resources exist in the Landscape and could be worked in the future.

Indirect threats

(1) Weakness of institutional capacity

CNPN was created in 2002 to manage national parks, but it possesses neither the technical nor financial resources necessary. In addition, there is a rivalry or lack of understanding between CNPN and MEFEPNN.

(2) Weak interministerial coordination

Between the Ministry with authority over the mines and the Ministry in charge of the environment and conservation there is little coordination and antagonistic actions are frequent.

(3) Economic slowdown

The decrease in oil reserves is increasing the pressure on forest ecosystems.

State of the vegetation

In general, the forests are still in good condition and even though certain areas are made up of a mosaic of primary formations and secondary formations of different ages, enormous areas that are scarcely disturbed still remain. The savannahs of Lopé could be locally degraded by overly frequent fires.

State of the fauna

The Landscape still has significant populations of large mammals, but the majority of large-sized species with slow reproduction rates have become rare or very rare in the proximity of villages and roads. The population of elephants

is suffering from ivory hunting and chimpanzees are suffering from the opening up of the forests by industrial logging. The invertebrate fauna are seriously disturbed locally by the presence of the ant *Wassmannia*.

Increasing capacity

The training center in Lopé, financed by WCS, offers an excellent basis for training agents and local, national and international researchers in scientific field methods, including monitoring. This center was chosen by the MIKE program for the organization of a workshop on analyzing data from regional inventories of elephants, large apes and human impacts in a number of selected sites throughout the Congo Basin. More than twelve agents participated in this workshop, representing all the countries of the Congo Basin, with the exception of Equatorial Guinea.

Courses for governmental and non-governmental researchers are organized periodically. In 2004 and 2005, a course of 8-10 weeks was organized by WCS, entitled: '*Méthodes de conservation pour les inventaires et le suivi de la faune*'¹⁷. In 2003, the Lopé center was also chosen as a training base for the People and Parks Program, financed by NDF, which consisted of evaluating the impact of national parks on human wellbeing and the living standards of the populations. In 2005, a conceptual modeling course was organized for the commissioners of Birougou, Waka, Lopé and Batéké national parks, as well as seven agents of the Gabonese administration. The training center was used again for the organization of numerous short-duration courses in subjects, including: telemetry applied to fauna, methods of socio-economic surveys, the use of computers and GIS. Recently a course in ArcGIS was given in cooperation with the University of Maryland and OSFAC. The Lopé training center therefore has impacts considerably beyond the scope of the Landscape.

¹⁶ To collect its bark, this tree is felled and even its roots are often used.

¹⁷ In 2004, ten Gabonese students were trained, including three officials from the Ministry, a Cameroonian and two Europeans. In 2005, four Gabonese, a Nigerian and four Cameroonians were trained. One of the students trained in 2004 participated as a trainer in 2005.

Management and governance in the field of renewable natural resources

(1) *At the scale of the Landscape*

Financing was recently granted by USFWS to set up a mobile unit for fighting poaching based in Libreville. In cooperation with WCS, this team has started to carry out patrols throughout the Gabonese section of the Landscape.

(2) *In the national parks*

The prospects for developing ecotourism are being evaluated as an alternative for the economic development of natural resources. This program is well advanced in and around Lopé National Park and efforts have been undertaken by WCS and CNPN so that a larger share of the profits go to the local populations. Waka and Birougou national parks, because of their isolation, do not constitute immediate destinations for ecotourism, but potentially interesting sites continue to be catalogued.

The MEFEPN brigade based in Lopé has been involved for a great many years in the battle against poaching. Unfortunately, with the interruption of the ECOFAC program, the brigade has lost the major part of its financial resources and very few patrols could be organized in the course of 2005. WCS has contributed funds and equipment, but a conflict between the Ministry and CNPN created an obstacle to their use. These problems will have to be resolved in the near future.

(3) *In the logging areas*

In Gabon, negotiations are under way between WCS and several logging companies with a view to implementing a reduced-impact logging (RIL) area in the Landscape and management of the fauna in the concessions. Discussions are under way to limit hunting by the workforces of the companies. The logging companies are also being encouraged by the Gabonese government to put 5% of the area of the concessions into a 'protection category'. WCS has offered its cooperation for the identification of these categories.

(4) *In the rural areas*

A process is under way to define the needs of units for the community management of natural resources. It includes participatory mapping of the areas used by the villages: the agricultural areas, the hunting areas and the traditionally defined and accepted areas in the north of the Landscape¹⁸. Participatory maps have been produced for each village on the periphery of Waka and Birougou

national parks, and the formalization of community lands is under way. As a general rule, teams of social scientists work with the local communities to define their lands, as well as identify sources of conflict and ways to attenuate them.

Monitoring renewable natural resources and their management

Ecological monitoring

In the Gabonese section of the Landscape, Lopé National Park has been selected as a MIKE site and a permanent MIKE agent is responsible for law enforcement monitoring in the national park and its environs. In 2005, inventories were designed and implemented in the three national parks; some are still being completed. In Lopé National Park these inventories include linear transects to estimate the densities of elephant dung and of great apes' nests. Financial limitations have reduced the Waka and Birougou inventories to simple reconnaissance missions.

In the Congolese section, basic inventories have been completed by WCS, by the *Centre d'inventaires et d'aménagement des ressources forestières et fauniques* (CNIAF) and by MEF teams. Follow-up inventories are planned for the first half of 2006. In parallel, botanical inventories have been performed by the *Institut de développement rural de Marien Ngouabi* of the University of Brazzaville. These inventories have revealed the presence of 299 plant species, five of which could be endemic to the Landscape. WCS and CNIAF have expanded their inventories between the Landscape into the fauna reserve of Mount Fouari, the fauna reserve of Nyanga-Nord, the hunting domain of Mount Mavoumbou and the hunting domain of Nyanga-Sud. In all, 19 species of large mammals have been found.

¹⁸ In total, seven village use areas have been proposed in Lopé National Park, covering an overall area of 7,727 ha.

15. Dja-Odzala-Minkébé (Tridom) Landscape

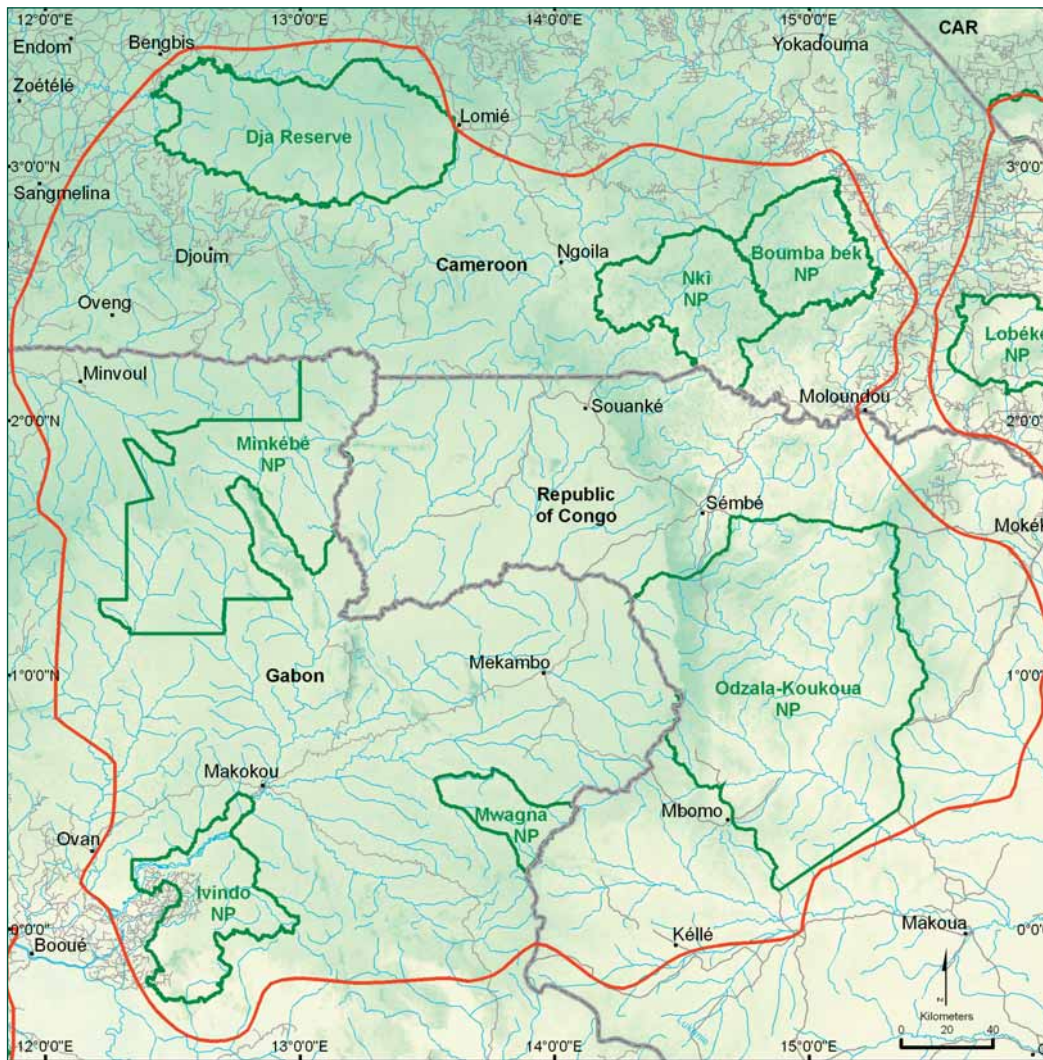


Figure 15.1. Map of Dja-Odzala-Minkébé (Tridom) Landscape (Sources: Atlas of Cameroon, GFW/WRI, CARPE, JRC, SRTM, WCS-Congo, WCS-Gabon, WWF-Jengi).

Location and area

The Tridom Landscape extends over the Republic of Congo, Gabon and Cameroon (Figure 15.1). It includes seven protected areas and covers a surface area of 141,000 km², with 35,968 km² (24%) encompassed by protected areas.

Physical environment

Relief and altitude

The entire Landscape lies on a plateau at an altitude of between 300 and 1,000 m. In many places, especially in the regions of Minkébé in Gabon and the Dja in Cameroon, the plateau is punctuated with inselbergs (Figure 15.2). Along the Gabonese-Congolese border the Landscape is

The Landscape in brief

Coordinates: 3°29'53"N – 0°26'28"N; 11°51'54"E – 15°57'21"E

Area: 141,000 km²

Elevation: 300-1,000 m

Terrestrial ecoregion: Ecoregion of the northwest Congolese forests

Aquatic ecoregions: Southwest equatorial coastal ecoregion

Sangha ecoregion (Thieme *et al.*, 2005)

Protected areas:

Odzala-Koukoua National Park, 1,250,000 ha, 1935/1999, Republic of Congo

Minkébé National Park, 756,700 ha, 1997/2002, Gabon

Ivindo National Park, 300,274 ha, 1971/2002, Gabon

Mwagna National Park, 116,500 ha, 2002, Gabon

Boumba-Bek National Park, 309,300 ha, 2005, Cameroon

Nki National Park, 238,300 ha, 2005, Cameroon

Dja Fauna Reserve, 526,000 ha, 1950, Cameroon



Figure 15.2. An inselberg of the Minkébé region.



Figure 15.3. The Djidji waterfalls.

¹ The common species are *Entandrophragma utile* (sipo), *E. cylindricum* (sapele), *E. angolense* (tiama) and *E. candollei* (kosipo). They make up 90% of the exports of sawn timber from northern Congo. This explains the logging companies' interest in this region.

² Studies carried out in Odzala-Koukoua National Park show that these Marantaceae forests have a tendency to spread to the detriment of dense forests (Brugière et al., 2000).

also cut from north to south by a steep vertical escarpment that is 75 km long and represents a total drop of 100 m.

Geology and soils

The major part of the Landscape rests on Archaean rocks 3.2 billion years old, with the exception of Mount Bélinga and Mount Minkébé in Gabon, which are part of a ring of greenstone rock ferrous fissures (itabirites, metabasalts, amphibolites) that are 2.8 to 3.2 billion years old. The basin of the Djoua includes enormous expanses of quaternary alluviums. In the north, the Congolese section includes Archaean plateaus

that descend toward the south and the east. The alluvial basin of the Mambili represents an extension of the sedimentary basin of the central Congo Basin and consists of alluvial soils of the Quaternary age. In the far south, this section of the Landscape includes the last extensions of the Batéké plateau.

Hydrology

The Gabonese section of the Tridom is drained by the Ivindo, the main tributary of the Ogooué; the Ivindo is separated from the Ogooué by a succession of falls and rapids that form a biogeographical barrier (Figure 15.3). The Minvoul region is drained by the Ntem. The central and southern parts of Ivindo National Park are drained by the Djidji and the Langoué, two minor tributaries of the Ogooué. The Cameroonian section is drained by the Ntem and more significantly the Dja and the Boumba, tributaries of the Congo River. The Congolese section is drained by the Mambili and pertains entirely to the basin of the Congo River. In the high streams of the Ivindo and the Ntem the waters are 'black'; within the drainage of the Mambili they are heavily loaded with alluviums.

Climate

The annual rainfall is between 1,600 and 2,000 mm. Since the Tridom Landscape is located very close to the Equator, the climate is bimodal. There are two seasons with less rainfall, around January and July, and two rainy seasons, around October and April-May. There are four to five 'dry' months. In the north of the Landscape the driest period occurs around January-February; in the south around July-August.

Vegetation

The majority of the Landscape is covered with forests (Figure 15.4). Among the terra firma forests, there are: dense mixed semi-caducifoliated forests rich in Meliaceae¹, Ulmaceae and Sterculiaceae (in particular *Triplochiton scleroxylon*) with an abundance of *Terminalia superba* and *Lophira alata*; forests scattered with Marantaceae²; forests with a monodominance of *Gilbertiodendron dewevrei*; and young and old secondary forests with *Musanga*. Flooded or floodplain forests are represented by vast expanses of riparian forests of *Uapaca heudelotii*, swamp forests of *Hallea sp.*, palm groves of *Phoenix reclinata* (along the Mambili) and raffia palm groves. These



Figure 15.5. The Langoué bai in Ivindo National Park.



Figure 15.6. A rocky clearing in the south of Ivindo National Park.

forest formations contain a gradient of influences: Atlantic in the west and Congolese in the east. They are punctuated with marshy clearings (or 'bais') with Cyperaceae. These clearings only cover a small area, but they are very important for the fauna (Figure 15.5). Certain clearings are rich in mineral salts and merit the name 'salt marshes'³.

The inselbergs and rocky outcrops of Gabon and Cameroon are covered with grassy prairies of *Afrotrolepis pilosa* (Figure 15.6) and a variety of woody thickets that shelter a succession of very specialized plants, in particular numerous orchids and cactus-shaped Euphorbiaceae (*Elaeophorbia grandifolia*, *Euphorbia letestui*). Savannahs found in the southern Congolese portion of the Landscape represent the northern extremity of

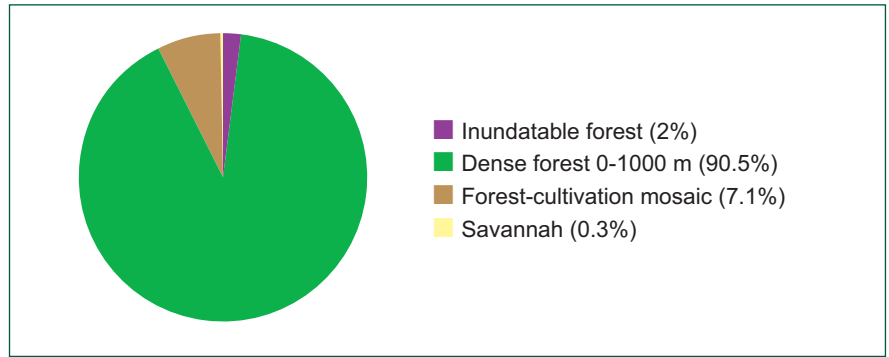


Figure 15.4. The main vegetation types (Source: JRC).

the savannahs of the Batéké plateau. Fields and fallow land are located around the villages of this area. Because of itinerant slash-and burn farming, significant proportions are gradually becoming occupied by secondary species and an invasive Asteraceae, *Chromolaena odorata*.

Fauna

Mammals

The Tridom is rich in large mammals, in particular the elephant *Loxodonta africana* (Figure 15.7), the western lowland gorilla *Gorilla gorilla*, the chimpanzee *Pan troglodytes*, the buffalo *Syncerus caffer*, the forest hog *Hylchoerus meinertzhageni*, the bush pig *Potamochoerus porcus*, the bongo antelope *Tragelaphus euryceros*, the aardvark *Orycteropus afer*, the giant pangolin *Manis gigantea* and the spotted hyena *Crocuta crocuta* (only in Odzala National Park). Among the primates, there are the agile mangabey *Cercocebus agilis*, the black and white colobus monkey *Colobus guereza*, the De Brazza's monkey *Cercopithecus neglectus* and the mandrill, whose distribution in Minkébé-southern Dja is limited by the Dja River, the Ivindo and the Katangoua. The Landscape is home to the largest population of forest elephants in Central Africa⁴ and these animals, a keystone species, play a major ecological role. The buffalo population in the forests of eastern Odzala is one of the largest surviving populations of buffalo in the Congo Basin. The prevalence of large concentrations of large mammals in the Tridom Landscape is related to the fact that a major portion of the Tridom is located outside of areas used by professional bushmeat hunters, far from roads and navigable rivers. A few lions may still survive on the savannahs of Odzala. However, in places like Minkébé, Mwagna, Lossi and Odzala, the great apes have fallen victim to the Ebola virus. It is estimated that almost 98% of the great apes living in the intact heart of Minkébé National Park have disappeared in this way.

³ Certain clearings, like that of Lango near Mboko, were traditionally worked for their salt.

⁴ Inventories carried out in Minkébé, within the framework of the MIKE program, revealed a population density of three elephants per km² in an area of 10,000 km² (a third of the Minkébé forest). These findings indicate the presence of 30,000 elephants.



Figure 15.7. An elephant in a swamp along the upper Ivindo River.



Figure 15.8. A butterfly of the genus *Euphaedra*, typical in the understory of dense forest.

Birds

The avian fauna includes 350 species found in the Dja region, 444 species found in the Odzala region and more than 400 species found in the region of the lower Ivindo⁵. Among the species with restricted distributions are the grey-necked rockfowl *Picathartes oreas* and the forest swallow *Hirundo fuliginosa*, which are associated with the presence of rocks or caverns, and a variety of other species including Zenker's honeyguide *Melignomon zenkeri*, Gosling's apalis *Apalis goslingi*, the black-eared ground-thrush *Zoothera camerounensis*, the grey ground-thrush *Zoothera princei*, the eastern wattled cuckoo-shrike *Lobotos oriolinus*, Verreaux's batis *Batis minima*, Bates's weaver *Ploceus batesi*, the yellow-capped weaver *Ploceus dorsomaculatus* and Rachel's malimbe *Malimbus racheliae* (Christy, pers. comm.). Among the vulnerable species are the black-casqued hornbill *Ceratogymna atrata*, *Bycanistes sp.* and certain large birds of prey like the crowned-hawk eagle *Stephanoaetus coronatus*. The grey parrot *Psittacus erithacus* is abundant, and roosts of more than 5,000 grey parrots have been observed recently in Ivindo National Park.

Herpetofauna

There are no exhaustive lists of reptiles and amphibians found in the Tridom Landscape, but the majority of species with a wide distribution and typical of the forests of Central Africa are present. Locally the slender-snouted crocodile *Crocodylus cataphractus* is abundant (Odzala, Ivindo). The

Nile crocodile *Crocodylus niloticus* is very rare on the Dja, the Boumba and perhaps the Mambili.

Invertebrates

Of the invertebrates, only the butterflies have been studied in this region: 346 species have been found in Odzala National Park and 647 in the park and its periphery (Dowsett, 1997); 440 species have been found in Ivindo National Park, not counting the Hesperidae (G. Vande weghe, *in prep.*). For the entire Landscape, 25 species are believed to be endemic, among them 17 species of Lycaenidae⁶. In Ivindo National Park, the diversity of species in the undergrowth (Figure 15.8) is unique in Central Africa⁷ and a new species was just described in 2005: *Bebearia ivindoensis*. The inselbergs of Cameroon and the rocky outcrops of the Langoué clearing are inhabited by *Acraea rupicola*, a species endemic to these environments. The floating aquatic plant habitats of the Ivindo River accommodate *Acraea encoda*, a species that has not been found anywhere else other than on the Sangha River.

Humans in the Landscape

Density and distribution

The average human population density is on the order of 1-2 inhabitants/km² in the majority of the Landscape, but it reaches 3-4 inhabitants/km² in the region of Djoum and Somalomo in Cameroon. Vast expanses, especially in the regions of the Landscape covering portions of Gabon and the Republic of Congo, are totally uninhabited. The majority of human populations are grouped together in villages located along roads and in nine larger towns (Table 15.1).

⁵ In terms of ornithology, the Ipassa Reserve in the north of Ivindo National Park is the most well studied forest area in Central Africa because of the presence of the IRET research station, which has been there since the 1960s.

⁶ Among these species are 12 species of the sub-family Lipteninae which are particularly fond of Marantaceae forests.

⁷ In the old forests of Caesalpinioideae, 41 of the 200 species of the genus *Euphaedra* found in the Guinea-Congolese region have been recorded, one of which, *E. abri*, is not known from any national parks other than Ivindo (G. Vande weghe, 2006).

Ethnic groups

The main ethnic groups are the Fang, Badjoué, Bulu, Kwélé, Kota, Nzime, Ndjem, Mboko, Bonguili and Sangha-Sangha. In addition to these groups who are mostly farmers, groups of BaAka and Bakola Pygmies also live within the Tridom Landscape.

Activities

(1) Agriculture

The rural economy is based on slash-and-burn (shifting) agriculture, cacao and/or coffee crops, supplemented with simple gathering. The predominant forms of agriculture cover only very small areas and, in part because of the physical effort required to clear primary forests, are generally carried out at the expense of the secondary forests. Their impact on the primary forests, therefore, is minimal. Locally there are industrial plantations, including palm oil plantations to the southwest of Ouessou and rubber plantations in the region of Mitzic. In Cameroon, there is a strong trend toward agro-industry, principally in the southwest area of the Dja Reserve, involving crops such as pineapple and rubber. According to Ngo Nlend (2002), these crops currently occupy a surface area on the order of 7,000 ha for the industrial production of pineapples and 15,000 ha of rubber trees (primarily in the southwest).

(2) Logging

In Cameroon, logging is becoming an increasingly important part of the village economy, especially as 40% of the taxes on logging are transferred to the communities. Community forestry is also becoming important in Cameroon. In Gabon, there has been an increase in the practice of 'family felling' affecting bands of trees located within 5 km on either side of the roads. No community forests have been designated in these areas of Gabon as of yet. This type of logging represents a new source of quick income for rural populations who sub-contract the logging to medium-sized companies.

(3) Hunting

Hunting supplies a variety of proteins to humans occupying the villages and small towns. It also represents a source of income for many unemployed people and does not demand a great deal of investment or technical expertise. Hunting produces a very quick yield, in contrast to cacao plantations, which require a year's wait before obtaining a yield and which present a greater

Table 15.1. The principal towns and cities of the Landscape.

Country	Town or city	Number of inhabitants
Cameroon	Yokadouma	15,000
	Lomié	4,000
	Djoum	3,000
Gabon	Makokou	12,000
	Oyem	23,000
Republic of Congo	Ouessou	18,000
	Sembe	3,000
	Souanke	5,500
	Mbomo	5,000

economic risk. The trade in meat is primarily in the hands of women—the '*buyam-sellam women*'. The Baaka and Bakola hunter-gatherers are much less involved in agriculture and therefore depend significantly on the immediate resources of the forest or on temporary work they perform for the Bantus. The Baaka are also often engaged as elephant hunters for Bantu bosses.

(4) Mining activities

Panning for gold affects several rivers in the basin of the Upper Ivindo in Gabon (Figure 15.8) and in the Republic of Congo.

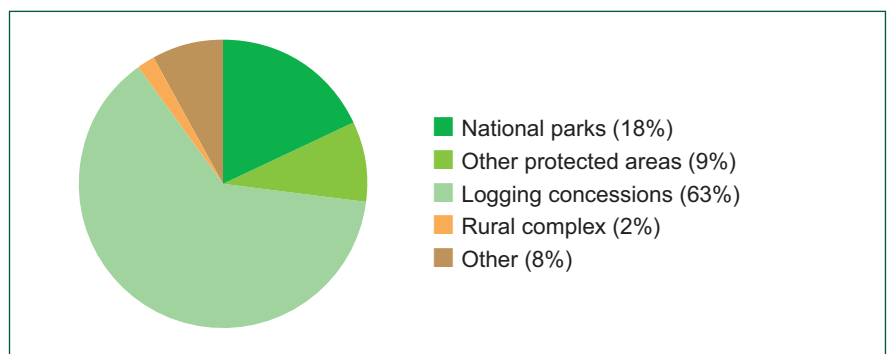
(5) Trade

This is in the hands of the West African traders who are found in all areas of human occupancy, including the most remote mining camps.

Land use

Around 24 % of the Landscape is occupied by protected areas and 50% by logging concessions (Figure 15.9). There are still vast expanses of intact forests that have not been designated to concessions or protection (Table 15.2).

Figure 15.9. The main landuse types.



Logging

The expansion of industrial logging has been rapid in the Tridom Landscape. Ten years ago, only a small fraction of the Landscape had been allocated. Currently nearly 50% of the area has been allocated. The majority of allocation has been done without planning, with the exception of in the south of Cameroon. The areas of the Tridom located between the existing protected areas offer some of the few opportunities in Central Africa to create new protected areas that have not been exploited and could function as a corridor linking the existing protected areas. Only careful land use planning can achieve this objec-

tive. Among the concessions allocated, several have approved management plans (in particular Rougier in Gabon, IFO-Danzer in the Republic of Congo, Decolvenaere, TTS-SCFS, Pallisco in Cameroon) and are involved in the certification process. Cooperation between governmental agencies, NGOs and logging companies is being strengthened, specifically as pertains to the sustainable management of fauna.

Reasons for the identification of the Landscape

- (1) The value of the Landscape was estimated as very high in several fields (mammals, birds, etc.) at the time of the workshop in Libreville in 2000, which was aimed at establishing priorities for conservation in the ecoregions of the Congolese forests (Kamdem *et al.*, 2006).
- (2) The Landscape is home to significant populations of large primates and forest elephants.
- (3) The protected areas of the Landscape (Dja, Boumba-Bek, Nki, Odzala-Kokoua, Ipasa and Minkébé) have been recognized as important zones for the conservation of birds in Africa (Fishpool & Evans, 2001).
- (4) The Landscape has been recognized since 1996 as offering unique possibilities for connecting a network of existing (Odzala, Dja) and proposed (Minkébé, Boumba-Bek, Nki) protected areas by means of corridors of intact and very sparsely populated forests in the areas of Ngoïla, Mintom, Souanké and Mékambo.
- (5) There are significant opportunities for conservation because of the low human density and overall low accessibility by road. The Tridom Landscape can be viewed as a collection of enormous blocks of forest that are demarcated by a few public roads, and which contain portions of interconnected and intact forests void of human activities.

Conservation

History

Odzala National Park was created in 1935 in the Republic of Congo. It covered an area of 126,600 ha and was surrounded by the Lékoli-Pandaka Fauna Reserve (68,200 ha) and the Mboko Game Reserve (90,000 ha). In Cameroon, the Dja Reserve was created in 1950 as a fauna and game reserve. It became a fauna reserve in 1973, a Biosphere reserve in 1981 and a World

Table 15.2. 'Non-status' Forests.

Country	Site	Area	Comments
Cameroon	Forest of Ngoïla-Mintom	830,000 ha	Allocations to logging companies were suspended by the Cameroonian government pending the results of surveys looking at creating a conservation area. These forests have been proposed as a cross-border corridor between the protected areas of the Dja, Nki and Minkébé.
Gabon	Forest of the Ayina	250,000 ha	Has not yet been allocated because of the poor timber quality. The forest is marshy and difficult to access. It could form part of the cross-border corridor linking the Minkébé forest with a new protected area in Cameroon (Mengame).
	Forests of the Djoua and the Zadié	200,000 ha	The flooded or floodplain forests have not been allocated because they cannot be logged; they could form part of a corridor for conservation between Odzala and the forests of the Djoua and the Ivindo in the Congo. These forests were identified as providing significant habitat for large primates in May 2005 in Brazzaville. Zoning that takes into account the iron deposits of Bélinga is imperative.
Republic of Congo	The forests of Souanké-Garabinzam	900,000 ha	Have not yet been allocated for logging because they contain enormous marshy areas. A conservation corridor has been proposed to link Minkébé with the forests of the Djoua and the Odzala.
	Forest of Ntokou	300,000 ha	Located to the south of the IFO concession, it extends into the Pikounda area which has been proposed for logging (to the south of the UFA of Pikounda allocated to the CIB). The forest is home to very large populations of gorillas and elephants.

Heritage site in 1983. In Gabon, the Ipassa Reserve (10,000 ha) was created in 1971 and became a Biosphere reserve in 1983. As of 1986, an IUCN-WWF report proposed the creation of a protected area in the Minkébé region (Nicholl & Langrand, 1986).

Between 1989 and 1990, the IUCN, with financing from the European Commission, carried out a series of national studies to assess the conservation of the forest ecosystems of Central Africa. Numerous existing and potential protected areas were identified as critical sites for conservation (Wilks, 1990; Hecketsweiler, 1990; Gartlan, 1989). This process generated numerous conservation projects focused on these sites, notably the ECOFAC program, which supported the protected areas of Dja and Odzala and will enter its fourth phase in 2007. In Gabon, work by the IUCN led to the creation in 1997 of the Minkébé Reserve (Christy *et al.*, 2003) with the support of WWF, the Dutch Cooperation and USAID. The reserve was enlarged and became a national park in 2002, at the same time as Ivindo, which incorporated the Ipassa Reserve, and Mwagna national parks were created. In the Republic of Congo, the same work gave rise to the extension of Odzala National Park. It officially became the Odzala-Koukoua National Park, encompassing enormous stretches of forests located further to the north and the adjacent protected areas (Lékoli-Pandaka and Mboko). This expansion led to the creation of the national parks of Boumba-Bek and Nki in Cameroon in 2005.

Players

(1) Governmental players

Until December 2004, the forest domain in Cameroon was managed by the Ministry of the Environment and Forests (MINEF) through the Directorate for Forests (DF) and the Directorate for Fauna and Protected Areas (DFAP). At the provincial level, it fell within the responsibility of the provincial delegation of MINEF, which provided supervision for the national park wardens and the district delegates established in Yokadouma, Abong Mbang and Sangmélina. The management of the Dja Fauna Reserve, which straddles two provinces, was monitored directly at the DFAP level. From December 2004 to December 2005, owing to the decree reorganizing the government after the presidential election of 11 October 2004, management of the protected areas was temporarily entrusted to the new Ministry of the Environment and for the Protection of Nature (MINEP), while respon-

sibility for the forests and the fauna outside the protected areas fell within the jurisdiction of the Ministry of Forests and Fauna (MINFOF). An alteration of the organizational structure of the two Ministries, which occurred on 31 December 2005, brought the protected areas back under the authority of MINFOF.

In the Republic of Congo, the forest domain is administered by the Directorate for Forests (DF) of the Ministry of the Forest Economy and the Environment. The fauna and the protected areas are administered by the Directorate for Fauna and Protected Areas (DFAP). The provincial delegation of the Ministry is based in Ouesso, while the district delegations are based in Souanké and Sembé. Odzala-Kokoua National Park is managed by a national park warden with an assistant warden in Mbomo and an assistant warden in Sembé.

In Gabon, forests are administered by the Ministry of Forest Economy, Water, Fishing, the Environment and the Protection of Nature (MEFEPCEPN). This Ministry is represented in the field by the provincial inspectorates of Oyem and Makokou, which supervise activities at the Provincial level. These inspectorates are responsible for supervising activities concerned with both fauna and forests. The Directorate for Fauna and Hunting has brigades in Oyem and Makokou. The CNPN has appointed four wardens: one each for Minkébé-West, Minkébé-East, Ivindo National Park and Mwagna National park.

(2) Development programs

The national institutions have obtained the support of numerous and varied programs, including the following:

- The ECOFAC program of the European Commission, which has been involved since 1992 in the Dja Reserve and Odzala-Kokoua National Park; it will enter its fourth phase in 2007.
- The CARPE projects of USAID and CAWHFI, which target the entire Landscape.
- The CAWHFI-FFEM program aimed at strengthening conservation outside the protected areas and the UNDP-GEF conservation program of the Tridom will begin in 2006. The latter program will last a duration of seven years with a total budget of 10 million US dollars. It will target conservation in the whole of the Tridom, with a special focus on the interzone between protected areas.
- The Minkébé project of the European Union, which targets the management of fauna in the great forests of northeastern Gabon. The EU

is also providing support for the renovation of the IRET research station in Ipassa (Ivindo National Park).

- The GEF/Biodiversity Cameroon Program (1994–2003) made it possible to classify the Boumba-Bek and Nki national parks.
- The Project of Accompanying Measures around the Dja Fauna Reserve (2003–2006) financed by the European Union, provided support for social organization and community self-promotion in the northern periphery of the reserve.

(3) *International NGOs*

The international NGOs working in the Landscape are:

- WWF, active with the help of numerous sponsors (among others the EU, USAID, WWF Network, USFWS and DGIS) since 1994 in the southeast of Cameroon, since 1997 in the northeast of Gabon and since 2004 in the northwest of the Republic of Congo.
- WCS, active in Ivindo National Park in Gabon and in the IFO concession to the east of Odzala-Koukoua National Park.

(4) *Logging companies*

Consideration of logging companies in the Tridom is important because they manage enormous areas of forests that are essential for conservation. A number of companies (Rougier, IFO-Danzer, Pallisco, etc.) are involved in sustainable management based on rural development plans.

Direct threats

(1) *Commercial hunting*

Commercial hunting is carried out from the villages and affects a large part of the Tridom. Hunters move on foot and use rifles and/or metal snares. In Cameroon, where the meat is primarily sold smoked, some hunters venture up to 50 km into the forest, but normally do not go farther than 30 km. In Gabon and the Republic of Congo, where the meat is sold fresh, hunters may venture 15–20 km from the villages. The impact of the hunters will become much more significant, however, when they are able to benefit from roads and paths built for logging, which can extend up to 100 km into the forest. As the Landscape is gradually opened up by concessions, the impact of the hunters is increasing and the heart of the forests—the last refuge of the fauna—is being threatened.

However, hunting has an extremely variable impact on species. Monkeys, ungulates and bush

pigs are the primary wild game, but the impact can be more serious on species that are only accessory or accidental victims. Opportunistic hunting of gorillas and chimpanzees presents a serious threat for these species that survive in significant numbers only in regions where there is no hunting. Leopards have very large territories and are likely to be caught when the density of traps is sufficiently high. Giant pangolins are also occasionally appreciated prizes. On the rivers, the slender-snouted crocodile and the softshell turtle are the most frequent opportunistic catches, while the Congo otter is often killed by fishermen.

Hunting is being pushed to excess by a strong demand for bushmeat in the villages and towns. This demand, however, can only be supplied thanks to the transport networks (roads, railways, watercourses). These networks play a very important role in the supply of bushmeat and must be carefully monitored and controlled.

(2) *Hunting for ivory*

Hunting elephants for their ivory and meat poses a significant threat to forest elephant populations within the Tridom Landscape. Unfortunately, these activities largely escape enforcement and monitoring control. Contrary to popularly held beliefs, forest elephants are very easy to ambush on forest tracks and they only survive far from inhabited areas. Given the elephants important ecological role, it can be predicted that a severe decrease in population numbers or the outright disappearance of elephants would have a significant impact on forest formations. The elephant is a key species in the forest, and can represent up to 50% of the biomass of vertebrates. It disperses great quantities of numerous species' seeds over vast distances and likely plays a role in the maintenance of certain types of plant formations, including the forest clearings and Marantaceae forests. The local disappearance of forest elephants could therefore lead to profound modifications in ecological processes⁸.

(3) *Epidemic diseases*

In certain parts of the Tridom Landscape, particularly in the forests of Minkébé, the forests of Mwagna-Lossi and Djoua-East, and Odzala-Kokoua National Park, the populations of large primates have suffered an epidemic of Ebola fever, which has been raging for ten or so years.

(4) *Logging*

It is projected that soon 60% of the surface area of the Tridom will be allocated for industrial logging. This will lead to major changes in the

⁸ The real impact of the disappearance of the elephant is very difficult to evaluate because of the fact that the forest 'reacts' slowly to any ecological modification. However, the elephant could play a very important role, especially in the case of the moabi *Baillonella toxisperma*, a species that is very slow growing, has very late fructification, and is highly desired by loggers. By transporting fruit from the protected areas to the concessions, the elephants may compensate for the increased scarcity of the trees.

forest. Although the volume of timber harvested was relatively low (5-15 m³/ha) at the time it was first cut, it was concentrated on a small number of species and therefore affected the population and the ecological role of these targeted species in a significant way. In addition, the trees were felled over very large areas and required the development of a major network of tracks of road for their removal. This caused substantial damage to the undergrowth and involved the felling of more trees than the logging itself. The development of the road network also opened the forests up to hunters. It is vital, therefore, that logging companies incorporate principles of conservation into their internal regulations.

(5) Traditional mining activities

Panning for gold is very common in the Gabonese and Congolese portions of the Landscape. It seriously disturbs the aquatic ecosystems and also brings significant human populations, who also hunt, into the intact forests. The gold-panning camps are often used by elephant poachers. In Gabon, with the help of WWF, a memorandum of understanding on hunting connected with panning for gold in the region of the Upper Ivindo has been written. The negotiations on this memorandum have also made it possible to develop a very constructive dialogue with the gold panners.

(6) Industrial mining

In Gabon, the mining of iron from the Bélinga and Minkébé mountains is envisaged. This assumes the construction of a Booué-Makokou railway line and a hydroelectric installation on the Ivindo. Without good coordination and exchange of information between the Ministry in charge of forests, the Ministry in charge of mining, the private sector and the conservation bodies, these developments could seriously affect the entire Gabonese section of the Tridom⁹. In Cameroon, there is a plan to mine cobalt and nickel in the Lomié area on the eastern periphery of the Dja reserve, and in the Republic of Congo, there is a plan to mine gold.

Indirect threats

(1) Immigration and the establishment of new villages.

There is a danger that some gold panning or hunting camps will one day be recognized as permanent villages, which would reduce the essential value of the Tridom as an area with significant connectivity between protected areas and vast

continuous uninhabited areas. It should be possible to control this danger through well planned land usage in the medium term. In the short term, conservation departments must closely monitor this potential problem, because it is very difficult to revoke the status of a village once it has been accepted. Increasing the awareness of this matter to the administrative authorities is therefore essential to avoid the establishment of permanent camps in areas that are essential for connectivity.

(2) Destruction of crops

If nothing is done to reduce the damage caused to crops, the frequent human-elephant conflicts in the Odzala sector and Dja are likely to prevent the acceptance of ideas about conservation among the local populations.

State of the vegetation

The forests are largely intact and unfragmented; there are no significant stretches of agricultural land as of yet.

State of the fauna

The Tridom Landscape contains significant blocks of forest whose central areas lie outside of the hunting territories of the villages. Numerous reconnaissance missions carried out during the last ten years in different forest blocks of the Landscape provide evidence of the presence of intact groups of large mammals. This picture is not true for the great apes, however, which have suffered losses on the order of 98% in the heart of Minkébé due to the Ebola fever epidemic. Probably only a few individual lions remain on the savannahs of the Odzala and the hippopotamus and the Nile crocodile have become extremely rare¹⁰.

Management and governance in the field of renewable natural resources

(1) At Landscape level

The three governments, as well as WWF, WCS and the ECOFAC program, actively participated in the development of the Tridom. During the second summit on conservation and sustainable management of the forest ecosystems, held in Brazzaville in February 2005, the Ministers of forestry for Cameroon, Gabon and the Republic of Congo signed the Tridom cooperation agreement in which they agreed to cooperate in management of the Landscape. This agreement defines the trilateral governance structures. In Cameroon, the government has also introduced a moratorium on

⁹ In addition to direct damage to environments, significant immigration, disruption of the aquatic ecosystems and an increase in hunting are to be expected.

¹⁰ A few hippopotamuses survive in the Mambili (Odzala). The Nile crocodile survives only in the lower course of the Dja and in the Mambili.

the logging of 800,000 ha of the Ngoïla-Mintom forest, where logging was originally planned in the forest zoning plan, pending the results of the negotiations concerning its definitive use.

Everywhere in the Tridom, real management is oriented towards a Landscape approach. The Ministries in charge of the forests, the protected areas and fauna are working together with the partners at the Landscape level. Together they are trying to resolve the problem of poaching for ivory and bushmeat in the logging concessions and the protected areas. They are focused on increasing the surveillance capabilities, involvement of the communities in management of the natural resources (for example, memorandums of understanding on the management of the Oua River in Gabon), forest zoning, strengthening capacity and cross-border cooperation. Fruitful bilateral meetings have been held between Cameroon and Gabon and between the Republic of Congo and Gabon.

In the Republic of Congo, WWF has concluded an agreement with MEFE for cooperation within the Congolese interzone of the Tridom area.

At the Landscape level, management of natural resources based on customary zoning of hunting and the establishment of new rules is taking concrete shape. This management is based on innovative examples that are being replicated in other parts of the Landscape:

- The work of WCS with the CIB company, in the tri-national Landscape of the Sangha, has been replicated at IFO-Danzer.
- The WWF experiment at Bordamur in Gabon serves as an example in the majority of the other medium-sized concessions in Gabon.
- Agreements concerning panning for gold in the Minkébé region could inspire similar agreements in the Republic of Congo.
- The agreement on the management of the Oua River at Minkébé could inspire other agreements on management of the rivers.
- The experiment in southeast Cameroon on the community managed hunting concessions (ZICGC) and community based fauna resources committees (COVAREFS) around the Boumba-Bek and Lobéké national parks could be replicated elsewhere in the Tridom. This is true also for certain agreements (Mambélé agreement and agreement on action to combat poaching with the private sector).

(2) *In the protected areas*

In Ivindo National Park in Gabon:

- a warden has been appointed, based in Makokou (CNPN)
- demarcation has been completed (WCS)
- a permanent structure has been built near the Langoué forest clearing which can accommodate visitors (WCS)
- 16 eco-guards have been trained and 12 have been selected (WCS)
- a census of the great apes, elephants and traces of human activities has been carried out (WCS)
- a camp to host visitors has been constructed at the Kongou Falls (FIGET)

In Mwagna National Park in Gabon:

- a warden has been appointed (CNPN)
- surveys have been organized

(3) *In extraction areas*

Several logging companies are involved in sustainable planning and certification, but others have only a short term vision. Several are cooperating actively with the NGOs with a view to better conservation of the fauna, in particular IFO with WCS, Rougier, Pallisco and Decolvenaere with WWF. In Cameroon, the Decolvenaere, Pallisco and TTS-SCFS groups are in the process of FSC certification for the timber from their forest management unit. The first two companies have already completed the pre-audit and an action plan has been introduced. Inventories of fauna have been carried out in seven UFAs of southern Cameroon, as well as at IFO in the Republic of Congo and Rougier in Gabon.

(4) *In rural areas*

In the Republic of Congo, an awareness campaign among the local communities has been conducted by WCS and APEDTS concerning the problem of haemorrhagic fever caused by the Ebola virus. A prefectorial decree prohibiting the consumption of primates has been promulgated. The WCS Field Vet Program has continued to implement a strategy for identification of high risk areas in order to limit human loss.

Monitoring of natural resources

Information has been exchanged between Cameroon, Gabon and the Republic of the Congo, both at the level of NGOs and at the ministerial level.

Large mammals

Inventories using the 'recce-transect' method have been carried out within the framework of MIKE in Minkébé, Boumba-Bek and Odzala. A complete inventory of the large mammals has also been carried out in Ivindo National Park, with linear transects. There is a need to develop a follow up system at the Landscape scale. In the course of 2005, monitoring in the Congolese sector primarily targeted the distribution and abundance of large mammals in Odzala-Kokoua National Park and its periphery. In Odzala-Kokoua National Park, the study on large mammals has been completed (cooperation by ECOFAC, MEFE, and WCS). Sampling will continue in 2006 in the Ntokou forest and the IFO logging concession on the eastern periphery of the national park. Still in the Republic of Congo, MEFE and WWF have conducted reconnaissance missions in the forest of Souanké-Garabinzam. In 2005 in Gabon, WWF, CNPN and MEF cooperated on reconnaissance missions in Mwagna National Park, in the forest of LAFICO, and in the Minkébé-Mengame interzone. In Cameroon, WWF's reconnaissance missions in the Ngoïla Mintom forest and Boumba-Bek National Park demonstrate the importance of these areas for large mammals.

Health of the fauna

A program connected with the Ebola virus has been initiated in the Congolese sector.

Socioeconomic parameters

Throughout in the Landscape, studies have been carried out to evaluate the pressure of hunting on wild fauna and to evaluate the extent of the hunting areas in order to carry out zoning for hunting.

Elephants

In order to gain a better understanding of the movements of forest elephants in the Landscape, a monitoring program has been under way since 2003. Collars with incorporated GPS receivers and computers have been placed on nine elephants in Ivindo and Odzala-Kokoua national parks and two in Nki National Park. The movements of these elephants appears to be more limited than those observed in the Sangha Tri-national Landscape and movements from one protected area to another or from one Landscape to another have not been observed¹¹. However, it has been found that some of them move over considerable distances outside the protected areas, including inside the logging concessions. This shows once again the importance of the concessions for fauna. Frequent movements of elephants have been confirmed between the forests of the Monts de Cristal and the forests of Minkébé, and between the forest of Minkébé and the forest of Ivindo. Signs of elephants have also been found across the interzone between Minkébé National Park and Odzala National Park, indicating a population of elephants that extends from Minkébé to Odzala. In Cameroon, the elephants of the Dja also move into the forest of Ngoïla Mintom (Djablé corridor).

Box 15.1. Towards a Landscape of Landscapes?

The Tridom, with its vast un hunted forests located in the center of great forest blocks, offers a major opportunity for the conservation of species vulnerable to hunting pressure (elephant, great apes, giant pangolin, panther, crowned-hawk eagle, etc.). All the forests of the Tridom still contain these species, but for their populations to endure it will be essential to control access via the logging trails and national roads. The traditional hunting areas of the villages must also be clearly established. It will be necessary for each forest area to establish a central area that is not hunted and where intact collections of species can be maintained. Village hunting should operate on the periphery of these non-hunted zones and its sustainability will be ensured by the flow of animals coming from the non-hunted areas. It is also important to maintain the connectivity between the forests, just as between the Landscapes. In order to achieve this connectivity the establishment of villages in corridors identified as critical must be prohibited. Moreover, the Tridom is ecologically connected to the Sangha Tri-national, Monte Alén - Monts de Cristal, and Lopé-Chaillu-Louesse Landscapes. The preservation of this connectivity within and between the Landscapes could be a formula for conserving the Congo Basin as a Landscape of Landscapes.

¹¹ The initial results show that the elephants use an area ranging from several hundred to more than 1,000 km² and the maximum distance covered was 54 km.

16. Sangha Tri-National Landscape

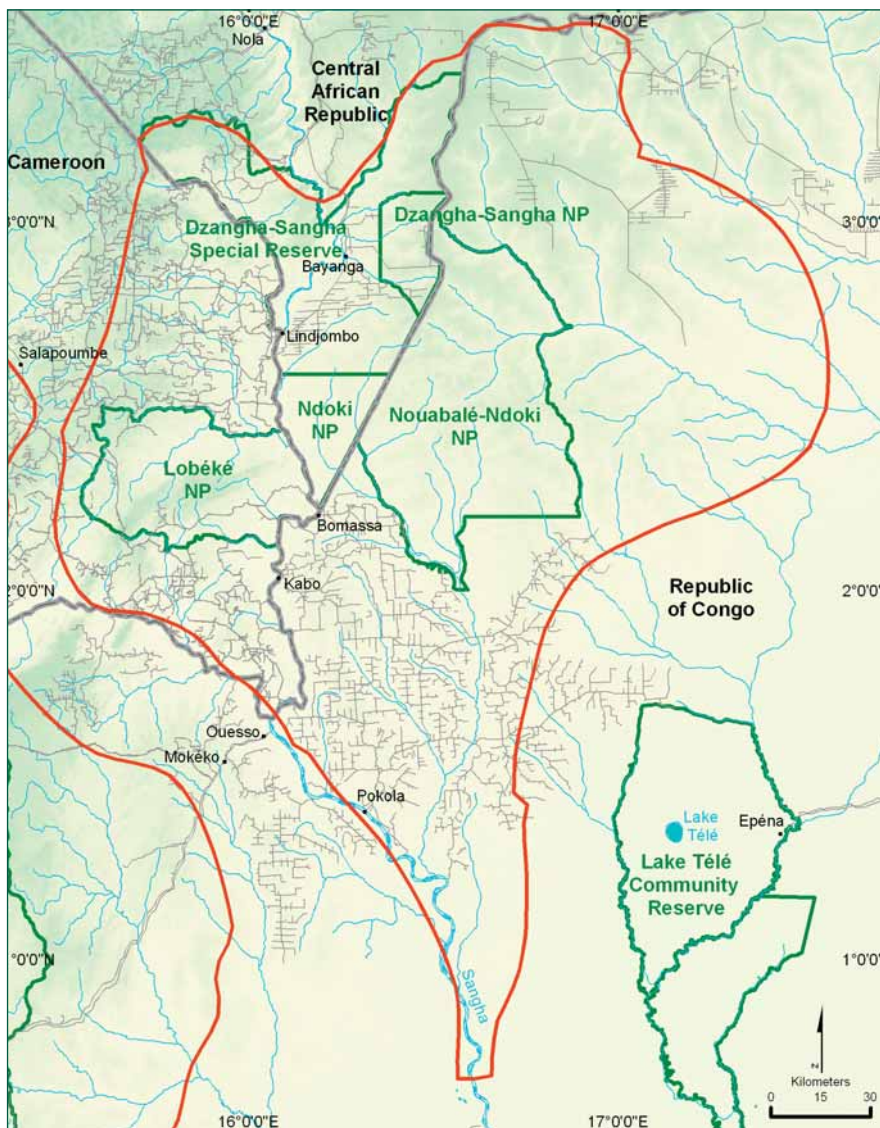


Figure 16.1. Map of Sangha Tri-National Landscape (Sources: Atlas of Cameroon GFW/WRI, CARPE, JRC, SRTM, WCS-Congo, WCS-Gabon, WWF-Jengi).

The Landscape in brief

Coordinates: 3°32'12"N – 0°40'29"N; 15°28'26"E – 17°34'8"E

Area: 36,236 km²

Elevation: 330-700 m

Land ecoregions: Northwest Congolese forests ecoregion

Aquatic ecoregion: Sangha ecoregion

Protected areas: Nouabalé-Ndoki National Park, 419,000 ha, 1993, Republic of Congo

Lobéké National Park, 43,000 ha, 2001, Cameroon

Dzanga-Ndoki National Park, 125,100 ha, 1990, Central African Republic

Dzanga-Sangha Special Reserve, 310,100 ha, 1990, Central African Republic

Location and area

The Sangha Tri-national Landscape is spread over three countries: Cameroon, the Central African Republic (CAR) and the Republic of Congo (Figure 16.1). The Congolese section of the Landscape extends over the administrative departments of Sangha and Likouala. It covers 21,470 km² and includes Nouabalé-Ndoki National Park (PNNN) plus five forest management units (UFAs) which cover an overall area of 17,280 km² and form the buffer zone of the national park. In the north, the area is delimited by the UFA of Mokabi; in the south by the UFAs of Pokola and Toukoulaka; in the east by the UFA of Loundoungou and in the west by that of Kabo. In the west, Nouabalé-Ndoki National Park borders on Dzanga-Ndoki National Park and Dzanga-Sangha Special Reserve in CAR. The CAR section covers 4,644 km² and includes Dzanga-Ndoki National Park and Dzanga-Sangha Special Reserve. The Cameroonian section is centered on Lobéké National Park.

Physical environment

Relief and altitude

The entire Landscape is located on plateaus broken up by alluvial plains. The altitude varies between 330 and 600 m in the Republic of Congo, but it reaches nearly 700 m in CAR.

Hydrology

The Landscape contains the headwaters of four major rivers that drain the north of the Congo River. Those of the Mabale, the Likouala and the Ndoki rivers are in PNNN; that of the Ibenga River is located in the UFA of Mokabi.

Climate

The average annual precipitation is on the order of 1,450 to 1,600 mm. The dry season lasts an average of two to three months and is centered on January-February. August is the rainiest month.

Vegetation

The Landscape essentially includes: semi-caducifoliated terra firma forests (Figure 16.2) rich in *Terminalia superba* (limba), Sterculiaceae, in particular *Triplochyton scleroxylon* (ayous), and Ulmaceae; forests with a monodominance of *Gilbertiodendron dewevrei*; forests of Marantaceae; mixed swamp forests; riparian forests of *Uapaca heudelotii*; and raffia palm groves. These forests are punctuated with grassy clearings and bais (Figure 16.3), as well as lakes, rivers and streams. In the areas that have been logged, rattan forests are growing.

In the Congolese section more than 1,700 species have been inventoried. Among the trees several species appear on the IUCN Red List: *Austranella congolensis*, *Pericopsis elata* (afroformosa), *Diospyros crassiflora* (ebony) and *Swartzia fistuloides* (pao rosa or African tulip wood). In addition, all the species of the genera *Entandrophragma* and *Khaya* that have been logged are considered vulnerable, as are other commercial species: *Aningeria altissima* (anigre), *Mansonia altissima*, *Pausinystalia macroveras* (tsanya) and *Gambeya pulpuchra* (longhi). PNNN is a sanctuary for all these species, but the surrounding concessions must also be managed in an intelligent way in order not to lose these important resources.

Fauna

Mammals

In the CAR sector, 105 species of land mammals have been identified (Blom, 2001), in particular: the African forest elephant *Loxodonta africana cyclotis*; sixteen species of primates, among them the gorilla *Gorilla gorilla*, the chimpanzee *Pan troglodytes* and at least six small nocturnal species; fourteen species of ungulates, including the bongo antelope *Tragelaphus euryceros* (a species that is declining rapidly in Central Africa and is very rare in East Africa); and fourteen species of carnivores, including the leopard *Panthera pardus* and the spotted neck otter *Lutra maculicollis*. The hippopotamus *Hippopotamus amphibius* still has a significant population along the Sangha River.

Birds

The avifauna includes 428 species in the Congolese section, 379 in the CAR section and 350 in the Cameroonian section. A significant population of the Dja River warbler *Bradypterus grandis*, a species endemic to the marshes of

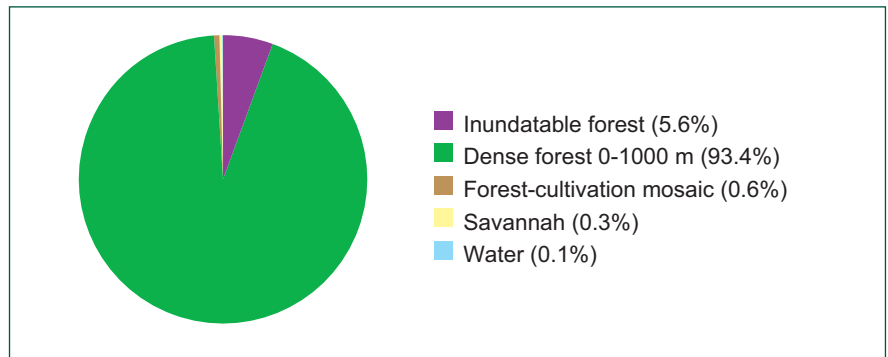


Figure 16.2. Main vegetation types (JRC).

Rhynchospora of Lower-Guinea, exists in Lobéké National Park; this species is also known in the marshes of PNNN. An as of yet undescribed species of night jar *Caprimulgus sp.* has been found in Lobéké National Park and PNNN. A new species of Turdidae, *Stiphrornis sanghae*, was described in 1999 in Dzanga-Sangha and has not yet been found elsewhere.

Herpetofauna

Species of reptiles found in this Landscape are typical for the region and include the Nile crocodile *Crocodylus niloticus*, the slender-snouted crocodile *Crocodylus cataphractus*, the dwarf crocodile *Osteolaemus tetraspis* (an endangered species), the Nile monitor lizard *Varanus ornatus*, the softshell turtle *Trionyx triunguis*, the African rock python *Python sebae*, the royal python *Python regius*, the coiled Gabon viper *Bitis gabonica* and the green mamba *Dendroaspis jamesoni*.

Figure 16.3. An elephant bai.



Ichthyofauna

The ichthyofauna is still insufficiently known, although it is very important for local populations. In the Cameroonian portion of the Sangha Basin, more than 200 species of fish have been identified, and the whole basin has nearly 300 identified species (Thieme *et al.*, 2005). The Sangha is a very dynamic environment because of silting and seasonal fluctuations that influence reproduction, the feeding regime and the distribution of the fish. Among the most remarkable families in the areas of the flooded or floodplain forests are the Alestiidae with *Hydrocynus goliath*, the Aplocheilidae, the Cichlidae with the genus *Tilapia*, the Claroteidae with the genus *Auchenoglanis*, the Cyprinidae with the genera *Labeo* and *Barbus*, the Mochokidae with the genus *Synodontis*, the Malapteruridae with the electric catfish *Malapterurus sp.* and the Schilbeidae.

Humans in the Landscape

Density and distribution

In the Landscape as a whole, the density of human populations is estimated at 0.7 inhabitants/km², but this varies from one section to the next.

In CAR, the human population is estimated at 5,977 inhabitants in the protected areas of Dzanga Sangha, with an average density of 1.2 inhabitants/km². These inhabitants are distributed along the Bayanga-Lindjombo-Bomandjokou and Bayanga-Yobé axes in the interior of Dzanga Sangha Special Reserve. The urban and industrial area of Bayanga houses 60% of this population. In the north of the Salo reserve, there is another major site for industrial logging (Ngonda-Ngbalet, 1995).

In the Congolese section the density averages 1.5 inhabitants/km² (Mavah, 2005). Around PNNN, the indigenous Bangombe and Bambendzele traditionally led a semi-nomadic hunter-gatherer life, but in the last 30 years permanent villages have been established along the Sangha and in proximity to the logging bases of Kabo and Pokola. In the UFA of Mokabi, it appears that immigration and growth of the human population have increased significantly since the beginning of logging in 2000-2001 by Rougier. The concession of Pokola, currently assigned to CIB, has the largest population center in the region with 13,417 inhabitants, representing the greatest potential impact on the national park and its environs. CIB has strongly developed the

infrastructure of Pokola, which has considerably improved the quality of life of the employees and of the community in general. Between 1999 and 2003, the growth rate of the population in Pokola was 11% per year, primarily due to immigration associated with job opportunities and the standard of living (Moukassa and Mavah, 2003). Other centers in the CIB concession are Kabo (2,600 inhabitants), the forest camp of Ndoki I (949 inhabitants), Ndoki II (1,000 inhabitants) and smaller villages along the Sangha and in the region of Kabounga (Mavah and Auzel, 2004). In this region, however, there has been a decrease in populations due to emigration toward the large population centers of Pokola and Kabo (Paget and Desmet, 2003).

Ethnic groups

In CAR, the ethnic groups originating in the region are the BaAka Pygmies, a hunter-gatherer people, and Sangha-Sangha, a fishing people. The other groups, such as the Ngoudi, Mpiemou and Bogongo are from the region of Sangha Mbaere. Foreign populations include the Gbaya, Banda, Nzakara, Nzande and Kaba, who come from other regions of CAR, as well as Chadians, Cameroonians and Mauritians. The Pygmy populations constitute around 30% of the total human population of the reserve.

In the Congolese section, Pokola is home to nearly fifty different ethnic groups which co-habitate; 32% of the groups are indigenous to the region (Mavah, 2005). The principal ethnic groups in the villages are Pomo, Yasua, Ngondi and Sangha-Sangha. The semi-nomadic groups of Bambendzele represent 32% of the population. In Kabo, more than thirty ethnic groups are present, and more than 70% of the population are originally from the department of Sangha. The semi-nomadic communities of Bangombe and Bambendzele constitute 15% of the population. In the Loundougou region 45% of the population is made up of semi-nomadic Bambendzele, 25% of Bomitaba, 25% of Bondongo and 5% of Kaka, all concentrated along the Motaba River, and with more than 95% of them originating in the department of Likouala (Mavah, 2005). Of the lands of Kabounga in the UFA of Toukoulaka, 61% are inhabited by Bomitaba and 39% by semi-nomadic Bambendzele.

Social organization

In the Congolese portion of the Landscape, the villages are organized geographically, as op-

posed to politically, because of the forced re-grouping that they suffered during the colonial era. However, the villagers gather together according to the ethnolinguistic groups present: Pomo, Ngondi, Yasua or Bomassa. The organization connected with lineage membership has a tendency to give way to ethnolinguistic organization because of the rural exodus toward the urban centers and the establishment of logging. Inter-ethnic marriages have contributed to the merging of several ethnic groups. Semi-nomadic communities and the villagers form only one economic and social unit, most of the time using the same forest spaces and sharing forest and agricultural products. In the semi-nomadic communities, social organization connected with clan membership is still observed.

In the Republic of Congo, there are two kinds of chiefs within the local populations:

- the village chief, who represents the government and is often chosen for the influence that he has on the other villagers
- the customary chief and/or clan chief, who represents the ancestors and is chosen through a ritual

None of these chiefs have a great deal of influence on the population, except in the case of semi-nomads and the heads of clans. The societies are generally acephalous and the chiefs vary from one activity to another or from one rite to another.

Activities

In CAR, the principal human activities taking place in the interior of the Landscape are logging, mining, hunting, fishing, agriculture, livestock breeding, gathering, conservation, tourism and trade (Table 16.1).

In the Republic of Congo, the principal sources of income for the local populations include industrial logging, services for employees of the logging companies, hunting, fishing and agriculture. Fishing is mostly practiced in the dry season, hunting in the rainy season—legally, hunting is prohibited in the dry season. Rifles and metal cables, which are illegal, are used most often for hunting. Traditional nets and snares made of plant fibers are no longer used except sporadically by the semi-nomads. Activities are divided: the men hunt and fish, while the women do the gathering, take care of the household, and occasionally fish in the streams.

Table 16.1. Main activities in the human population in the Central African Republic of the Sangha Tri-national landscape.

Activity	Percentage
Fishing	20
Logging	17
Agriculture	16
Collecting NTFP	13
Public services	11
Hunting	7
Other activities	16

Land use

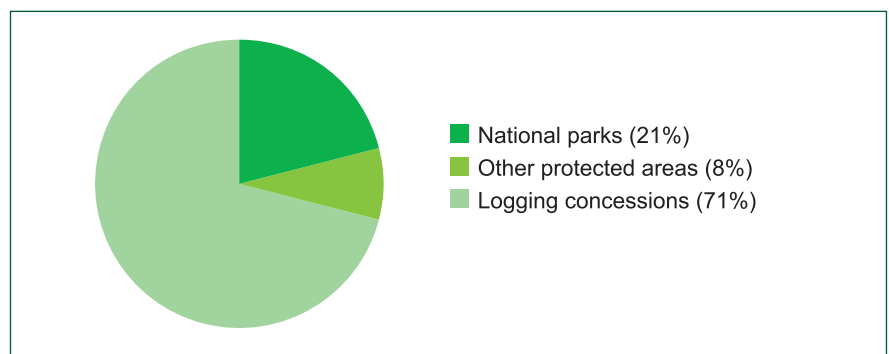
In CAR, Dzanga-Sangha Special Reserve represents 69% of the protected areas while the national park accounts for 27%. In the reserve, 70% of the land is allocated to hunting safaris and 83% to logging. The two activities therefore partly overlap. The community area for hunting covers around 14.6% and it is the only area where traditional hunting and gathering are authorized. The 'pre-park' area is a buffer zone that surrounds the two sectors of the national park over a width of 2 km.

In the Congolese section, PNNN covers 20% of the Landscape. The logging concessions, including areas reserved for the management of fauna by village communities and based on the traditional hunting lands, cover 80% of the Landscape (Figure 16.4).

Infrastructure

- In the Republic of Congo, the roads, all maintained by CIB, are in good condition.
- There are no bridges, but CIB and IFO manage a ferry on the Sangha and soon will do the

Figure 16.4. Main land use types.



same on the Motaba River to allow access to the Loundoungou-Ibendja concession to the northeast of PNNN.

- Three private primary schools built and subsidized by WCS are established near PNNN; in the concessions, there are relatively well-equipped primary and secondary schools subsidized by CIB.
- Pharmacies have been built, financed and supplied by WCS in the villages near the national park; there is a good hospital in Pokola and one is under construction by the CIB in Kabo.
- Portable telephones reach Pokola and will soon reach Kabo.

Logging

In CAR, logging began in the Dzanga-Sangha region around 1972, with the establishment of the Yugoslavian company Slovenia Bois (SB). This led to a rapid increase in the population of Bayanga. Following financial difficulties, activities were stopped in 1986. The company Sangha Bois took over in 1988, but due to a failure to respect commitments vis-à-vis the State it was closed in 1990. In 1992, this concession was bought out by a French group, *Sylvicole de Bayanga*, which operated between 1993 and 1997. In 1999, the *Société de bois de Bayanga* (SBB) restarted logging activities in the reserve over an area of 186,900 ha. These activities ended in December 2005. The *Société d'exploitation forestière de Sangha Mbaéré* (Sesam) has had a logging concession in the northwest of the reserve since 1991 and its logging permit covers 88,800 ha in the special reserve. Thanks to financing from the French Development Fund (CFD), it has established another industrial site in Salo in the north of the reserve, but logging activities have currently been stopped. Around 265,800 ha, that is 83% of the reserve, are being logged industrially and the loss of forest cover due to industrial logging is estimated at 2,500 ha/year.

In the Republic of Congo, the logging concessions of Kabo, Loundoungou and Pokola/Toukoulaka were assigned to CIB, which has been actively logging the concession of Pokola since 1962. The Kabo concession has been worked since the 1970s, initially by the company Bois Sangha, and the Loundoungou concession has never been logged. CIB acquired the rights to these two concessions in 1997. The concession of Mokabi, which borders PNNN to the north, was allocated to Rougier in 1999.

In 1999, cooperative work was initiated be-

tween WCS, the Congolese government, CIB and the local communities in order to promote responsible management of the fauna and the forest resources in the Kabo-Pokola-Toukoulaka-Loundoungou area that surrounds PNNN. The activities are focused on education, raising awareness about conservation, the development of alternative activities, community management of the fauna, protection of the fauna, socioeconomic studies, ecological research, monitoring and improving the exploitation of the forest. CIB is now drawing up overall development plans for its concessions, taking into account the conservation of biodiversity and the development of socioeconomic objectives.

Reasons for the identification of the Landscape

- (1) The Landscape contains vast extents of intact forests of different types, a rare phenomenon in the world, and its ecological integrity is remarkable. It provides habitats for some of the largest intact communities of large mammals in Africa. It is particularly important for forest elephants and great apes. The presence of baobabs, environments very much sought after by many mammals and birds, is an essential asset.
- (2) The forests of the Landscape have been recognized as critical for conservation in Africa (Monza, 1996) and as one of the priority areas for the conservation of forests in the northwest Congolese forests ecoregion (Kamdem Toham *et al.*, 2006).
- (3) There are major opportunities for conservation: the protected areas cover 21.5% of the whole landscape (752,000 ha) and cross-border cooperation agreements were signed in 2000 by the three countries involved, with a view to improve conservation of the protected areas.
- (4) Conservation of the protected areas could be strengthened by sustainable management of the buffer zones in two of the three countries.¹

Conservation

History

In CAR, after the signing of agreements between the government and WWF in 1988, the Ministry in charge of forests initiated, in collaboration with WWF, the Dzanga-Sangha Project in 1988. Law no. 90.017 of 29 December 1990 clas-

¹ In the Republic of Congo and Cameroon, WCS and WWF are providing technical assistance to CIB and the company Decolvenaire in order to promote sustainable management of the fauna. In 2004, CIB requested FSC certification for its concessions, three of which directly border on PNNN. Other companies also seem to want to move towards sustainable logging.

sified 125,100 ha as a national park (category II of the IUCN) and law no. 90.018 of 29 December 1990 classified Dzanga-Sangha Special Reserve of around 335,900 ha for multiple use (category VI of the IUCN).

In the Republic of Congo, WCS signed an agreement with the Congolese government in 1991 to supply technical support for the creation and management of a national park through the Nouabalé-Ndoki Project. PNNN was consequently created in 1993. In 2003, the management plan for the park was officially adopted and the Goulougo triangle was included in the protected area. This area, previously included in the concession of Kabo, has a remarkable and intact biodiversity due to its isolation and its inaccessibility between the Ndoki and Goulougo rivers.

In Cameroon, Lobéké National Park was classified in 2001.

The cross-border dialogue between the conservation bodies operating in PNNN, the area of Lobéké and the Dzanga-Sangha complex began in 1996. In December 2000, the three countries involved signed a cross-border cooperation agreement. Certain cross-border activities in the form of patrols on the rivers and borders began in 2001 and have made it possible to reduce commercial hunting on the Sangha. The partners have been coordinating their efforts by focusing on the problems of cross-border conservation, specifically as concerns the application of laws, research, monitoring and the institutional framework.

Players

(1) Governmental players

Management of the protected areas is under the direction of the Ministries of Water and Forests in the three countries.

(2) NGOs

In CAR the Ministry is supported by WWF and GTZ-LUSO; in the Republic of Congo, by WCS; in Cameroon by WWF and GTZ. In CAR, WCS has also been carrying out research on forest elephants for the last 15 years.

(3) Private companies

The main logging companies are CIB and Rougier in the Congolese section, Decolvenaere in Cameroon and SBB in CAR. However, SSB was liquidated at the end of 2005. Hunting tourism is organized in CAR by three companies: Aouk Sangha Safari, National Safari and Safaria.

Direct threats

(1) Commercial hunting

Commercial hunting represents the primary threat for wildlife throughout the Landscape, but most notably in Cameroon and CAR. The animal populations in the concessions are subject to growing pressure because of the opening up of the forests by logging roads and the increase in the human populations.

(2) Ivory hunting

The pressure on the elephants from hunting for their ivory is substantial in the southern part of the concession of Pokola, and incursions by ivory hunters along the northern edge of PNNN from the CAR are becoming more and more frequent.

(3) Hunting by villagers

With the increase in the human populations in Kabo and Pokola, Republic of Congo, the pressure on animal populations is increasing greatly. Practiced in zones that are already emptied of game, it cannot be sustained. Responsible management of the hunting pressure is essential to bring this type of hunting back down to a sustainable level.

(4) Industrial logging

The primary threat posed by industrial logging is the opening up of the forests to hunters. Logging companies, however, are currently felling a larger and larger number of species and it is foreseeable that the loss of canopy is going to become a problem in certain regions. The poor planning of roads and tracks is also causing major unnecessary damage to the canopy. Non-sustainable logging of certain species will eventually change the composition of the forest around PNNN. The disturbance of the clearings and the bias by logging presents certain threats to the wildlife that depends on these habitats for their nutritive resources.

(5) Traditional mining

Diamond mining is a threat in the north of the special reserve in CAR (Ngakeu *et al.*, 2002).

Indirect threats

(1) Lack of information

The information necessary for management and planning is lacking. The ecological needs of endangered species, such as the forest elephant, the gorilla and the chimpanzee, are poorly known.

It is therefore very difficult to evaluate the direct impacts of industrial logging on these species and improve measures for conserving biodiversity.

(2) *Lack of capacity*

Capacity and support for conservation are weak. The governments of the three countries would have to increase their capacities enormously before being able to set up effective protection and management of the Landscape. Staff members have to be identified, trained and monitored.

(3) *Lack of resources*

Alternative resources for proteins and monetary income do ease pressure on wildlife. The logging companies therefore absolutely must facilitate the supply of alternative proteins in logging camps and towns.

(4) *Poor standards of institutions*

Policies and support in the areas of wildlife management and forest management are insufficiently developed. These aspects must be developed both for community logging and for industrial logging in order to control access, commercial hunting and immigration following logging activities. Wildlife management, the planning of land use at the Landscape level, the problems concerning indigenous peoples and conservation in areas adjacent to national parks have to be incorporated into the laws concerning the long term management of the forests. Guidelines must be developed for national and international policies for conservation and management in tropical forest areas supporting multiple uses.

State of the vegetation

A large part of the forests that cover the banks of the Sangha seem to have been inhabited between the years 2,300 and 900 BP, when they were transformed into palm groves of *Elaeis*. After the region was abandoned by these populations, they were covered by forests of *Entandrophragma*. However, industrial logging has once again affected a large part of these forests by opening up their canopy. The majority of the forests in the center of Lobéké National Park and all the forests of PNNN have never been logged.

State of the fauna

In CAR, the data gathered by the MIKE program in 2005 showed a clear reduction in the populations of large mammals and a contraction of the distribution area. Key species like the ele-

phant, the chimpanzee and the gorilla are concentrated in the interior of Dzanga-Ndoki National Park² (Box 16.1).

In the Republic of Congo, populations of large mammals are still largely intact (Table 16.2). In the south of PNNN, in the concessions of Kabo, Pokola and Toukoulaka, animal populations are stable and in good health as a result of proper management. These concessions contain habitat for elephants and bongo antelope. The protection of these habitats is essential to allow the population of bongo antelope to recover from the epidemic caused by the *Stomoxys* flies in 1997. The concession of Mokabi, however, has lost a large part of its fauna since the beginning of activities in 2001. Human immigration and uncontrolled hunting have considerably reduced populations of elephants in the north of the concession (Box 16.1). Large populations of mammals nonetheless remain in the south of the concession bordering PNNN.

Tourism

In CAR, the concessions of the three hunting safari companies that are operating in the Landscape cover a large part of the special reserve and overlap with the logging concessions over an area of 225,400 ha. In terms of ecotourism, a reception center and a tourist hotel, Doli Lodge, have been developed. Around 820 tourists visited the site in 2004. The tourist activities available include: elephant viewing in the bai of Dzanga; primate watching (gorillas and mangabeys); participation in hunting, using snares and traps; the traditional dance of the BaAka; a trip on the Sangha; and collecting raffia palm wine.

In the Republic of Congo, the development of ecotourism expanded considerably in 2005 with the construction of new accommodation infrastructure in PNNN and the organization of cross-border excursions.

Management and governance in the field of renewable natural resources

(1) *At the Landscape level*

The TNS cooperation agreement created four cross-border management structures:

- the Tri-National Supervision and Arbitration Committee (CTSA) at the ministerial level
- the Tri-National Scientific Committee (CST)
- the Tri-National Monitoring Committee (CTS) at the level of the provincial administrations, which includes representatives from the agencies funding and/or executing pro-

² In Dzanga-Ndoki National Park the average density is 0.6 elephants/km², thanks to protection efforts carried out by the Dzanga-Sangha Project. In the Dzanga-Sangha Special Reserve, the density is reduced to 0.09 elephants/km². For the entire complex of protected areas, the population of gorillas is between 1,794 to 4,063 weaned individuals; the population of elephants is between 671 to 1,124 individuals.

grams, as well as the conservators or national directors of each site

- the Tri-National Planning and Execution Committee (CTPE) at the level of the sites, made up of conservators, project managers and associated technical assistants

The CTPE is the main administrative body of the Sangha Tri-national and the most active committee with meetings twice a year. It is responsible for monitoring all of the activities and problems that occur in the Landscape and planning future actions. It is the principal means of communication on the state of the Landscape to all the parties concerned, through periodic reports. Since it includes all the players in the Landscape, this committee has shown that it is very effective in identifying and carrying out activities, especially those relating to combating poaching.

The development of a land use plan at the Landscape level is well advanced. A working meeting was held in 2005 and a preliminary document has been prepared. The document brings together all available information relating to national development plans and land use plans in order to sum up the current and future focal points for development and overall strategies for the Landscape.

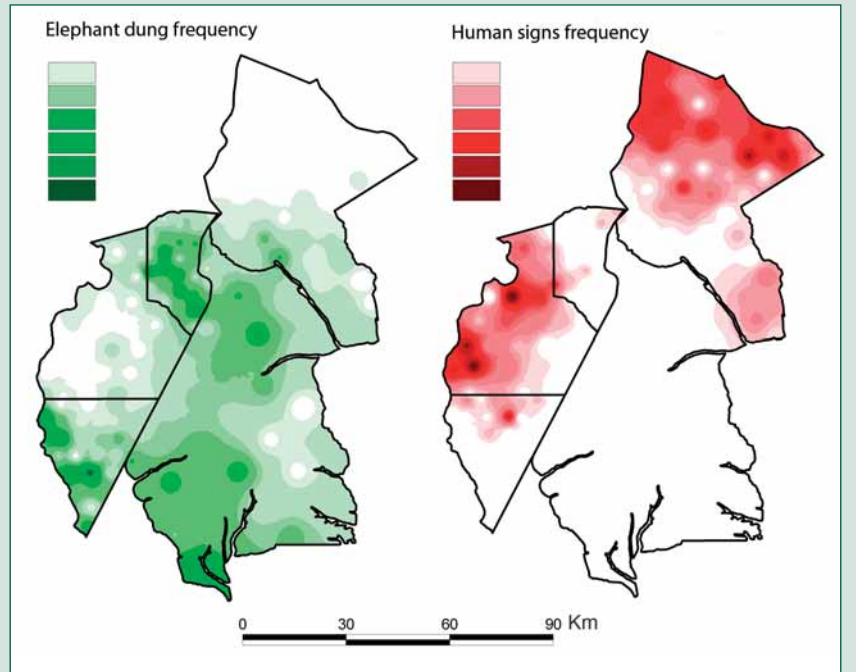
In the Congolese section, mobile guard patrols and fixed surveillance posts on the access roads have been maintained over the entire extent of the Congolese section of the Landscape, in the national park as well as in the concessions. Consequently, elephant poaching in PNNN has remained nil. Bi-national patrols have been organized every six months, with agents from the Republic of Congo and CAR.

(2) In the protected areas

In CAR, in order to harmonize human activities in the protected areas of Dzanga-Sangha and possibly improve the use of renewable natural resources, the complex of Dzanga-Sangha has been organized according to a zoning plan, which implements the legal texts in force³. The two sectors of the national park are designated as conservation areas, excluding every activity other than those connected with tourism and research, and are surrounded by a buffer zone. Dzanga-Sangha Special Reserve is classified as a peripheral zone with multiple uses, where anthropogenic activities are authorized under certain conditions and in areas specifically planned for logging, sport hunting, traditional hunting, agriculture or fishing. In the interior of the special reserve there is a community hunting area where the traditional ac-

Box 16.1. Elephants and humans in the Sangha Tri-National Landscape

During the MIKE program, inventories were undertaken by WCS and WWF in the Sangha Tri-national Landscape. These have demonstrated that indices of human presence and indices of elephant presence are inversely co-related. Elephant distribution and human distribution are totally in opposition.



tivities of local populations are permitted (camping, hunting, fishing and gathering) and hunting for non-native residents who hold a hunting permit is also allowed.

The activities developed by the Dzanga-Sangha Project in the protected areas include:

- action to combat poaching, promote ecological monitoring, continue the habituation of primates, and the formation and maintenance of local infrastructures
- support for the management of forest harvesting
- self-promotion of local initiatives and micro-projects
- elimination of illiteracy and provision of pre-schools for Pygmies
- ecotourism and environmental communication

The local arbitration committee of the Dzanga-Sangha Project is tasked with serving as an interface between the local population and the

³ In CAR, the management of renewable natural resources is governed by the forest code of 1991, which expresses the need to conserve biological resources and confirms the customary rights of the populations while taking into account the status of the ecosystems and the interests of future generations, and the wildlife protection code, which regulates hunting and also recognizes the traditional right of usage of animal resources by the local residents of the forest ecosystems.

Table 16.2. Present situation as concerns wildlife and human presence in the Sangha Tri-national Landscape in the Republic of Congo.

Species	Density per km ² [Confidence interval] (Rate of encounter / signs per km)					
	Logging concession					National Park
	CIB				Rougier	
	Kabo UFA	Pokola UFA	Loundougou UFA	Toukoulaka UFA	Mokabi UFA	Nouabalé-Ndoki National Park (PNNN)
Gorilla (nests)	1.36 [1.05; 1.75] (1.05)	2.15 [1.51; 3.06] (1.00)	0.56 [0.04; 8.23] (0.42)	2.25 [1.60; 3.17] (1.17)	(1.4)*	(1.88)*
Chimpanzee (nests)	0.29 [0.24; 0.35] (0.67)	0.35 [0.28; 0.43] (0.88)	0.03 [0.11; 0.78] (0.86)	0.44 [0.35; 0.57] (1.21)	(0.43)*	(0.12)*
Great ape (indeterminate species)	-	-	-	-	(3.9)*	(6.2)*
Elephant (droppings)	1.23 [1.03; 1.48] (1.50)	1.06 [0.83; 1.35] (1.06)	0.39 [0.12; 1.31] (0.69)	0.23 [0.15; 0.34] (0.48)	0.30 [0; 0.6] (1.85)	1.40 [0.6; 2.2] (8.45)
Buffalo (signs)	(0.11)	(0.07)	(0.01)	(0.02)	-	-
Bongo antelope (signs)	(0.06)	(0.04)	(0.02)	(0.02)	-	-
Bushpig (droppings)	(0.01)	(0.08)	(0.04)	(0.04)	-	-
Forest hog (droppings)	(0.02)	(0.00)	(0.00)	(0.00)	-	-
<i>Monticola</i> Duiker (droppings)	(0.11)	(0.57)	(0.81)	(0.10)	-	-
Medium-sized duiker (droppings)	(1.38)	(3.54)	(2.40)	(1.89)	-	-
Yellow-backed duiker <i>silvicultor</i> (droppings)	(0.77)	(1.61)	(1.11)	(1.75)	-	-
Human (casings)	(0.18)	(0.21)	(0.01)	(0.06)	(0.15)	(0)
Transect Effort (km)	777	1181	889	610	46	25
Monitoring year	2001-2002	2002-2003	2002	2002-2003	2003-2004	2003-2004
Source	(Poulsen <i>et al.</i> , 2005)	(Poulsen <i>et al.</i> , 2005)	(Poulsen <i>et al.</i> , 2005)	(Poulsen <i>et al.</i> , 2005)	(Boudjan and Makoumbou, 2004)	(Boudjan and Makoumbou, 2004)

* an analysis of data concerning the great apes is under way

Dzanga-Sangha Project, particularly in regards to the management of disputed issues concerning access to renewable natural resources and dividing up the benefits resulting from their development (taxes from the exploitation of resources and income from tourism)⁴. Access to biodiversity resources for hunting and gathering is unrestricted in the authorized areas of the special reserve, but it is strictly prohibited in the two sectors of the national park. The ancestral practices of hunting

(rituals at the beginning of the hunting year) have been abandoned except by the BaAka⁵.

(3) In the logging areas

In the Republic of Congo, CIB announced in November 2004 that it was setting aside large areas in the concession of Kabo as a part of FSC certification. Two areas cover more than 14,000 ha and are in the Bomassa triangle. They constitute a major addition to the network of protected areas in the Landscape by connecting the national parks of CAR and the Republic of Congo. In October 2005, CIB also presented its first development plan, which included measures for implementing sustainable practices that reduce environmental and social impacts.

Community projects were initiated by WCS in the four concessions of CIB through the formalization of management committees and the organization of a workshop to define a participatory process in the development of regulations concerning hunting, fishing and the harvesting of non-timber forest products in community areas.

Logging in the Bomassa triangle (concession of Kabo) was authorized for the next four years by the government, with the condition that this area would receive the status of a protected area in the future. Certain standards have been adopted by CIB and MEFE, with the support of WCS, in order to reduce the impact of logging and to provide surveillance of hunting in this sensitive area of the Landscape.

(4) In the rural areas

With the considerable increase in human populations connected to the development of industrial logging, conservation at the community level has become an increasingly important strategy in the Landscape. As part of an evaluation of the possible sustainable sources of proteins that could serve as an alternative to bushmeat, a tri-national project aimed at developing systems for managing fish was created and will be implemented in 2006.

The village chiefs and the local administrative authorities have become key players. They are consulted at times of decision making in regards to strategies for sustainable development and conservation. They are also tasked with managing the repercussions arising from the exploitation of biodiversity resources: 40% of the revenue from taxes on logging and 40% of the taxes on ecotourism are set aside for rural development organizations. However, there is a lack of capacity regarding the management of this revenue and a program for strengthening capacity in this area is essential.

The success of actions taken to combat poaching has led to an increase in the elephant population and elephants are found near the villages increasingly frequently. This phenomenon has caused an increase in crop damage. Experimental measures aimed at driving the elephants away from the fields using strong peppers (pili-pili) have been tried in Zimbabwe and are currently under way in the village of Bomassa, close to PNNN. These measures could be applied on a larger scale.

Monitoring renewable natural resources and their management

(1) Training

National and tri-national training programs in ecological and socioeconomic monitoring were continued in 2005:

- A training course in methods for monitoring bais was provided to national researchers of the three countries by a senior researcher at Dzanga-Sangha in CAR.
- An annual training course in methods of monitoring and research was given to national researchers in PNNN.
- A training course in GIS was given at both the tri-national and national levels.

(2) Ecological monitoring

The GIS databases have been updated and new remote sensing methods have been introduced. In the Congolese section, a program of ecological monitoring at the Landscape level has been designed and finalized. It will be implemented in 2006. This program covers 2.8 million hectares under improved development and will offer an effective tool for the evaluation of strategies for management in regards to conservation objectives in the different land use zones. Standardized methods are used throughout the Landscape and the three protected areas are within the framework of national and regional programs, such as MIKE.

In addition to monitoring at the Landscape level, there are also specific monitoring actions that focus on particular species or habitats, such as bais:

- In the Republic of Congo, a long term study of gorilla populations and their demography has been under way at the bais of Mbeli since 1995.
- A study of the eco-ethology of the chimpanzee has been underway in the Goualougo triangle in PNNN since 1999; it targets the impact of logging on this species.

- Studies of the impact of logging and hunting are also under way in the buffer zone of the national park.
- Monitoring of the bais frequented by elephants should make for a better understanding of the use of the environment by this species and its population structures; it is also meant to provide information on poaching.

In CAR, monitoring patrols in 2004 and 2005 made it possible to evaluate the frequentation of the bais⁶ at a time when poaching around the salt marshes was diminishing and the poaching network in the area was being weakened. In 2005, the monthly rates of frequentation by elephants were higher than for 2004 and numerous species were seen more often than before⁷.

(3) Monitoring wildlife health

Monitoring wildlife health was extended to the entire Landscape and focused on the development of a means of surveillance aimed at the rapid detection of epidemics such as Ebola.

⁴ At the village level, the chiefs of groups that have authority over natural resources delegate their power to the village chiefs who are in a position to rule on disagreements and disputes. They are often chosen from the founding family of the village. Currently, within the framework of the participatory management of renewable natural resources, they are often consulted by projects at times of major decisions relating to zoning and other issues concerning access to the resources.

⁵ The ritual of the beginning of the hunting year still exists among the BaAka Pygmies who follow the tradition of the Djengi personified by the patriarch of the village.

⁶ Of a total of 3,500 patrols carried out in 2004, 11% were done in the north of the Dzanga sector of the national park, a sensitive area for poaching, 36.2% around the principal bais of Dzanga, Mongambe and Hokou and 1.6% in the Ndoki sector of the national park. On average there were 1.7 patrols a day in the whole of the protected areas of Dzanga-Sangha.

⁷ These species include: the sitatunga, the forest buffalo, the bongo antelope, the forest hog, the bushpig, the black and white colobus monke, white-cheeked mangabey and the greater white-nosed monkey (Turkalo, 2005).

17. Léconi-Batéké-Léfini Landscape

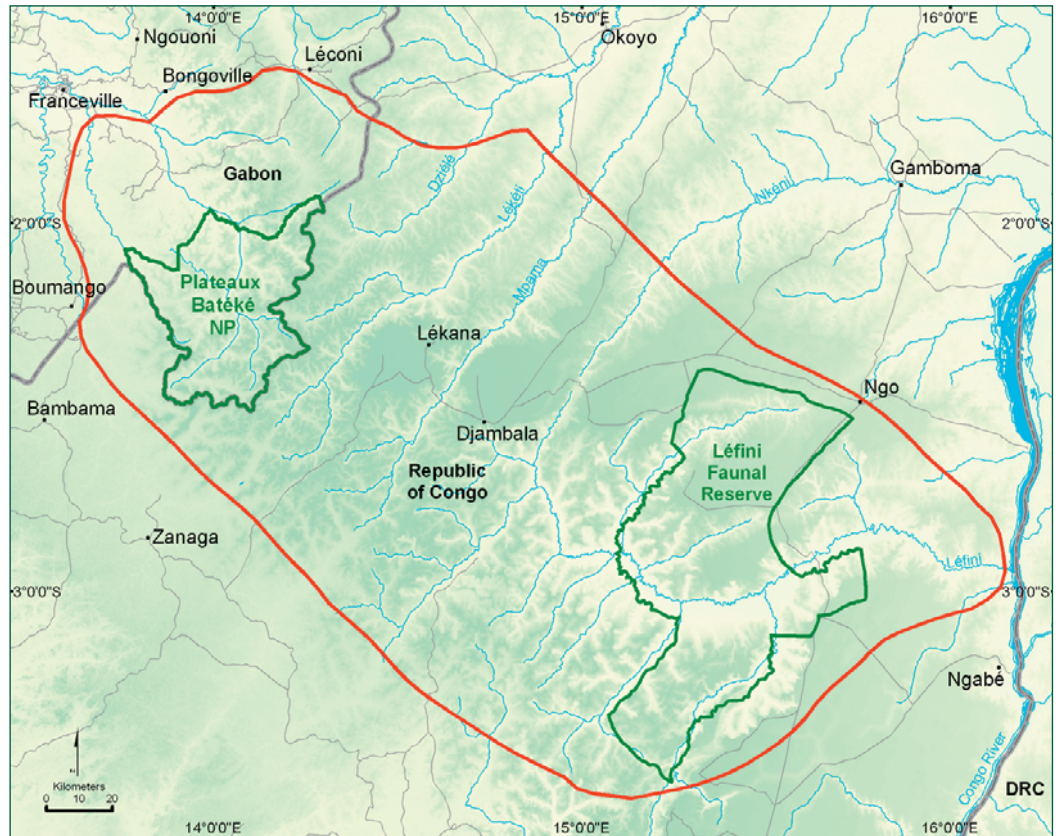


Figure 17.1. Map of Léconi-Batéké-Léfini Landscape (Sources: CARPE, JRC, SRTM, WCS-Congo, WCS-Gabon).

The Landscape in brief

Coordinates: 1°34'49"S – 3°33'42"S; 13°35'39"E – 16°8'57"E

Area: 35,164 km²

Elevation: 300-870 m

Terrestrial ecoregion: Southwest forest-savannah mosaic ecoregion

Aquatic ecoregions: Southwest equatorial coastal ecoregion

Sangha ecoregion

Protected areas: Batéké Plateau National Park, 205,000 hectares, 2002, Gabon
Léfini Wildlife Reserve, 125,000 hectares, 1956, Republic of Congo

Physical environment

Relief and altitude

The relief consists of plateaus that were deeply cut out by the hydrographical network (Figure 17.2) and, particularly in Gabon, are crisscrossed by areas of giant fossilized dunes which appear to be linked to the Kalahari Desert and are locally eroded by spectacular cirques (Figure 17.3). The lowest valley beds are at an altitude of about 350 m and the peaks reach 830 to 870 m.

Location and area

The Landscape is located in Gabon and the Republic of Congo (Figure 17.1). It covers a total area of 35,164 km², but the activities carried out within the framework of the CBFP are focused on a priority area of 35,350 km² covering the western part of the Léfini reserve and the Bambama-Lékana area in the Republic of Congo, together with Batéké Plateau National Park (BPNP) in Gabon.

Geology and soils

The Batéké plateaus form the western edge of the vast sedimentary basin from the Cretaceous to Miocene eras, stretching farther to the east into DRC. The oldest formations belong to the Stanley Pool group, which lies directly on the Precambrian bedrock. The most recent formations belong to the Batéké plateaus group, whose lower strata date from the Eocene and rest on Stanley Pool formations. These are mostly soft friable sandstone. The

most recent strata are composed of sandy silt or quartzose sand from a local alteration (Hudley & Belmonte, 1970) and eolian sand. The soils are mostly sandy, highly permeable and poor.

Hydrology

In Gabon, the Landscape is drained by the Ogooué River and its tributaries, particularly the Léconi and the Mpassa, whose sources are in the Republic of Congo in the Bambama-Zanaga region, converging in the Franceville region. In the Republic of Congo, most of Landscape is drained by parallel rivers flowing into the Congo River, especially the Leketi, Moama and Nkene, which run towards the northeast, and the Léfini, which runs to the east. The Landscape is also studded with numerous lavakas or fossil valleys. The masses of soft sandstone and sand form a major reservoir of good quality underground water that ensures that the rivers have a regular flow in all seasons (Beaujour, 1971) and which is commercially exploited. That is why the Batéké hills and plateaus, although dry on the surface are called the 'water tower' of the Republic of Congo and Gabon.

Climate

The Landscape as a whole has a tropical transitional climate. Average annual precipitation is around 1,700 to 2,000 mm. The dry season is from the end of May to September and in January-February there is a period of less rainfall.

Vegetation

Savannahs cover around 70% of the area of the Landscape (Figure 17.4). They comprise vast stretches of relatively short and sparse savannah and expanses of bush and tree savannah of *Hymenocardia acida* (Euphorbiaceae) and *Annona senegalensis* (Annonaceae). Valley bottoms are occupied by gallery forests (Figure 17.2) rich in rattan *Laccosperma* and *Eremospatha* (Arecaceae). The undergrowth is dominated by *Palisota* (Commelinaceae) and, among the trees, *Anonidium mannii* (Annonaceae) is common. At the heads of some valleys there are also drier forest formations, relics of an older more extensive cover, but these have not yet been studied. In Batéké Plateau National Park, the flora is being studied by the Missouri Botanical Garden and 800 species of plants have already been listed¹. They include a new species (*Memecylon batekeanum* of the Melastomataceae family), discovered in the buffer zone of the national park in Gabon,



Figure 17.2. The Batéké Plateau in Gabon.



Figure 17.3. Gallery forests in Batéké Plateau National Park, Gabon.

and a second species that is in the process of being described.

Fauna

Mammals

In the savannah, mammals are represented by widely distributed but rare species in the Congo Basin, notably the grey duiker *Sylvicapra grimmia*, the common reedbuck *Redunca arundinorum*², the defassa waterbuck *Kobus ellypsiprymnus*³, the side-striped jackal *Canis adustus*, the Egyptian mongoose *Herpestes ichneumon* and the armadillo *Orycteropus afer*. The serval *Felis serval* and the

¹ Preliminary botanical explorations have been carried out, but more detailed work will begin in 2006 (Walters, 2004 and 2005).

² The common reedbuck now exists only in the Léfini; it seems to have disappeared from BPNP, but according to local hunters it was there previously.

³ A small population of defassa waterbuck survives in the Léfini; along with those in the Nyanga valley in Gabon, it is probably the last existing population of the western form of this species.

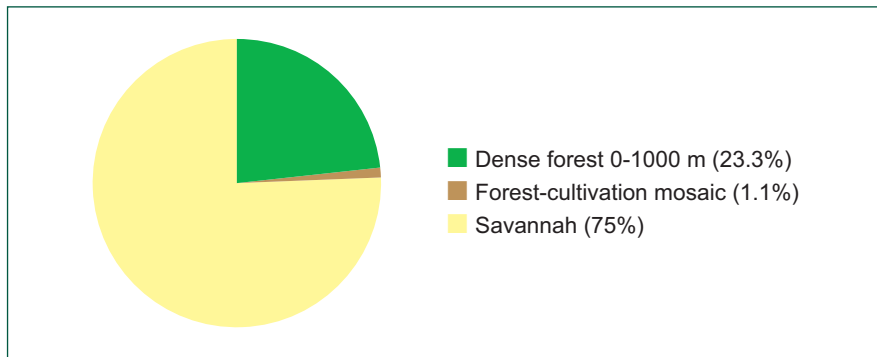


Figure 17.4. The main vegetation types (Source: JRC).

lion *Panthera leo*⁴ could also still be present. In the forest area, live the elephant *Loxodonta africana cyclotis*, the buffalo *Syncerus caffer nanus*, the bush pig *Potamochoerus porcus*, six species of primates including the chimpanzee *Pan troglodytes*, the western gorilla *Gorilla gorilla* and DeBrazza's monkey *Cercopithecus neglectus*, three species of pangolins (Manidae) and twelve species of carnivores other than the serval and the lion.

Birds

In terms of avifauna, 267 species of birds have been identified to date (Christy, 2001). They include species linked to very open environments, such as the Stanley bustard *Otis denhami*, the black-bellied korhaan *Eupodotis melanogaster* and the white-bellied bustard *E. senegalensis* (three species with a wide distribution but yet very vulnerable), the red-necked francolin *Francolinus afer*, the coqui francolin *Francolinus coqui*, Finsch's francolin *F. finschi*, the Congo moorchat *Myrmecocichla tholloni*, five species of pipits *Anthus sp.* and the rufous-naped lark *Mirafra africana*. However, the latter could be a species endemic to the Batéké plateau⁵. The Angola buff-back flycatcher *Batis minulla* and the black-chinned weaver *Ploceus nigritum* are endemic or quasi-endemic to the plateau. They like the wooded savannahs and dry gallery forests, which also contain Perrin's bush-shrike *Malaconotus viridis*, the African broadbill *Smithornis capensis* and the olive long-tailed cuckoo *Cercococcyx olivinus*. In the Congolese portion of the Landscape there are some species that have not been recorded in Gabon: Brazza's martin *Phedinopsis brazzae*, a species endemic to the plateau, and the Congo black-bellied sunbird *Nectarinia congensis*, endemic to the central basin and limited to the banks of the Congo River and some of its tributaries. On the savannahs of Gabon, perhaps also in the Republic of Congo, there is an as yet undescribed cisticola *Cisticola sp. nov.* (Christy, pers. comm.).

⁴ In Gabon, a lion was killed and photographed in Moanda in 1969 (Trolez, pers. comm.), several individuals were poisoned when the Lekabi ranch was created in 1980-1981 and another was killed by an officer of the Water and Forests Department at the request of villagers in Léconi in 1996. In 2001 and 2002, no trace could be found (Henschel, 2003), but several tracks closely resembling lion prints were identified in September 2004 (Bout, 2005). Unfortunately, no photo was taken. Following the latest workshop on carnivores in Central Africa, held in Douala at the end of 2005, the presence of lions on the plateaus was classed as probable and studies on it are considered a priority.

⁵ This lark was described by Chapin in 1946 as *Mirafra malbranti*, endemic to the Batéké plateau. It has subsequently become synonymous with *Mirafra africana*, but recent observations of its song indicate that could indeed be a different species of *Mirafra africana*.

Humans in the Landscape

Density and distribution

The average density of the human populations is around 0.2 inhabitants/km², but their distribution is uneven. A rural exodus has led to sizeable concentrations in the main district, departmental or provincial centers: Lekana, Zanaga and Djambala in the Republic of Congo and Léconi and Franceville in Gabon.

Ethnic groups

In the Republic of Congo, the main ethnic groups are the Teke-Kukuya, Teke-Kali (Lekana-Congo), Teke-Lali, Obamba and Ndassa. The Babongo Pygmies, who are in fact 'autochthonous' populations, live in the regions of Zanaga, Bambama, Dziku and Boma.

In Gabon, the savannahs around Léconi are exclusively occupied by Teke while the forests around Boumango are home to Bawoumbou and a smaller population of Teke.

Activities

In the Landscape, 90% of the population are involved in agriculture, 50% in hunting, 5% in fishing and 40% in collecting (Table 17.1).

Land use

As of yet there are no quantitative land use estimates for the Landscape as a whole (Figure 17.5), but a study is being carried out on the use of natural resources in the peripheral area around Batéké Plateau National Park. It should be noted, that pastoralism has never existed in the Landscape.

Logging

For the time being, there is no industrial logging in the Landscape, although logging did exist in the past in the western areas, particularly the Zanaga region of the Republic of Congo and the region in the northeast of Batéké Plateau National Park in Gabon. Presently, there is only small-scale logging in the regions of Lekana, Zanaga and Ngo in the Republic of Congo. The only people involved in logging are local craftsmen.

Reasons for the identification of the Landscape

- (1) The Batéké plateau forms a unique landscape of very open savannahs which are an extension into the heart of the forests of Central Africa of the savannahs of western DRC and Angola.
- (2) Batéké Plateau National Park in Gabon and the adjacent area of Bambama-Lekana in the Republic of Congo still contain fairly representative large fauna.
- (3) The Léconi savannahs and the Léfini reserve have been designated as important areas for bird conservation (Fishpool & Evans, 2001).
- (4) The two protected areas have an interesting and complementary tourist potential, capable of economically supporting a few villages.
- (5) There is perhaps still a very small population of lions that could be protected.
- (6) The Batéké plateau landscape is intimately linked to the kingdom of the Teke, whose population is severely threatened by acculturation; conservation of the Landscape's biological diversity could also permit specific aspects of the culture to be preserved.
- (7) The beauty of the Landscape, particularly the erosion cirques, is largely due to the creation of protected areas.

Conservation

History

In the Republic of Congo, the Léfini reserve with an area of 600,000 ha was classified in 1961 and the Bambama-Zanaga-Lekana site was designated a critical site by the IUCN in 1986 (Hecketsweiler, 1990). There is currently a project to create a new protected area of 360,000 ha in the Bambama-Lekana zone.

In Gabon, the Léconi region had been designated a critical site by the IUCN and was proposed

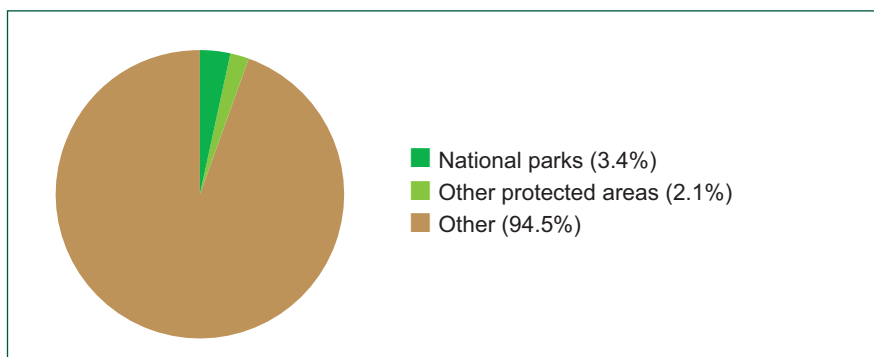


Figure 17.5. The main land use types.

as a protected area in 1990 (Wilks, 1990). Batéké Plateau National Park was created on August 30, 2002 (decree 609/PR /MEFPEPN) farther to the south. It covers an area of 204,854 ha.

Players

In Gabon:

- The national park is managed by MEFPEPN, through the wildlife and hunting directorate, and CNPN.
- WCS carried out preliminary studies within the context of its assessment of the protected areas in 2001 and launched its Batéké project in the national park in April-May 2004.
- The Gorilla Protection Project (PPG) began its activities in the gorilla sanctuary in the national park in 1997.

In the Republic of Congo:

- The Ministry of Water and Forests (mainly the DFAP)
- The PPG, essentially financed by the John Aspinall Foundation, located in Brazzaville in 1987 and Lesio Louna in the Léfini reserve in 1994.
- WCS has been active in the Léfini reserve and since 2003, has been working on the creation of Bambama-Lekana National Park, as well as redefining the limits of the Léfini reserve within the framework of the CARPE-CBFP program.

Table 17.1. Relative importance of the principal activities in the Léconi-Batéké-Léfini Landscape.

Activity	Percentage
Agriculture	49
Hunting	27
Collecting	22
Fishing	2

Direct threats

(1) Poaching and the trade in bushmeat

Cross-border poaching is carried out by Congolese who come to hunt in Gabon and supply food to Brazzaville⁶. Hunters with 4x4 vehicles operate at night from Franceville, sometimes using official vehicles. Their activities are facilitated by the open nature of the terrain.

(2) Fires

Anthropogenic bush fires have probably become too frequent for biodiversity to be maintained: many sections of the national park catch fire at least twice a year.

Indirect threats

(1) Low management capacity

Human and financial resources, infrastructure and equipment are insufficient to be able to manage the national park effectively.

(2) Institutional weaknesses

In Gabon, there is no clearly defined wildlife management policy in the forest law, although the latter has a section entitled 'wildlife planning and management'. There is also no legal executive structure with the capacity necessary to manage the national parks. CNPN is an 'interdepartmental council' that was created for the guidance and supervision of the network of national parks. A bill to create a 'national parks agency' was drafted in 2005⁷.

State of the vegetation

As in many other regions, the areas around the urban centers are subject to growing deforestation. There are extremely frequent fires on the savannahs (at least twice a year) and their plant cover has perhaps suffered irreversible degradation. However, this is very difficult to determine because the savannahs have been burning for centuries, perhaps even millennia⁸.

State of the fauna

The lion and serval are in a critically endangered state and may have already disappeared. The spotted hyena and the African wild dog *Lycaon pictus* have surely disappeared, the latter from a large proportion of all sub-Saharan Africa during the second half of the 20th century⁹ and the black rhinoceros *Diceros bicornis* even longer ago¹⁰. The

hippopotamus *Hippopotamus amphibius* has disappeared from Batéké Plateau National Park¹¹.

Financing and conservation

In Gabon, current prospects for conservation financing are as follows:

- Financing from the John Aspinall Foundation for the PPG is ensured for the next ten years but there is still no cooperative agreement.
- USAID funds are anticipated for another three years.
- FORINFO financing for environmental education for a year is probable.
- GEF will probably provide three years of financing to monitor hunting in the peripheral area of the national park.
- The AFD could be interested in one-off investments in infrastructures and the FFEM in environmental education.

Environmental education and capacity building

Activities in this field have been very dynamic, thanks to the Gabonese official who has been in charge since July 2004 and a partnership forged with the specialized NGO RARE, which has assisted in training and supervision. A good part of the efforts (around 50%) in 2006 will be focused on this activity. On the other hand, there is no local NGO or even a tradition in 'collectivism', so there is no possibility of supporting local NGOs.

The creation of a new association based in Franceville (the '*Maison du tourisme et de la nature*') has received support. It has already organized several events and in 2006 is going to create an ecomuseum in Franceville with a budget from FFEM and the *Coopération française*.

Management of renewable natural resources

(1) At the Landscape level

Outside the protected areas, conservation activities are virtually non-existent. In March 2005, WCS supported a workshop in Franceville to bring together the technical directors of Water and Forests in the Republic of Congo (departments of Plateaus and Lekoumou) and Gabon involved in the Landscape, for an initial consultation to formulate cooperation strategies to address transborder poaching. In 2006, these meetings will continue with the involvement of sub-prefects and prefects from the districts and/or

⁶ In Gabon, the village communities are far from the park; they are small communities with very limited impact on the park or its periphery. The main threat comes from commercial hunters from the towns and cities. Therefore, a plan to mobilize villagers so that they contribute towards the protection of their area and do not themselves pose a threat is set for 2006, within the context of environmental education activities (probably through the GEF project). With the USAID-CARPE budgets, it is impossible to work both within and outside of the park.

⁷ In Gabon, the creation of the network of national parks has been a significant advancement. However, the process of setting up a management agency and recruiting and training personnel for the national parks has been slow. This process includes obtaining financing (governmental, national or international). The absence of a national policy or will to combat poaching is another handicap. The next two years will be critical to assess the progress being made.

⁸ The savannahs of the Batéké Plateau have an edaphic and historical origin. Their present day extension is the result of the last glaciation and it is very difficult to know what they would look like without the long existing fires. An ethnobotanical study of this question (by Gretchen Walters) is to begin in April 2006.

departments concerned (Léconi and Boumango in Gabon; Lekana, Zanaga and Bambama in the Republic of Congo). The next meeting is to be held before the end of the first quarter of 2006. Ecological and socioeconomic studies carried out in the Congolese portion of the Landscape to demarcate the future protected area also constitute a beginning for the introduction of transborder strategies for the management of natural resources. They have allowed village territories to be identified, which over the course of 2006 will make it possible to propose an overall zoning plan. In 2006, additional participatory cartography will allow for more precise zoning around the Léfini reserve.

(2) In the protected areas

In the Léfini reserve, surveillance is very ineffective. In Batéké Plateau National Park, management was not in effect until 2004. It includes close cooperation with PPG, which manages the gorilla sanctuaries in the Republic of Congo and Gabon. On the ground, bases have been identified, platforms for the installation of tents have been laid and three qualified ecoguards have been assigned to surveillance. They are being assisted by three village trackers. Transborder poaching remains the main problem and measures have been taken to work with the authorities on either side of the border to try to stop this practice.

(3) In the rural areas

Discussions with IGAD took place to implement small rural development projects that would offer alternative resources to the populations. Following socioeconomic surveys, however, it emerged that the villagers around Batéké Plateau National Park were not interested in the 'intensification' of agriculture or stock farming (or perhaps aviculture). On the other hand, they welcomed the tourism studies organized in May 2005¹². Community tourism, combined with the development of tourism in the park, may represent the only alternative economic activity in rural areas close to the park.

Natural resources and governance

Technical and administrative coordination of activities at the Landscape level began with a meeting of Gabonese and Congolese partners in Brazzaville in 2004. A technical follow up meeting was held in February 2005. The meeting focused on the monitoring of transborder poaching, which is still absent. Meetings with local communities have also taken place, but their involvement is only in its infancy. Cooperation between the technical support NGOs (WCS and PPG) and the Ministries of Water and Forests of the Republic of Congo and Gabon and the CNPN in Gabon is evolving.

Monitoring of natural resources

Ecological monitoring activities are being carried out at present in the existing protected areas (Batéké Plateau National Park and Léfini), as well as in the proposed protected area of Bambama-Lekana.

Unfortunately, there is still no metadata bank. Numerous data are available, but there is still no comprehensive collection of management information, spatial data or bibliographical references at the level of Batéké Plateau National Park or the Landscape¹³.

⁹ The African wild dog has never been mentioned in the Gabonese part of the Landscape, but it did exist in the Pool region in the 1940s and in the Niari valley. The spotted hyena also existed in the Niari valley and in the Pool region. It survives in Odzala (Henschel, pers. comm.).

¹⁰ Two teeth of the black rhinoceros, dating from 7,000 BP, were found in Ntadi Yomba in the middle valley of the Niari in the 1980s (Van Neer and Lanfranchi, 1985). In addition, the presence of black rhinoceros was reported in the 20th century in the dense moist forests of southeast Cameroon and the Republic of Congo (Lavauden, 1934; Blancou, 1954), but this has never been confirmed. It cannot be ruled out that this species lived on the Batéké plateaus in recent millennia.

¹¹ Hippopotamuses used to live in the Lewou River, but they have since disappeared (Henschel, pers. comm.).

¹² A detailed review has been produced of the tourist studies conducted in the villages and the national park in May 2005 and a feasibility study on several ecotourism products was circulated in November 2005.

¹³ The final ecological monitoring report on Batéké Plateau National Park is expected by March 2006, as is the final sociological report. A first meeting on the management plan for Batéké Plateau National Park could be organized at the end of March 2006 and a first draft could be available during the second half of 2006 for discussion.

18. Lake Télé-Lake Tumba Landscape

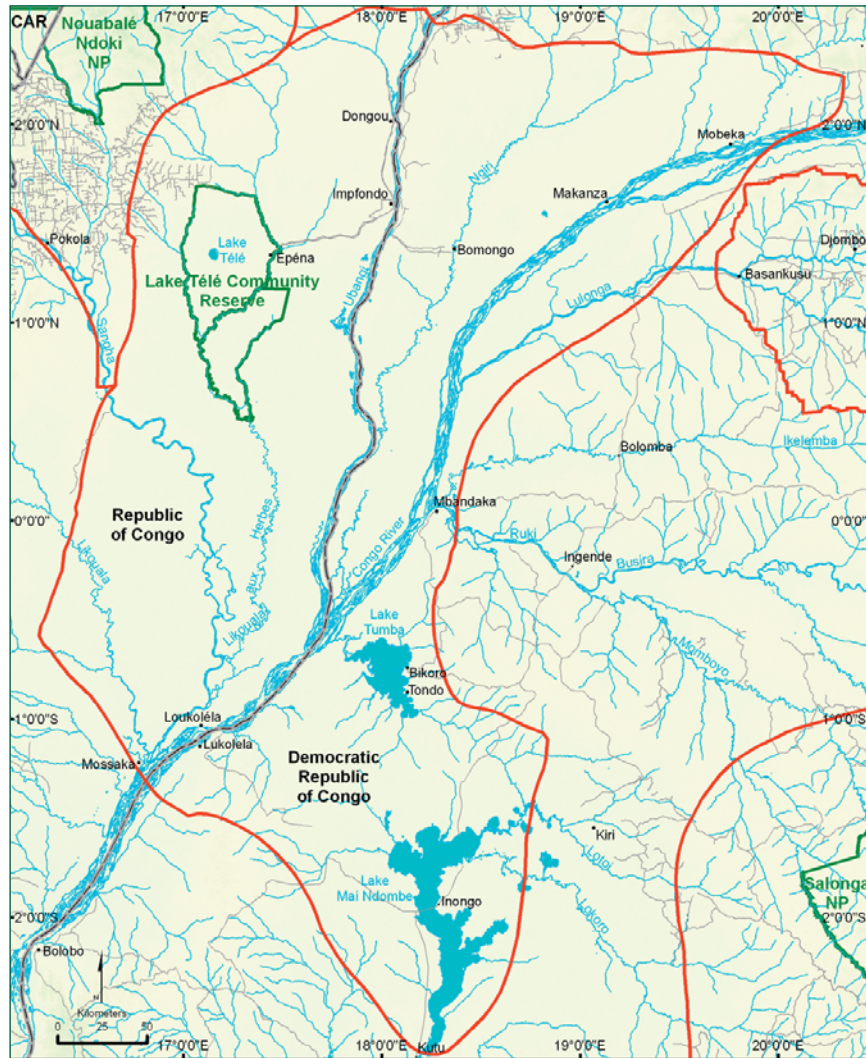


Figure 18.1. Map of Lake Télé-Lake Tumba Landscape (Sources: AWF-DRC, CARPE, JRC, SRTM, WCS-Congo, WWF-DRC).

The Landscape in brief

Coordinates: 2°35'2"N – 2°41'27"S; 16°16'15"E – 20°19'35"E

Area: 126,440 km²

Elevation: 300-330 m

Terrestrial ecoregions: Northwest Congolese forests ecoregion

Western Congolese swamp forests ecoregion

Eastern Congolese swamp forests ecoregion

Central Congolese forests ecoregion

Aquatic ecoregions: Ubangui ecoregion

Central Basin ecoregion

Lake Tumba ecoregion

Lake Mai-Ndombe ecoregion

Kasai ecoregion

Protected areas: Lake Télé Community Reserve, 440,000 ha, 2001, Republic of Congo

Mabali Scientific Reserve, 1,900 ha, Democratic Republic of Congo

Location and area

The Lake Télé-Lake Tumba Landscape is situated at the heart of the Congo Basin region, centering on Lake Télé in the Republic of Congo, and the Tumba and Mai-Ndombe lakes in DRC (Figure 18.1). It extends over an area of 126,440 km². The 54,001 km² western section is situated in the Republic of Congo and the 72,439 km² eastern section is in DRC. It includes one protected area: Lake Télé Community Reserve in the west.

Physical environment

Relief and altitude

The entire Landscape is located in the alluvial plain of the Central Basin region of the Congo

River. The altitude varies between 300 and 330 m and its relief is highly uniform, with very indeterminate watersheds separating the poorly-defined drainage basins.

Geology and soils

The bedrock of Cretaceous sediment is entirely covered by post-Upper Pliocene lacustrine or fluvio-lacustrine sediment forming yellow sandy-clay soils. The alluvial formations from the Holocene era, which occupy the floors of the large valleys and the whole region between the Congo and Ubangui rivers, have a low clay content and are characterized by a very fine sandy fraction. The soil is waterlogged throughout the year, often having a black, organic, peaty or semi-peaty superficial horizon. (Marlier, 1973).

Hydrology

The entire Landscape is located in the basin of the Congo River, which traverses this area over a length of nearly 500 km (Figure 18.2). It comprises the confluence of the Congo River with the Ubangui, Sangha, Likouala-aux-herbes and Ngiri rivers. Two very shallow lakes are located in the eastern section. Lake Tumba (765 km²) drains the Loko, Bituka, Lobambo and Nganga rivers; it flows directly into the Congo River via the Irebu channel and its maximum depth does not exceed 8 m, but seasonal variations in its level may reach 4 m (Figure 18.3). Lake Mai-Ndombe (2,300 km²) drains the Lokoro and Lotoi rivers and flows indirectly into the Congo River via the Fimi, Lukenie and Kasai rivers. Its average depth is 3 m. The waters of these lakes are black, humic, acidic, chemically poor and loaded with plant detritus¹. In the western section, Lake T  l   is smaller in size, at 23 km², but physically resembles the other large lakes in the Landscape. Unlike the waters of the swamp and floodable forests, water in the lakes is oxygenated to its full depth because of the violent winds that periodically agitate the surface. All watercourses have a very shallow incline (3 cm/km) and therefore run very slowly. Throughout the Landscape water levels vary by around 3 m, but in the Ubangui these variations may reach 5 m. During periods of flooding in the southern part of the Congo Basin, the direction of water flow is actually reversed and the water washes back hundreds of kilometers northwards. In addition to the principal waterways, the Landscape is crossed by a dense maze of narrow channels that link together the major watercourses. A large part of the Landscape is flooded permanently or



Figure 18.2. The Congo River with its multiple side-arms.



Figure 18.3. Lake Tumba.

during the flood period, which limits access and hampers road construction. During the main flood periods, water accumulates behind natural dams formed by alluvial levees and only flows very slowly through small channels.

Climate

Annual rainfall ranges from 1,600 to 2,000 mm on average. Precipitation reaches a maximum in October-November and March-May, but there is no real dry season in the areas close to the equator. Hours of sunshine exceed 2000 per annum. The mean annual temperature is 25°C with very little seasonal variation (Marlier, 1973).

¹The pH of the water in Lake Tumba is 4.5-5.5 and transparency is limited to 2 m (Corsi, 1984). Plankton are rare (Bailey, 1986).

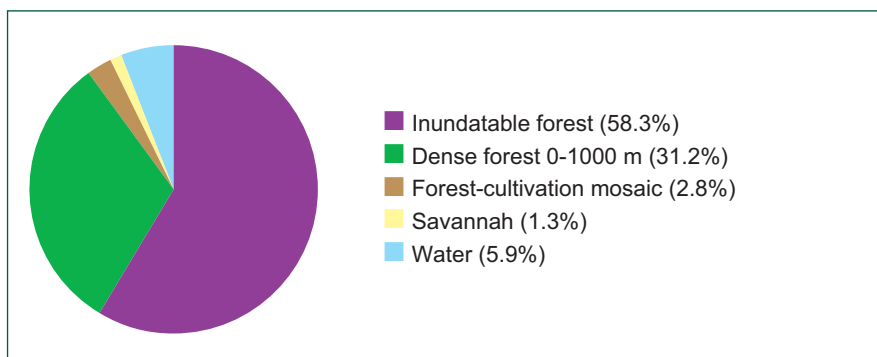


Figure 18.4. The main vegetation types (Source: JRC).

Vegetation

In the western section, apart from rare islands of dryland forest, the majority of the forests are permanently or temporarily flooded (Figure 18.4). According to estimates by Poulsen & Clark (2002) carried out for the community reserve of Lake Télé, dryland forests cover 44,000 ha (10%), swamp forests 215,600 ha (49%), riparian forests 35,200 ha (8%) and floodable forests 74,800 ha (17%). Floodable herbaceous vegetation covers 70,400 ha (16%).

The swamp forests, which are almost permanently flooded, are characterized by the presence of the following species: *Entandrophragma palustre*, *Coelocaryon botryoides*, *Hallea stipulosa*, *Alstonia boonei*, *Nauclea pobeguinii* and *Symphonia globulifera*. The swamps associated with small streams are occupied by forests of *Lasiodiscus mannii*. The floodable forests are characterized by the presence of *Lophira alata*, *Gambeya perpulchra* and *Uapaca heudelotii*. The riparian forests are dominated by *Uapaca heudelotii* and *Guibourtia demeusei*. The dryland forests, mainly situated at the center of the reserve, are characterized by the presence of various species of *Entandrophragma* and by *Terminalia superba*, *Pterocarpus soyauxii* and *Piptadeniastrum africanum*. There are also monodominant stands of *Gilbertiodendron dewevrei*. Herbaceous vegetation is dominated by *Hyparrhenia diplandra*. There are also extensive areas of raffia palms (*Raphia* spp.).

In the eastern section, swamps or floodable forests cover 60–65% of the area. They are characterized by the presence of numerous Euphorbiaceae (*Alchornea floribunda*, *A. birtella*, *A. cordifolia*, *Uapaca guineensi*, etc.) and Caesalpinioideae, notably *Guibourtia demeusei*. The remaining 35–40% of dryland forests, chiefly located in the south of the Landscape, are punctuated by islands of savannah. These forests comprise mixed vegetation, characterized by the presence of Burseraceae, such as *Dacryodes edulis*, *D. yangambensis* and *Canarium schweinfurthii*, and a monodominance

of *Gilbertiodendron dewevrei*. A large part of these forests were commercially harvested up until 1975 and were replaced by forests of Marantaceae (including *Haumania liebrechtsiana*, *Sarcophrynium* sp. and *Megaphrynium macrostachyum*).

Fauna

Mammals

In the western section, the forests of the community reserve are home to large populations of gorilla² and chimpanzee³ (Fay *et al.* 1989, Fay & Agnagna 1992, Blake *et al.* 1994). In addition to primates, the four main species of large mammals are the elephant *Loxodonta africana cyclotis*, the hippopotamus *Hippopotamus amphibius*, the buffalo *Syncerus caffer* and the sitatunga *Tragelaphus spekei*. Nine species of diurnal primates are known, notably the agile mangabey *Cercocebus agilis*, the white-cheeked mangabey *Cercocebus albigena*, as well as the swamp monkey *Allenopithecus nigroviridis* and De Brazza's monkey *Cercopithecus neglectus* which are often found together. The mantled guereza *Colobus guereza* and Central African red colobus *Piliocolobus oustaleti* are found throughout the community reserve. Altogether, there are a total of 16 endangered species (Annex C).

In the eastern section, primates are represented by the bonobo *Pan paniscus* (on the left bank of the Congo River), the common chimpanzee *Pan troglodytes* (on the right bank of the Congo River), the Angola colobus *Colobus angolensis*, Thollon's red colobus *Piliocolobus tholloni*, the golden-bellied mangabey *Cercocebus chrysogaster*, the swamp monkey *Allenopithecus nigroviridis*, the black crested mangabey *Lophocebus aterrimus*, the red-tailed monkey *Cercopithecus ascanius*— which is replacing mustached guenon *C. cephus* in the eastern portion of the Landscape — and De Brazza's monkey *C. neglectus*. Among the other large mammals that are variably present are the elephant, buffalo and leopard *Panthera pardus*. The hippopotamus is also present.

Birds

In the western section, over 350 species have been found in the community reserve and this is considered to be an important area for bird conservation, particularly owing to the presence of large colonies of water birds: the African darter *Anhinga rufa* and the purple heron *Ardea purpurea* (Fishpool & Evans, 2001). There are three threatened species in the reserve: Hartlaub's duck

² Recent censuses (2002–2005, Poulsen & Clark, 2004) have recorded a density of gorillas of 3–4/km². Gorillas move seasonally between terra firma forests and swamps or floodable forests. Local density may reach 20/km². Blake (1994) also found gorillas in raffia palm areas at a density of 5/km².

³ The density of chimpanzees is 0.7/km².

Pteronetta hartlaubi, the great snipe *Gallinago media* and the African skimmer *Rynchops flavirostris*.

Herpetofauna

In both sections (Republic of Congo and DRC), the three African species of crocodile are present. The Nile crocodile *Crocodylus niloticus* inhabits the large watercourses in small numbers, the slender-snouted crocodile *Crocodylus cataphractus* is very widespread, also in low-density populations, while the dwarf crocodile *Osteoleaemus tetraspis* is restricted to the swamp forests. A complete inventory of herpetofauna has not been carried out.

Ichthyofauna

The Landscape is divided into five aquatic ecoregions: Ubangui, the Central Basin, Lake Tumba, Lake Mai-Ndombe and Kasai. It is probable that the ichthyofauna is very rich. In the western section, it has been studied by WCS and at least 40 species have already been recorded. In the eastern section, ichthyological studies have been conducted in the Tumba and Mai-Ndombe lakes (Corsi, 1984; Bailey, 1986). Lake Tumba is home to 119 fish species (Marlier, 1973; Compere & Simmoens, 1987) the most common of which are *Auchenoglanis occidentalis*, *Clarotes laticeps*, *Gephyroglanis congicus*, *Clarias buthopotogon*, *Distichodus sp.* and *Channa obscurus* (Corsi, 1984). Several species are endemic to the lake or its immediate environs, in particular *Clupeocharax schoutedeni* and *Tylochromis microdon*. Lake Mai-Ndombe is much less well known, but its ichthyofauna was recorded at 41 species in 1918 and it is probable that the actual number is much higher. Three species are endemic: *Amphilius opisthoptalmus*, *Hemichromis cerasogaster* and *Nanochromis transvestitus*. The Landscape also comprises an extensive portion of the middle reaches of the Congo River, where 206 species of fish have been recorded, including *Protopterus dolloi*, *Hydrocyon vittiger* and *Hydrocyon goliath*, three species endemic to the Congo Basin.

Humans in the Landscape

Density and Distribution

In the western section, almost all the landscape villages are situated along roads and rivers. In 2001, 22 villages surveyed in the community reserve of Lake Télé had a total population of 13,400 inhabitants (Poulsen & Clark, 2002).

New censuses in 2005 found a total population of 14,390 inhabitants (RCLT Project, not published), suggesting an increase of 1-2% a year. However, this second census included workers living temporarily in the reserve. The village populations range from 64 to 2,280 people. The population is young: 59% under 20 years of age. The regional capital, Impfondo, numbers at least 14,000 inhabitants.

In the eastern section, the population density is variable, with significant clusters around Mbandaka, the main town in the province of Equateur. Situated at the heart of the eastern section of the Landscape, this town has grown rapidly: in 1984 it had 124,263 inhabitants. The population rose to 136,738 in 1990 (De Saint Moulin, 1991) and is probably around 500,000 at present. The 300,000 people displaced by the war between 1998 and 2003 need to be added to this figure. Outside of Mbandaka, the population density is estimated to be 23.9 inhabitants/km² in the Bikoro area, 6.2 inhabitants/km² around Makanza, 18.5 inhabitants/km² around Lukolela and 7.9 inhabitants/km² around Bomongo (UNDP/UNOPS, 1988).

Ethnic groups

In the western section, 91% of the population in the community reserve belongs to the Bomitaba group, represented by the subgroups Babole, Nzobo and Bokolou. A small number of semi-nomadic Pygmies also live around the reserve, often for short periods. The rest of the population consists of Congolese from other regions of the country and some immigrants from neighboring countries.

In the eastern section, the southeast portion is inhabited by six Mongo groups: the Basengele, Bolia, Bokote, Ekonga, Ntomba and Losakanyi. They cohabit with a minority of Batwa Pygmies. The Ntomba are the dominant group in the area of Bikoro within Equateur province. The northwest part, between the Congo River and the Ubangui, is inhabited by a cultural mosaic of 13 ethnic groups with very different sensibilities and knowledge concerning the use of renewable natural resources. These groups are the Bobangi, Baloi, Libinza (or Balobo), Boloki (or Iboko-Mabale), Bapoto, Djamba, Lobala, Likoka (or Ngili or Likawe), Bamwe (or Djando), Bonkula, Bodzinga, Ndobu, Mbonji and Ngombe. This broad cultural diversity is further increased by the fact that certain groups are actually an amalgam of subgroups with different cultural characteristics⁴. However, what all these groups have in com-

⁴ The Bamwe are divided into 12 smaller entities: the Monya, Giyando, Moliba, Ebuku-Lingonda, Sombe, Lifonga, Limpoko, Likata, Bomole, Libobi, Mondongo and Bobaza.

mon is that their livelihoods basically depend on aquatic resources, particularly fish.

Activities

In the western section of the Landscape, the greater part of the population is principally engaged in farming; as well as other activities: fishing, hunting, trade and livestock farming (Table 18.1). About 85% of the protein in the diet of the population is derived from fishing and 6% from hunting. The populations depend on the forest and rivers for more than 90% of their normal protein intake. The main staples are cassava, maize and bananas, with seasonal crops of the African plum. The main livestock are poultry, ducks, pigs, goats and sheep.

In the eastern section, socioeconomic studies by WWF around Lake Tumba have shown that farming, fishing and the gathering of non-timber forest products constitute the main occupations and generate the bulk of the income of local communities (Table 18.2). Approximately 15% of the population has permanent employment in education, local administration or the police, but these activities only provide very low incomes and the majority of these employees report that they have to supplement their salaries from farming and fishing.

Cassava, maize and bananas are the staple cultivated crops throughout the eastern section of the Landscape. Plantations of oil palms are the principal commercially cultivated product in the northern part of this section, particularly in the areas of Bomongo and Mankanza. Groundnuts and rice are cultivated in the southern part, but rice cultivation has also recently been introduced in the north. In addition, sweet potatoes and sugarcane are found throughout in small quantities.

Fishing is the second most important activity and fish is the most highly regarded food culturally in most areas of the Landscape. In certain regions (Mobeka, Mankanza, Bomongo) fish is also a commercial product: the fish is smoked and sold to the boats which go down to Mbandaka, Kinshasa and Brazzaville. In the region of the Tumba and Mai Ndombe lakes, studies have shown that fishing is also practiced by fishermen who come from distant towns situated outside the Landscape and who use a large number of nets. The local inhabitants complain about the commonly acknowledged reduction in fish stocks. This perception is confirmed by WWF studies carried out at Lake Tumba⁶.

The gathering of non-timber forestry products is carried out on a large scale. The raffia palm *Raphia sese* and rattan *Laccosperma secundiflorum* are collected for craft activities. Other products sought include the bark of *Scorodophloeus zenkeri*, the roots of *Aframomum*, copal from *Guibourtia demeusei*, leaves or young shoots from Marantaceae, the fruits of *Dacryodes edulis*, *Coula edulis*, *Canarium schweinfurtii* and *Anonidium manni*, mushrooms and caterpillars. All these products are traded to different degrees, but apart from firewood, they generate very little monetary income. They are common property and collected within well defined areas for each village⁷.

Land use

Within the Landscape, 3.5% of the area (440,000 ha) is occupied by the community reserve. The remainder (12,644,000 ha) is made up of land that has not been zoned (Figure 18.5). In the eastern section, there is the small Mabali Scientific Reserve (1,900 ha or 0.02% of the eastern part of the Landscape).

Logging

In the western section of the Landscape, industrial logging is restricted to the outskirts of the Landscape, where it adjoins the Sangha Tri-National Landscape. The poor quality of timber and logistical or access problems only permit very limited small-scale exploitation in the swamps or floodable forests.

In the eastern section of the Landscape there are 10 concessions—8 in the south, 2 in the north—four of which are in operation. These concessions have been awarded to six companies (CFT, SODEFOR, SCIBOIS, SOCOBELAM, BIMPEAI and SOMI-CONGO) who are engaged in prospecting or logging. These conces-

⁵ Not to be confused with occupation: many children report 'going to school' as an activity and 60% of the women report working 'in the home'.

⁶ These studies show that while there is a considerable amount of fishing, the fish catches per unit are extremely low and certain species formerly known to be in the lake seem to have disappeared.

⁷ Each village has a clear knowledge of the boundaries of its territory, which is used not only for farming but also for foraging, hunting and fishing. These territories are administered by the traditional chief, assisted by a cohort of elders acting as advisers to the chief.

Table 18.1. Activities of populations in the community reserve of Lake T  l  , Republic of Congo (Poulsen & Clark, 2002).

Activity ⁵	% primary activity		% secondary activity		% tertiary activity	
	Men	Women	Men	Women	Men	Women
Farming	51	85	32	15	13	5
Fishing	22	12		77		
Hunting	10		13			
Small-scale trade		2		5		27
Stock farming			29		47	47
Crafts					10	

Table 18.2. Economic activities in the area surrounding Lake Tumba, DRC, calculated on the basis of 460 households surveyed in 36 villages selected at random.

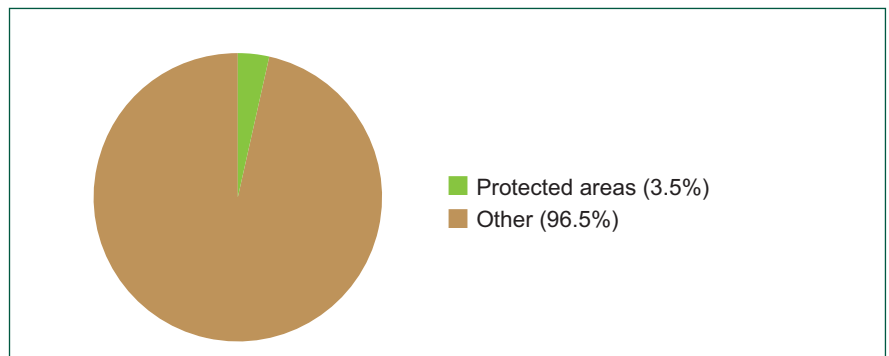
Activities	Absolute frequency	Relative frequency
Farming	96.7 %	28.4 %
Hunting	36.1 %	10.6 %
Fishing	82.6 %	24.2 %
Foraging	54.6 %	16.0 %
Trade	33.7 %	9.9 %
Crafts	22.2 %	6.5 %
Traditional medicine	7.2 %	2.1 %
Temporary employment	2.2 %	0.65 %
Permanent employment	15.2 %	0.04 %
Retired	0.2 %	0.06 %
Other	1.7 %	0.50 %
Average number of activities per family	3.5 %	1.03 %

Figure 18.5. Main land use types.

sions cover almost 40% of this section of the Landscape. Most are concentrated in the south where there is an abundance of species such as tiamma *Entandrophragma angolense*, sipo *E. utile*, dabema *Piptadeniastrum africanum*, afina *Strombosia tetrandra* and, above all, wenge *Millettia laurentii*. Wenge accounts for about 75% of the wood extracted between the Tumba and Mai Ndombe lakes.

Reasons for the identification of the Landscape.

- (1) The region of flooded and floodable forests of the central region of the Congo Basin covers a total area of over 200,000 km², representing the second-largest swamp after the Pantanal in South America and the largest tract of floodable forest in the world (Vandeweghe, 2004). It constitutes a unique ecosystem in Africa.
- (2) The region plays a key role in regulating the hydrological conditions of the Congo Basin and the climate of Central Africa.
- (3) The only protected area in this complex, the community reserve of Lake Télé (440,000 ha) in the Republic of Congo, is one of the few protected areas of Central Africa to preserve huge expanses of flooded and floodable forest. Initial surveys show that it is rich in both botanical and zoological species and that it has at least 23 species of mammals and birds on the IUCN red list, the highest density of gorillas observed in Central



Africa, a highly diversified herpetofauna and ichthyofauna with several endemic species and a very large population of black crocodile, one of the most endangered crocodile species in the world.

- (4) The Mai-Ndombe and Tumba lakes alone represent two aquatic ecoregions with their particular range of species and endemic species.

Conservation

History

In the Republic of the Congo, Lac Télé Community Reserve was created on 21 May 2001. It comes under category VI of protected areas according to the IUCN and covers 440,000 ha. In the DRC, the Landscape accommodates

⁸ The Mabali reserve was created in 1949 by the Belgian government for the *Institut de recherche scientifique en Afrique centrale* (IRSAC) to study the regeneration of low altitude forest following timber extraction, the ecology of four primate species present at the time (the black crested mangabey, the red-tailed monkey, Wolf's mona monkey and the Angola colobus) and in particular the response of primates to forest exploitation.

the small Mabali Scientific Reserve of almost 1,900 ha and representing just 0.02% of this section of the Landscape⁸.

Players

The community reserve of Lake Télé is managed in partnership by the Ministry of the Forest Economy and Environment and WCS. There are also local NGOs, the most effective of which is *Conservation de la Fauna Congolaise* (CFC). It is active on the outskirts of the reserve and assists in developing the sustainable management of resources in two villages. In the eastern sector, administration of the Mabali reserve has been entrusted to the *Centre de recherche en écologie et foresterie*, a body of the Scientific Research Ministry of DRC. Within this segment of the Landscape, WWF is working in cooperation with the Ministry for the Environment, Nature Conservation, Water and Forests, the Bonobo Conservation Initiative (BCI) and Innovative Resources Management (IRM).

Direct threats

(1) Commercial hunting.

In the western section of the Landscape, commercial hunting for bushmeat and ivory is the greatest immediate threat to the fauna. Much of this activity is organized by people who live outside the community reserve, but who supply guns and organize the export of the products. This hunting is carried out mainly along the roads and rivers and has had a devastating effect all along the road running from Impfondo to the reserve. In the northwest, logging companies have created new roads which now reach into the reserve and have opened up the forest to hunters and meat traders. This trade combines with that in ivory along the same roads. Ivory buyers, soldiers and police officers bring in weapons (AK47s and grenades) and leave with the tusks and meat which are resold in the markets of Brazzaville and Impfondo.

In the eastern section, hunting is also a serious threat, particularly in the southern part of the Landscape where there are larger tracts of terra firma forest. The greatest danger comes from the military training camp situated at the mouth of the Irebu Channel, 90 km southwest of Mbandaka. Unpaid and undisciplined soldiers live from hunting, notably elephant, hippopotamus, red river hog and buffalo (WWF/BCI, 2005). However, all the large mammals are hunted. Hunting using metal snares is very intensive and the most sought after species are those with significant meat: elephant, hippopotamus, buffalo, red river hog and

all the diurnal primates.

One particular case of hunting is the hunting of the live young of great apes (bonobo and chimpanzee) for sale as domestic pets in the large towns. This hunting is all the more destructive as it necessitates slaughtering the adults.

(2) Village hunting and foraging

In the 22 villages situated in the community reserve there are some 14,000 people of whom 95% are highly dependent on fishing, hunting and the sale of other forest products for their survival. In the medium term, this situation cannot be sustainable.

(3) Fishing

In the eastern section of the Landscape, fishing is practiced in an intensive, anarchic and uncontrolled fashion, mainly by fishermen coming from regions outside the Landscape. National regulations concerning the mesh size of nets are completely disregarded.

(4) Brush fires

Each year huge tracts of forest around savannah areas, particularly riparian forests, are deliberately burned, creating problems that affect fishing, increase erosion, reduce the navigability of rivers and deplete available firewood.

(5) Diseases

No epidemic diseases have been recorded in the fauna, but owing to the high-density of gorillas, Ebola fever could have a devastating effect. Unvaccinated domestic animals could also transmit diseases to wild bovids, particularly as many cattle are imported into the region using opened roads.

(6) Oil extraction

Oil prospecting by ESSO has revealed the presence of hydrocarbon deposits in the Congo Basin near Mbandaka. For political reasons, these deposits have never been worked, but could be in the future. This would risk increasing immigration into the region and could have disastrous environmental impacts on the aquatic ecosystems and the very fragile environments of the flooded and floodable forests.

Indirect threats

(1) Geographical location

Situated at the confluence of several major waterways, large numbers of people are continually crossing through the Landscape in boats.

They trade products, such as soap, sugar, salt, fishing hooks, nets and clothing for smoked fish and bushmeat, which encourages non-sustainable hunting and fishing.

(2) Demography

With an internal demographic growth rate of 3.8% per year in the eastern section (De Saint Moulin, 1991), the increase in the population has accelerated, partly due to the immigration of labor for logging operations located at the heart of the eastern section of the Landscape and partly due to the displacement of people by war, specifically into the eastern part.

(3) Lack of knowledge

It is unknown if the fish catches, which provide 90% of protein intake for the human populations, are sustainable. A study to monitor the situation has been launched in the community reserve of Lake Télé and a study of fish stocks is in progress in Lake Tumba and the Congo River.

(4) Poverty and the lack of alternative means of subsistence

This is a very important factor in encouraging people to exploit the available forest resources in an ever more intensive and unsustainable manner.

(5) Absence of supervision

In the scientific reserve there is nobody to enforce laws and regulations⁹.

(6) Climatic and hydrological disturbances

Currently, the hydrological balance in the central basin region appears to be negative and the level of Lake Tumba, for example, is dropping at an alarming rate¹⁰. This phenomenon may be temporary, cyclical or a manifestation of longer-term climatic changes. Any additional extraction of water from the Congo Basin, notably in connection with the planned construction of the Ubangui-Chari canal, however, could exacerbate and seriously affect the fragile ecosystem of flooded and floodable forests in the central basin region.

State of the vegetation

In the western section of the Landscape, the forests are still quite intact thanks to their impenetrability, both on foot and by vehicle. In the eastern section of the Landscape, a halo of rapid deforestation has developed around Mbandaka, not only for the construction of housing but also for producing firewood.

In the eastern section of the Landscape, the dryland forests in the south are chiefly older secondary forests. The last timber felling operations date back to 1975. In the scientific reserve, large expanses have been cleared to plant cassava crops by the staff at the research station¹¹. The local population also uses the reserve for farming, fishing and illegal felling of wenge. A tree found in the riparian forest, *Guibourtia demeusei*, is highly prized as firewood and becoming increasingly rare around Mbandaka; gatherers have to go ever further into the forest to find it.

State of the fauna

In the western section, the swamp and floodable forests of the community reserve still contain substantial populations of large mammals, notably gorilla, but certain areas have nevertheless been overexploited by commercial hunting for meat and ivory¹².

In the eastern section, the Angola colobus has become very rare or has disappeared from the scientific reserve¹³ and WWF studies underway at Lake Tumba indicate a severe decline both in the specific composition and in the abundance of fish. In addition, these studies have revealed the existence of small populations of forest elephants in the region situated between the Tumba and Mai Ndombe lakes, as well as between Bomongo and the Congo River. These studies have supplemented those conducted by BCI and make it possible to pinpoint six groups of bonobo in the area between the Tumba and Mai Ndombe lakes, as well as at the edge of the Landscape between Bolobo, Fimi and Mushie, in the province of Bandundu.

Environmental education and capacity building

Teams of training and information personnel regularly visit each village and two new staff members have been recruited.

Management and governance in the field of renewable natural resources

(1) Across the Landscape

No zoning or planning exists for the Landscape as a whole.

(2) In the community reserve

In the western section, management has been developed using a Landscape-wide approach and conservation of biodiversity has been included in a sustainable community management policy for

⁹ Despite the support of the Bonobo Conservation Initiative (BCI) and in spite of its old but substantial infrastructures, the scientific reserve remains a reserve on paper only.

¹⁰ These observations are confirmed by the Mabali research station.

¹¹ These personnel have not been paid for a long time and, all research having ceased, there were no means of survival other than cultivating crops.

¹² Blake (1995) counted 228 gorilla nests in 1993 near the road shortly after its completion. Observations in the same areas in 2005 did not record a single nest.

¹³ According to a recent study conducted by WWF in the scientific reserve, no member of this species was observed (Mwanza, pers. comm.).

the reserve and for areas on the outskirts of the Landscape.

The Lake Télé Community Reserve project has the primary objective of implementing and improving a participatory approach to managing the renewable natural resources of the local communities. Each community has traditional territories in which it has the authority to utilize its resources for hunting, fishing and farming. All the territories were mapped in 2005 and, as 95% of the population is made up of indigenous Bomitaba, it is anticipated communities will be motivated to implement sustainable management. Participatory management is in the process of being implemented in the reserve. In 2006, pilot development programs will be launched for alternative means of subsistence.

Supervision is being provided by staff from the Ministry of Forest Economy and the Environment (MEFE): one conservation officer and seven eco-guards. In addition, the regional MEFE office in Impfondo is cooperating, within the limits of its resources, to organize joint patrols of the roads and rivers leading to this town. The regional office also takes part in monitoring cross-border movements of bushmeat. In 2005, ten military weapons with their ammunition and a grenade were seized by the staff of the community reserve. The establishment of a network of informers has allowed information to be obtained about individuals possessing weapons and their location in the reserve. Part of the development of participatory community management consists of encouraging observance of the law by the communities and visitors to the reserve.

In the eastern section, there are no protected areas—apart from the token scientific reserve—and in order to preserve the environment of this Landscape with its fauna, in particular the bonobo, it is essential that one be created. The government of DRC, in partnership with WWF and local communities, is therefore working on a project to create a reserve of 750,000 ha in category VI according to IUCN criteria. However, this project requires the involvement of donor funding, which could be achieved through the CBFP.

Monitoring renewable natural resources and their management

(1) *Large mammals*

Monitoring populations of large mammals entered its third year in 2006 and aims to evaluate the effects of management on the animal populations. The evaluations in 2004 showed that the populations are probably stable but that it will take four years of monitoring to determine the precise trends.

(2) *Aquatic birds*

In 2006, monitoring of aquatic bird populations entered its 10th year and showed that the populations are stable.

(3) *Hunting, fishing and the trade in bushmeat*

Programs to monitor levels of hunting and fishing were started in 2005 in the community reserve, by WCS, to establish whether these are sustainable. A program has been launched to determine the origin and volume of bushmeat going to Impfondo. Monitoring of the cross-border trade in bushmeat will be discussed at a meeting between the partners of the Republic of Congo and those of DRC in 2006.

19. Salonga-Lukenie-Sankuru Landscape

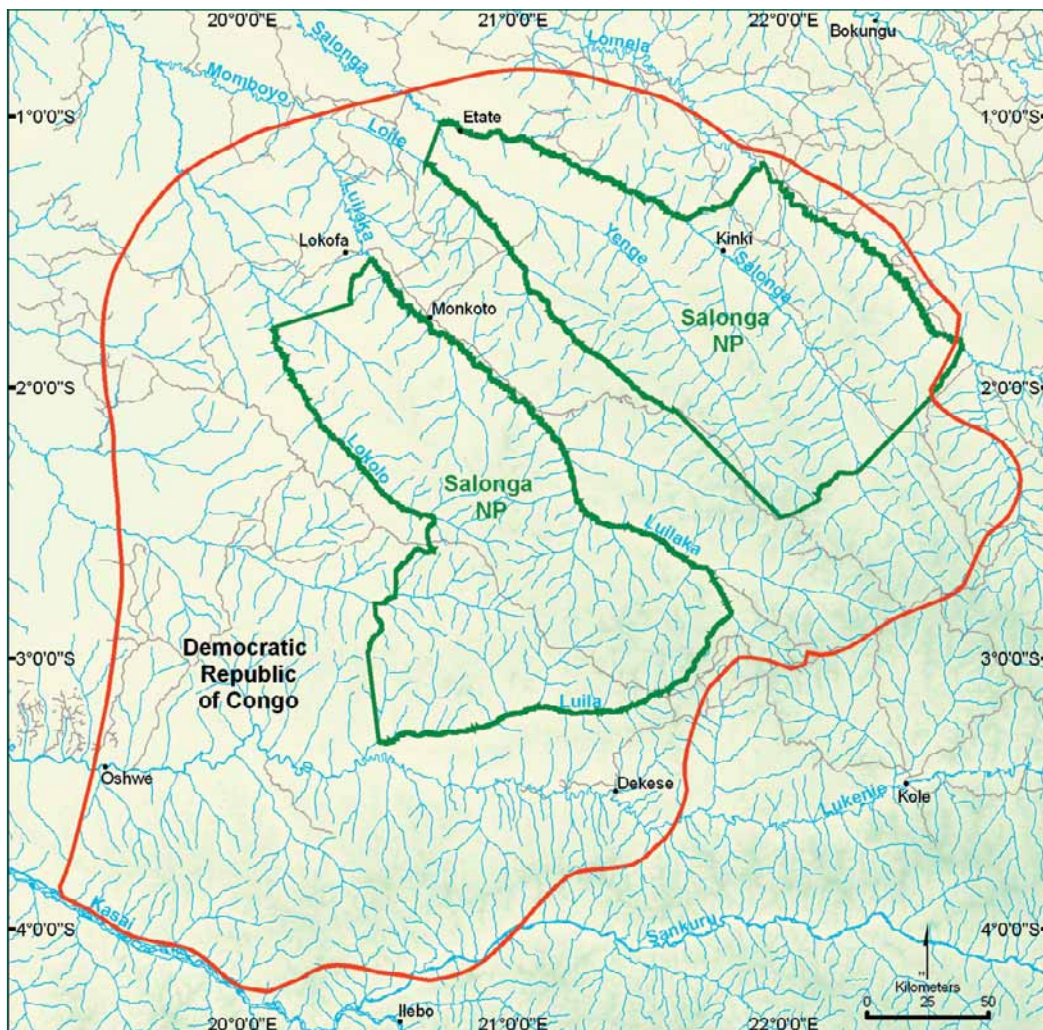


Figure 19.1. Map of Salonga-Lukenie-Sankuru Landscape (Sources: JRC, SRTM, SYGLAP, WWF-DRC).

Location and area

The Landscape lies in the heart of the central basin of the Congo River in the Democratic Republic of Congo, straddling the provinces of Equateur, Bandundu, Kasai-Occidental and Kasai-Oriental. It covers 102,847 km² and is centered on Salonga National Park. The latter has an area of 33,350 km² and is the second largest area of protected forest in the world, but it is divided into two separate blocks (Figure 19.1)

The Landscape in brief

Coordinates: 0°49'32"N – 4°13'49"S; 19°19'23"E – 22°52'24"E

Area: 102,847 km²

Elevation: 300-700 m

Terrestrial ecoregion: Central Congolese forests ecoregion

Aquatic ecoregions: Central Basin ecoregion

Kasai ecoregion

Protected areas: Salonga National Park, 33,350 km², 1970

Physical environment¹

Relief and altitude

The relief comprises low-altitude plateaus, terraces and 'high' plateaus at an altitude of 300 m in the west and 700 m in the east. Most of the

Landscape is occupied by low-lying marshy or flooded land. In places, cliffs reaching 80 m high line the rivers.

¹ This section is largely taken from Evrard (1968).

Geology and soils

The Landscape lies entirely within the alluvial basin of the Congo River. The youngest sediments are from the Pliocene, Pleistocene and Holocene ages; the oldest, which can be seen in the valleys, are Cretaceous. In the east, south and center of the Landscape, the soils are sandy or sandy-clayey (arenoferrals and ferralsols). The valleys are covered with white sands and the marshy areas are covered by a horizon of organic matter showing little decomposition. In the lower part of the Landscape, in the north and northwest, hydromorphic soils are dominant and cover more than 50% of the surface area.

Hydrology

The northern half of the Landscape is drained to the northwest by more or less parallel rivers, notably the Lomela and the Salonga (Figure 19.2), tributaries of the Ruki which joins the Congo River at Mbandaka. In the southwest, part of the Landscape is within the basin of Lake Mai-Ndombe. In the far south, it is drained by the Lukenie and Sankuru rivers, tributaries of the Kasai, which flow into the Congo River at Kwamouth. Most of the Landscape is subject to major seasonal flooding.

Climate

Average annual rainfall is 2,100 mm in the north and 1,700 mm near Lukenie in the south.

Monthly precipitation varies very little, but it does decrease slightly between June and August.

Vegetation

The Landscape forms part of the central Congolese forests ecoregion and 94% of it is covered by diverse forest formations (Figure 19.3): 23.6% swamp or floodplain forests and 70.8% terra firma forests, which constitute a mosaic of mostly evergreen formations (in the moist lowlands) or caducifoliated formations (on plateau peaks and crests). The different formations include: small expanses of forest with a monodominance of *Gilbertiodendron dewevrei*, *G. ogoouense* or *Brachystegia laurentii*; semi-caducifoliated forests of *Staudtia stipitata*, *Greenwayodendron suaveolens*, *Scorodophloeus zenkeri*, *Anonidium manni* and *Parinari glabra*; riparian forests of *Uapaca heudelotii* and *Parinari congensis*; floodplain forests of *Oubanguia africana*, *Scytopetalum pierrea-num* and *Guibourtia demeusei*; and swamp forests of *Entandrophragma palustre*, *Coelocaryon botryoides* and *Symphonia globulifera*. The forest flora is dominated by legumes of the Caesalpiniaceae subfamily and then by Euphorbiaceae and Apocynaceae (Evrard 1968). Species with a high commercial value include various African mahoganies (*Entandrophragma spp.*) and various species of ebony (*Diospyros spp.*).

In the south, the Landscape has a transition area between the moist forests and the ecoregion of the mosaic of southern Congolese forests-savannahs represented by islands of savannahs (0.9%)

Figure 19.2. The Salonga River.



surrounded by forests. Finally, a very important habitat for fauna is formed by the swampy clearings rich in mineral salts and elephant baths or 'botoka njoku'. Several were identified during the initial survey work for the MIKE program and WCS studies; others have been mentioned by hunters in socioeconomic studies (WWF, 2006; WCS, 2005a; WCS, 2005b).

Fauna

Mammals

The Landscape is home to the bonobo *Pan paniscus*, a great ape endemic to the central Congolese forests ecoregion, and which lives in Salonga National Park, the only national park in the DRC to contain this species (Figure 19.4). Its fragmented distribution seems to be linked to the habitat (Alers *et al.*, 1992; Bila Isia *et al.*, 2000; Van Krunkelsven *et al.*, 2000; Reinartz, 2003). Nine other species of diurnal primates are present, notably the golden-bellied mangabey *Cercocebus chrysogaster*², the black mangabey *Lophocebus aterrimus*, Thollon's red colobus *Piliocolobus tholloni* and Wolf's monkey *Cercopithecus wolffi*. The riparian forests also contain Allen's swamp monkey *Allenopithecus nigroviridis*. Other species of particular interest are the forest elephant *Loxodonta africana cyclotis*, the bongo *Tragelaphus euryceros*, the giant pangolin *Manis (Smutsia) gigantea* and the hippopotamus *Hippopotamus amphibius*.

Birds

The avifauna is not yet well known, but 101 of the 228 species typical of the Guinea-Congolese forests have already been inventoried and the number should rise to 153 (Fishpool *et al.*, 2001). Among the species identified is the Congo peafowl *Afropavo congensis*, whose distribution is limited to the forests in the center and the east of the Congo Basin.

Ichthyofauna

The aquatic ecosystems form part of two ecoregions: the Kasai ecoregion and the central Congo Basin ecoregion (Thieme *et al.*, 2005), which have over 200³ and 300–400 species of fish respectively, but are still very little known⁴.

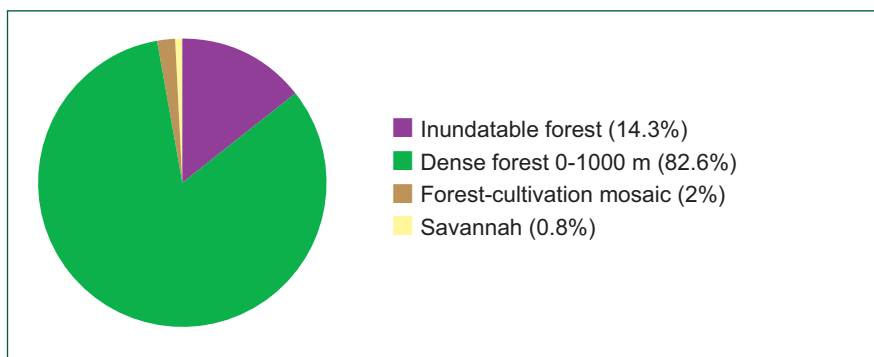


Figure 19.3. Main vegetation types (Source: JRC).

Human populations⁵

Density and distribution

The relatively low population density in the Landscape is estimated at 2.4 inhabitants/km², but there are some large human concentrations in the towns of Oshwe and Dekese and between the two sections of the national park, especially to the north of Monkoto. These densities are strongly influenced by the presence of the national park, which covers 35% of the Landscape. Two populations reside entirely or partly within the limits of the park: the Kitawalists⁶ and the Iyaelima⁷.

Ethnic groups

The Landscape is primarily inhabited by one of the largest ethnic groups of the DRC, the Mongo⁸, represented by the subgroups Nkundo (81% of the Lokolama sector), Ndengese (99% of the Ndengese-Ikolombe-Isolu sector), Iyaelima (resident in the southern block of the park) and Isolu. Other groups include the Mbole (55.6% of the Wini sector), the Twa Pygmies (16.5% of the Lokolama sector) and a small population of Ngombe (4.4% in the Luay and Loombo sector).

Activities

Agriculture⁹, hunting and fishing are quoted respectively as the main economic activities in the Landscape. All the other activities (traditional medicine, gathering, permanent or temporary jobs, retirement) concern fewer than 15% of the participants in socioeconomic surveys, except for in Monkoto where 20% of households say that they earn a living from temporary or permanent jobs. In the territories of Oshwe and Dekese, over 20% of households have only two sources of income: generally agriculture and hunting.

Agriculture is practiced year round, but the

² This species is limited to the northwest part of Salonga National Park and its conservation status is largely unknown at present.

³ The Kasai aquatic ecoregion is very rich, with over 200 species of fish described, of which 25% are endemic. Some species are associated with the savannah watercourses, while others are only found in rivers bordered by flooded or floodplain forests. Little research has been done in recent decades (Thieme *et al.*, 2005).

⁴ In two inventories on the edge of Salonga National Park, 32 species of fish were identified by Inogwabini (2005).

⁵ A lot of these data come from the findings of socioeconomic studies carried out by WWF (2006) (sample: 836 households) in the Landscape and by WCS (2004) in portions of the park corridor and the northern limits of its southern block.

⁶ The Kitawalists are a religious sect of Watchtower origin. They live both inside and outside the park and cite the 1960s as the official date of their installation in the area.

⁷ These are members of the Mongo group. Their villages are situated in the southern sector of the national park, where they apparently arrived in the 19th century from the province of Equateur, as did other Mongo groups in migratory movements just before the colonial era.

Figure 19.4. The bonobo *Pan paniscus*.



products grown or harvested vary according to the season. Fishing is almost entirely limited to the low-water season (June to August). Men, families and sometimes entire villages move to temporary fishing camps during the low-water season. In the communities that practice fishing, hunting probably falls off during periods of intensive fishing.

The gathering of non-timber forest products is widespread¹⁰, but few inhabitants consider this activity as income-generating as the products are sold very cheaply at the village level. Caterpillars, mushrooms and some fruits are offered on the markets during certain seasons, but these products also contribute very little to household incomes. It is only in the Dekese territory that households mention this activity as generating income¹¹.

Technological changes are reaching even the most remote communities. While agricultural tools have not developed much, hunting and fishing equipment and methods are changing constantly. Fishing practices include the building of dams on small streams by women and the making of traps by both men and women. The men fish with hooks and nets of natural or synthetic fibers. Meshes are becoming smaller and smaller and some fishermen would now seem to be using mosquito nets. Men and women also fish by using plant poisons or chemicals such as DDT. Increased fishing pressure is also connected with the increase in the number of fishing instruments per family, the extension of the fishing season and the rise in the number of fishermen, particularly in the Salonga and Lomela rivers.

Changes in hunting date back to the end of

the 1970s and beginning of the 1980s, when firearms became more accessible and poachers arrived. Political trouble and civil wars also contributed to the increase in firearms. Other hunting methods include the use of metal wires, nylon thread and liana traps. Men and boys often carry spears, and/or bows and arrows, which are frequently poisoned. The use of hunting dogs is very widespread. However, old people complain that youngsters are no longer interested in collective hunting with nets or in partitioning game according to clan membership and age. Growing individualism and the need for cash are mentioned as the reasons for these changes.

Trade

Formal markets have only been seen in the largest towns and cities, such as Oshwe, Monkoto and Dekese, and even then they are not very big. There is no system of weekly or twice weekly markets as known in other regions of the country. Trade is also hampered by transport and difficult access. Paradoxically, the lack of economic opportunities elsewhere in the country, as well as the high demand for bushmeat, fish and certain non-ligneous forest products in the expanding urban (Kinshasa, Mbandaka, etc.) and mining centers (Kananga, Tshikapa, etc.), encourages people to travel long distances by foot, bicycle or canoe to trade forest products for products of prime necessity (salt, soap, medicine, etc.). Sixty-five percent of households in the Landscape acknowledge that they barter to obtain products of prime necessity and manufactured goods.

Land use

Salonga National Park covers 36% of the Landscape, while concessions account for 26% and the remaining 38% can be classified as other land uses (Figure 19.5). The rural complex made up of cultivated land and young secondary forests covers only 2% of the surface area of the Salonga Landscape (Figure 19.3).

Logging

At present, there are 13 companies with logging or prospecting permits in 21 concessions, which cover 25.7% of the total area of the Landscape. Most have been inactive for the last few years, but at least one concession is preparing to carry out biological and socioeconomic inventories in 2006. With the exception of the Oshwe region, industrial logging is severely handicapped

⁸ 99% in the sector of Ndengese-Ikolombe-Isolu, territory of Dekese, western Kasai; 91.3% in the sectors of Luay and Lombo, territory of Bokungu, Equateur; 83.7% in the sector of Lokolama, territory of Oshwe, Bandundu; 44.4% in the sector of Wini, territory of Boende, Equateur.

⁹ Most fields are polyculture with an average of 4.5 different products. Their area varies from 0.5 to 1.5 ha. The main products include manioc, groundnuts, rice, maize and, to a lesser extent, beans, gourds, sweet potatoes and sugarcane. Fallow periods vary from 5 to 10 years. Fields are more extensive to offset portions of the harvest destroyed by animals or disease. Destruction of fields is also controlled by traps set around the fields.

¹⁰ Over 95% of households include gathering of non-ligneous forest products in their activities, except for within the Lokolama sector where the figure was only 89%.

¹¹ Gathering is mentioned as the third biggest source of income by 28% of households in Dekese.

by isolation and difficulties associated with access and removal. Nevertheless, one case of illegal logging was observed recently in the northwest corner of the southern block of the park and other cases of illegal logging, albeit on a small scale, have been reported on the Lokolo River. Timber from this region is floated to Mbandaka.

Reasons for the identification of the Landscape

- (1) The Salonga National Park region has been designated a priority area for conservation in the Guinea-Congolese forests (Kamdem Toham *et al.*, 2006).
- (2) Although the animal populations are currently threatened by uncontrolled commercial hunting and poaching, the immense size of the forest blocks and the low human population density should offer good long term opportunities for conservation of wildlife endemic to the central Congolese forests ecoregion and important species like the forest elephant and bongo.
- (3) Salonga National Park is an Important Bird Area (IBA) according to BirdLife International (Fishpool *et al.*, 2001).
- (4) The forests in the Landscape play an important ecological role from the hydrological point of view and with regards to carbon sequestration.

Conservation

History

The Landscape is centered on Salonga National Park, the second largest protected area of tropical forest in the world, covering about 33,350 km² of intact forests and representing 36% of the Landscape. This national park (category II, IUCN) was created by presidential decree in 1970, became a World Heritage Site in 1984 and registered as a threatened World Heritage Site in 1999, but it has received little attention from national and international conservation bodies. At the beginning of the 1990s, Salonga National Park was slated to host the Zaire component of the ECOFAC program, financed by the European Commission, but the political events in 1991 meant that this program did not start up in Zaire¹². However, during the decades of 1990 and 2000, several organizations (LWRP, MPI and ZSM) have begun research activities in and around the national park and are working to provide support to ICCN.

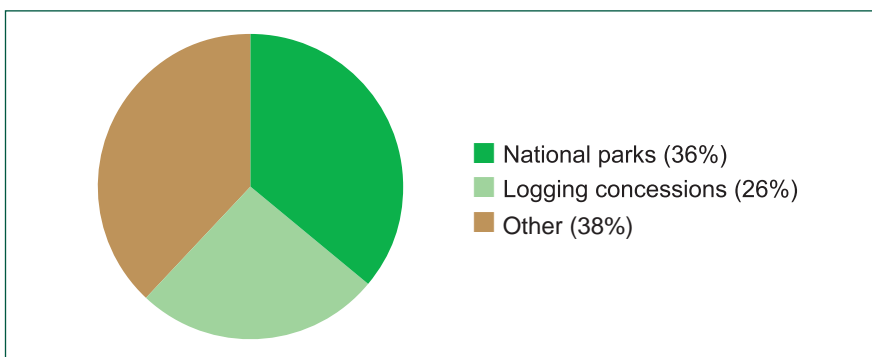


Figure 19.5. Main land use types.

Players

(1) Governmental institutions

ICCN is responsible for the management of Salonga National Park. Outside the national park, management is in the hands of MECNEF.

(2) International NGOs

- The Lukuru Wildlife Research Project (LWRP) has been working on bonobos in the south of the Landscape since 1992 and currently supports ICCN.
- The Max Planck Institute (MPI) has been managing a research site just outside the western limit of the southern block since 2000.
- The Zoological Society of Milwaukee (ZSM) has been active since 1997 in monitoring the bonobos and other large mammals in the northern block of the national park, in support of ICCN and actions to combat poaching.
- WCS played an important role in the MIKE surveys in 2003 and 2004. This NGO continues to focus its resources (CARPE/USAID, private donors, UNESCO) on the national park and its buffer zone. It is carrying out inventories of bonobos and other large mammals. In collaboration with ICCN and local communities, it is working on the settlement of disputes related to the limits of the national park. It is also helping to create a GIS unit.
- WWF has supported activities in the national park since 1997 through ZSM. In 2004, it accepted the role of 'Landscape Leader' under the USAID CARPE program with additional financing from the EU. WWF is involved in strengthening ICCN capacities, carrying out basic socioeconomic and biological surveys, exploring the possibilities offered by community joint management and identifying new partners to assist in matters concerning resources and community management.

¹² In 1988, following the tropical forestry action plan (TFAP), the IUCN, with financing from the European Commission, prepared a regional action plan for Central Africa (PARAC) from which the conception of the ECOFAC program derived. The Zairian component of this program was to be concentrated on Salonga National Park. A budget of 3.2 million ECU was written into the finance agreement for the first phase of the program in 1990. The specificity decided upon for this component was 'conservation and management of a forest park through the strengthening of regional infrastructure, the creation of a research station and the start-up of small development initiatives'. Due to the political events of 1991, this program was never started up. However, in 1991 and 1992, the EC financed field activities to prepare for the installation of a new station in Botsima in the northern block. Cartography of the region was also carried out on the basis of satellite images and some equipment was installed, but looted shortly afterwards (d'Huart, 2003).

Direct threats

(1) Trade in bushmeat

Surveys by ZSM, WCS and the MIKE program, socioeconomic studies and studies on the capacity of ICCN and direct observation by the managers of Salonga National Park have shown that uncontrolled hunting on a commercial scale and poaching in the park are the most serious threats to wildlife. The demand for bushmeat comes mostly from outside the Landscape, from remote urban and mining areas.

(2) Trade in live animals

Trade in live animals, especially bonobos, is a fact and officials based in the Landscape will issue a certificate of legal capture for a live bonobo for the sum of 4,500 Congolese francs (US \$10).

(3) Ivory trade

There is no precise information on the ivory trade, but ivory hunting continues and several cases were recorded in 2005 and at the beginning of 2006 in Salonga National Park.

(4) Military poaching

Apart from hunting by the civilian populations, the national park is also threatened by the cynegetic activities of troops and armed gangs. This situation is a danger not only for wildlife but also for the human populations and undermines the authority of ICCN. To compensate for this, ICCN and its partners are actively lobbying the military, as well as provincial and national authorities.

(5) Destructive fishing

The use of dynamite, poison and nets with smaller and smaller meshes may contribute towards the increasing rarity of certain species of fish.

(6) Lack of regulations for human populations in the national park

The populations who live in the national park, either permanently or temporarily, clear land, grow crops, hunt and fish freely.

Indirect threats

(1) Collapse of the agricultural sector

According to the local communities, the collapse of the agricultural sector, following the civil war, would seem to be the most important reason young people are turning to hunting and fishing.

(2) Proliferation of arms

Hunting and poaching have been facilitated by the proliferation of arms.

(3) Limited accessibility

The Landscape is only accessible by airplane or boat and access to most of the villages is problematic. In the past, merchants and missionaries traveled in vehicles on the roads of the colonial era and a network of navigable rivers crossed all the Landscape and made travel and trade easier. During the 1990s, these transport networks disappeared following the general economic decline and the civil war. Bridges have fallen, ferries were destroyed during the civil war and roads have deteriorated to such a degree that it is even hard to ride bicycles on them. The State owned boats do not run any more and private boats go to some remote sectors just once a year. This problem of access is a serious impediment to obtaining basic data, carrying out activities (including alternative activities to the trade in bushmeat), and monitoring and controlling exploitation of the natural resources.

(4) Weakness of government departments

ICCN capacity is very limited and many wardens have received no training, have no specific knowledge and do not have the means to protect the national park. Furthermore, the authority of ICCN is diminished by its ill-defined involvement in the buffer zone. Outside the national park, the government agents responsible for management of the natural resources have suffered considerably from growing isolation following the war. They have neither the tools nor the knowledge to educate the populations in the field on environmental legislation and methods for managing natural resources.

(5) Lack of information

Other than basic information on the key species (elephant, bonobo), there is very little information on the fauna and flora. The local communities are ignorant of the environmental legislation in force in the Landscape.

State of the vegetation

The forests are basically intact.

State of the fauna

Although data are rare and probably imprecise, the findings of the MIKE inventories (WCS, 2005a) reveal a worrying absence of elephants in

most of the park and densities are extremely low in areas where the species still exists¹³. This phenomenon probably extends outside the national park because the local communities in savannah areas often refer to the elephant and the buffalo as two species whose numbers have fallen considerably over the last 10-20 years. Even less information exists on the bonobo¹⁴ but more recent reconnaissance in the national park has led to several new populations being discovered. In general, the distribution of the bonobo is very irregular and is probably influenced by the habitat and pressure from poaching (Reinartz *et al.*, 2006). There is a protected population outside the national park in the south of the Landscape, between the Lukenie and Sankuru rivers, where LWRP is supporting efforts by villagers in the fields of conservation and development.

According to villagers in the south of the Landscape, the cane rat *Thryonomys sp.* has appeared over the last 20 years¹⁵, but the lion seems to have disappeared¹⁶. The status of other savannah species is worthy of special attention.

As for the widespread small-scale fisheries, which export large quantities of smoked fish outside the Landscape, nothing is known about their impact on fish populations.

Financing and conservation

The funding agencies:

- CARPE/USAID finances activities at the level of the national park and the Landscape.
- The EU focuses on the national park, but also intervenes at the Landscape level.
- UNESCO/UNF has financed some socioeconomic studies (WCS, 2004) and the payment of bonuses to national park staff.
- UNDP/FEM is going to provide communication equipment to the ICCN stations.
- The Trust Fund of the European Union and the World Bank (No. 050991) is providing equipment to ICCN, through WWF, in addition to the European Union's own program.
- The European Union is going to start activities in the Landscape through the ECOFAC program.

There is no long term funding available, and tourism promotion is unrealistic because of the isolation of the area and the weakness of management structures.

Environmental education and capacity building

No structured environmental education program exists for Salonga National Park and the Landscape. A few rare consciousness raising concepts are provided by the teams of conservators or researchers during their working visits. The lack of a program does not help promote a good understanding of disputes, such as questions concerning the limits of the national park. To fill this gap, the Landscape partners are collaborating to define and apply an environmental education strategy.

Management in the field of renewable natural resources

(1) At the Landscape level

Basic data are necessary before a zoning plan can be produced for the Landscape. Socioeconomic studies have been carried out and will guide the future establishment of local partnerships, the choice of indicators for monitoring living standards and the identification of interventions in the field of sustainable use of natural resources. A map on the scale of the Landscape is being improved at present.

(2) In the national park

Inventories of large mammals were undertaken within the framework of the CITES MIKE program as of 2003. Since the beginning of CARPE activities in October 2003 and the European Commission's program to strengthen the management capacities of ICCN and support the rehabilitation of protected areas in the DRC in August 2004, the partners involved in the national park have joined forces with ICCN to collect basic data and strengthen management, research and monitoring capacities. Players previously excluded from this process were incorporated. Given the serious threats to this national park, the partners embarked upon the following interventions:

In the field of basic data collection:

- evaluation of ICCN capacities, including recommendations for staff recruitment, the development of infrastructure, equipment and anti-poaching strategies
- finalization of the basic map
- analysis of threats
- socioeconomic studies and surveys

¹³ In 1989, the number of elephants in the national park was estimated at 8,300 (>2.2 individuals/km²) (Alers *et al.*, 1992) and according to MIKE surveys in 2003-2004, it was estimated at only 2,000 (WCS, 2005a). It should be noted, however, as indicated in the WCS report, that it is difficult to compare these surveys given the enormous potential sources of errors in each of them. (WCS, 2005a, p. 98).

¹⁴ In 1998 the density of the bonobo populations in the northern part of the northern block was estimated at 1.15 individuals/km² (Van Krunkelsven *et al.*, 2000). A more recent density estimate indicates 0.73 adults/km² according to the surveys carried out in both the southern block (3 sites) and the northern block (8 sites) of the park, between October 2000 and May 2002 (Reinartz *et al.*, 2006).

¹⁵ Villagers living between Dekese and the national park say that this species has apparently arrived in their region from the south over the last 20 years.

¹⁶ In Dekese, villagers talk of the well documented killing of the last lion (a man-eater) on the savannahs between Lukenie and Sankuru or south of Sankuru in 1999 (WWF, 2006).

In the field of training:

- creation of the site coordination committee (CoCoSi)
- support for ICCN as regards equipment, fuel and the training of administrators and wardens

In the field of surveillance:

- creating anti-poaching patrols at the six stations
- payment of bonuses to wardens
- creation of new jobs at Eate, Kinki, Beminyo and Lokofa

In 2006, the partners are going to finalize a strategic management plan for the national park with the technical support of USFS.

(3) *In the extraction areas*

Many coffee, palm-oil and rubber plantations have been listed, but none are active. Similarly, although 25% of the Landscape is allocated to logging companies, no logging on a commercial scale has been observed. The moratorium in place at present on industrial logging also prevents formal cooperation between conservation agents and logging companies, but the possibility of collaborating on biological or socioeconomic studies has nevertheless been informally discussed.

(4) *In the rural areas*

Although satellite imaging makes it possible to locate agricultural activities, only field work makes it feasible to identify the hunting and fishing areas. Some of this information was collected during the socioeconomic studies. Additional data will be collected as a part of the biological surveys. Two studies are planned to begin work with the local communities on improving the management of natural resources. Meetings were held with representatives of the communities, particularly with a view to resolving disputes concerning demarcation of the national park. In fact, one of the priority requests by the communities is to be able to fish the rivers that form the boundaries of the national park. During the dry season in 2006, a partner institution is going to carry out a study on the management systems on these rivers in order to put forward recommendations concerning collaborative management between the local communities and ICCN. A second study will explore the economic feasibility of marketing selected agricultural produce and non-ligneous products in the Landscape, in order to ease the pressure on wildlife and diversify the economic opportunities of the local communities. GTZ has

supported MPI for a feasibility study on exporting ornamental fish (Schliewen, 2002).

The CARPE Small Grants Program is supporting local NGOs whose activities deal with the management of natural resources and conservation of biodiversity. The first year's results will allow long term partnerships to be better defined and additional resources and/or expertise to be brought in.

Governance in the field of renewable natural resources

Governance as regards renewable natural resources is based on a major ambiguity between theory and reality. According to the law, ownership and management of the land and its natural resources are a State mandate. This situation is common in Central Africa. In a Landscape characterized by its isolation and the low level of State services, it is very marked indeed: access to and management of resources are usually determined by the local communities or local authorities, such as the traditional chiefs. The ambiguity between the legal situation and the reality means that the communities come under external pressure from 'outsiders' who do not live in the Landscape and who have greater political and economic means to hunt and fish on village lands through authorizations and the payment of fees¹⁷. Most communities describe similar systems of local governance of the land and its natural resources.

Salonga National Park could be an exception given the presence of ICCN, a governmental authority. In practice, six ICCN management stations spread over the park are responsible for management of Salonga National Park. However, these stations do not operate well due to an insufficient budget, a lack of sufficient training¹⁸, lack of equipment, inadequate staff and poor infrastructure. Nevertheless, local communities, displaced before and after the creation of the national park and excluded from its management, continue to demand a right of authority over their former lands and resources. They still gather fruit and other products in their old fields. The vague policies pursued by ICCN have caused much confusion, due to the fact that some cooperatives and individuals have obtained authorization to fish in the park by paying taxes. Another ambiguity concerns the fishing rights for the local populations in the rivers forming the limit to the national park: where does the national park begin? Midstream or on the bank? This exclusion and ambiguity, combined with the feeble capacity of ICCN, the civil war and centralized but inef-

¹⁷ Village lands are separated by known limits, often based on streams or rivers. The inhabitants have access rights to the forests on their land for agriculture, the gathering of non-ligneous forest products, hunting and fishing. Neighboring villages can be invited to join in collective hunts, but this practice is disappearing. Outsiders interested in hunting on these lands must obtain the permission of the chief of the land and pay access fees in cash or munitions. Access to fishing lodges is more restricted: some villages even prohibit access completely, while others demand payment. However, the use of seasonal fishing camps can be extended to family members living as far away as Mbandaka. Gathering non-ligneous forest products is not regulated unless it is for commercial purposes.

¹⁸ Between December 2003 and January 2004, 54 Salonga National Park wardens received paramilitary training in collaboration with the Ministry of Defense and organized by ICCN with financing from ZSM.

efficient governmental structures, have all contributed towards the anarchic use of natural resources in and around the park.

With a view to developing management and decision making capacities, a site coordination committee (CoCoSi) has been set up for management of the park. It includes ICCN and partner organizations (LWRP, MPI, ZSM, WCS and WWF). It is hoped that in time representation on CoCoSi can be extended to include representatives from the local communities. For the immediate future, several wardens have established standing committees for local consultation with the villages. ICCN is also working with partner organizations to better define the concept of community conservation. At the same time, there are also initiatives from the natural resources sector, such as the creation of community forests, which will encourage participation by the local communities at the Landscape level.

Monitoring of renewable natural resources

MIKE studies carried out in 2003-2004 provided some important basic information that will allow future monitoring of wildlife in the park to be put into place, particularly for forest elephants. These inventories of large mammals will continue and a preliminary study on the potential for biological monitoring is planned.

Several research institutions are studying the ecology, distribution and behavior of the bonobo.

A national database managed by ICCN's SYGIAP (*Système de gestion des informations des aires protégées*) already exists for the World Heritage Sites and a map of the park and its buffer zone has been produced. This database will be directly accompanied by the development of similar capacities for use in the field. A database at Landscape level is to be completed and will serve to produce a map like the one for the national park. The two databases will be the main tools for long term monitoring of conservation activities and sustainable management of natural resources.



Figure 19.6. Bicycles remain the last available transportation vehicle in many parts of the central Congo Basin.

20. Maringa-Lopori-Wamba Landscape



Figure 20.1. Map of Maringa-Lopori-Wamba Landscape (AWF-DRC, JRC, SRTM).

The Landscape in brief

Coordinates: 1°51'50"N – 0°26'28"N; 19°41'5"E – 23°32'43"E

Area: 74,544 km²

Elevation: 350-400 m

Terrestrial ecoregion: Ecoregion of the Central Congolese forests

Aquatic ecoregion: Central Basin ecoregion

Protected areas: Lomako-Yokokala Faunal Reserve (proposed, in process of designation)

Location and area

The operational limits of the Maringa-Lopori-Wamba Landscape have changed relative to the original limits identified within the framework of the CBFP (Figure 20.1). Today, the Landscape is limited to the basin of the Maringa and Lopori rivers and includes the administrative and territorial entities of Bongandanga, Basankusu, Befale and Djolu in the districts of Equateur, Mongala and Tshuapa in the province of Equateur. This change in the limits was based on ecological, socioeconomic and administrative realities. The Landscape covers 74,544 km² and is characterized by tropical forests and some inhabited strips along

the rivers. It is a very isolated enclave, especially since the deterioration of the road infrastructures in the 1980s and 1990s and the discontinuation of river transport since the war.

Physical environment

Relief and altitude

The Landscape is situated entirely on the alluvial plain of the central basin, at an altitude of 350-400 m.

Geology and soils

The soils are composed of coarse sand derived from a penplain dating from the Pleistocene.

Hydrology

The sources of the Maringa and Lopori rivers are in the southeast corner of the Landscape and encompass the whole of the Landscape with their tributaries: Lomako, Iyokokala and Bolombo. The Maringa and the Lopori join in the northwest at Basankusu in Lulonga. The high waters are from

October to December and the low waters last from February to August.

Climate

The Landscape has an equatorial-type climate with an average annual rainfall of around 2,000 mm with little seasonal variation. The wettest period is from August to October and the dry season (January-February) lasts less than two months.

Vegetation

The majority of the Landscape is covered by dense moist forests (Figure 20.2): 67% terra firma forests and 25% floodplain and/or swamp forests which stretch along the rivers and streams. The terra firma formations comprise semi-evergreen rainforests of *Scorodophloeus zenkeri* and evergreen rainforests with a monodominance of *Gilbertiodendron dewevrei* or *Brachystegia laurentii*. The edaphic formations include riparian forests of *Uapaca heudelotii*, floodplain forests of *Oubanguia africana* and swamp forests of *Entandrophragma palustre* and *Coelocaryon botryoides*.

The remainder (7%) is made up of degraded forests and cultivated areas for shifting agriculture. Forest plantations cover less than 1%. They are found primarily beside main roads and inhabited strips of land along the Maringa, the Lopori and the Bolombo, including the square formed by the roads linking Djolu, Lingomo, Mompono and Befori.

Fauna

Mammals

At least eleven species of diurnal primates have been observed. The dryas monkey *Cercopithecus dryas* is endemic to the basins of the Maringa and the Lopori and only two examples of the species are known¹. The bonobo *Pan paniscus*, Tholan's red colobus *Piliocolobus tholloni*, the golden-bellied mangabey *Cercocebus chrysogaster* and the black mangabey *Lophocebus aterrimus* are endemic to the central Congolese forests. Allen's swamp monkey *Allenopithecus nigroviridis* is endemic to the flooded or floodplain forests of the Central Basin and the Angolan colobus *Colobus angolensis* is only known in the Central Basin, the north-east of DRC and the Great Lakes region. Other large mammals include the elephant *Loxodonta africana*, the buffalo *Syncerus caffer*, the bongo *Tragelaphus euryceros*, the African golden cat *Felis aurata* and the leopard *Panthera pardus*.

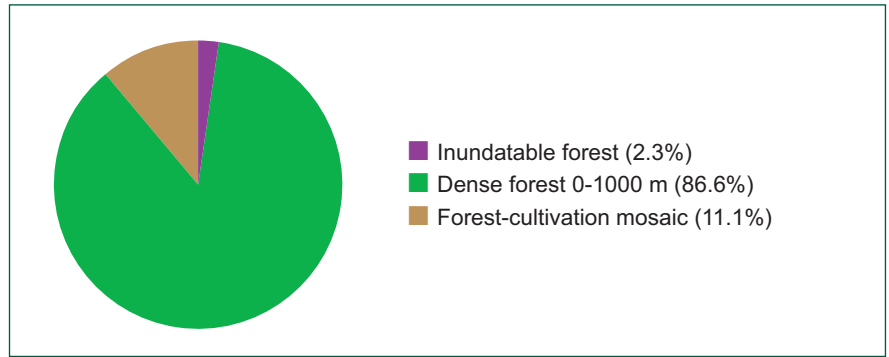


Figure 20.2. Main vegetation types (Source: JRC).

Birds

The avifauna comprises over 400 species. In certain places, the density of Congo peafowl *Afropavo congensis*, a species endemic to the center and the northeast of the Congolese forests and very sensitive to anthropogenic disturbances, is probably the highest in the country.

Ichthyofauna

The whole of the Landscape is situated in the Central Basin ecoregion, whose ichthyofauna comprises 240 identified species (probably 300-400 total species), with at least 12 endemic species. Few studies have been carried out since the 1960s (Thieme *et al.*, 2005).

Humans in the Landscape

Density and distribution

According to the data available (UNDP/ UNOPS, 1998; *Monographie de la Province de l'Equateur*, PNSAR 1997-200; *Institut national de la Statistique*, 1995, *Totaux définitifs*; *Direction d'Etudes et Planification du Ministère de la Santé*, 2003), the population density in the Landscape is estimated at about 3-6 inhabitants/km². This population is mainly concentrated along the main roads and in the towns of Basankusu, Befale, Bongandanga, Mompono, Djolu and Lingomo.

Ethnic groups

The Landscape is almost entirely within the territory of the Mongo (Mongo and Mongando). Over the last few decades, there has been new immigration, by Ngombe who are regarded as great hunters, from the north to the hunting forests. Limited populations of Pygmies are scattered around the central northeast. In the middle of the Landscape, between the Lomako and Yokokala

¹ A juvenile was described in 1932 and an adult in 1985.

ivers, towards Lingomo, there are thousands of Kitiwalists (Jehovah's witnesses) who withdrew into the forest in the 1960s and do not accept the State authority.

Activities

The populations, centered on the main roads, focus their activities on agriculture (Figure 20.3). However, due to the collapse of agriculture and the lack of market access, the populations are turning to the forest to live off its available natural resources: bushmeat (Figure 20.4), fish and non-timber forest products. It can be estimated that almost 100% of the Landscape is influenced by hunting.

Logging

Industrial logging in the Landscape began in the 1970s and stopped in 1998 because of the war. Although almost 100% of the Landscape had been allocated in concessions, logging remains very limited due to difficulties associated with access (Figure 20.5). Today, 32% of the Landscape is in the official production forest (Figure 20.6), awaiting the conversion process to turn logging rights into forest concessions. The most well known and active company is SIFORCO (Danzer group), with 725,068 hectares of concessions in the Landscape. The Trans-M company obtained 358,513 hectares in the south of the proposed Lomako-Yokokala Reserve following the moratorium of 2 July 2004 (Ministerial Order No 050/CAB/MIN/ECN-EF/2004).

Reasons for the identification of the Landscape

- (1) The main reason for the creation of this Landscape, which does not have a national park, was the fact that it had the richest history of scientific research on the bonobo. Primatologists have been working in the Wamba and Lomako forests since the 1970s. Over 90% of the scientific literature on bonobos in the wild comes from these two sites.
- (2) The Lomako-Yokokala forest was identified in the 1950s as an area of great importance for biodiversity and in the 1980s as an area deserving protection. It is considered by BirdLife International to be an Important Bird Area (Fishpool & Evans, 2001). Full protection of this forest of 3,625 km² is still a priority for ICCN.
- (3) Despite the biodiversity, most of the Landscape is covered by forest concessions and industrial forestry could endanger this richness. Developing partnerships with the private sector is one of the key objectives of the CARPE program and the Landscape provides ample opportunities for establishing such partnerships.

Conservation

History

The only protected zone in the Landscape is Luo Scientific Reserve, covering 22,700 hectares. This reserve is under the supervision of the Ministry for Scientific and Technological Research. The bonobos in the reserve are the subject of scientific



Figure 20.3. Shifting cultivation remains the main activity of human populations in the Landscape.



Figure 20.4. Smoked bushmeat.



Figure 20.5. Logging faces many problems because of the remoteness of the concessions.

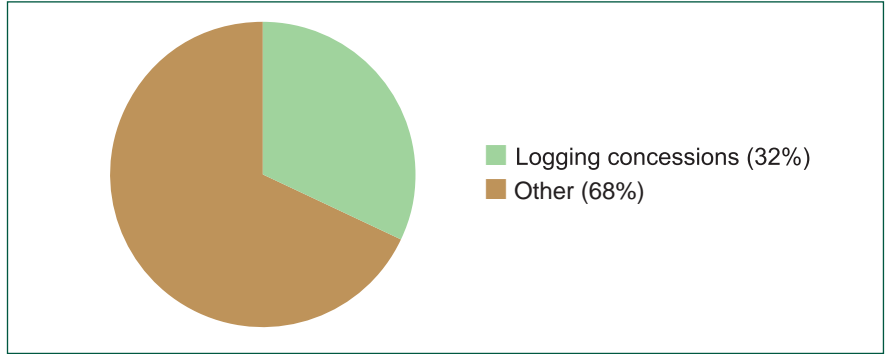


Figure 20.6. The main land use types.

studies by the University of Kyoto (WCBR) in collaboration with the *Centre de recherche en écologie et foresterie of Mabali* (CREF). At the beginning of the 1990s, a proposal for the creation of the Lomako Forest Reserve was submitted to the Ministry for the Environment, but because of political problems this proposal was never advanced. However, the creation of a protected area in the Lomako-Iyokokala forest, identified as a critical site for conservation (IUCN, 1990), is a priority for ICCN (2004) and measures for its creation are currently being facilitated by AWF.

Players

Very few conservation players are active in the Landscape. Representatives of the Ministry for Development are present in Basankusu, Bongandanga, Befale and Djolu, but have no resources or program of activities. The creation of the Luo Scientific Reserve around 1994 was initiated by the University of Kyoto, which still has a team working in Wamba. The NGO Bonobo Conservation Initiatives is working in collaboration with the local NGO *Vie sauvage* around Kokolopori and in Lonua with a view to creating community reserves. However, there are no official reports available as of yet.

Finally, AWF has been working throughout the Landscape since the beginning of 2004 in conjunction with five local NGOs based in Bongandanga, Basankusu, Befale, Mompono and Djolu. The latter have received development support in conjunction with some precise conservation objectives. In addition, a growing number of local NGOs are prepared to launch consciousness-raising activities for conservation, and have already achieved palpable results on the ground, in return for development support.

Direct threats

(1) Shifting agriculture

This form of agriculture gradually turns the primary forests into agricultural land and secondary forests.

(2) Hunting

Whether it is subsistence or commercial hunting, it contributes towards the disappearance of certain endemic animal species.

(3) Industrial logging

This changes the abundance and the specific composition of forests, the structure of their populations and the behavior of animal populations. Although it has not been developed to any great extent, it also indirectly causes social disturbances and encourages hunting.

Indirect threats

(1) Demography

Population growth, through a rising birth rate or immigration, places increasing pressure on resources.

(2) Economic collapse

The disappearance of infrastructure and the collapse of an economy essentially based on agriculture have caused a migration of populations towards what used to be undisturbed forests. Analyses of satellite photos by the University of Maryland clearly show this exodus to the forest and the creation of a growing number of small hamlets, which serve as bases for hunting.

(3) Loss of cultural values

This is leading to non-development of the original assets and the destabilization or degradation of a system that worked in the past.

State of the vegetation

The majority of the landscape is covered with virtually intact forest. Deforestation and degradation are limited. Nevertheless, satellite photos show an increase in destruction of the canopy in the middle of the Landscape. This destruction is far from the strips inhabited by humans and confirms the fact that populations are moving into these areas.

State of the fauna

Recent censuses (AWF, 2004) confirm the richness of the fauna in the Landscape, as well as the disappearance of fauna in specific areas. Between the years 1970 and 1980, poachers equipped with military weapons had already exterminated the large populations of elephants and hippopotamuses along the rivers, not only the Maringa and the Lopori but also along remote rivers like the Lomako and the Iyokokala. Over the last few years, however, traces of elephants have returned and there have been new observations of hippopotamuses. This can be explained by the difficulty that villagers have in gaining access to heavy arms and munitions.

Financing and conservation

Financing comes from USAID/CARPE and AWF, but FFEM, the Arcus Foundation, Columbus Zoo (USA), the Abraham Foundation and *Kreditanstalt für Wiederaufbau* (KfW) all show an interest in financing the Maringa-Lopori-Wamba Project. DGIS has obtained some indirect financing.

Management and governance in the field of renewable natural resources

(1) At the Landscape level

The AWF program is aimed at indicative zoning of the Landscape. This zoning is being organized in a participatory manner. The different zones identified, in particular the protected area being proposed, community-managed forests, logging areas and areas being used for silvicultural-agricultural-pastoral purposes, are covered by a participatory process to formulate a management plan. This management plan will contain management and follow-up elements and establish cooperation with the State's supervisory bodies. At the very beginning of 2006, a mission with USFWS experts was scheduled to lay the first foundations for planning and utilization of land throughout

the Landscape. However, AWF stresses that these areas must be subject to not only precise management, they must also be discussed beforehand with the real parties concerned in the Landscape.

(2) In the protected areas

As of yet there are no protected areas in the Landscape, but the AWF program supports the creation of such areas.

(3) In the extraction areas

Given the absence of governance and conservation players, logging companies have free scope for anarchic logging. Some logging companies have, however, expressed interest in being involved in the process of sustainable management of the forests through the development of a management plan and obtaining certification (particularly SIFORCO). Loggers admit that the lack of governance is a handicap when it comes to implementing a management plan. AWF aims to establish a partnership with a logging company, preferably within the proposed protected area. The area concerned would cover approximately 1,700,000 hectares.

(4) In the rural areas

The AWF's Maringa-Lopori-Wamba Project is involved in three community-management areas.

Monitoring of natural resources

As activities have just begun in the Landscape, no monitoring arrangements have been defined or implemented, but this will form part of the Landscape planning.

21. Maiko-Tayna-Kahuzi-Biega Landscape



Figure 21.1. Map of Maiko-Tayna-Kahuzi-Biega Landscape (CARPE, DFGFI, JRC, SRTM, WWF-EARPO).

Location and area

This Landscape is situated in the eastern part of the Democratic Republic of Congo (Figure 21.1). It covers an area of 67,121 km² and includes the Kahuzi-Biega and Maiko national parks as well as the Tayna Gorilla Reserve. Altogether, protected areas make up 27.4% of the Landscape.

The Landscape in brief

Coordinates: 0°20'30"N – 2°45'17"S; 26°35'8"E – 29°2'51"E

Area: 67,121 km²

Elevation: 495–3,279 m (average: 1,010 m)

Terrestrial ecoregions: Northeastern Congolese forests
Afromontane forests of the Albertine Rift

Aquatic ecoregions: Albertine Rift mountains
Upper Congo

Protected areas: Maiko National Park, 1,000,000 ha, 1970

Kahuzi-Biega National Park, 660,000 ha, 1970-1974

Tayna Gorilla Reserve, 88,600 ha, 2002

Physical environment

Relief and altitude

It is mountainous in the east, and the eastern part of Kahuzi-Biega National Park extends across the mountain chain forming the western rim of the Albertine Rift. Towards the west and in the direction of the Congo River, the land is lower, creating a significant altitudinal gradient (495-3,279 m). The western part of both national parks is relatively flat.

Geology and soils

The entire Landscape has a substrate of metamorphosed proterozoic rock belonging to the Kibarian system. There are two extinct volcanoes in the upper part of Kahuzi-Biega National Park dating from the end of the Tertiary or Quaternary era: Kahuzi and Biega.

Hydrology

The hydrographical system belongs entirely to the Congo Basin. All rivers originate in the mountains to the east and discharge into the Lualaba, which becomes the Congo River downstream of Kisangani.

Climate

Annual rainfall averages between 1,800 and 2,300 mm. The driest season is July to August and the rainiest seasons are in October-November and March-April. The mean annual temperature varies depending on altitude.

Vegetation

Most of the Landscape is covered by dense terra firma forests (Figure 21.2), with varying composition and structure depending on alti-

tude (Pierlot, 1966). The plain (lowland) forests extend up to an altitude of 1,000 m, with mixed vegetation of *Strombosia* and *Parinari* and a monodominance of *Gilbertiodendron dewevrei* or *Michelsonia microphylla*. Between 1,000 and 1,600 m are the submontane or transition forests, characterized by the presence in particular of the genera *Pentadesma*, *Lebrunia*, *Cynometra*, *Julbernardia*, *Pouteri* and *Staudtia* or by the local dominance of *Ocotea michelsonii* (Pierlot, 1966; Doumenge, 1998). Above 1,600 m are afro-montane forests characterized by the genera *Diospyros*, *Entandrophragma*, *Ficalhoa*, *Olea*, *Parinari*, *Podocarpus*, *Prunus* and *Syzygium*. As of 2,300 m, but especially above 2,800 m, these forests are intermixed with thickets of bamboo *Synarundinaria alpina*. The afro-subalpine vegetation comprises high-altitude mountain forests of *Olea*, *Podocarpus* or *Hagenia abyssinica*, thickets of Ericaceae and mountain grasslands. At the summit of Kahuzi there is a small area of tree groundsel *Senecio sp.* and giant lobelias *Lobelia sp.* Below 1,300 m there are large stretches of swamp and riparian vegetation.

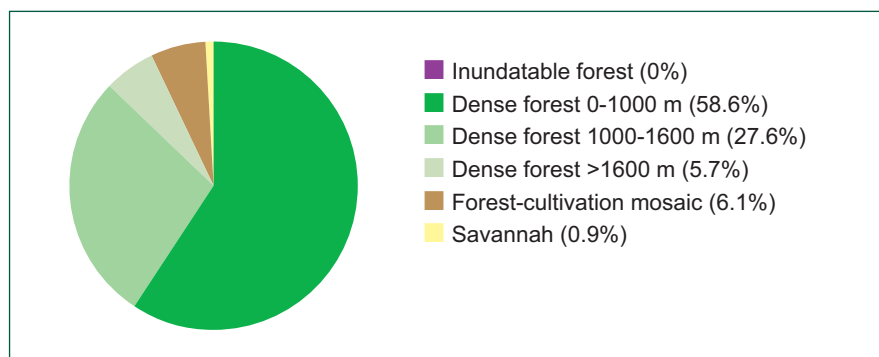
The flora is abundant, including many endemic species. It represents a transitional area between the Guinea-Congolese biogeographical region in the west and the Kivu-Ruwenzori region of the Albertine Rift in the east, which forms part of the biogeographical region of afro-montane forest (Pierlot, 1966). A recent global analysis conducted by Conservation International (CI) has identified it as a unique region as it combines Congolese forest, a wilderness area of considerable biodiversity (Colyn *et al.*, 1988), and the Albertine Rift, a hotspot of worldwide importance: the eastern afro-montane archipelago (Mittermeier *et al.*, 2003; Mittermeier *et al.*, 2004). Paleoecological studies also show that this region contained refuges of montane forest during the cold and dry periods of the Pleistocene era (Myers *et al.*, 2000; Kingdon, 1980; Hamilton, 1988; Pomeroy, 1993).

Fauna

Mammals

In tandem with its diverse habitats, the Landscape is also home to a rich variety of mammals, in particular the elephant *Loxodonta africana*, the chimpanzee *Pan troglodytes*, the eastern gorilla *Gorilla beringei* (including almost the entire population of the *graueri* form), numerous other primates, amongst which Hamlyn's monkey *Cercopithecus hamlyni*, L'Hoest's monkey *C. lhoesti*, Dent's mona monkey *C. denti*, the blue

Figure 21.2. Main vegetation types
(Source: JRC).



monkey *C. mitis* (with notably an endemic hybrid form *kandti x stublmanni*), Schmidt's guenon form of the red-tailed monkey *C. ascanius*, the olive or anubis baboon *Papio anubis*, the grey-cheeked mangabey *Lophocebus albigena*, the ruwenzori form of the Angola colobus *Colobus angolensis*, the *elliotti* form of the red colobus *Piliocolobus oustaleti*, Thollon's red colobus *C. tholloni*, a hybrid form of these two colobus monkeys, the dusky bushbaby *Galago matschiei*, Prince Demidoff's bushbaby *Galagoidea demidoff*, Bosman's potto *Perodicticus potto*, the giant forest hog *Hylochoerus meinertzhageni*, the okapi *Okapia johnstoni*, the bongo *Tragelaphus euryceros* and the panther *Panthera pardus*.

Birds

The bird fauna is rich, including most of the endemic montane or submontane species of the Albertine Rift, notably the handsome francolin *Francolinus nobilis*, Grauer's broad-bill *Pseudocalyptomena graueri*, the yellow-crested helmetshrike *Prionops alberti*, Grauer's cuckoo-shrike *Coracina graueri*, Chapin's mountain babbler *Kupeornis chapini*, the Kivu ground thrush *Zoothera tanganyicae*, Archer's robin-chat *Cossypha archeri*, the yellow-eyed black flycatcher *melaenornis ardesiaca*, the Ruwenzori batis *Batis diops*, Rockefeller's sunbird *Nectarinia rockefelleri*, the regal sunbird *N. regia* and Shelley's crimson-wing *Cryptospiza shelleyi* (Fishpool & Evans, 2001). The Congo peafowl *Afropavo congensis* is found in the low-altitude forests (Hart & Upoki, 1995).

Humans in the Landscape

Density and distribution

Reliable demographic data is very thin for this Landscape, particularly since the significant displacement of populations during recent conflicts. Generally speaking the population is unevenly distributed, with a rising density gradient moving from west to east: on the mountains of the Albertine Rift, the density is over 300 inhabitants/km²; the western lowland regions are relatively sparsely populated and 80% of the Landscape is covered by forests without any permanent villages. The remaining 20% probably has an average density of under 30 inhabitants/km². The total population is estimated to be less than 400,000 inhabitants. Surveys by DFGFI suggest that more than 30% of this population is under 20 years of age.

Ethnic groups

The Landscape encompasses a mosaic of Bantu people characterized by their languages, notably Nande, Pere, Hunde, Nyanga, Rega, Kwame, Kumu and Shi. There are also small populations of Twa Pygmies, the majority of whom live near Kahuzi-Biega National Park in the south. Swahili is the most common language.

Activities

The principal economic activities in the Landscape are subsistence farming, hunting, extensive cattle farming, goat and/or sheep farming and small-scale mining. Most of the farming is carried out using slash and burn methods, but close to ancient villages there are oil palm, banana, coffee and cinchona tree plantations. At high altitude, around the upper regions of Kahuzi-Biega National Park, the Shi people carry out permanent agriculture.

Subsistence hunting takes place throughout the Landscape and active commercial hunting exists around the mining camps. The trade in bushmeat is not, or no longer,¹ as developed as in western Central Africa, but consumption of bushmeat is high in the smaller centers, such as Lubutu. Hunting for ivory also exists throughout the Landscape and is carried out by illegal armed groups.

There are no official mining concessions, but mining for gold, tin (tin-stone), coltan and diamonds is intensive in several areas of the Landscape (Tegera, 2002). In some places, notably Walikale, these operations are so successful that the inhabitants have abandoned farming. Consequently, large quantities of food are brought in by plane at very high prices, completely destabilizing the local economy.

There are few usable roads, but one asphalt surfaced road runs from Lubutu to Walikale in the center of the Landscape. At present, it is not accessible to vehicles except via a poor quality dirt road from Kisangani in the northeast. This road makes it possible for small planes used by the mining business to land.

Land use

Outside of protected areas the majority of land cannot be assigned to one particular use (Figure 21.3).

¹During the 1980s bushmeat was traded intensively with the towns of Goma, Bukavu and Kisangani. This trade has probably suffered from the poor state of the road network and perhaps also from the sharp fall-off in game.

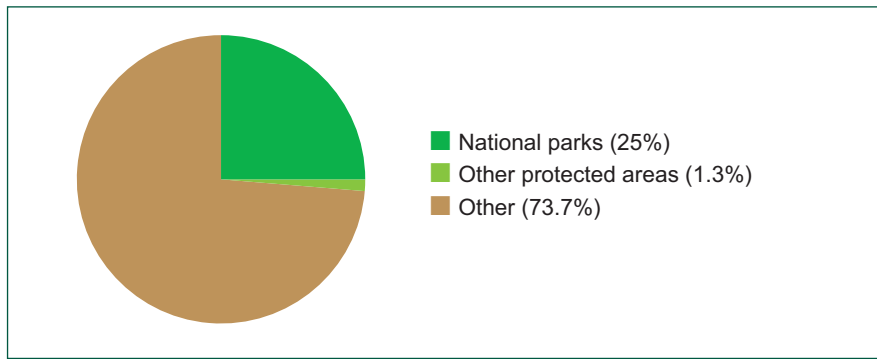


Figure 21.3. Land use types.

Logging

There are no official forestry concessions in the Landscape, but small-scale logging operations have long existed around certain villages. On the eastern fringes of the Landscape, charcoal production is also an important trade, supplying urban centers in the region.

Reasons for the identification of the Landscape

- (1) The region includes two national parks that were already established in 1970.
- (2) The region was recognized as having regional importance during the WWF workshop in Libreville in 2000 and designated a Landscape under the CARPE program.
- (3) In a global context, the region in this Landscape is characterized by a high degree of irreplaceability and an average degree of vulnerability; the conservation programs therefore have high priority.
- (4) The region is considered to be an Important Bird Area (IBA) by BirdLife International (Fishpool & Evans, 2001).
- (5) The region harbored one or more forest refuges during the cold and dry periods of the Pleistocene era.
- (6) The Landscape is a testing ground for innovative approaches to conservation, comprising a mosaic of national parks and community reserves managed in a traditional manner with the aim of matching conservation objectives to the needs and aspirations of local people.

² By the 1980s and early 1990s (well before the war) the park was partly occupied by gold panners and armed bands who tried to 'control' the former.

³ The boundaries of this extension were determined by overflights and did not take account of the people inhabiting these forests.

Conservation

History

Maiko National Park (1,000,000 ha) was created in November 1970, replacing a former hunting reserve established in 1938. However, given the lack of human and financial resources, the difficulties of getting around the park, the presence of large human populations within the bounds of the park, their hostility to conservation and the large distance between monitoring facilities and the park boundaries (often several days' walk), it has never been possible to supervise the park effectively².

Kahuzi-Biega National Park was created in November 1970 with an initial area of 60,000 ha of high-altitude land. In 1975, the park was extended by the addition of 600,000 ha of transition and lowland forest to the west³. Since the end of the mid-1980s, the park has benefited from a GTZ support program. During its first phase, this program focused on the operation of the park, tourism development and raising awareness among local people and authorities. During its second phase, starting in 1991, the program concentrated on the park periphery and involving local people in its management.

These two national parks, managed by ICCN, suffered enormously from the war between 1996 and 2003. Apart from the high-altitude part of Kahuzi-Biega National Park, which continued to benefit from GTZ support during the conflicts, the parks were practically abandoned.

The Tayna Gorilla Reserve (88,600 ha) was recognized by the government in 2002 and supported by DFGFI via the US Congressional Gorilla Directive of USAID.

In October 2003, the CARPE program resumed support for conservation activities and management of natural resources in the Landscape. CI has been assigned responsibility for conservation in the Landscape. They work with numerous partners: WWF as concerns Kahuzi-Biega National Park and DFGFI for Maiko National Park and a series of projects for community reserves located between the two national parks. WCS also receives funding from CARPE for support to the two national parks.

Direct threats

(1) Crop and livestock farming

The expansion in these activities represents a direct threat to the forests and protected areas. Already the forest corridor linking the higher and lower parts of Kahuzi-Biega National Park has been completely opened up. At present, the greatest threat lies in the continuous immigration of people from the high-altitude to low-altitude regions. This phenomenon is not new and was already taking place in the 1970s and 1980s. At that time, Shi farmers had moved in and established permanent crop farming, which is ill-suited to lowland forests in the low-altitude regions accessible via the Bukavu-Walikale road.

(2) Hunting

Hunting for bushmeat and ivory are both important activities. Okapi skins are highly sought after. This hunting has always existed, but it increased significantly during the 1980s with the large-scale introduction of the Soviet-made *Baikal* gun. For the first time, hunters were able to kill monkeys in the treetops. In the space of a few years, populations of colobus monkeys were decimated over vast areas of the Landscape⁴.

(3) Small-scale mining operations

Several areas of the Landscape are negatively affected by gold, coltan or tin-stone mining.

(4) Capture of live animals for export

Young gorillas⁵ and chimpanzees continue to be captured alive; this activity is usually accompanied by the massacre of the adults. Many African grey parrots *Psittacus erithacus* are also captured.

Indirect threats

(1) Economic collapse

The local population currently has no other resources than those provided by the forest. Economic collapse was precipitated by the war, but its origins date back to the 1960s, when a rebellion took place. Subsequently, from the early 1970s, the process of 'zairianization' of foreign companies was followed by the virtual disappearance of tea, coffee, cinchona and oil palm plantations. The steady dilapidation of the road network and the disappearance of bridges has prevented the export of agricultural produce.

(2) Insecurity, political instability and corruption

Some of the destruction of the communication infrastructure was supported by populations in the 1970s and 1980s, in order to hamper movements by the army, which tended to seize anything it could. Now that the conflict is over, the situation has not really improved and uncontrolled armed bands are still occupying some parts of the Landscape, including the protected areas.

(3) Weak institutional capacity of ICCN

ICCN is currently unable to carry out its mandate owing to a lack of finance, equipment and manpower.

State of the vegetation

With 81% of its area covered by primary forest, the Landscape represents one of the largest expanses of intact forest in Central Africa.

State of the fauna

Despite the good state of the forests, the fauna is at serious risk.

The elephant population has shrunk dramatically since the mid-1980s and during the last decade this decline has gathered speed. Currently, the species has virtually vanished from many regions, in particular the high-altitude section of Kahuzi-Biega National Park and the southern part of Maiko National Park (Hart & Sikubwabo, 1996; Hart & Liengola, 2002). It is feared that only small isolated populations still survive.

The eastern gorilla populations are facing different threats. Their current population size is unknown, but is thought to be between 5,000 and 25,000 individuals (Hall *et al.*, 1998; Nixon *et al.*, 2005). Although most of the biologists working in the Landscape believe that the true figure is closer to 5,000, recent surveys are thought to have revealed significant previously undiscovered populations⁶. In areas where the gorillas are still protected, as in the high-altitude section of Kahuzi-Biega National Park where GTZ directly supports ICCN, the populations are still below their pre-war levels, but are rising (Yamagiwe *et al.*, 1993; Hall *et al.*, 1998; Mehlman, *in press*). The *schweinfurthi* form of the eastern chimpanzee lives in the same regions as the gorilla, while occupying a wider area, and its population density is thought to be half that of the gorilla. All other primates are under heavy pressure from hunting

⁴ Until the end of the 1970s, five or six species of monkeys could easily be seen during a single day in the forests bordering the Bukavu-Walikale road, particularly in the Irangi region.

⁵ Although eastern gorillas are from time to time killed for their meat or to protect crops, the groups are now regularly attacked by armed bands that kill the adults and capture the live young to sell to traffickers.

⁶ This is based on research carried out in Maiko National Park by ICCN as well as research carried out by the staff of the Tayna Gorilla Reserve (Sivalingana-Matsitsi *et al.*, 2004).

in certain areas, particularly the two types of red colobus monkeys, Hamlyn's monkey and the other guenon monkeys.

A survey of the southern part of Maiko National Park in 2004 revealed frequent traces of large mammals (African river hog, buffalo, okapi and several species of duiker) on every transect. Recovery still seems possible provided that anti-poaching measures are stepped up and people are educated and provided with alternative sources of protein. The bongo may possibly still exist, but according to local inhabitants this species disappeared at least 20 years ago. The leopard still appears to be present and some village inhabitants have reported seeing the Ruwenzori form.

Financing and conservation

The success of the CARPE initiatives, an indication of the success of the overall CBFP, has drawn the attention of international financing agencies, such as the World Bank, UNDP and the European Union. These agencies have promised support at different levels. The private sector also wants to be involved: Pfizer Inc, in partnership with the DFGFI, has promised to give more than one million US dollars in medicines to meet the critical needs of the populations concerned and help provide health care for the personnel of community conservation and ICCN. CI has also promised to provide support via its Global Conservation Fund for sustainable conservation activities in the Landscape. With additional funding from DFGFI, established through the CARPE partnership approach, the first trust fund could come on-stream in 2007-2008.

Management and governance in the field of renewable natural resources

(1) At the Landscape level

No overall zoning exists for the Landscape as a whole, but a zoning procedure for the entire Landscape has been set in motion. This process has been strengthened by contributions from local communities involved in conservation and the sustainable use of their resources.

(2) In the national parks

The principal activities are focused on rehabilitating the national parks, through the CARPE program and GTZ, and enhancing skills of the personnel. Land use plans for the national parks are currently on the drawing board. ICCN patrols

now cover over 30% of the two national parks, compared with just 10% prior to 2003, and then only in Kahuzi-Biega National Park. This figure is set to rise. The community reserves have added 230,000 ha to the network of protected areas. Anti-poaching measures and scientific activities are being organized in the parks by interested local parties. Other community reserves will be created. A partnership has been forged with ICCN and the new network of protected areas will be absorbed into the overall ICCN network. For Kahuzi-Biega National Park, other avenues of participatory conservation are being explored.

(3) In extraction areas

No particular activities to report.

(4) In rural areas

With support from the DFGFI, the program focuses on creating community reserves located strategically inside a corridor linking the two national parks and on enhancing the skills of personnel employed in these reserves. In order to stimulate the interest of those involved, the project makes provisions for financial incentives and rural development activities directed at people actively involved in the community conservation initiatives at the local level. The community development projects are supported by the Jane Goodall Institute which, in partnership with DFGFI and local communities, creates opportunities underpinned by USAID funding for improving standards of living, health care and family planning.

Education in conservation is also a high priority for the future of the Landscape:

- Primary and secondary schools receive support to include conservation lessons in their curricula.
- A community university, approved by the government, has been developed under the Tayna program: the Tayna Center for Conservation Biology offers three-year conservation diploma courses.

The creation of these community reserves is an innovative approach conceived by the parties concerned in the Tayna Gorilla Reserve. This process has been boosted by the DFGFI Community Conservation Program launched during the war in 2001. It now supports eight NGOs that have formed UGADEC, a collective federation of community projects aimed at creating State-approved community reserves (Kakule & Mehlman,

2004) which will form a corridor between the two national parks. A second reserve of 120,000 ha, the Bakambule Community Primate Reserve (ReCoPriBa), has already been recognized by the provincial government and is awaiting recognition by the Ministry of the Environment in Kinshasa. This approach has enabled players to work on conservation, as well as draw up land use plans. This should lead to long term, more sustainable management of renewable natural resources and increase the coverage of protected areas to more than 40% of the Landscape. The designated areas for full protection in Tayna and ReCoPriBa will offer identical protection to that in the national parks and will be managed in partnership with ICCN.

Within the Tayna reserve, the Tayna Center

for Conservation Biology is currently helping to enhance skills in management, conservation biology and environmental education. The first students will receive their diplomas, with support from CARPE, and go out to work in their communities at the end of 2006. Other students from other regions of DRC will be joining the program: 14 new students have been accepted as members of ICCN staff.



Figure 21.4. The eastern gorilla Gorilla beringei graueri.

22. Ituri-Epulu-Aru Landscape

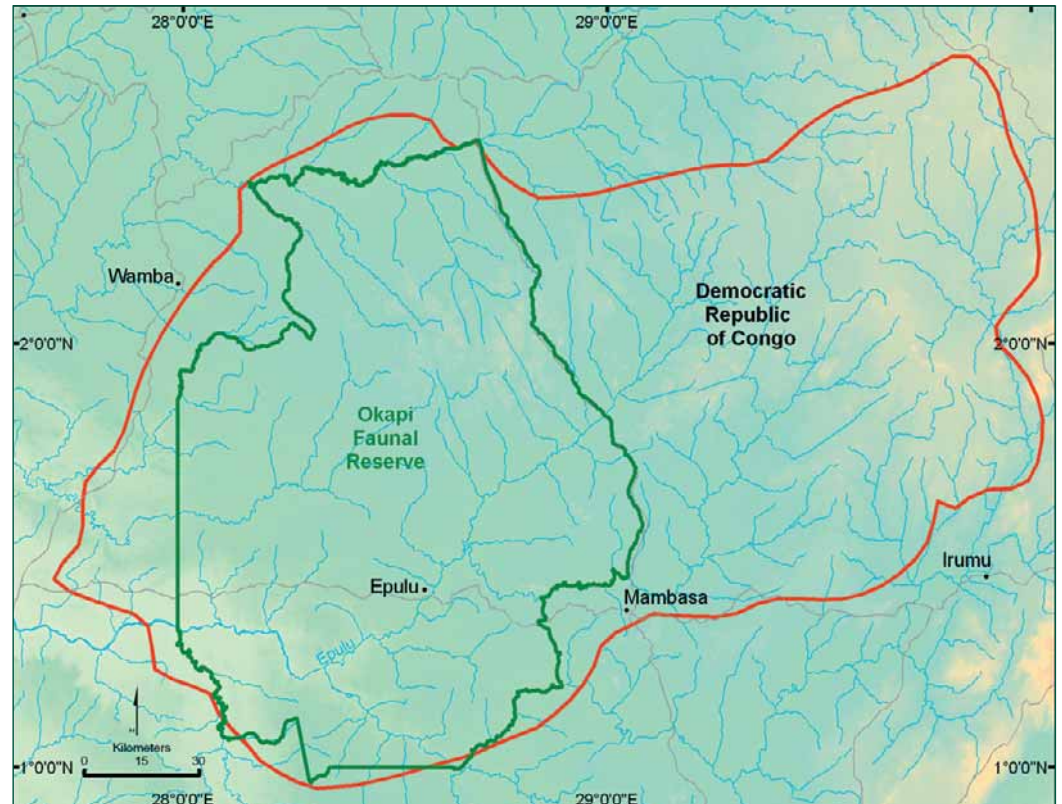


Figure 22.1. Map of Ituri-Epulu-Aru Landscape (Sources: CARPE, JRC, SRTM, SYGLAP).

The Landscape in brief

Coordinates: 2°40'37"N – 0°57'4"N; 27°41'41"E – 30°1'38"E

Area: 33,188 km²

Elevation: 700–1,300 m

Terrestrial ecoregions: Northeast Congolese forest
Northeast forest-savannah mosaic

Aquatic ecoregions: Central basin
Uélé

Protected areas: Okapi Wildlife Reserve, 1,370,000 ha, 1992

Location and area

The Landscape covers the upper basin of the Ituri River and thus the most northern part of the Congolese forest with its adjacent forest-savannah mosaic (Figure 22.1). It is mostly situated in the administrative territory of Mambasa (Ituri province). A strip of the Landscape is included in the territories of Irumu and Djugu in the Ituri province and the territories of Wamba and Watsa in the Haut-Uélé province. The Landscape touches on the province of Nord-Kivu, which is the

origin of the most important demographic and economic developments affecting the Landscape.

Physical environment

Relief and altitude

Most of the Landscape consists of a slightly undulating peneplain at an altitude of 700 to 900 m, but rising up to 1,000 m in the east. The mostly gentle relief is punctuated by low massifs covering 20 km² or more and rising to 50 to 300 m above the peneplain along old fracture lines in the Gondwanian shield. These massifs join to form a spectacular chain of granite inselbergs exposing large stretches of naked rock. This extends for over 100 km from east to west along the Ituri and Nepoko watershed in the north of the Landscape and small isolated massifs extending over 50 km in the central part of the forest.

Geology and soils

The soils of the Landscape are mostly derived from degraded granite and quartzite of the Gondwanian shield. The soils range from red oxysol, fine and highly degraded, to yellow or brown sandy clay. Alluvium deposits occupy the banks of the watercourses and poorly drained basins of the heads of numerous rivers. The soils are generally very acidic¹ and this acidity is associated with low fertility, as well as a shortage of available nitrogen and phosphorus. More fertile areas exist, particularly in association with red oxysol. A systematic evaluation of the agricultural potential in the Landscape remains to be carried out.

Hydrology

Almost all the Landscape belongs to the Congo Basin and is covered with a dense network of permanent watercourses which flow into the Upper Ituri and its main tributaries: the Epulu, Nepoko, Nduye, Lenda, Ebiena and Ngayu rivers. A small part of the Landscape belongs to the Kibali-Bomokandi Basin, which constitutes the head of the Uélé-Oubangui system.

The region's rivers have moderate high waters with the maximum reached between September and November. After heavy rains, the small watercourses undergo brief high waters which disturb their beds and take away debris. Flood plains are rare in the Landscape and are limited to the largest rivers in the west, especially the Ituri, the Lower Ngayu and the Lower Lenda. The heads of numerous streams have poorly drained areas that create dendriform networks of marshy environments. So far, the heads of most of the basins draining the Landscape have been very little affected by human activities, unlike the case with rivers originating outside the Landscape. The latter often have more turbid waters associated with deforestation and other changes. The alluvium load in the Ebiena River, which has its sources in the denuded regions of Kivu, can be very high. The alluvium load of the Ituri River, which has its origin in the extensively logged areas in the east of the Landscape, has increased appreciably over the last ten years.

There is still no hydroelectric development in the Landscape. With its extremely high gradients and vast volumes of water, the Upper Ituri and its main tributaries represent a substantial potential in this field.

Climate

The average daily temperature varies between 23°C and 25.5°C. Rainfall is bimodal, with rainy seasons centered on the equinoxes and dry periods centered on the solstices. Inter-annual variations can be considerable and are partly linked to the variability of the passing of the intertropical convergence. Rains often beat down during storms and are mainly caused by the climatic system of the Congo Basin. The monsoon effects of the Indian Ocean are not known², but it seems that the region's climate is influenced by dynamics outside the Congo Basin, leading one to suppose that it could undergo rapid changes.

The average annual rainfall in the Landscape is 1,600 to 2,000 mm. The driest month is January, the only time when the average rainfall dips below 50 mm in some parts of the Landscape. During the dry season, the sky is completely cloudless, humidity is low and evaporation very high. Even in dense forest, water losses are substantial. Some years, these dry periods are particularly long. In Epulu, in the center of the forest, during the span of the last 20 years, at least five years have had a sufficiently long dry period for forest fires to develop. As it is situated on the edge of the forest block and human impacts are increasing, the Ituri Landscape is very vulnerable to degradation and changes in its flora, even during relatively short periods of drought.

Vegetation

Most of the Landscape is covered with dense evergreen terra firma forests with a closed canopy (Figure 22.2). They comprise forests with a monodominance of *Gilbertiodendron dewevrei* (mbau), which forms both the canopy and the undergrowth, and mixed forests in which no species is predominant, but where other Caesalpinioideae, such as *Julbernardia seretii* and *Cynometra alexandri*, are abundant. In the north and the east of the Landscape, and on the dry slopes, there are semi-deciduous forests whose canopies contain more light-demanding species, such as *Entandrophragma spp.*, *Khaya anthotheca*, *Albizia spp.* and *Canarium schweinfurthii*, and a growing proportion of dendritic Euphorbiaceae and Rubiaceae. At the northern and eastern ends of the forests, the dense forests turn into a mosaic of dry forests, evergreen forest galleries and wooded savannahs. Swamp forests grow along watercourses or in poorly drained areas. They are characterized by the presence of *Hallea stipulosa*, *Uapaca*

¹ The average pH values are around 4 in the Epulu area, where measurements were taken recently.

² At the end of the dry season, black rain fell on the Ituri forests during the first Gulf War in 1990-1991. Large fires in the oilfields caused enormous black clouds over the Persian Gulf and the northern Indian Ocean. These observations suggest an eastern influence on the Ituri climatic system.

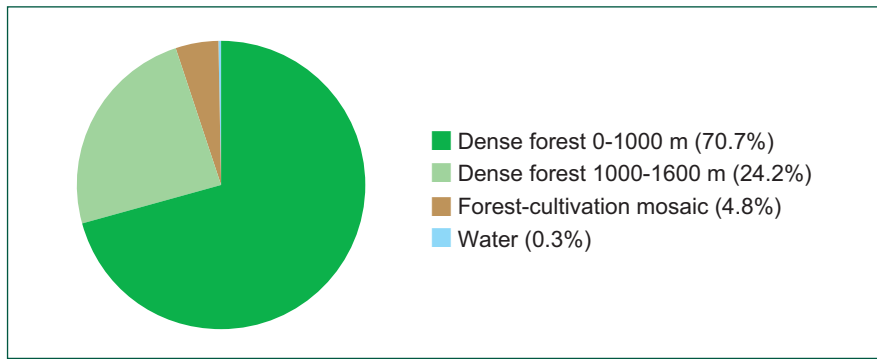


Figure 22.2. Main vegetation types
(Source: JRC).

guineensis, and a local dominance of *Raphia* sp.. Lianas are abundant.

On the shallow and rocky soils on the granite inselbergs are highly specialized xerophile plant formations comprising many species of plants that have a limited distribution and are of global importance for conservation.

Throughout the Landscape there are also clearings, called *edo* locally, which are maintained by elephants, but used by a wide variety of fauna. The size of clearings varies from less than a hectare to several hectares. They are recolonized by the forest when the influence of elephants disappears.

Secondary forests of varying ages cover large parts of the Landscape, partly as a result of natural causes. Violent storms effectively tear large holes in the forest and a mosaic of primary and secondary forest develops. These mosaics can cover an area of more than 10,000 ha³. Over the last 25 years, three violent storms that affected the canopy over an area of more than 1,000 ha were recorded within an area of 500 km² around the Epulu station. Secondary forests are also the result of human activities: shifting agriculture and, to a lesser extent, small-scale logging. Around 2% of land in the reserve, as well as land outside, is covered with anthropogenic environments of different ages. This area of old agricultural land is limited to a 6-km wide strip along the road that passes through the Landscape. In the southeast of the Landscape, degradation of the forests and deforestation have increased over recent decades, causing the formation of vast areas covered with a mosaic of degraded forest and cultivated land. The extension of this area is a threat to the Landscape.

From a floristic point of view, the Ituri forest is very diverse. CEFRECOF data and additional collections reveal the presence of 1,190 species of plants in the dense forests around the Epulu station⁴. Collections in other areas of the Landscape could raise this number to 1,500 and perhaps even 2,500 if the forest-savannah mosaic is included.

Fauna

Mammals

The Ituri forests are exceptionally rich in mammals and a total of 90 species have been found in the central sector. These forests are home to thirteen species of diurnal primates—the highest number for an African forest—and six species of duiker. The Landscape contains populations of world importance for several species with a limited distribution, endemic or almost endemic to the DRC: the okapi *Okapia johnstoni* (Figure 22.3), the aquatic genet *Osbornictis piscivora*, the giant genet *Genetta victoriae* and Hamlyn's monkey *Cercopithecus hamlyni*. It also has large populations of globally threatened species, such as the forest elephant *Loxodonta africana cyclotis* and the chimpanzee *Pan troglodytes*. Other important species are L'Hoest's monkey *Cercopithecus lhoesti*, the leopard *Panthera pardus*, the Cape buffalo *Syncerus caffer nanus*, the bongo *Tragelaphus euryceros*, the sitatunga *Tragelaphus spekei*, the African golden cat *Felis aurata*, the giant forest hog *Hylochoerus meinertzhageni*, the red river hog *Potamochoerus porcus*, the water chevrotain *Hyemoschus aquaticus* and the forest aardvark *Orycteropus afer eriksonni*.

The forest-savannah ecotone has not yet been systematically inventoried, but reports by missionaries before the recent civil war mention the lion *Panthera leo*, the spotted hyena *Crocuta crocuta*, the hippopotamus *Hippopotamus amphibius*, the East African Defassa waterbuck *Kobus ellipsiprymnus defassa*, the bongo *Tragelaphus euryceros*, the bushbuck *Tragelaphus scriptus*, the bohor reedbuck *Redunca redunca* and the vervet monkey *Cercopithecus aethiopicus*. The skin of a little known meerkat, Dyboswki's meerkat *Dologale dybowski*, a species which lives at the edge of forests, was collected recently. This suggests that the forest-savannah mosaic could contain specialized fauna that is rare or absent in other parts of the Congo Basin and absent from the more arid regions to the east and the north.

Birds

Ornithological inventories have only covered small portions of the Landscape, but at least 333 species have been observed in the central sector of the reserve. Systematic observations in the Epulu area have revealed a rich avifauna and a large number of specialized forest species, particularly among the ground thrushes *Zoothera* sp., Timalidae and Accipitridae. The golden-naped

³ In these areas, the undergrowth, including advanced regrowth of canopy species, is not destroyed by storms and is 'liberated' by the opening-up of the canopy, which allows rapid regeneration.

⁴ The botanical inventories carried out by the *Centre de formation et de recherche en conservation forestière* (CEFRECOF) since 1994 in the Epulu sector of the Landscape have revealed the presence of 700 woody plants with a stem diameter of over 1 cm in four parcels of 10 ha, including 460 species of trees and 243 species of lianas.



Figure 22.3. The Okapi *Okapia johnstoni*.

weaver *Ploceus aureonucha* is endemic to the Ituri forest.

Herpetofauna

There are no recent inventories and research will be necessary before the value of the Landscape for this group of animals can be estimated. However, collections in museums suggest that the Ituri forests are rich in reptiles, with three species of crocodiles, but that they do not constitute a 'hot spot' in this field. Very little is known of the amphibians.

Ichthyofauna

The Ituri River and its tributaries contain an ichthyofauna that is still largely unknown. It is fished locally, although not intensively at present. Given the fact that the Ituri Basin is well upstream in the Congo Basin, its fauna is not as rich as in the central basin. Furthermore, some major rapids on the middle course of the Ituri create a biogeographical barrier which isolates this river from the Congo River. Preliminary inventories carried out at the beginning of the 1980s showed that the ichthyofauna consisted primarily of generalist species that were usually widely distributed; it also included some species that have not yet been found elsewhere and specialist species such as rock browsers, which live in torrents and are probably endemic to the Ituri Basin. Some of these species were unknown to local fishermen whose methods are inappropriate for catching these specialist species.

Invertebrates

Diurnal butterflies are the only invertebrates that have been the subject of systematic inventories in the Landscape. Collections have been made in three places. In Epulu (altitude 750 m),

the 6,251 specimens collected belong to 116 genera and 487 species. They include the most eastern collections for five species previously known only in West or Central-West Africa. These species are absent at the collection spots in the east of the Landscape, where the altitude exceeds 900 m and where there are species linked to the higher altitudes of the Albertine Rift (Ducarme, pers. comm.). These results confirm the importance of the Ituri forests as areas where species from separate biogeographical regions come together.

Humans in the Landscape

Density and distribution

Until recently, the Ituri forest was one of the least populated areas in the northeast of the DRC, despite a very long history of human occupation. Cut stone tools found at the eastern edge of the Landscape indicate human presence in the Middle Stone Age. However, it is not certain if the region was covered in forests at that time. Recent excavations in sheltered areas under rocks in the north of the Landscape show that a few millennia ago the forest was inhabited, but played only a minor role in the development of human cultures, particularly in the expansion of iron-working.

When the first Europeans arrived at the end of the 19th century and the first documents were written, the forests of Upper Ituri contained only small scattered villages and vast areas were not inhabited on a permanent basis⁵.

The human populations in the Landscape increased during the colonial period, following the opening-up of the first roads and the development of mining and agricultural plantations in the region. Over the last 60 years, and most notably in the last 30, considerable migratory movements have invaded large portions of the Landscape. This immigration continued even during the latest conflicts between 1996 and 2003 and in spite of the clashes between rival militias who were present throughout the Landscape. Some immigrants were fleeing insecurity in their home region; however, even during the periods of conflict most of them were motivated by economic opportunities. These opportunities included easy access to cultivable land, jobs in mining or small-scale forestry and the small businesses that these activities generated.

Most recent immigrants in the Landscape come from the densely populated heights of the Albertine Rift, where the population density is over 100 inhabitants/km² and accessing new agricultural land is becoming difficult. The popula-

⁵ The members of the first expedition, which visited the region around the end of the 1880s and had to obtain supplies from the local inhabitants, found so few villages that they nearly starved to death. The Arab slave trade and clashes between Westerners and Arabs in this region had perhaps reduced even further the already sparse populations. Whatever the case may be, the Ituri forests were less inhabited than the forests situated just to the west or the forest-savannah ecotone to the north.

tions of Beni, Butembo and Bunia, the major urban centers on the eastern edge of the Landscape, are increasing at the rate of 4.2% a year. In the northwest, the populations of the Isiro region are also growing quickly. An analysis of satellite images taken over the last 20 years shows that the regions adjacent to the Ituri Landscape are undergoing the most substantial deforestation in DRC.

Two vast blocks of the Landscape still have a low human population density:

- The wildlife reserve (around 1,400,000 ha), where a census in 2003, at the beginning of the CARPE-CBFP program, revealed that there were 17,000 people in the reserve (1.2/km²) and 37,000 people within 15 km of the limits.
- Immediately to the east of the reserve, the Mai-Tatu block (1,200,000 ha) has not yet been the subject of censuses, but is constantly occupied by military poachers, which suggests that it still contains sizeable animal populations.

The total human population of the Landscape is unknown. Mambasa and Nia-Nia, the two major centers, have fewer than 20,000 inhabitants, but are growing rapidly. Very roughly, the total population of the Landscape and its immediate periphery can be estimated at 300,000. The population of the Beni and Butembo region is about 1.5 million and has a growth rate of 2.5-2.8% a year.

Ethnic groups

The semi-nomadic Mbuti and Efe (Figure 22.4) were probably the first inhabitants of the region, but when they arrived is unknown. While their way of life today is similar to what it was originally, these Pygmies have not been able to live inside the forest independently of other ethnic groups and had to colonize the forest at the same time as groups practicing shifting agriculture. The latter are believed to have come to the region 2,000-3,000 years ago. At present, the number of Pygmies in the Landscape is estimated at 30,000. They continue to lead a semi-nomadic lifestyle, but still depend heavily on the Bantu populations.

Among the forest farmers, the main ethnic groups are the Bila, Ndaka, Lese, Mbo and Mamvu. They depend on shifting agriculture, supplemented by fishing and hunting. The Ngwana arrived in the Landscape with the Arab slave trade in the 19th century. During the colonial era, new populations were added. The most numerous are

the Nande, from the mountains to the east of the landscape, and the Budu, from densely populated regions to the north and west. Many of the newcomers came to rejoin members of their family or clan. Today, all the centers where several families live contain several ethnic groups. The population of Epulu, with 2,000 inhabitants, comprises over 30 different ethnic groups.

Activities

Subsistence agriculture

Manioc, banana-plantain, rainfed rice, taro, yams and groundnuts are the main crops in the Landscape. Maize is used for the local production of alcohol. The agriculture practiced by the groups who traditionally live in the forest is based on a rotation system of two years of crops and ten years of fallow. Fields are small, generally less than 2 ha, and represent only a small proportion of the agricultural mosaic. The long periods of fallow allow the soil to regain its fertility and provide good habitats for fauna. The populations of certain animal species are denser in these secondary environments than in the adjacent forests. In areas where fallow periods are still long, clearing of the primary forest is very limited. The mosaic of secondary forests is rich in palm trees *Elaeis guineensis* and *Raphia sp.*, which are rare in dense forests.

The recent immigrants practice a more intensive agriculture, with larger fields, shorter fallow periods and more extensive clearing of the primary forest. Although more research is necessary, studies show that fallow periods of five years or less lead to the soil becoming depleted, regeneration of forest coming to a halt and the forest being replaced by prairies of *Imperata* or thickets of bushes and lianas.

Cash-crop agriculture

During the late colonial period and up to the 1970s, there was substantial production in the Landscape of products for marketing: rainfed rice and palm oil were intended for the urban and mining centers and coffee for export. The traditional forest populations had very few cash crops. Coffee was produced by small family businesses, generally belonging to recent immigrants, or vast plantations typically owned by Europeans. In the 1970s, the expatriates' companies were nationalized and, subsequently, quickly abandoned. By the end of the 1970s, the road network began to deteriorate, access to markets became difficult, prices fell and crops were gradually abandoned. Today, production is minimal and there are no longer any coffee plantations. These plantations



Figure 22.4. Semi-nomadic hunters.

have been converted into land for subsistence agriculture or have been invaded by the forest.

Fishing

Small-scale fishing using nets, traps, lines and hooks is the most important activity after agriculture. In some communities near watercourses, fishing is the main activity. Immigrants from lower down the hydrological basin bring new methods and fish more intensively. An inventory of the ichthyofauna and its productivity is an essential priority in the Landscape.

Hunting

Hunting is practiced throughout the Landscape and is the primary activity of the Mbuti and Efe, who generally practice hunting by tracking. The use of nets and rounding-up methods is practiced in the center and south of the Landscape, while hunting with bows and arrows is dominant in the north and the east. Eight species of small ungulates are the main targets of this hunting. Hunters using dogs also catch several species of primates and small animals such as meerkats or rodents. When hunting with nets or bows and arrows, many animals manage to escape. This reduces the impact of hunting and makes it profitable only when there are large numbers of animals.

Mbuti hunters have hunting territories with more or less fixed camp locations, which are used on a periodic basis by clan or family groups⁶. The villagers hunt as well, but in their case this ac-

tivity is carried out full-time by a few specialized individuals. Village hunters primarily use snares, which ensure a degree of success even when the animal populations are low. Budu hunters recently extended hunting with snares deep into the Landscape from the west. Few recent immigrants from Kivu are specialized hunters.

The use of firearms was not common until the civil war, when rival militia, joined by the national police, set themselves up in the Landscape to control access to gold and timber or to organize commercial and ivory hunting. At present, military arms are still circulating in the Landscape.

Incomes

Very few inhabitants of the Landscape have regular wages. Most of those with wages are employed through churches or international NGOs, including conservation NGOs.

The collapse of the road network in the 1970s has limited both access to markets and development possibilities. At present, bicycles are the main means of transport on what is left of the roads⁷. The economic context of the Landscape will probably change quickly when the roads are rebuilt. Repairs to the trans-African highway between Kisangani and Bunia are already under way. This road will facilitate immigration and improved access to markets will encourage the extraction of forest resources. In the absence of any controls, mitigation measures and management,

⁶ Preliminary mapping of these hunting areas has been undertaken around Epulu and it remains to be seen whether this type of demarcation is as extensive in other sections of the Landscape.

⁷ On the road that used to be trans-African, over 250 tons of goods were carried to Epulu on bicycles over a four-month period in 2002. Mostly, it consisted of cheap foodstuffs. There was no bushmeat and none of the agricultural products came from the Landscape.

the Landscape will come under unprecedented threats⁸.

Mining

Ituri is rich in minerals: gold, coltan and diamonds. Gold mining dates back to the colonial period. Kilo-Moto was one of the main companies at that time, located near the eastern edge of the Landscape. Access to mining resources was a major issue in the civil war and is still at the heart of the present conflicts. Hundreds of small permanent or semi-permanent mines have become active since the legalization of small-scale mining in the 1980s. No Landscape-wide survey exists, but at least 25 camps are operational in the wildlife reserve. Today, all mining operations are on a small scale, even in the Kilo-Moto concession where miners work under contract. Most operations are concerned with alluvial gold, but a growing number of miners are trying to extract gold from the parent rock after grinding and washing it with mercury. This trend will increase as the price of gold increases.

Land use

Most of the Landscape is not managed or legally allocated (Figure 22.5). The largest legal area is the Okapi Wildlife Reserve. As concerns extractive areas, there is an ENRA concession.

Logging

Logging is concentrated in semi-deciduous forests, near the transitional area between the dense forests and the wooded savannahs in the east, where valuable species such as *Milicia excelsa*, *Entandrophragma sp.* and *Khaya anthotheca* are more abundant.

There were no concessions in the initial Landscape, but in 2004 the limits of the Landscape were extended to encompass the only legally registered logging area in eastern DRC. It covers about 52,000 ha and has been allocated to ENRA, which has its base in Beni. This small company produces 5,000-7,000 m³ of sawn timber a year. Another company, Dara Forest, was active during the period of the rebellion, but it was unable to legalize its activities, most likely due to the fact that it was involved in illegal exploitation of the country's resources during the war. It is continuing with its illegal activities.

Most logging in the Landscape is in the form of small-scale activities stretching from the south and east right across the Landscape⁹. There is virtually no logging in the north or west, because of

the very bad state of the roads. This illegal small-scale logging and agriculture are major threats for the ENRA concession.

Reasons for the identification of the Landscape

- (1) The Landscape is one of the main reservoirs of biodiversity on the continent.
- (2) The Landscape is one of the last refuges for large fauna in DRC, especially for okapi, the last large populations of chimpanzees and forest elephants¹⁰.
- (3) BirdLife International has included the Ituri forest among its Important Bird Areas (IBA).
- (4) The Landscape has the last large forests where populations of semi-nomadic hunter-gatherers continue to live and the Okapi Wildlife Reserve constitutes a unique opportunity to develop participatory wildlife management with these populations, who represent 18% of the human population in the reserve. Without a legal definition of land uses, controls on immigration and regulations protecting traditional hunting, the Mbuti and the Efe will quickly become a minority on their own lands¹¹.

Conservation

History

The exceptionality of the Ituri forest was recognized as soon as the first biological explorations of the region were carried out at the beginning of the 20th century. Active conservation began with the installation of the station at Epulu, with a view to catching live okapis for zoos around the world. To this effect, the station set up a system of zones for catching the animals along the road running from the east of Nia-Nia to the west of Mambasa. In these zones, the okapis' habitat was left intact and those inside the zones were protected by the local populations, who were the first to be hired during the capturing campaigns.

Management of the station was taken over by ICCN, which continued the tradition of protected capture areas. During the 1980s, it became clear that the traditional authority was not going to be able to keep up this protection when faced with the level of immigration into the forest. Consequently, in 1992, the wildlife reserve was created and placed under the authority of ICCN. The legal text creating this protected area mentions conservation as a priority, but also allows for

⁸ At the moment and for the foreseeable future, the populations of the Landscape have no means of generating income other than by intensifying and marketing the products of subsistence activities, especially agriculture, hunting, fishing, crafts, small-scale logging, mineral extraction or small businesses. All of these activities are going to have to be managed to prevent degradation of the Landscape.

⁹ These small-scale loggers work in little associations using chainsaws to produce rough-sawn timber on the felling site and use modified bicycles to carry the wood as far as the road, where it is loaded onto vehicles for export to East Africa. About 150 loggers were active in the southeast of the Landscape, most of them without legal permits.

¹⁰ Recent studies over 5,500 km² in the central part of the reserve showed that 3,000 elephants have survived the war. Elephants also exist in another area of 3,000 km² and in an unknown portion of the Mai-Tatu block, where surveys are planned.

¹¹ This tendency is already clearly visible with the Pygmies living in the immigration areas or outside the Landscape.

a lot of freedom in the management of the reserve to accommodate access by the local populations and traditional non-destructive hunting. The reserve covers 1,370,000 ha, which represents over a third of the Landscape. In 1996, it became a World Heritage Site, on the basis of its faunal richness and its importance for the traditional peoples of the forest.

A coalition comprising ICCN and some international NGOs (WCS, WWF and GIC) has worked on conservation of the reserve since the mid-1980s, particularly through the creation of a research and training center (CEFRECOF). At the beginning of the civil war, ICCN, WCS and GIC, with the support of the United Nations through UNESCO, formed a partnership ensuring the permanent presence of conservation personnel in the reserve throughout most of the troubles. This presence continues to supply information which has allowed the reserve to be supported at the international diplomatic level and has protected its headquarters and at least some of its resources.

Since the mid-1990s, in accordance with the ICCN mandate to manage the reserve, the original capture areas have been consolidated to serve as the basis for a formal zoning plan, which continued to be developed during the conflicts and still constitutes a priority management objective. This zoning provides for the creation of 22 agricultural areas—six already existed—linked to well-established communities living on the edge of or in the reserve. Clearing of land inside the reserve will be limited to these areas and demarcated according to the present and future needs of the populations. Two additional areas have been proposed, but their limits and management method are still to be defined. The first is a traditional hunting area which will cover most of the reserve and will be used exclusively by the Mbuti and the Efe. The second will be an integrated protection area intended to protect large animal populations from any form of exploitation.

Players

The players active at present are:

- ICCN
- the local populations involved in the zoning program for the reserve
- the territorial administration, comprising group leaders, three sector leaders and the administrator of the territory of Mambasa
- international NGOs: WCS and Gilman International Conservation (GIC)
- UNESCO in support of the information

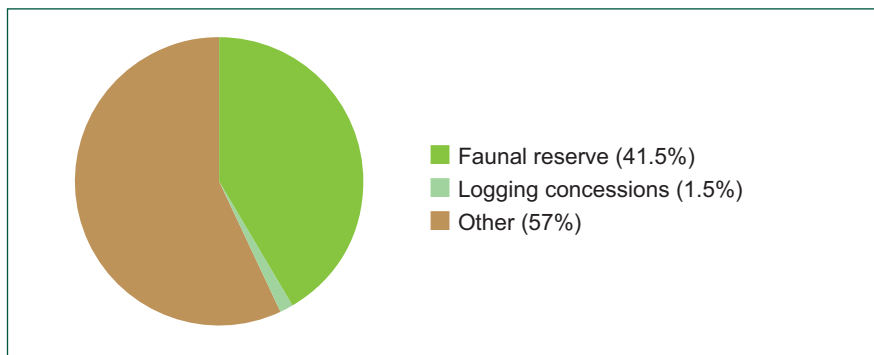


Figure 22.5. Main land uses.

management unit based in the reserve, which is linked to ICCN

- ENRA, the private logging company which wants to improve the management of its resources
- the association of small-scale loggers

Direct threats

(1) Small-scale logging and agriculture

These two activities fragment the forest. This process is well advanced at the southeastern edge of the Landscape, demonstrating what must absolutely be avoided if the Landscape is to retain its biological value and its importance for the traditional peoples of the forest¹². New access to markets and the rise in prices could set cash-crop agriculture in motion. Without sound management, this could open up the forest to major clearing and the arrival of new populations.

(2) Ivory hunting

Elephant hunting and the illegal ivory trade started in 1996 with the beginning of the civil war. They expanded in 2002-2004 when rival militia, joined by the national police, established hunting camps in the Landscape, recruited and armed professional hunters and signed contracts with local dealers to sell the meat and ivory¹³. ICCN drew up a report on these massacres, which perhaps had the effect of the military and poaching camps being removed in 2004 and 2005. Elephant poaching has now been reduced considerably, but there are far fewer elephants to hunt and the animals that survived are harder to find. An unknown number of hunting units are still active in the Mai-Tatu block, where poaching continues. ICCN has found that the number of military arms in circulation has fallen, but they are still present in the reserve.

¹² The increase in the settlement of populations begins with the creation of small isolated hamlets and the introduction of small-scale logging from existing roads. These gaps grow and increase in number, forming a mosaic of secondary vegetation and fields. In the more advanced stages, the forest is severely fragmented and/or reduced and new villages spring up, connected by trails and footpaths.

¹³ Over a 12-month period from 2002 to 2003, ICCN information gathering services identified 17 tons of ivory crossing the Landscape. They were unable to do anything about it due to the high-level of political protection enjoyed by some poachers.

(3) Hunting for meat

Hunting is very widespread and its impact on the fauna varies according to the methods used. Hunting with snares, which is very destructive, has grown considerably over the course of the last decade and has now reached remote regions of the Landscape. The trade in bushmeat has also increased significantly in the reserve and the Mai Tatu block. Animal populations in the southern part of the Landscape and the areas around large villages have been reduced to the point where meat consumption in these areas is virtually nonexistent. The trading network involves dealers and buyers in the regions of Beni, Butembo, Kisangani and Isiro, but there is also considerable meat consumption in Mambasa and Epulu, the headquarters of the reserve.

(4) Small-scale mining

This is a localized threat, but it can have major repercussions due to the fact that it is accompanied by uncontrolled population movements and an increase in the trade in bushmeat. Many small mines are characterized by significant variations in the level of activities; however, when mines are eventually abandoned the populations do not always leave the invaded areas. In this way, mining contributes towards the establishment of permanent communities. A recent census conducted in the reserve, where mining is illegal, reveals that many new immigrants are former miners who came from far away and have decided to become farmers.

(5) Commercial fishing

Recent observations suggest that small-scale fishing is growing in the Landscape, but it does not constitute a threat at the moment. With road repairs, this growth will continue and fish stocks will drop in the areas where fishing is heaviest.

Indirect threats

(1) Increase in human populations

A considerable increase in the populations, especially through immigration, has been observed in several places in the Landscape. The recent conflicts have not changed this trend and this increase will probably accelerate with improved access and the return of a certain level of security. In the reserve, censuses carried out by WCS between 1994 and 2003 reveal an increase of 6-16% in the major centers. Sometimes, this growth can be rapid: in 2004, the population of Epulu rose from 1,570 to 2,265 in six months when security returned and the NGOs supporting the reserve resumed their activities. Some of these increases

can be temporary, but it is clear that the overall population of the Landscape has risen considerably over the last 50 years.

(2) Lack of management capacity

The weakness of the local government authorities, including a lack of funds, weak institutions, incompetence and corruption, means that the State agencies responsible for the monitoring and management of natural resources are unable to carry out their tasks. The development of any new institutional platform for the implementation of management in the Landscape is also handicapped by the lack of a mandate. This compromises efforts to resolve conflicts concerning the use of resources and weakens the ability to control abuses. Without a clear mandate, local management programs can be wiped out or brushed aside by external forces that are more politically powerful. Even when such a mandate exists, implementing it can be compromised: ENRA, for example, has logging rights on its concession, but cannot prevent either illegal logging or illegal installations.

The problem of a lack of mandates is one of the reasons why conservation activities are focused on the reserve. Within its limits, ICCN exercises a mandate that covers a large number of management activities and, although some of these activities still have to be legally and administratively confirmed, its authority is clear. This is not the case outside the reserve or in the Landscape. Establishing mandates for these areas remains a major challenge.

Financing and conservation

Most of the financing for the Landscape comes from CARPE. Additional funds from WCS and GIC are primarily devoted to the reserve. Anticipated finance includes 3 million euros for the reserve from the German development bank (KfW) between 2007 and 2012 and US \$100,000 from UNESCO's emergency fund for 2007-2009. Outside the reserve, ENRA should be investing funds in the management of its concession, but as long as the limits are not respected and illegal logging continues, this company will not continue to make investments in sustainable forestry. The Catholic church of Mambasa and several humanitarian NGOs based in the Landscape are also injecting funds into development. Coordination among these players is only in its infancy. As for ICCN, the organization provides little financing for the reserve and the Ministries in charge of the environment and mines make even fewer funds available for the Landscape.

Environmental education and capacity building

Environmental education programs were first initiated by GIC in the reserve 15 years ago. Since the end of the civil war, these have been renewed and extended beyond the reserve. These programs are increasingly seen not only as a way of making the values of the reserve known, but also as a basis for a dialogue and exchange of information that can facilitate the development and implementation of the zoning of the reserve.

Management in the field of renewable natural resources

(1) At the Landscape level

There is no zoning or other activity in the pipeline at the Landscape level.

(2) In the reserve

Conservation-related activities are based in the reserve and focus on two crucial activities:

- anti-poaching patrols carried out by ICCN
- zoning of the different forms of land use undertaken by ICCN and its NGO partners

The reserve is to be split up into three types of areas:

- agricultural areas
- small areas where human settlements and land clearing will be permitted
- hunting areas, covering most of the reserve, where only traditional methods (nets, bows and arrows) will be allowed
- total protection areas for the conservation of key species

These activities require improved governance, particularly as relates to controls on immigration. To this effect, ICCN, in conjunction with its partners and the administrative authorities, is testing a pilot program to regulate access and the permitted length of residence in the reserve, through the introduction of a residence permit. Four types of status will be recognized:

- permanent resident
- temporary stay
- in transit
- returning to place of residence

Only the members of ethnic groups who traditionally used to live in the reserve and whose home villages were in the reserve can obtain the status of returning resident. The zoning program, including controls on immigration, has incorporated several administrative levels. Legalization of these activities must be pursued.

(3) In the extraction areas

The CARPE program for the Landscape is working with ENRA in an effort to establish a plan for the sustainable management of the concession. This plan will serve as a model for another proposed concession to be set up beyond the small-scale logging and agriculture front, so as to form a buffer zone at the edge of the reserve.

(4) In the rural areas

For zoning to be successful, shifting agriculture must be slowed down and agricultural production increased through improved methods. Towards this end, WCS and GIC have undertaken several assistance projects for farmers, which include technical support, the distribution of selected seeds and tools and the introduction of new crops, agro-forestry methods, composting and fish farming. These promising initiatives must now be assessed.

Human-animal conflicts must be controlled, especially as the animal populations around crops will increase.

Hunting must be managed. The present approach involves studying how traditional hunters use and manage access to their forests. The information collected will be used to develop culturally acceptable recommendations for controlling access and preventing the most intensive forms of commercial hunting, concurrently consolidating and confirming the rights and responsibilities of the traditional communities with respect to hunting.

Small-scale logging must be managed through support for legally recognized associations of small-scale loggers already established in the Landscape and its periphery. Major problems to be resolved concern the allocation and protection of concessions, working practices, controls on environmental attacks and taxation.

Research and monitoring

In the past, the wildlife reserve and the Ituri forest have served as a framework for basic research programs, which themselves serve as the basis for the management programs being developed today. These interventions must be continued and extended to address new challenges that are already taking shape.

The most important research over the last 30 years has concerned key species (okapi, duiker, elephant), basic studies on forest dynamics and phenology and socioeconomic subjects related to the traditional peoples of the forest and the new immigrants. Since it was created in 1990, CEFRECOF in Epulu has also served as a training and applied research center supporting the wildlife reserve.

Present work centers on obtaining post-conflict data on the biological and socioeconomic state of the Landscape and on the impacts of its utilization by human populations. Approximately 40% of the inventories have been completed. They have collected data on action to combat poaching and on the development of zoning. A program based at ICCN and supported by Belgium and UNESCO has produced a basic map of the wildlife reserve and is now developing capacity to manage data concerning the protected area in Epulu.

Transport and tourism

Before the war, Epulu was an important transit center for commercial and tourist vehicles traveling to or from Kisangani. Every day, 10-20 trucks stopped at Epulu and the local populations were able to sell their agricultural produce or buy salt, paraffin, cigarettes, food, clothing and many other items. Tourism was also an important source of income for local populations: between 1987 and 1993, 22,775 tourists visited Epulu to see the okapis in the captivity of their vast enclosures.

23. Virunga Landscape



Figure 23.1. Map of Virunga Landscape (Sources: CARPE, DFGFI, JRC, SRTM, WWF-EARPO).

Location and area

The Virunga Landscape covers 15,155 km² and includes two contiguous national parks, Virunga National Park in DRC and Volcans National Park in Rwanda, the Rutshuru Hunting Zone and a 10 km-wide strip at the edge of the national parks (Figure 23.1). It therefore contains human populations who have a direct impact on the protected areas. Although the more remote populations also have an influence, the conservation program has chosen to work with the immediate peripheral communities because they use the savannahs and forests in the parks to obtain firewood and building materials or to clear land for agriculture and the construction of infrastructure. Outside the Landscape, the two national parks are also contiguous with the national parks of Semuliki, Queen Elizabeth, Rwenzori and Mgahinga in Uganda. Together, these six national parks constitute the largest transborder complex of protected areas in Africa, to which must be

The Landscape in brief

Coordinates: 1°1'29"N – 1°44'21"S – 28°56'11"E – 30°5'2"E.

Area: 15,155 km²

Elevation: 680–5,119 m

Terrestrial ecoregions: Ecoregion of the Afroalpine barrens of Ruwenzori-Virunga
Ecoregion of the Afromontane forests of the Albertine Rift
Ecoregion of the forest-savannah mosaic of Lake Victoria

Aquatic ecoregions: Mountains of the Albertine Rift
Lakes Kivu, Edward, George and Victoria

Protected areas: Virunga National Park, DRC, 772,700 ha, 1925
Volcans National Park, Rwanda, 16,000 ha, 1925
Rutshuru Hunting Domain, 64,200 ha, 1946

added Bwindi-Impenetrable National Park situated a short distance away from the volcanoes in southwest Uganda. This complex functions as a single ecosystem and many animals move across the borders, which permits restoration of the populations¹.

Physical environment

Relief and altitude

The Landscape is focused on the central trough of the Albertine Rift, occupied by Lake Edward (916 m, 2,240 km²), and vast plains at an altitude of between 680 and 1,450 m. Its western edge stretches along the eastern bluff of the Mitumba Mountain Range forming the western ridge of the rift. In the northeast, it includes the western bluff of the Ruwenzori horst (fault block) with its active glaciers, whose peak reaches a height of 5,119 m and whose very steep relief comprises numerous old glacial valleys (Figure 23.2). In the south, on the border between DRC and Rwanda, it contains the Virungas, a series of eight large volcanoes surrounded by innumerable smaller volcanoes emerging from a vast plateau of lava. The highest volcano, Karisimbi, rises to a peak of 4,500 m (Figure 23.3).

Geology and soils

The mountains along the western fringe of the Landscape consist of metamorphosed rocks from the Proterozoic era. The Ruwenzori is a block of highly metamorphosed rocks (mainly gneiss) which was pushed and driven upwards in the middle of the graben, splitting it into two branches: the Semliki along the line of the rift and

¹ In the first half of the 1990s, following years of war and troubles in Uganda, hundreds of elephants reoccupied Queen Elizabeth National Park, very probably coming from DRC.



Figure 23.2. The high summits of the Rwenzori Range.



Figure 23.3. The Virunga.

² The volcanoes are split into three groups, of which the group lying farthest west, formed by the Nyamulagira (3,058 m) and the Nyiragongo (3,470 m), is still active. The last major eruption in January 2002 seriously affected the city of Goma.

³ Before the colonial power installed water supplies, mainly in the 1950s, this volcanic region was very sparsely populated, however, it was used in places as a pasture area by transhumant herdsmen.

⁴ Lake Kivu is itself formed by the damming of a river, which flowed into Lake Edward following the formation of the Virungas.

Lake George farther east. The plains to the north and south of Lake Edward consist of Quaternary alluvions providing sandy or clayey-sandy soils, but there are also horizons of volcanic dust. The oldest volcanic formations date from the Miocene (12 million years); the most recent are present-day². These volcanic formations provide highly permeable soils that are unable to hold water but are extremely fertile³. The soils of the plains around Lake Edward have also been influenced by the area of explosive volcanisms in Uganda, just to the east of the Landscape in Queen Elizabeth National Park.

Hydrology

The volcano region has no or very few watercourses, but most of the southern part of the Landscape drains into Lake Edward through the Rwindi, Ishaha and Rutshuru rivers. From Lake Edward, the waters descend into Lake Albert via the Semliki, which also receives the waters from

Mitumba and the western slopes of Ruwenzori, and then on to the White Nile. Apart from Lake Edward, the Landscape also contains Lakes Bulera and Ruhondo in Rwanda, high-altitude lakes formed by the dam of high valleys following volcanic eruptions, together with the northern shore of Lake Kivu⁴ in DRC. These lakes also belong to the Nile Basin via the Akagera River. Only the shores of Lake Kivu and the few streams that flow into this lake belong to the Congo Basin.

Climate

The climate is bimodal with two rainy seasons around October–November and April–May and two dry seasons around January and July. However, rainfall and temperatures vary enormously according to altitude and relief⁵. Gradients are very steep in places. The plains to the south of Lake Edward are hot and receive less than 1,000 mm of precipitation a year on average, while the saddle between the Karisimbi, Mikeno and Bisoke volcanoes receives over 2,000 mm at an altitude of 3,000 m. The flanks of the Ruwenzori are also very rainy, while the highest peaks, over 4,000 m, are dry⁶. Locally there are fog effects which accentuate rainfall. Above 3,500 m, night frost is frequent.

Vegetation

The main types of vegetation are (Figure 23.4):

- (1) grassy savannahs; bush and tree savannahs of *Acacia* and *Combretum*; savannahs with xerophile thickets; and wooded savannahs having close floristic affinities with East Africa, dominant in the central part of the Landscape between the towns of Rutshuru and Beni and around Lake Edward
- (2) sclerophyllous forests and thickets, associated with the lava fields in the south of the Landscape, in the Nyiragongo and Nyamulagira sectors
- (3) xerophile forests of *Euphorbia dawei* and *Olea europea*, endemic to the piedmonts of the rift mountains
- (4) Guinea-Congolese plain forests, limited to the northern part of the Landscape along the Semliki River and comprising mixed formations and formations dominated by *Cynometra alexandri*
- (5) riparian forests
- (6) submontane and montane forests with formations of *Podocarpus*, *Hagenia* and *Hypericum* and thickets of bamboo *Synarundinaria alpi-*

- na, limited to the flanks of Ruwenzori to the northeast and the volcanoes in the south
- (7) high-altitude barrens and thickets of Ericaceae (*Philippia benguelensis*, *Ph. johnstoni*, *Erica arborea*, *E. kingaensis*)
 - (8) Afroalpine barrens with giant lobelia *Lobelia sp.* and dendritic senecios *Senecio sp.*, above 3,500 m on the volcanoes and Ruwenzori⁷ (Figure 23.5)
 - (9) degraded forests and cultivated land, generally outside the protected areas
 - (10) swampy areas around Lake Edward.

In Virunga National Park, 2,077 plant species have been recorded, of which 230 are endemic to the mountains of the Albertine Rift (Plumptre *et al.* 2003).

Fauna

Mammals

Over 210 species of mammals have been found in the Landscape. Of these, 21 are endemic to the Albertine Rift, particularly the Ruwenzori otter shrew *Micropotamogale ruwenzori* and the mountain gorilla *Gorilla beringei beringei* (Figure 23.6); others are endemic to the northeast of the Guinea-Congolese forests, especially Elliot's red colobus of Uganda *Piliocolobus oustaleti* and the giant genet *Genetta victoriae*. Among the important but widely distributed species, mention must be made of the chimpanzee *Pan troglodytes*, the elephant *Loxodonta africana*, L'Hoest's monkey *Cercopithecus lhoesti*, Hamlyn's monkey *Cercopithecus hamlyni* and the giant forest hog *Hylochoerus meinertzhageni*.

The savannah species include the lion *Panthera leo*, the spotted hyena *Crocuta crocuta*, the aardvark *Orycteropus afer*, the topi *Damaliscus lunatus* and Buffon's kob *Kobus kob*. The population of hippopotamuses *Hippopotamus amphibius* was the largest in Africa in 1959 with over 25,000 individuals.

Birds

The avifauna comprises 706 species of which 25 are endemic to the Albertine Rift. Most of these endemics are forest species, particularly the yellow-crested helmetshrike *Prionops alberti*, the Kivu ground-thrush *Zoothera tanzanicae*, Shelley's crimson-wing *Cryptospiza shelleyi* and Stuhlmann's double-collared sunbird *Nectarinia stuhlmanni*, which is known only in Ruwenzori; others live in high altitude vegetation, particularly

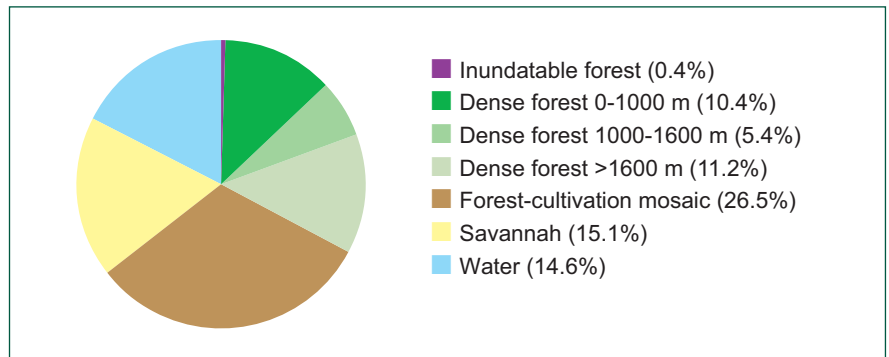


Figure 23.4. Main vegetation types (Source: JRC).

the red-tufted sunbird *Nectarinia johnstoni*, while one species, Grauer's scrub-warbler *Bradypterus graueri*, only lives in high-altitude marshes with Cyperaceae. The papyrus gonolek *Laniarius mufumbiri*, which is specific to papyrus, is endemic to the Lake Victoria region⁸. Finally, the humid environments of the Landscape are also important for migratory populations of certain Palearctic birds, particularly many shorebirds and the white-winged tern *Chlidonias leucopterus*.

Herpetofauna

Reptiles are represented by 109 species of which 11 are endemic to the Albertine Rift (including the bush viper *Atheris nitschei*). The Nile crocodile *Crocodylus niloticus* has recolonized Lake Edward after an absence of probably several thousand years. Amphibians are represented by 78 species of which 21 are endemic.

⁵ The average temperature falls by 0.6°C per 100 m rise in altitude.

⁶ Rainfall on the summit of Karisimbi is estimated at 800 mm/year on average.

⁷ The high-altitude environments of the volcanoes and Ruwenzori have a similar, but not identical flora; many species are common, but others are limited to a single massif.

⁸ Of the 9 species connected with this region and known in the DRC, 6 have been found in the Landscape (Fishpool & Evans, 2001).

Figure 23.5. Afroalpine moorland with giant lobelias and groundsels.



Table 23.1. Percentage cover of different types of vegetation in the Virunga Landscape

Type of vegetation	Cover in the Virunga National Park (%)
Afroalpine moorland and thickets	1.42
Moorland and thickets with heath	2.81
Forest of <i>Hagenia</i>	0.37
Bamboo thickets	2.36
Forest galleries	1.4
Montane forests of <i>Podocarpus</i> and <i>Neoboutonia</i>	11.25
Sclerophyllous forests and thickets	10.95
Sclerophyllous forests of <i>Euphorbia dawei</i>	1.31
Dense moist forests	11.78
Savannahs	35.79
Recent lava flows (less than 10 years ago)	2.3
Lakes	18.26



Figure 23.6. The Mountain Gorilla
Gorilla beringei beringei.

Ichthyofauna

The ichthyofauna of Lake Edward has been shaped by several phases of mass extinction, probably on the occasion of volcanic events, the latest of which date back 8,000-10,000 years (Thieme *et al.*, 2005). Some families, particularly the Mastacembelidae, Characidae and Schilbaeidae, well represented in the waters of the Nile Basin, are absent now. The Cichlidae in Lake Edward, which constitute the majority of the fish biomass in the lake, are related to those in Lake Victoria⁹. About 80 species have been described to date, of which 60 or so are endemic to Lakes Edward and George, but some waters have not yet been explored and some species are still to be described. Lake Edward is therefore very important from the point of view of biodiversity and until recently it was also one of the least disturbed of African lakes.

Invertebrates

Of the diurnal butterflies, 21 species are endemic to the Albertine Rift, particularly *Papilio leucotaenia*, a species that has only been found in a very few places.

Humans in the Landscape

Density and distribution

The population density varies from 6 to 600 inhabitants/km²; on average, it is 300 inhabitants/km². These populations are scattered

throughout the Landscape, especially outside the protected areas, but locally they can also be found in the protected areas, particularly in the fishing villages around Lake Edward. The urban centers with more than 10,000 inhabitants include Goma, Beni, Rutshuru and Kiwanja in DRC and Ruhengeri in Rwanda. Before 1950, the volcanic land around the Virungas was practically only inhabited by transhumant herdsman (Gogwe). Farmers did not move into this region until water supplies had been installed by the colonial authorities.

Ethnic groups

The main groups are the Nande of Lubero, Beni and Rutshuru, the Hunde of Masisi, Rutshuru and Goma, the Nyanga of Walikali, the Pere, the Kumu, the Twa and the *Banyarwanda* (Hutu and Tutsi).

Activities

The main activity is permanent intensive agriculture; about 80% of the population practices this activity. Around 5% of the population fishes—several thousands illegally—and fewer than 1% are involved in pastoralism. Many people hunt, but hunting is not a main activity; it is only a supplement to agriculture. About 14% of the Landscape's inhabitants are supported through other activities, mainly jobs in towns.

Land use

The main land use is conservation (52%); agriculture covers 45% and fishing 3% (Figure 23.7). Around 80% of land outside the national parks is used for permanent agriculture. Industrial crops include coffee, tea, cocoa and, in Rwanda, pyrethrum. Apart from fishing in Lake Edward, there are no protected areas with extractive activities and there are no forestry concessions.

Main reasons for the identification of the Landscape

- (1) The Virunga (DRC) and Volcans (Rwanda) national parks form part of the first national park created in Africa (1925) for the spectacular large fauna that used to live on the savannahs around Lake Edward and for the unique mountain and lake landscapes; Virunga National Park has become a World Heritage Site (1979) and Volcans National Park is a Biosphere Reserve.

⁹ A genetic study of the Cichlidae in Lakes Edward and Victoria shows, however, that the species of this family are derived from species in the Congo Basin and are not Nilotic. In fact, until 400,000 years ago, the waters in these regions drained into the Congo Basin and were not captured by the Nile until after the upheaval caused by the formation of the rift (Seehausen *et al.*, 2003).

- (2) Given the extraordinary diversity of habitats, this Landscape is the most diversified in Central Africa, at least as far as vertebrates are concerned.
- (3) The high-altitude ecosystems around the volcanoes and Ruwenzori are unique.
- (4) It is an area of world importance for conservation due to the fact that it is home to a very large number of species of mammals endemic to the Albertine Rift and which do not exist in other CBFP Landscapes, apart from the Maiko-Tayna-Kahuzi-Biega Landscape.
- (5) It is considered to be an important area for bird conservation (Fishpool & Evans, 2001).
- (6) It is important for its ichthyofauna, notably its large number of endemic Cichlidae.

Conservation

History

Volcans National Park and Virunga National Park were created in 1925 as a single entity: Albert National Park. They were separated in 1960, with the independence of DRC. The Rutshuru Hunting Zone was created in 1946. Volcans National Park has had areas removed on two occasions, cutting its total area by about 50% and also reducing its habitat diversity¹⁰. Since the 1970s, the two national parks have benefited from some major support projects, particularly from the Belgian Cooperation and the European Community.

Players

(1) Governmental players

ICCN in DRC and ORTPN in Rwanda are in charge of managing of the protected areas.

(2) Conservation NGOs

These are represented by AWF, FFI, WWF, FZS, DFGF-Europe, DFGF-International, MGVP, ZSL, BRD, CBO and CBV.

(3) Conservation projects

The principal projects are the WWF project (800,000 US\$/year), which covers the entire Virunga National Park, and the International Gorilla Conservation Program (AWF, FFI and WWF), which covers both national parks

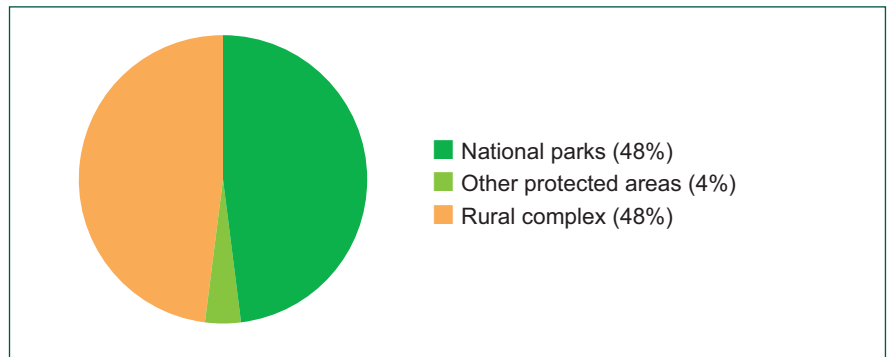


Figure 23.7. Main land use types.

(800,000 US\$/year for these two areas). The zoological societies of London and Frankfurt also have important projects in support of ICCN for Virunga National Park. WSC, DFGF and other organizations also support conservation efforts in this Landscape.

Direct threats

(1) Conversion of habitats

This is the main threat to the Landscape, with irreversible effects (Box 23.1). Over 168,000 farmers have invaded Virunga National Park over the last seven years. They have degraded 90,000 ha. Although a number have been relocated elsewhere, 50,000 people still live in the Kilolirwa area and 30,000 on the western shore of Lake Edward.

(2) Military camps

The presence of military positions and camps in Virunga National Park has a negative impact on natural resources: uncontrolled and poorly paid troops poach, their families grow crops and the camps attract much human activity and trading.

(3) Small-scale mining

Small-scale mining concerns only 5% of the Landscape and is much less important than in other Landscapes in DRC.

(4) Hunting

Hunting for meat has dramatically reduced all the populations of large mammals in Virunga National Park.

(5) Fishing

Illegal and unsustainable fishing is a serious threat to the resources of Lake Edward.

¹⁰ In 1958, 70,000 ha were given over to agriculture and in 1969, 10,000 ha were cleared for the planting of pyrethrum. The *Prunus africanus* forests have thus disappeared (Vande weghe, 2004).

Box 23.1. Deforestation crisis in Virunga National Park

Virunga National Park, one of the most prominent World Heritage sites in DRC, lost more than 15 km² of forest between May 19 and July 3, 2004. The extent of the deforestation was derived from SPOT 10-m multi-temporal images. Once alerted, ICCN, the WWF Albertine Rift Ecoregion Programme and UCL-Geomatics (Belgium) acquired high resolution imagery to quickly quantify the ongoing deforestation and make these images available to decision makers. More than 7 km² of forest was clear-cut and more than 8 km² degraded by about 6000 people; according to different NGO reports these people mainly came from Rwanda. The self-explanatory satellite images timely disseminated using the Internet provided visual evidence to raise the issue to the international community. Thanks to the NGO community, as well as to international diplomatic efforts, the deforestation process was stopped in early July 2004.

The Virunga continues to be monitored by both WWF and UCL through a combination of field and satellite remote sensing observations. Following this deforestation crisis in the Mikeno sector of the national park, UNEP, WWF, IGCP, FZS and the EU have released emergency funds to support ICCN with the construction of a dry stone wall to restore the integrity of the park boundary. By mid-August 2004 more than 7 km of the wall had already been completed by 12 Congolese and 6 Rwandan associations; more than 20 km were completed by November 2004. The rapid intervention and collaborative efforts of the NGO community, national and international bodies has demonstrated to locals and the international audience, the determination to protect this World Heritage site, the oldest national park in Africa.

(6) Logging

According to a recent study, the city of Goma alone consumes over 47,000 tons of charcoal a year, which represents more than 250,000 tons of wood. More than 90% of this wood comes from Virunga National Park. The human populations in the Landscape do not have any other sources of energy and burn about 6 kg per family per day. Construction timber is also harvested on a small scale.

(7) Disease

The hippopotamus populations have been hit by anthrax epidemics twice since 1975.

(8) Volcanic eruptions

A major eruption could have extremely serious impacts on the vegetation, the aquatic ecosystems and human populations. Emissions of toxic gases are a constant danger for humans and animals.

Indirect threats

(1) War, lack of security and political instability

The region has suffered recurrent troubles since 1960, but as of 1994 they have reached a paroxysm. The national parks have become battlefields and mass movements of human populations have had catastrophic effects on vegetation, fauna and all renewable resources. Between 1994 and 1996, several hundreds of thousands of Rwandan refugees lived in the south of Virunga National Park. Today, the Nyamulagira sector of Virunga National Park (about 30% of the Landscape) is still inaccessible because of the presence of armed gangs and about 14,000 displaced families are scattered throughout the Landscape. They affect 5% of the land.

(2) Lack of capacity for park management

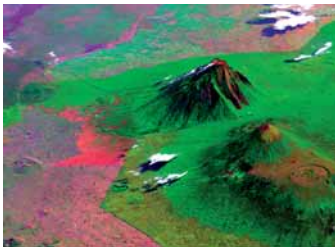
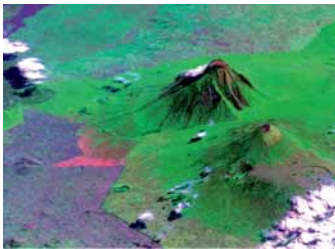
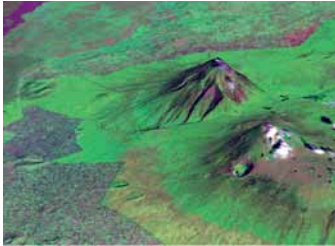
With no capacity, it is impossible to enforce the laws.

(3) Lack of jobs

The communities in the Landscape have no alternative employment possibilities and can only survive on the naturally occurring resources.

(4) Political interference

Highly placed individuals are encouraging the populations to occupy the protected areas.



State of the vegetation

In 2004, Virunga National Park lost 1,500 ha of forests because of populations arriving from Rwanda. In 2005, large-scale deforestation for charcoal production continued in the Nyamulagira sector of Virunga National Park and land clearance for agriculture spread outside the protected areas. In the hunting domain of Rutshuru, 90% of the surface area has been entirely degraded. The dramatic drop in the elephant and hippopotamus populations is also leading to dense ligneous vegetation invading the remaining savannahs.

State of the fauna

Observations in 2003 reveal the following in particular:

- There were 400 gorillas, comprising 380 mountain gorillas *Gorilla b. beringei* around the volcanoes and 20 Grauer's gorillas *Gorilla b. graueri* on Tshiaberimu.
- Elephants numbered 376, of which 286 were savannah elephants and 90 were forest elephants¹¹ in Volcans National Park and the Miikeno sector of Virunga National Park. The number of elephants in the north and south of Virunga National Park remains unknown because these areas are unsafe.
- The number of chimpanzees in Virunga National Park was estimated at 150, but decreased to only 130 in 2005 because of a loss of habitats due to the clearing of land for charcoal making and agriculture.
- The population of hippopotamuses in Virunga National Park was estimated at 26,359 in 1959 and 22,875 in 1989; it fell to 1,309 in 2003 and fewer than 900 in August 2005.
- On the plains of Rwindi-Rutshuru, the ungulate biomass fell from 27.6 tons/km² in 1980 to 2.5 tons/km² in 2005, a reduction of over 90%.
- Fish populations in Lake Edward are suffering from the effects of overharvesting.

Financing and conservation

The largest funding agencies are the European Union, USAID, SIDA and the MacArthur Foundation. When the first CoCoSi was created in 2005, a total of US \$2,800,000/year was pledged by ICCN partners.

Tourism

Both in the DRC and in Rwanda, the national parks saw considerable tourism in the past, but this collapsed with the troubles and wars that have been raging there since the beginning of the 1990s. In Virunga National Park, most of the tourist infrastructure has been destroyed but parts are being rehabilitated. Ecotourism focusing on gorillas resumed in 2004 and in the month of December 2005 alone 180 visitors were checked into Virunga National Park.

In Rwanda, tourism started again at the end of the 1990s and in 2005 there were 10,641 visitors, bringing in about US \$3 million. A new hotel for visitors to Volcans National Park was recently built in the Ruhengeri region.

Management in the field of renewable natural resources

(1) *At the Landscape level*

The Landscape is very complex, with a host of different land uses and several organizations active in conservation and the socioeconomic development of the local communities. Coordination of these activities is essential to ensure efficient use of the insufficient resources, synergy and impacts in the field. NGOs have been working in a partnership with the administrations of the protected areas to develop a coordinated plan covering the whole of the Albertine Rift. At the same time, a strategic transborder plan is also being formulated for all the central part of the Albertine Rift. An initial version of this plan has already been presented to those concerned and will be submitted to the executive directors of ICCN (DRC), UWA (Uganda) and ORTPN (Rwanda) at the beginning of 2006.

To strengthen conservation, a regional co-operation framework has been established with a view to transborder management of resources. This formalizes the unofficial cooperation that had been initiated by the different partners in the area of the gorillas back in 1991 and extends this cooperation to other areas in the Landscape.

An analysis of the policies, legislation and regional processes relating to conservation of the large primates in DRC, Rwanda and Uganda has been undertaken with a view to influencing the development of these regional processes and the legal frameworks for better conservation in the future.

¹¹ This figure may be too high because it is based on extrapolations and not actual counting.

(2) In the national parks

The research and monitoring plan for Virunga National Park was finalized in 2005 and a first planning meeting for the general plan was organized in June 2005. The process is set to continue in 2006. A management plan for Virunga National Park already exists and an assessment of the quality of its data is planned. The two plans will serve as the basis for the regional plan.

The legal texts demarcating Virunga National Park have been compiled and analyzed (Box 23.2). Previously, demarcation was determined by ten different decrees, which caused confusion and gave rise to poor interpretations. WWF and ICCN have started to consolidate these decrees in a single text so that all those involved start off on the same basis.

Despite this difficult context, there have been several successful activities in the field:

- Demarcation of the protected areas has been given tangible form on a participatory basis along 293 km of the limits of Virunga National Park by means of 235 posts and 989 planted trees.
- Meetings have been organized with those concerned.
- The authorities of the national parks have received material support (five patrol posts have been rehabilitated and equipment has been supplied) and technical support for training.
- 121,135 people who had illegally invaded the national park have been removed from the forests of Tshiaberimu, Nubilia, Lume, Kanyati, Kongo, Ishasha, Kibirizi and Mubambira; 70,667 ha have been recovered and the means of subsistence of the populations have been diversified (Box 23.3).

The strength of the CARPE program lies in the implementation of regional initiatives:

- Meetings between wardens from the different national parks have been organized to discuss law enforcement in the protected areas. At these meetings, information is exchanged on illicit or criminal activities with a view to improving management of the parks. These meetings were organized over the period covered by the report and one of the key themes was ivory hunting.
- Synchronized patrols have been organized by wardens from the two countries in their respective sectors. These patrols proved to be very important; they allowed snares to be removed, charcoal-making sites to be destroyed, loggers to be stopped, and poachers' camps and military camps to be uncovered.

Consequently, observations of animals have already increased.

- In the north, 150 patrols were carried out in 199 days—some at night, others during the day.
- Two regional meetings have been held, (1) to conduct an analysis of key species in the Landscape and reach an agreement on the action to be taken and (2) to discuss law enforcement among conservators in DRC, Rwanda and Uganda; they led to the interception in Uganda of four leopard skins from DRC.

Institutional support aims to strengthen these coordinated patrols, along with training, surveys of the fauna, monitoring of ecosystems and populations and the compilation of existing data on the Landscape.

(3) In the rural areas

The second key component of the CARPE program for Virunga has been the development of a plan for community management of resources, which will show the way forward for the integration of conservation into community activities and support for the conservation action undertaken. This activity was initiated in Kinigi, Rwanda, in May 2005 with the drawing up of the terms of reference, the definition of key activities and players and the preparation of a timetable. The plan is expected to be finalized by the beginning of 2006.

The program has trained members of the communities in business management so as to ensure the sustainability of their enterprises. This training covered subjects such as enterprise development, management structures and their role, strategic planning, keeping records and specific aspects of beekeeping, mushroom-growing, community tourism and craftwork. A team of national park managers also did a tour to explain to personnel the lessons learned in Uganda. All in all, 354 entrepreneurs, 62 of them women, heads of community organizations and managers of protected areas were given training.

Monitoring renewable natural resources and their management

(1) Monitoring of hippopotamuses and elephants on the savannah

Surveys are planned for 2006.

(2) General monitoring

The Landscape has a great deal of available information that can be used to plan the moni-

toring and management of natural resources. This information comprises data obtained from:

- guard patrols (illegal activities, key species of flora and fauna, known gorillas)
- socioeconomic surveys
- remote sensing

Socioeconomic monitoring of the volcanoes area in 2002 was extended to the entire national park in 2005. A study on charcoal consumption and trade in the Goma area was also carried out in 2005 in order to define the area that needed to be planted with trees for sustainable supplies to the city.

(3) Monitoring of gorillas

The monitoring activities that began in the volcanoes area in 1997 have been extended to the entire Virunga National Park so as to complete the data on gorillas and provide ICCN with standardized information on the national park as a whole, for use in management and financing.

(4) Remote sensing

WWF has bought and analyzed a series of SPOT images taken in 2004-2005 over all the Landscape, so as to determine a basis for monitoring the forest cover in the Landscape and invasion of the protected areas.

Box 23.2. Properly documenting the legal boundaries of protected areas as a prerequisite for sound rehabilitation: the case of Virunga National Park

In order to find a lasting solution to high levels of encroachment, such as those into Virunga National Park, it is important to document properly the level of encroachment. This can only be accomplished if protected area boundaries are clearly identified and agreed upon by all.

Even in the case of a well-established national park, such as Virunga (created in 1925), clear identification of boundaries may be a very difficult process. This was exemplified in the difficulties experienced by ICCN and WWF who joined force to tackle this issue.

The process began by obtaining the legal texts delineating the national park, which was done by collating all legal decrees directly pertaining to the description of boundaries. In the case of Virunga National Park, there were eight such texts that dated from 1925 to 1950. The next step was to analyze and produce a consolidated text resulting from these various decrees. This was achieved in January 2005 and the document was subsequently published.

The next crucial step was to 'translate' the text into a means of physical identification in the field. This was a particularly difficult exercise in the case of Virunga National Park, because some of the old beacons no longer exist and where they do, they are often far-between. In addition, the texts make regular reference to human infrastructure (small villages, traditional paths, markets, local concessions) that existed in 1925 or 1935, but which has since disappeared or been displaced. Finally, the texts often refer to natural features whose names have since been forgotten, such as tiny rivers or summits of small hills.

To overcome these difficulties, several sources of information were overlaid into a Geographic Information System (GIS). The GIS layers included: 1/50,000 scale maps from 1948, which provided invaluable information on old toponyms; aerial photos from 1959; satellite images at 5m resolution from 2004 and 2005, which served as the map base and clearly identify areas of encroachment, as well as many features that are not visible from the ground; and numerous ground control points taken in the field.

The results of this exercise were sometimes dramatic and demonstrated how important this activity was. For example, in the Kilolirwe area, the exercise required overlaying the 1948 map, three sets of boundaries derived from different legal decrees, a 1959 aerial photo and SPOT images. The results showed that in some places the boundaries being used in the field are off by as much as 500 meters. In some cases these discrepancies may be the result of local arrangements between ICCN and local communities that have never been formalized or incorporated into delineation exercises.

Once the official boundaries of the park were established, it was possible to add an additional GIS layer showing the area of encroachment. Following this procedure allowed ICCN and WWF to make an official calculation of the area of encroachment, which totaled 10,000 hectares in the study area alone.

Box 23.3. Progress made towards the voluntary withdrawal of illegal cultivators from Virunga National Park

Virunga National Park in eastern DRC covers an area of approximately 780,000 ha in a region that has one of the highest human population densities in Africa. It is therefore only somewhat surprising that the wars and socio-economic crises that have hit eastern DRC during the last 8 years have increased the pressure for local cultivators to move into the national park. Due to strong political interference and a lack of logistical capacity, as well as a lack of security, ICCN has had little power to prevent this encroachment and, in total, close to 170,000 people have, at some point in time, invaded the World Heritage Site. This has been a dynamic process, with a continued influx of illegal settlers in some areas and people leaving from other areas. It should be noted that the majority of these 'settlers' were actually people from neighboring communities who extended their activities into the park or growing human settlements that spilled over the park boundaries, as opposed to long-distance immigrants (although the latter also exist). ICCN and WWF began to document and monitor the process, and have been working on a case-by-case basis to obtain as much voluntary evacuation of encroached areas as possible. Significant results have been achieved during the past three years in terms of recovered encroached areas and reaching agreements for local communities to stop cultivating inside the National Park, as can be seen in Table 1. These results (Table 2) were achieved, in part, with support from CARPE and other sources of funding, including the European Union and WWF.

Table 1. Degree of encroachment in Virunga National Park (DRC) between 1998-2004 and September 30, 2005.

	1998-2004	Sept 2005	1998-2004	Sept 2005
Site	Encroached area (ha)	Encroached area (ha)	Number of people	Number of people
Tshiaberimu	3,500	0	1,800	0
Lubylia	4,200	7	22,000	100
Mavivi	19,000	19,000	25,000	25,000
Kyavinyonge	5,000	0	0	0
Kanyatsi	3,000	0	7,000	0
Lume	2,300	0	4,600	0
Côte ouest	12,000	12,000	30,000	30,000
Kibirizi	19,000	0	0	0
Kongo	9,000	0	18,000	0
Ishasha	500	0	15	0
Kanyabayonga	2,100	1,200	0	0
Kilolirwe	10,200	10,200	60,000	60,000
Tongo	60	0	0	0
Total	89,860 ha	42,407 ha	168,415	115,100

Table 2. Surface area recovered and the number of people evacuated peacefully from Virunga National Park during the first two years of CARPE funding, with co-financing by the European Union and WWF. None of the people involved were displaced. All individuals were members of local communities who took advantage of the socio-political situation to spread their activities into the national park.

Site	Area recovered (ha)	Number of people evacuated
Tshiaberimu	3,500	1,800
Lubylia	4,193	21,900
Kyavinyonge	5,000	0
Kanyatsi	3,000	7,000
Lume	2,300	4,600
Kanyabayonga	900	0
Tongo	60	0
Total	18,953	35,300

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Annex A. Institutional and Legislative Indicators

	Cameroon	Eq. Guinea	Gabon	CAR	RC	DRC
Year	2005	2005	2005	2003, 2004	2003	2005
Primary source	MINFOF	COMIFAC CARPE	MEFEPPN	OCDN (NGO)	IGEFE	ICCN
1. Regulations to insure sustainable natural resource management and conservation						
Existing or modified regulations pertaining to protected areas, concessions, and community exploitation zones	38	2	2	3	3	3
Existing or modifications to regulations pertaining to protected areas, concessions, and community exploitation zones that have been nullified	6	2	0	3	3	1
2. Enforcement of conservation and forest laws						
Agents assigned to the field						
Total number	899	33	143	?	350	?
In concessions	659	17		?	47	?
In protected areas	240	12	52	?	?	1,961
At control check points		4				
Budget earmarked for the field (US\$)						
State source	?	0	578,807	80,000	?	11,000
Foreign source	?	40,000		1,000,000	?	?
3. International Conventions						
Algiers Convention	1978		1987	1970	1981	1976
Ramsar Convention	?		1975	In progress	1998	1996
World Heritage	1982				1987	1974
Washington Convention	1981		1987	1980	1982	1976
Bonn Convention on Migratory Species	1983		1979	In progress	1999	1990
Convention on Biological Diversity (Rio)	1994		1997	1995	1997	1995
Kyoto Convention on Climate Change	2002		1998	1995	1997	
Convention on Desertification	1997		1996	1995	1992	
Convention on Maritime Fishing			1958		1994	
Convention for the Protection of the Ozone Layer	1988				1997	
Bamako Convention				1991	1997	
Lake Chad Basin Commission				1994		
4. Infractions to forest and environmental laws						
Total number of infractions pertaining to forests and poaching	53	?	282	?	27	?
Number of infractions prosecuted	11	0	?	?	1	?
5. Institutional Capacity to Monitor Natural Resource in the Congo Basin						
Institutions in charge of natural resources monitoring						
Category 1-Lumber	7	1	?	?	?	1
Category 2- NTFP	7	1	?	?	?	?
Category 3-Fauna	7	1	?	?	?	?
Category 4- Fuelwood	7	1	?	?	?	?
Category 5- Special products	7		?	?	?	?
Documents published by natural resource category						
Category 1-Lumber	?	?	?	?	?	1
Category 2- NTFP	?	?	?	?	?	?
Category 3- Fauna	?	?	?	?	?	?
Category 4- Fuelwood	?	?	?	?	?	?
Category 5- Special products	?	?	?	?	?	?

	Cameroon	Eq. Guinea	Gabon	CAR	RC	DRC
6. COMIFAC						
Country that has ratified COMIFAC	No	Yes	?	?	Yes	?
Country contributing financially to COMIFAC	Yes	Yes	Yes	Yes	Yes	?
State contribution to proposed COMIFAC budget (%)	10	10	10	10	10	?
7. Mechanisms for cooperation between the government sector, non-government sector, and civil society						
Number of mechanisms	5	0	?	?	1	2
8. Forest Management Plan at the national level						
National mechanism for forest attribution (y/n)	Yes	Yes	Yes	Yes	Yes	?
9. International environmental NGOs contribution to national programs						
Mechanism for NGO coordination (y/n)	Yes	Yes	?	Yes	?	Yes
Outreach activities realized by NGOs or civil society organizations pertaining to environmental governance	7	0	3	?	?	2
10. Research and Training						
Research institutes						
Forestry	7	2	1	2	2	?
Agronomy	5	2		1	1	?
Biology/ecology	4	3	1	2	2	?
Number of forest engineers trained in 2002-2003	?	5	28	?	?	?
Number of agronomy engineers trained in 2002-2003	?	3	?	?	?	?
Number of biologists trained in 2002-2003	?	0	?	?	?	?

Annex B. Industrial Logging Indicators

	Cameroon	Eq. Guinea	Gabon	CAR	RC	DRC
Year		2005	2005	2003	2005	
Primary source	MINFOF	COMIFAC/ CARPE	MINEF	MEFEPPN	IGEFE	DGF
1. Forest areas attributed to exploitation						
Total forest area (ha)	22,000,000	2,058,301	22,000,000	5,200,000	22,471,262	1,280,004,246
Forests attributed to conservation (ha)	3,424,606	591,000	3,000,748	633,472	989,740	22,653,178
Forests attributed to production (ha)	7,598,238	1,597,253	13,000,000	3,327,012	19,817,687	105,351,068
Concessions total area (ha)	6,853,189	nd	12,999,000	3,960,484	nd	21,024,921
Attributed concessions (ha)	5,737,000	170,000	?	3,327,012	11,387,154	21,024,921
Community and other forests (ha)	744,049	42,000	0	0	nd	0
2. Mechanism for attributing concessions						
Formal request for applications	Yes	No	No	Yes	Yes	No
Freely negotiated permits	No	Yes	Yes	No	nd	Yes
3. Concessions						
Number of concessions < 100,000 ha	63	9	604	0	21	51
Total area (ha)	3,990,384	170,000	10,440,000	0	1,259,275	2,972,312
Number of concessions 100,000 - 200,000 ha	11	0	25	13	19	53
Total area (ha)	1,746,956	0	2,343,000	3,458,577	2,753,447	8,121,608
Number of concessions > 200,000 ha	0	0	1	9	20	42
Total area (ha)	0	0	216,000	2,686,176	7,374,432	9,931,001
4. Number of concessions per company						
At least 1 concession	56	1	?	4	25	40
Total area (ha)	5,737,340	15,000	?	1,425,272	2,753,447	4,842,421
1-2 concessions	54	4	?	4	5	16
Total area (ha)	5,390,602	155,000	?	1,425,818	1,486,225	4,733,873
3-5 concessions	2	0	?	4	6	10
Total area (ha)	346,738	0	?	701,107	3,897,522	5,570,943
>5 concessions	0	0	?	0	0	4
Total area (ha)	0	0	?	0	0	5,877,684
5. Area of concessions per company						
<100,000 ha	30	5	?	0	20	22
Total area (ha)	2,061,398	170,000	?	0	1,250,275	1,234,785
100,000-200,000 ha	26	0	?	9	14	13
Total area (ha)	3,675,942	0	?	3,458,677	2,753,447	1,968,252
>200,000 ha	0	0	?	4	16	35
Total area (ha)	0	0	?	2,626,176	7,374,432	17,821,884
6. Nationalities of concessions						
National companies	25	0	?	9	8	nd
Total area (ha)	2,143,715	0	?	3,458,677	2,109,482	nd
Mixed companies	0	0	?	0	0	nd
Total area (ha)		0	0	?	0	0
International companies	31	5	?	0	28	nd
Total area (ha)	3,593,625	170,000	?	0	9,268,672	nd

	Cameroon	Eq. Guinea	Gabon	CAR	RC	DRC
7. Progress in concession management						
Forest concessions attributed	74	9	630	9	60	146
Total area (ha)	5,737,340	170,000	13,000,000	3,458,677	11,378,154	21,024,921
Concessions in process of developing management plans	58	0	24	9	10	5
Total area (ha)	4,325,518	0	6,040,357	3,458,677	4,113,859	nd
Concessions with an approved plan	42	0	7	2	0	0
Total area (ha)	3,495,187	0	2,195,070	52,675	0	0
Certified concessions	1	0	2	0	0	0
Total area (ha)	41,965	0	868,441	0	0	0
8. Production						
Logs (m ³)	1,372,347	nd	nd	454,402	1,350,408	nd
Volumes transformed (m ³)	1,167,000	nd	nd	nd	167,153	nd
Volumes of exported logs (m ³)	33,000	nd	nd	144,391	776,013	nd
9. Industrial transformation statistics						
Sawn timber (m ³)	342,000	nd	141,725	74,186	167,753	nd
Peeled veneer (m ³)	13,000	nd	141,363	1,434	26,136	nd
Veneer and other (m ³)	34,000	nd	1,165,661	0	3,537	nd
10. Artisanal transformation statistics						
Sawn timber (m ³)	nd	nd	553	nd	nd	nd
Peeled veneer (m ³)	nd	nd	0	nd	nd	nd
Other (m ³)	nd	nd	387	nd	nd	nd
11. Total commercialization statistics						
Logs exported (m ³)	33,000	?	1,057,291	144,391	776,013	nd
Local commercialization			?	nd		
Sawn timber exported (m ³)	342,000	?	106,036	52,878	141,199	nd
Local commercialization			16,501	8,089		
Veneer exported (m ³)	32,000	?	78,879	nd	16,066	nd
Local commercialization			156	nd		
Plywood exported (m ³)	13,000	?	26,236	5		nd
Local commercialization			2,286	506		
Other (e.g. sliced) exports (m ³)	2,000	?	1,086,493	nd	86,592	nd
Local commercialization			3,436	nd		
12. Species						
Number of species exploited	55	27	nd	nd	-30	nd
Okoume (<i>Aucoumea klaineana</i>) (m ³)		x	x		259,055	nd
Tali (<i>Erythrophloeum ivorense</i>) (m ³)	72,717	x				
Padouk (<i>Pterocarpus soyauxii</i>) (m ³)			x			
Ayous (<i>Triplochiton</i>) (m ³)	360,189			x	49,735	
Douka (<i>Thiegemella africana</i>) (m ³)			x			
Azobé (<i>Lophira alata</i>) (m ³)	62,697	x				
Moabi (<i>Baillonella toxisperma</i>) (m ³)			x			
Bossé (<i>Guarea</i>) (m ³)					29,393	
Sipo (<i>Entandrophragma utile</i>) (m ³)				x	85,965	
Aniégré (<i>Pouteria</i>) (m ³)				x		
Sapelli (<i>Entandrophragma cylindricum</i>) (m ³)	173,754			x	602,825	
Iroko (<i>Milicia excelsa</i>) (m ³)	178,704			x		
Ilomba (<i>Pycnanthus angolensis</i>) (m ³)		x				
Ozigo (<i>Dacryodes buettneri</i>) (m ³)			x			
Eyong (<i>Eribroma oblonga</i>) (m ³)		x				

	Cameroon	Eq. Guinea	Gabon	CAR	RC	DRC
13. Revenue generated through recycling of industrial waste						
Steam production for drying	5 units	0	nd	nd	nd	nd
Production of steam and electricity	0	0	nd	nd	nd	nd
Commercial production of firewood and charcoal	15 units	0	nd	nd	602,818 m ³	nd
14. Contribution of the forest sector to the economy						
To GDP (%)	5.11	nd	4.10	13.04	nd	nd
To national export revenue (%)	20.30	nd	nd	nd	nd	nd
Forest taxes (US\$)	nd	nd	nd	nd	nd	nd
Total recovery rate (%)	nd	nd	nd	nd	nd	nd
15. Employment generated by the forest sector						
In forest exploitation	45,000	nd	nd	nd	nd	nd
In industry	22,000	nd	6,009	nd	nd	nd
In transport	nd	nd	nd	nd	nd	nd
Total direct employment	nd	nd	nd	nd	nd	nd
Number of individuals per family	nd	nd	nd	nd	nd	nd
Ratio of direct employment to indirect employment	nd	nd	nd	nd	nd	nd
Total direct and indirect employment	nd	nd	nd	nd	nd	nd
16. Fiscal incentives for sustainable management						
Are there fiscal incentives for sustainable management?	No	No	Yes	Yes (?)	No	Yes
17. Redistribution of forest taxes to local populations						
Redistribution supported by law	Yes	No	Yes	Yes	Yes	Yes
If yes, what percentage?	50	0	(variable)	30	50	40
18. Partnerships with conservation						
Number of partnerships with environmental NGOs	8	8	5	0	nd	nd
19. Conservation series						
Area in concessions (ha)	245,356	0	114,836	0	0	nd
20. Taking social aspects into consideration as a part of concession planning						
Health care	Yes	nd	Yes	Yes	Yes	nd
Education	Yes	nd	Yes	Yes	Yes	nd
Environmental outreach	Yes	nd	Yes	Yes	Yes	nd
Support for agriculture, small husbandry, or fishing	Yes	nd	No	No	Yes	nd
Hunting and poaching management	Yes	nd	Yes	Yes	Yes	nd
Alternative protein	Yes	nd	No	No	Yes	nd
21. Safety Measures						
In transportaion of logs	Yes	No	Yes	Yes	Yes	nd
In companies	Yes	nd	Yes	Yes	Yes	nd

Annex C. Biodiversity Indicators

Indicators of Pressure	AC		GMC	LC	Tridom			TNS			BL	TT		SLS	ML	MKB	It	VIR
	Gab	EG	Gab	G/RC	Cam	Gab	RC	Cam	RC	CAR	RC	RC	DRC	DRC	DRC	DRC	DRC	DRC
Human population density (persons/km ²)	0.4	17	0.4	?	3	1	1.3	3	1.5	1.2	?	?	9	2.4	6	30	7	7-640
Number of cities with >10,000 inhabitants	5	1	0	2	2	1	1	1	1	0	2	1	8	0	6	?	2	5
Shifting agriculture (% of Landscape area)	7	75	3.5	5	4.6	2.96	?	4.6	0.3	10	5	?	?	?	7	30	?	<3
Principal activity for Landscape population (%)	79	80	?	30	85	80	90	85	12.8	39	30	?	51	53	85	?	85	0
Portion of protected areas affected (%)				6	0	0	0	0	0.13	6	<5	?	?		?	?	38.2	<5
Permanent agriculture (% of Landscape area)	0	40	0	0	0.75	3	1	0.75	0	0	?	?	?	<1	0	>15	13.5	25
Principal activity for Landscape population (%)	0	80	0		5	?	60	5				?	?	?		?	?	90
Portion of protected areas affected (%)					0	0	2	0				<5	?	?		?	?	0
Cacao	0	Yes	0	Yes	Yes	Yes	Yes	Yes	No	0	Yes	Yes	Yes	?	Yes	No	No	Yes
Tea	0	0	0	No	No	No	No	No	No	0	No	0	No	0	0	Yes	No	Yes
Coffee	0	Yes	0	Yes	No	Yes	No	No	No	0	Yes	0	Yes	Yes	Yes	Yes	Yes	Yes
Palm oil	0	Yes	0	No	Yes	No	Yes	No	No	0	No	0	Yes	Yes	Yes	Yes	Yes	Yes
Rubber tree				No	No	No	No	No	No		No		No	Yes			No	No
Industrial agriculture (% of Landscape area)	0	2	0	0	0	0	2	0	0	0	0	0	2	<1	<1	0	0	5
Principal activity for Landscape population (%)	0	1	0				0			0		0	0	?	?		0	0
Pastoralism (% of Landscape area)	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	1
Principal activity for Landscape population (%)									0		0	<1					0	1
Portion of protected areas affected (%)												0					0	2
Stock farming (% of Landscape area)	0.01	1	2	0	0	0	0	0	0	0	0	<1	?	?	0	10	0	0
Principal activity for Landscape population (%)	1	1	?						0			<1	?			?	0	
Artisanal mining (% of Landscape area)	2	2	0	2	0.01	?	<1	0.1	<0.01	0	2	<1	?	?	0	>40	20-35	0
Principal activity for Landscape population (%)	24	0.5	0	2	0.01	?	<1	0.1	<0.01	0	2	<1	?			?	?	
Portion of protected areas affected (%)				0	0	0	0.004	0				?					33	
Industrial mining (% of Landscape area)	3.4	0	0	0	0.02	0	<1	0	0	0	0	0	0	0	0	0	0	0
Principal activity for Landscape population (%)	0				0.001		<1											0
Oil exploitation (% of Landscape area)	0	5	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Principal activity for Landscape population (%)	0	35	1200						0		0							0
Portion of protected areas affected (%)	0		42						0		0							0
Road density (km/km ²)	0.04	?	0.037	?	?	0.016	0	0.076	0	0.022	?	0.001	?	0.037	0.03	?	0.021	0.056
Accessible to cars and trucks (km/km ²)	0.037	?	0.037	?	?	?		0.076	0	0.022	?		?	?	?	?	0.021	0.056
Navigable rivers density (km/km ²)	0.009	?	0.034	?	?	0.012	?	0.02	0.03	0.034	?	0.006	0.5	?	0.04	?	0	0.056
Number of bushmeat markets	5	4	12	2	18	10	2	11	3	2	2	3	8	>6	7	>4	>4	0
Bushmeat as a portion of diet (%)	70	60	55	?	75	?	40	65	38	?	?	8	?	?	?	>50	low	1
Wood as a portion of household energy consumption (%)	95	?	40	?	?	?	100	?	?	99	?	?	99	?	?	90	100	100
Consumption/day/family (kg)				?	?	?	?	?	?		?		?			10	?	6
From natural forests	Yes	?	?	?	?	Yes	Yes	?	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
From plantations	Yes	?	?	?	?	No	No	?	No	No	No	No	No			Yes	No	Yes
From agricultural clearings	Yes	?	?	?	?	Yes	Yes	?	Yes	Yes	Yes	Yes	Yes			Yes	No	Yes
Faunal epidemics since 2000	No	?	No	Yes	No	Yes	Yes	No	No	No	Yes	No	No	No	?	No	No	Yes
between 1975 and 2000	?	?	No	No	No	Yes	No	No	No	No	No	Yes	No	?	?	No	No	Yes
Transmitted to humans since 2000	No	?	No	No	No	Yes	Yes	No	No	No	No	No	No	No	?	No	No	No
between 1975 and 2000	?	?	No	No	No	Yes	No	No	No	No	No	No	No	?	?	No	No	No
Uncontrolled armed groups	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Portion of Landscape occupied (%)													50			?	20-35	30
Refugees	No	No	Yes	No	No	No	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
in camps			No				No					Yes	Yes		?	No	No	No
number of families			2200				?					?	300000		?	?	?	12300
Invasive species (yes/no)																		
Chromolaena odorata	No	?	No	Yes	Yes	abund	abund	Yes	abund	abund	Yes	spor	No	No	No	No	Yes	No
Eichhornia crassipes	No	?	No	No	Yes	No	spor	Yes	spor	abund	No	spor	Yes	No	No	spor	?	No
Wassmannia auropunctata	No	?	abund	Yes	?	No	?	?	No	spor	Yes	No	No	No	No	No	?	No
Major pollution of rivers (Yes/No)	No	Yes	Yes	No	No	No	No	No	No	Yes	No	No	Yes	No	No	No	Yes	No
Hydrocarbons		Yes	Yes						No									No
Alluvium		No	No						Yes			Yes					Yes	

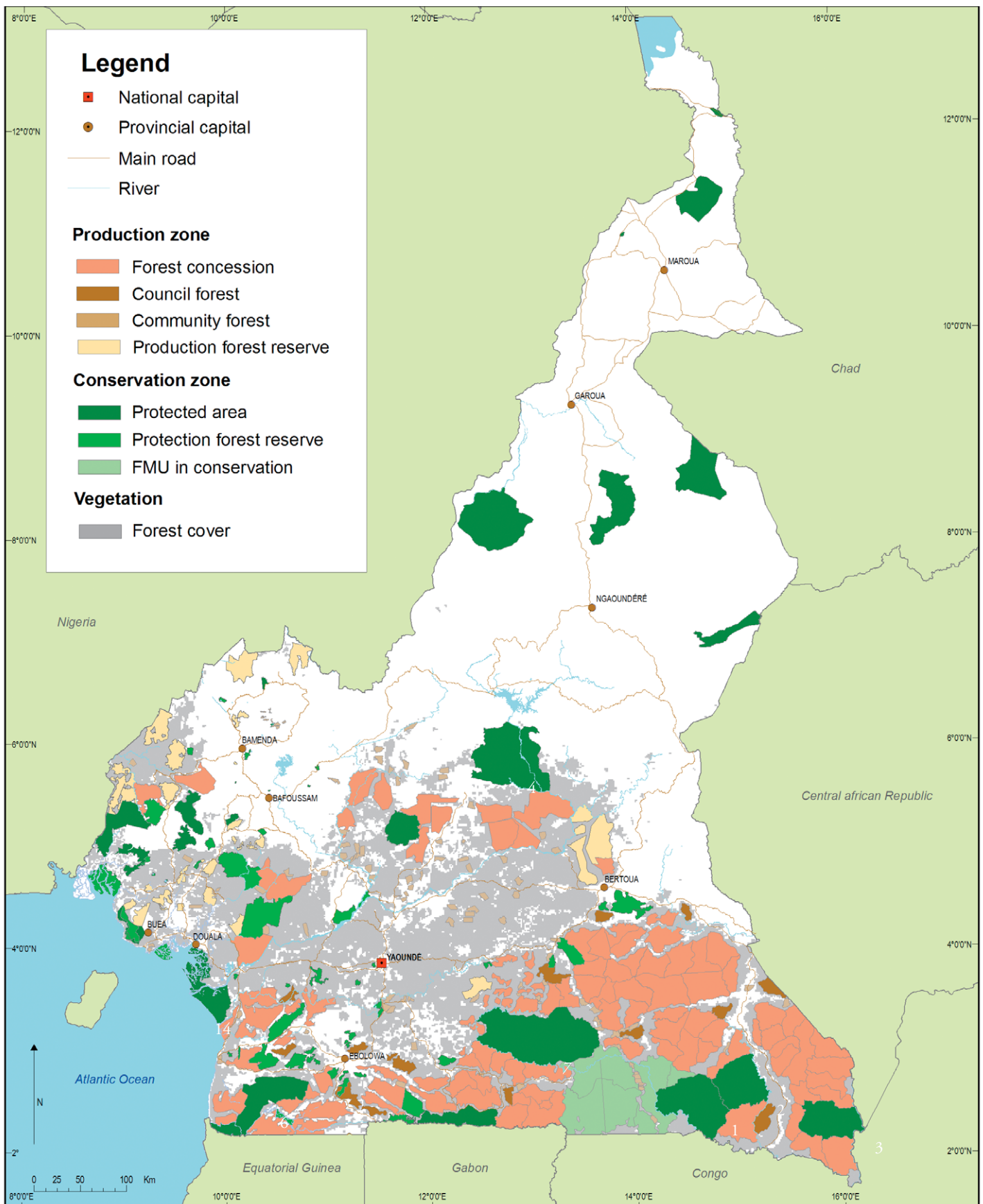
Indicators of Pressure	AC		GMC	LC	Tridom			TNS			BL	TT		SLS	ML	MKB	It	VIR
	Gab	EG	Gab	G/RC	Cam	Gab	RC	Cam	RC	CAR	RC	RC	DRC	DRC	DRC	DRC	DRC	DRC
Mining/industrial waste		Yes	No							No							No	
Urban waste		Yes	Yes							No		Yes					No	
Annual rate of deforestation (%)	nd	nd	nd			0.003			nd		nd	0.073	0.073	0.074	0.1	0.294	0.117	nd
Annual rate of forest degradation (%)	nd	nd	nd	nd		0.069			nd		nd	0.097	0.097	0.04	0.19	0.128	0.141	nd

Indicators of state of biodiversity	AC		GMC	LC	Tridom			TNS			BL	TT		SLS	ML	MKB	It	VIR
	Gab	EG	Gab	Gab	Cam	Gab	RC	Cam	RC	CAR	RC	RC	DRC	DRC	DRC	DRC	DRC	DRC
Species that have disappeared since 1900	0	?	?	?	?	1	?	?	?	?	?	?	?	1	?	?	?	?
Species that have appeared since 1900	0	?	1	?	?		?	?	1	1		?		1	?	?	?	?
Composition of bushmeat (%)																		
Primates	1	15	8	?	19	?	27	?	21	5	?	41		?	37	?	10.6	18
Large hooved mammals	4	10	3	?	15	?	4	?	53	25	?	3		?	34	?	2.4	22
Small hooved mammals	2	25	57	?	46	?	53	?	26	64	?	19		?	4	?	86.6	38
Rodents	3	10	5	?	4	?	10	?	0	1	?	6		?	8.5	?	0.4	5
Birds	5	5	1	?	3	?	6	?	0.15	0	?	<1		?	<1	?	<0.1	?
Reptiles	0	0	23	?		?	0	?		0	?	<1		?	13.4	?	<0.2	

Indicators of Response/Management	AC		GMC	LC	Tridom			TNS			BL	TT		SLS	ML	MKB	It	VIR
	Gab	EG	Gab	Gab	Cam	Gab	RC	Cam	RC	CAR	RC	RC	DRC	DRC	DRC	DRC	DRC	DRC
Legal mechanism for allocating land tenure	Yes	?	Yes	Yes	Yes	?	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Land use plans in Landscape	No	?	No	partial	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No
in preparation	Yes			Yes					Yes									Yes
produced	No																	No
agreed	No				Yes			Yes										No
implemented	No				Yes			Yes		Yes								No
Area covered by that plan (km ²)				35000					35000	4644								0
Number of management units (PA, CBNRM, conc.)	13	3	10	?	51	?	3	28	11	11	?	1	1	22	>20	3	2	3
Number of units with land use plans	1	?	10	?	11	1	2	12	10	11	?	1	0	0	?	0	0	2
in preparation	0		8	?	9		2	7	8	2	?	1						2
produced	0		0	?	11		1	11	1		?	0						0
agreed	0		2	?	11		0	12	1		?	0						0
implemented	?		0	?	11		1	6	2	9	?	0						0
Area of landscape covered by these units (%)	18.5	?	54	?	?	?	?	?	83	100	?	4	?	61	?	35	38.3	56
Total number of protected areas without extractive activities	8	1	3	3	4		1	1	1	1	1	0	1	1	0	3	0	2
Total area (km ²)	4500	1200	6900	6730	10736	3	13000	2170	4190	1251	2048	0	19	36560	0	17370	0	7938
Number with georeferenced limits	8	1	3	3	3	?	1	1	1	1	1	1	1	0		2	0	1
Number with a management plan in prep.	0	1	3	3	3	?	1	0	0	1	1		0	0		0	0	1
Number with a management plan implemented	0	0	0	0	0	?	0	1	1	0	0		0	0		0	0	1
Number with a business plan in prep.	1	0	0	3	3	?	0	0	1	1	0		0	0		0	0	0
Number with a business plan implemented	0	0	0	0	0	?	0	1	0	0	0		0	0		0	0	0
Number with short term funding (<2 years)	1	1	3	3	2	?	0	1	1	1	1		0	1		3	0	2
Number with medium term funding	0	0	3	3	0	?	0	0	1	1	0		0	0		1	0	2
Number with long term funding (>5years)	0	0	0	3	0	?	0	0	0	1	0		0	0		0	0	0
Number of pers. affiliated with PAs (N/1000km ²)	3.1	?	0.76	26.1	8.4	?	?	15.2	13.8	28.1	60		?	6.1		?	?	?
Number with primary education	1.1	?	0.27	15.7	4.7	?	?	10.6	9.8	4.5	20		?	1.2		?	?	?
Number with secondary education	1.6	?	0.32	6.7	2.8	?	?	2.8	7.4	19.1	20		?	3.6		?	?	?
Number with post-secondary education	0.4	?	0.15	3.7	0.9	?	?	1.8	3.6	4.5	20		?	0.08		?	?	?
Number of PAs with monitoring by remote sensing	1	0	0	3	0	?	1	0	1	1	0		0	1		0	0	2
Number of PAs with ecological monitoring	1	1	3	3	3	?	1	1	1	1	0		0	0		3	0	2
Number of PAs with an ecological monitoring report	1	-1	3	1	3	?	1	1	1	1	0		0	0		3	0	2
Number of PAs with an available ecological monitoring report	0	-1	2	1	3	?	1	1	1	1	0		0	0		3	0	2
Total number of protected areas with extractive activities	?	0	4	0	?	?	0	?	0	11	0	1	0	0	1	0	1	0
Total area (km ²)	?	0	?	0		?				3201		4400	0	0	3600	0	13760	0

Indicators of Response/Management	AC		GMC	LC	Tridom			TNS			BL	TT		SLS	ML	MKB	It	VIR
	Gab	EG	Gab	Gab	Cam	Gab	RC	Cam	RC	CAR	RC	RC	DRC	DRC	DRC	DRC	DRC	DRC
Number with georeferenced limits	?		4			?				11		1						1
Number with a management plan in prep.	?		2			?				6		1						1
Number with a management plan implemented	?		0			?				0		0						0
Number with a business plan in prep.	?		0			?				6		0						0
Number with a business plan implemented	?		0			?				0		0						0
Number with short term funding (<2 years)	?		4			?				1		1						1
Number with medium term funding	?		4			?				1		0						0
Number with long term funding (>5years)	?		0			?				1		0						0
Number of pers. affiliated with PAs (N/1000ha)	?		0.76			?				28.1		7.7						6.8
Number with primary education	?		0.27			?				4.5		3.4						1.6
Number with secondary education	?		0.32			?				19.1		2.3						5.1
Number with post-secondary education	?		0.15			?				4.5		2						0.2
Number of PAs with monitoring by remote sensing	?		0			?				11		0						1
Number of PAs with ecological monitoring	?		3			?				11		1						1
Number of PAs with an ecological monitoring report	?		3			?				11		1						1
Number of PAs with an available ecological monitoring report	?		2			?				11		1						?
Anti poaching measures																		
Number of citations for poaching	26	30	29	10	15	?	?	33	215	13	3	?	0	73	?	>135	13	?
in protected areas	15	0	29	5	5	?	?	10	3	13	3	?	0	71		?	13	100
outside of protected areas	11	30	?	5	10	?	?	23	212	0		?	0	2		?	0	50
Number of arrests	7	0	11	?	15	?	?	33	?	13	12	2	0	103	?	?	25	?
in protected areas	3		11		5	?	?	10	3	13	12	1	0	101		131	25	45
outside of protected areas	4		0		10	?	?	23	?	0		1	0	2		?	0	300
Number of seizures	0	28	45	?	446	?	?	1971			12	10	0	7937	?	?	27	?
in protected areas		0	45		30	?	?	657	1		12	8	0	7933			25	1500
outside of protected areas		28	0		417	?	?	1324		0		2	0	4		?	2	50
Number of citations prosecuted	0	0	3	?	15	?	?	33	?	13	0	?	0	1	?	?	4	15
in protected areas			3		5	?	?	10	3	13		?	0	1		5	4	10
outside of protected areas			0		10	?	?	23	?			?	0	0		?	0	5
Bushmeat trade																		
Is there a bushmeat study?	No	?	Yes	Yes	Yes	Yes	?	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	No
Is there a mechanism for monitoring bushmeat?	No	No	Yes	Yes	No	No	?	No	?	No	No	Yes	No	No	Yes	No	Yes	No
focused on protected areas			Yes	Yes			?		?			Yes			Yes		Yes	
focused on logging concessions			Yes	Yes			?		?			No					No	
implemented by the State			Yes				?		?			Yes					Yes	
implemented by NGOs			Yes	Yes			?		?			Yes			Yes		Yes	
implemented by the private sector			Yes				?		?			No					No	
Protected areas																		
Number of visitors to protected areas	<200	50	305	?	0	?	?	0	77	817	0	0	0	0	0	120	?	10641
Revenue from visits (in US \$1000)	<15	0	4.1	?	0	?	?	0	46.65	47.45	0	0	0	0	0	?	?	3000

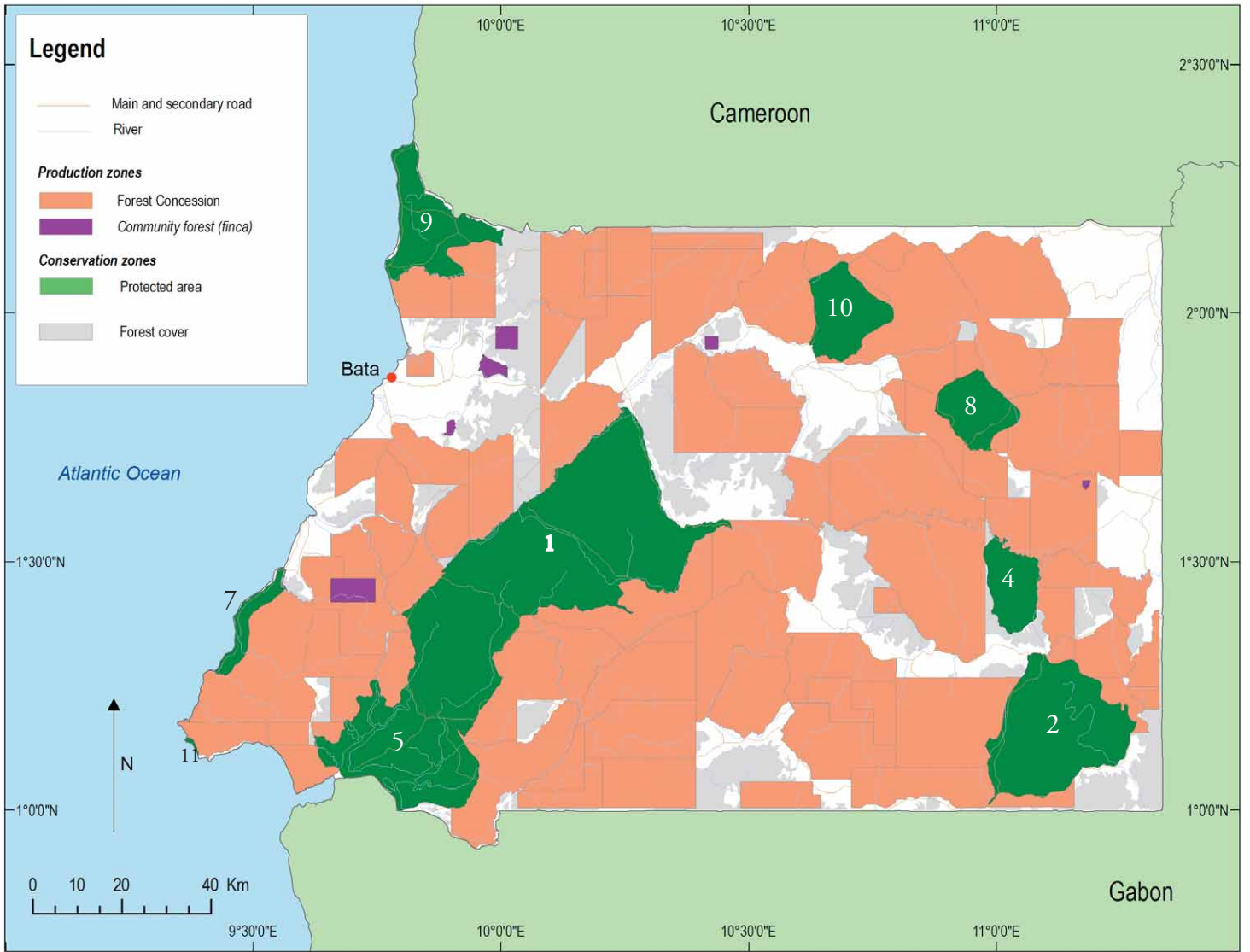
Annex D. Country data with maps showing the current state of logging and conservation



Cameroon

Forests	Official data	SoF data	Country area	
Total area (ha)	22,000,000	19,639,000	Total area (ha)	47,544,000
Swamp and riverine forests (ha)		117,834	Demographic trends	
Terra firma forests 0-300 m (ha)		1,886,933	Total population in 1975 ¹	7,600,000
Terra firma forests 300-1000 m (ha)		16,261,092	Total population in 2003 ¹	15,700,000
Terra firma forests 1000-1600 m (ha)		194,585	Total population in 2015 ¹	19,000,000
Terra firma forests >1600 m (ha)		58,917	Annual rate of increase of population in 1973 ¹	2.6
Forests allocated to conservation (ha)	3,424,606		Annual rate of increase of population in 2003 ¹	1.6
Production forests (ha)	7,598,238		Individuals <15 years (% of total) in 2003 ¹	41.9
Annual net deforestation rate (%)		0.19	Individuals <15 years (% of total) in 2015 ¹	37.2
Annual degradation rate (%)		0.02	Urban population in 2004 (%) ²	52
Industrial logging			Rural population in 2004 (%) ²	48
Allocated forests (ha)	5,737,000		Mean ann. rate of urban change (%) (2000-2005) ³	3.39
Sustainably managed forests (ha)	3,495,187	42 concess.	Mean ann. rate of urban change (%) (2000-2005) ³	0.21
Certified forests (ha)	41,965	1 concess.	Life expectancy at birth, men (2000-2005) ⁴	45
Total number of concessions (N)	74		Life expectancy at birth, women (2000-2005) ⁴	45
Mean area of concessions (ha)	77,532		Economic trends	
Log production (m ³)	1,372,347		GDP (million US\$) 2003 ¹	12,500
Log export statistics (m ³)	33,000		GDP/inhabitant (US\$) 2003 ¹	776
Production/hectare (m ³)	0.24		Annual increase rate of GDP/inh 1975-2003 (%) ¹	-0.5
Production of prim. transformation (m ³)	389,000		Annual increase rate of GDP/inh 1990-2003 (%) ¹	0.2
Exports of prim. transformation (m ³)	389,000		External debt (millions US\$) 1990 ⁵	6,657
Number of species exploited	55		External debt (millions US\$) 2004 ⁵	9,496
Main species	Ayous, iroko, sapelli, tali, azobé		Debt (% of GNI) 2004 ⁵	20
Contribution to GDP (%)	5.11		<i>Sources :</i>	
Employments in forests (N)	45,000		1. UNDP, Human Development Report, 2005.	
Employments in factories (N)	22,000		2. UN, Population Division, 2003.	
Conservation series in concessions (ha)	243,356		3. UN, Population Division, 2003.	
			4. UN, World Population Prospects, 2004.	
			5. World Bank, 2006.	

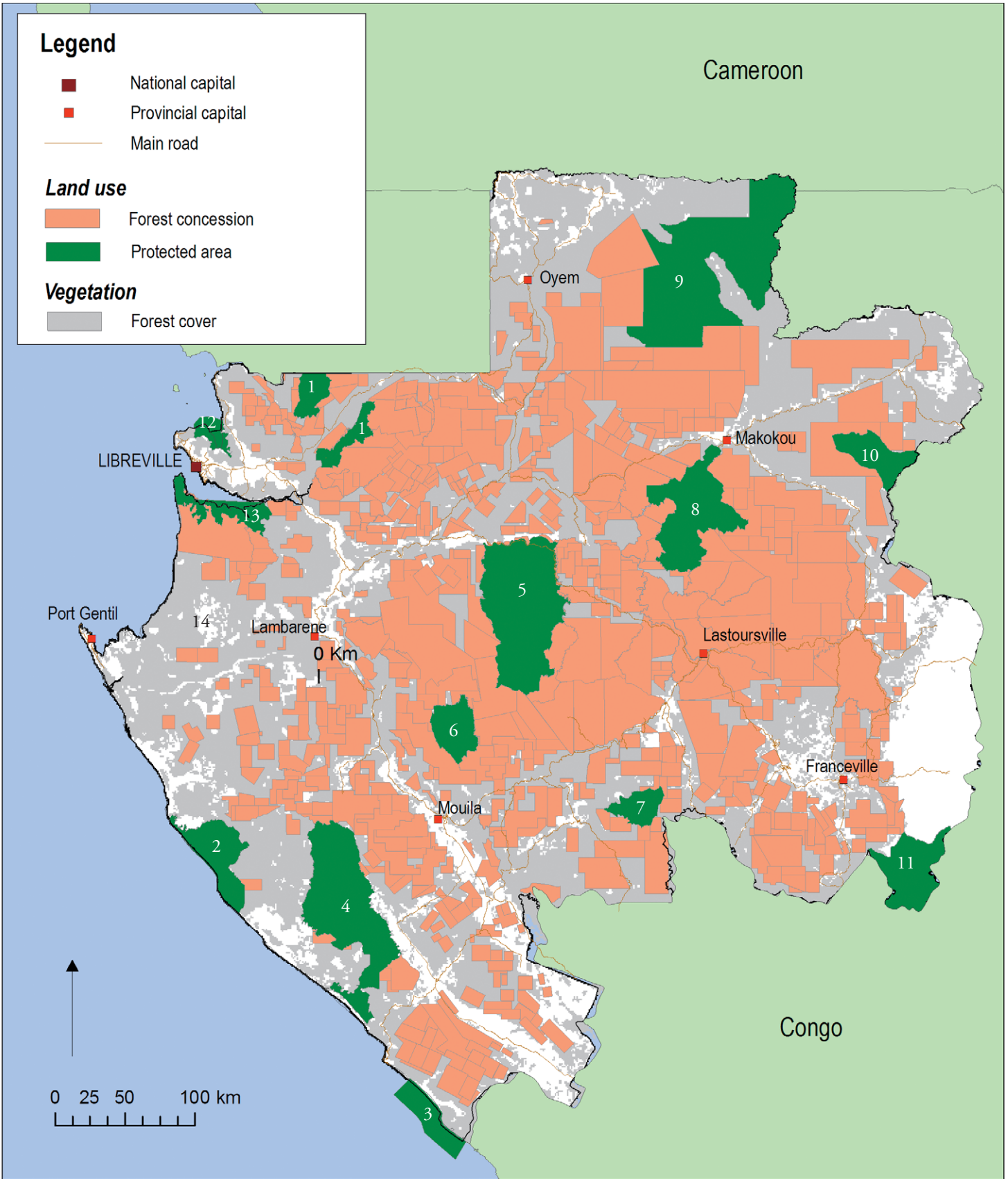
Forest national parks	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
1. Boumba-Bek	309,300	2005	Tridom	in prep.	0.14	short term
2. Nki	238,300	2005	Tridom	in prep.	0.12	short term
3. Lobéké	183,855	2001	Sangha TN	implem.	0.20	short term
4. Mbam et Djerem	416,512	2000	outsides Landscapes			
5. Korup	125,900	1986	outside Landscapes			
6. Campo Ma'an	264,060	2000	outside Landscapes			
Other forest reserves	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
7. Dja (faunal reserve) WH*, BR**	526,000	1950	Tridom	implem.	0.12	short term
8. Santchou (faunal reserve)	7,000	1933	outside Landscapes			
9. Kimbi (faunal reserve)	5,625	1964	outside Landscapes			
10. Cratère de Mbi (faunal reserve)	370	1964	outside Landscapes			
11. Lac Ossa (faunal reserve)	4,000	1968	outside Landscapes			
12. Bakossi (faunal reserve)	5,520	1965	outside Landscapes			
13. Takamanda (faunal reserve)	61,816	1934	outside Landscapes			
14. Douala-Edéa (faunal reserve)	128,360	1932	outside Landscapes			
15. Banyang-Mbo (sanctuary)	69,145	1996	outside Landscapes			
<i>Total</i>	<i>2,345,763</i>					



Equatorial Guinea

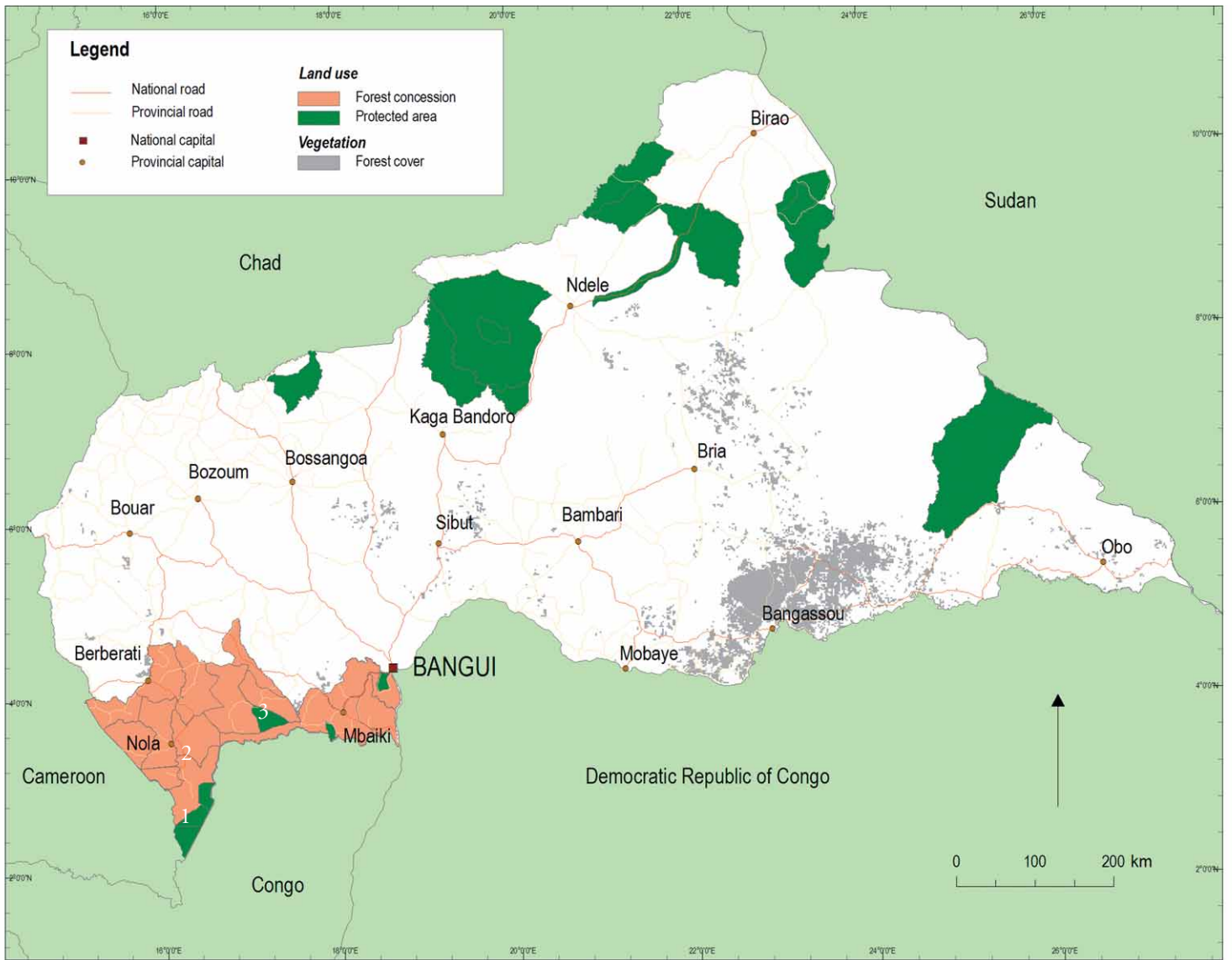
Forests	Official data	SoF data	Country area	
Total area (ha)	2,058,000	1,900,000	Total area (ha)	28,051
Swamp and riverine forests (ha)		0	Demographic trends	
Terra firma forests 0-300 m (ha)		442,700	Total population in 1975 ¹	200,000
Terra firma forests 300-1000 m (ha)		1,451,600	Total population in 2003 ¹	500,000
Terra firma forests 1000-1600 m (ha)		5,700	Total population in 2015 ¹	600,000
Terra firma forests >1600 m (ha)		0	Annual rate of increase of population in 1973 ¹	2.7
Forests allocated to conservation (ha)	591,000		Annual rate of increase of population in 2003 ¹	2.2
Production forests (ha)	1,597,253		Individuals <15 years (% of total) in 2003 ¹	44.2
Annual net deforestation rate (%)		0.41	Individuals <15 years (% of total) in 2015 ¹	45.6
Annual degradation rate (%)		0.52	Urban population in 2004 (%) ²	49
Industrial logging			Rural population in 2004 (%) ²	51
Allocated forests (ha)	170,000		Mean ann. rate of urban change (%) (2000-2005) ³	4.68
Sustainably managed forests (ha)	0		Mean ann. rate of urban change (%) (2000-2005) ³	0.80
Certified forests (ha)	0		Life expectancy at birth, men (2000-2005) ⁴	43
Total number of concessions (N)	9		Life expectancy at birth, women (2000-2005) ⁴	44
Mean area of concessions (ha)	18,889		Economic trends	
Log production (m ³)	na		GDP (million US\$) 2003 ¹	2,900
Log export statistics (m ³)	na		GDP/inhabitant (US\$) 2003 ¹	5,900
Production/hectare (m ³)	na		Annual increase rate of GDP/inh 1975-2003 (%) ¹	11.2
Production of prim. transformation (m ³)	na		Annual increase rate of GDP/inh 1990-2003 (%) ¹	16.8
Exports of prim. transformation (m ³)	na		External debt (millions US\$) 1990 ⁵	na
Number of species exploited	na		External debt (millions US\$) 2004 ⁵	na
Main species	na		Debt (% of GNI) 2004 ⁵	na
Contribution to GDP (%)	na		<i>Sources :</i>	
Employments in forests (N)	na		1. UNDP, Human Development Report, 2005.	
Employments in factories (N)	na		2. UN, Population Division, 2003.	
Community forests (ha)	42,000		3. UN, Population Division, 2003.	
			4. UN, World Population Prospects, 2004.	
			5. World Bank, 2006.	

Forest national parks	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
1. Monte Alén	200,000	1990	M. Alén-M. de Cristal	na	na	na
2. Altos de Nsork	70,000	2000	M. Alén-M. de Cristal	na	na	na
3. Pico Basilé (Ile de Bioko)	33,000	2000	Outside Landscape			
Other forest reserves	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
4. Piedra Nzás (natural monument)	19,000	2000	M. Alén-M. de Cristal	na	na	na
5. Estuario del Rio Muni (nature reserve)	60,000	2000	M. Alén-M. de Cristal	na	na	na
6. Caldeira de Luba (scientific res., Bioko)	51,000	2000	Outside Landscapes			
7. Playa Nendyi	500	2000	Outside Landscapes			
8. Piedra Bere (natural monument)	20,000	2000	Outside Landscapes			
9. Rio Campo (nature reserve)	33,000	2000	Outside Landscapes			
10. Monte Temelon	23,000	2000	Outside Landscapes			
11. Punta Llende (nature reserve)	5,500	2000	Outside Landscapes			
<i>Total area</i>	<i>514,500</i>					



Gabon

Forests	Official data	SoF data	Country area			
Total area (ha)	22,000,000	22,069,000	Total area (ha)	26,766,777		
Swamp and riverine forests (ha)		154,483	Demographic trends			
Terra firma forests 0-300 m (ha)		7,194,495	Total population in 1975 ¹	600,000		
Terra firma forests 300-1000 m (ha)		14,720,023	Total population in 2003 ¹	1,300,000		
Terra firma forests 1000-1600 m (ha)		0	Total population in 2015 ¹	1,600,000		
Terra firma forests >1600 m (ha)		0	Annual rate of increase of population in 1973 ¹	2.9		
Forests allocated to conservation (ha)	3,000,748		Annual rate of increase of population in 2003 ¹	1.5		
Production forests (ha)	13,000,000		Individuals <15 years (% of total) in 2003 ¹	40.9		
Annual net deforestation rate (%)		0.12	Individuals <15 years (% of total) in 2015 ¹	35.5		
Annual degradation rate (%)		0.09	Urban population in 2004 (%) ²	85		
Industrial logging			Rural population in 2004 (%) ²	15		
Allocated forests (ha)	na		Mean ann. rate of urban change (%) (2000-2005) ³	3.69		
Sustainably managed forests (ha)	2,195,070	7 concess.	Mean ann. rate of urban change (%) (2000-2005) ³	-2.70		
Certified forests (ha)	868,441	2 concess.	Life expectancy at birth, men (2000-2005) ⁴	54		
Total number of concessions (N)	630		Life expectancy at birth, women (2000-2005) ⁴	55		
Mean area of concessions (ha)	20,635		Economic trends			
Log production (m ³)	na		GDP (million US\$) 2003 ¹	6,100		
Log export statistics (m ³)	1,057,291		GDP/inhabitant (US\$) 2003 ¹	4,505		
Production/hectare (m ³)	na		Annual increase rate of GDP/inh 1975-2003 (%) ¹	-1.5		
Production of prim. transformation (m ³)	1,448,749		Annual increase rate of GDP/inh 1990-2003 (%) ¹	0.4		
Exports of prim. transformation (m ³)	1,297,644		External debt (millions US\$) 1990 ⁵	3,983		
Number of species exploited	nd		External debt (millions US\$) 2004 ⁵	4,150		
Main species	Okoume, padauk, douka, moabi, ozigo		Debt (% of GNI) 2004 ⁵	75		
Contribution to GDP (%)	4.10		<i>Sources :</i>			
Employments in forests (N)	na		1. UNDP, Human Development Report, 2005.			
Employments in factories (N)	6,009		2. UN, Population Division, 2003.			
Conservation series in concessions (ha)	114,836		3. UN, Population Division, 2003.			
			4. UN, World Population Prospects, 2004.			
			5. World Bank, 2006.			
Forest national parks	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
1. Monts de Cristal	120,000	2002	M. Alén-M. de Cristal	in prep.	0.12	< 2 yrs
2. Loango	155,000	2002	Gamba-May.-Conk.	in prep.	0.07	nd
3. Mayumba	8,000	2002	Gamba-May.-Conk.	in prep.	1.8	2-5 yrs
4. Moukalaba-Doudou	450,000	1962, 2002	Gamba-May.-Conk.	implem.	0.07	2-5 yrs
5. Lopé	491,000	1947, 2002	Lopé-Chaillu-Louesse	implem.	0.1	2-5 yrs
6. Waka	107,000	2002	Lopé-Chaillu-Louesse	in prep.	0.15	2-5 yrs
7. Birougou	69,000	2002	Lopé-Chaillu-Louesse	in prep.	0.23	2-5 yrs
8. Ivindo	300,274	2002	Tridom	in prep.	?	2-5 yrs
9. Minkébé	756,700	1997, 2002	Tridom	in prep.	?	2-5 yrs
10. Mwagna	116,500	2002	Tridom	in prep.	?	2-5 yrs
11. Plateaux Batéké	205,000	2002	Léconi-Batéké-Léfini	implem.	?	< 2 yrs
12. Akanda	54,000	2002	Outside Landscapes			
13. Pongara	87,000	2002	Outside Landscapes			
Other forest reserve						
14. Wonga-Wongué (presidential reserve)	380,000					
<i>Total area</i>	<i>2,919,474</i>					



Central African Republic

Forests	Official data	SoF data
Total area (ha)	5,200,000	6,250,000
Swamp and riverine forests (ha)		0
Terra firma forests 0-300 m (ha)		0
Terra firma forests 300-1000 m (ha)		6,225,000
Terra firma forests 1000-1600 m (ha)		18,750
Terra firma forests >1600 m (ha)		0
Forests allocated to conservation (ha)	633,472	
Production forests (ha)	3,327,012	
Annual net deforestation rate (%)		0.07
Annual degradation rate (%)		0.02
Industrial logging		
Allocated forests (ha)	3,327,012	
Sustainably managed forests (ha)	52,675	2 concess.
Certified forests (ha)	0	
Total number of concessions (N)	9	
Mean area of concessions (ha)	369,668	
Log production (m ³)	570,000	2004
Log export statistics (m ³)	194,000	2004
Production/hectare (m ³)	0.17	2004
Production of prim. transformation (m ³)	108,000	2004
Exports of prim. transformation (m ³)	58,000	2004
Number of species exploited	na	
Main species	Ayous, iroko, sapelli, aniégré, sipo	
Contribution to GDP (%)	13.04	
Employments in forests (N)	na	
Employments in factories (N)	na	
Conservation series in concessions (ha)	0	

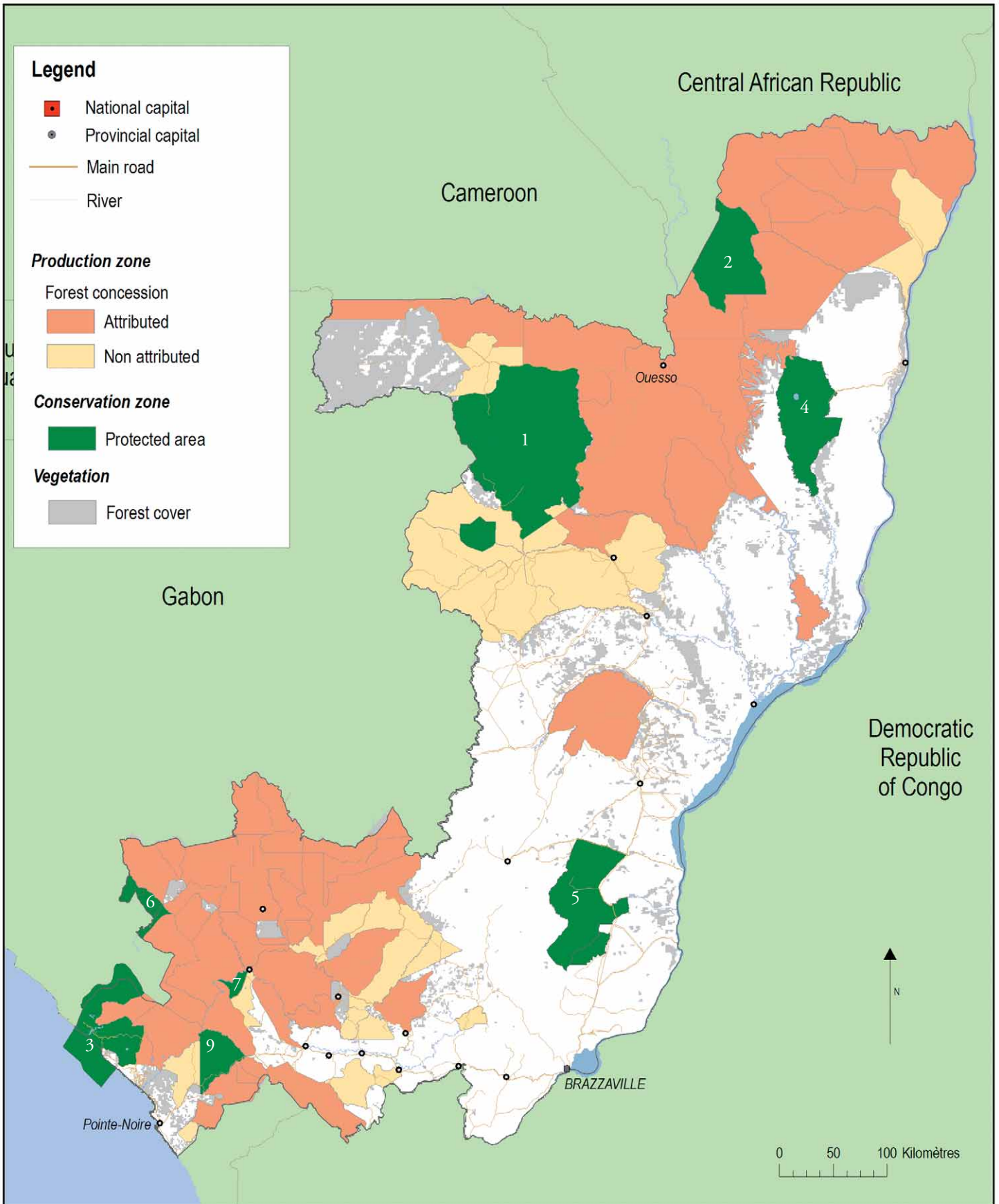
Country area	
Total area (ha)	62,298,400
Demographic trends	
Total population in 1975 ¹	2,100,000
Total population in 2003 ¹	3,900,000
Total population in 2015 ¹	4,600,000
Annual rate of increase of population in 1973 ¹	2.3
Annual rate of increase of population in 2003 ¹	1.4
Individuals <15 years (% of total) in 2003 ¹	43.2
Individuals <15 years (% of total) in 2015 ¹	40.6
Urban population in 2004 (%) ²	43
Rural population in 2004 (%) ²	57
Mean ann. rate of urban change (%) (2000-2005) ³	2.49
Mean ann. rate of urban change (%) (2000-2005) ³	0.40
Life expectancy at birth, men (2000-2005) ⁴	38
Life expectancy at birth, women (2000-2005) ⁴	40
Economic trends	
GDP (million US\$) 2003 ¹	1,200
GDP/inhabitant (US\$) 2003 ¹	309
Annual increase rate of GDP/inh 1975-2003 (%) ¹	-1.5
Annual increase rate of GDP/inh 1990-2003 (%) ¹	-0.4
External debt (millions US\$) 1990 ⁵	698
External debt (millions US\$) 2004 ⁵	1,078
Debt (% of GNI) 2004 ⁵	75

Sources :

1. UNDP, Human Development Report, 2005.
2. UN, Population Division, 2003.
3. UN, Population Division, 2003.
4. UN, World Population Prospects, 2004.
5. World Bank, 2006.

Forest national parks	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
1. Dzanga-Ndoki	122,000	1990	TNS	in prep.	0.25	> 5 yrs
Other forest reserves	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
2. Dzanga-Sangha (special reserve)	335,900	1990	TNS	in prep.	0.25	> 5 yrs
3. Basse-Lobaye (BR*)	18,200	1977	Outside Landscapes			
<i>Total area</i>	<i>476,100</i>					

* BR: Biosphere Reserve

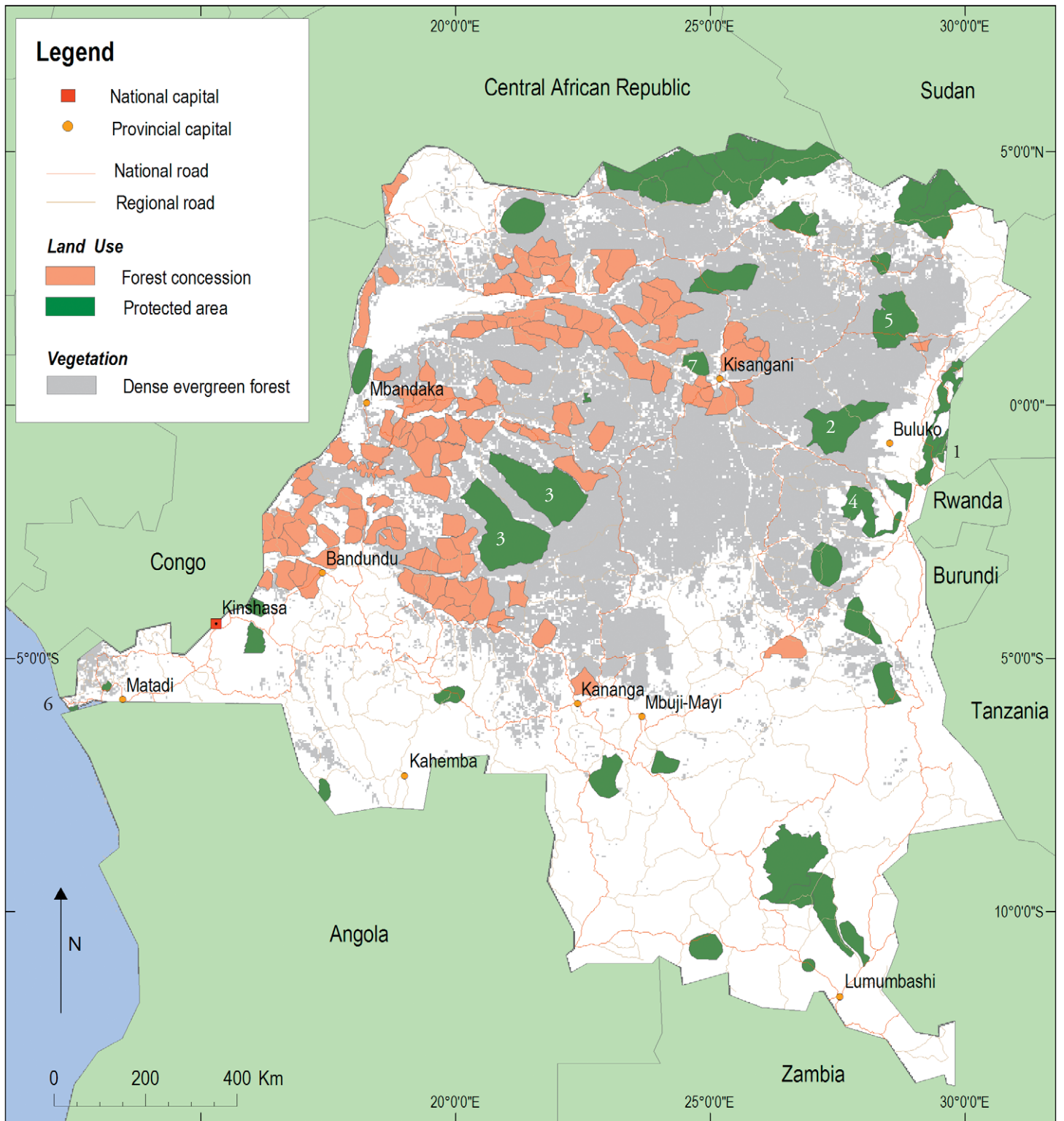


Republic of Congo

Forests	Official data	SoF data	Country area	
Total area (ha)	22,471,262	22,263,000	Total area (ha)	34,200,000
Swamp and riverine forests (ha)		4,452,600	Demographic trends	
Terra firma forests 0-300 m (ha)		2,003,670	Total population in 1975 ¹	1,500,000
Terra firma forests 300-1000 m (ha)		15,828,993	Total population in 2003 ¹	3,800,000
Terra firma forests 1000-1600 m (ha)		0	Total population in 2015 ¹	5,400,000
Terra firma forests >1600 m (ha)		0	Annual rate of increase of population in 1973 ¹	3.2
Forests allocated to conservation (ha)	989,740		Annual rate of increase of population in 2003 ¹	3.1
Production forests (ha)	19,817,687		Individuals <15 years (% of total) in 2003 ¹	46.9
Annual net deforestation rate (%)		0.03	Individuals <15 years (% of total) in 2015 ¹	47.4
Annual degradation rate (%)		0.01	Urban population in 2004 (%) ²	54
Industrial logging			Rural population in 2004 (%) ²	46
Allocated forests (ha)	11,387,154		Mean ann. rate of urban change (%) (2000-2005) ³	3.39
Sustainably managed forests (ha)	0	2 concess.	Mean ann. rate of urban change (%) (2000-2005) ³	1.64
Certified forests (ha)	0		Life expectancy at birth, men (2000-2005) ⁴	51
Total number of concessions (N)	60		Life expectancy at birth, women (2000-2005) ⁴	53
Mean area of concessions (ha)	189,786		Economic trends	
Log production (m ³)	1,350,408	2005	GDP (million US\$) 2003 ¹	3,600
Log export statistics (m ³)	776,013	2005	GDP/inhabitant (US\$) 2003 ¹	949
Production/hectare (m ³)	0.12	2005	Annual increase rate of GDP/inh 1975-2003 (%) ¹	-0.1
Production of prim. transformation (m ³)	197,426	2005	Annual increase rate of GDP/inh 1990-2003 (%) ¹	-1.4
Exports of prim. transformation (m ³)	243,857	2005	External debt (millions US\$) 1990 ⁵	4,947
Number of species exploited	>30		External debt (millions US\$) 2004 ⁵	5,829
Main species	Ayous, bossé, sapelli, okoume, sipo		Debt (% of GNI) 2004 ⁵	331
Contribution to GDP (%)	nd		<i>Sources :</i>	
Employments in forests (N)	nd		1. UNDP, Human Development Report, 2005.	
Employments in factories (N)	nd		2. UN, Population Division, 2003.	
Conservation series in concessions (ha)	0		3. UN, Population Division, 2003.	
			4. UN, World Population Prospects, 2004.	
			5. World Bank, 2006.	

Forest national parks	Area (ha)	Creation	Landscape	Man. Plan	Staff/1000 ha	Funding
1. Odzala-Koukoua	1,250,000	1935, 1999	Tridom	na	na	na
2. Nouabalé-Ndoki	386,600	1993	TNS	implem.	0.19	2-5 yrs
3. Conkouati-Douli	504,950	1999	Gamba-May.-Conk.	proposed	0.04	na
Other forest reserves	Area (ha)	Creation	Landscape	Man. Plan	Staff/1000 ha	Funding
4. Lac Télé (community reserve)	439,960	1999	Lac Télé-Lac Tumba	in prep.	0.07	< 2 yrs
5. Léfini (faunal reserve)	630,000	1951	Léconi-Batéké-Léfini	nd	nd	nd
6. Mont Fouari	15,600	1958	Outside Landscapes			
7. Nyanga-Nord	7,700	1958	Outside Landscapes			
8. Tsoulou (faunal reserve)	30,000	1984	Outside Landscapes			
9. Dimonika (BR*)	na	1983	Outside Landscapes			
10. Nyanga-Sud (hunting domain)	na	1955	Outside Landscapes			
11. Mont Mavoubou (hunting domain)	na	1955	Outside Landscapes			
<i>Total area</i>	<i>3,264,810</i>					

* BR: Biosphere Reserve



Democratic Republic of Congo

Forests	Official data	SoF data	Country area	
Total area (ha)	128,000,420	108,339,000	Total area (ha)	234,541,000
Swamp and riverine forests (ha)		8,017,086	Demographic trends	
Terra firma forests 0-300 m (ha)		8,125,000	Total population in 1975 ¹	23,900,000
Terra firma forests 300-1000 m (ha)		88,296,000	Total population in 2003 ¹	54,200,000
Terra firma forests 1000-1600 m (ha)		3,033,492	Total population in 2015 ¹	78,000,000
Terra firma forests >1600 m (ha)		866,712	Annual rate of increase of population in 1973 ¹	2.9
Forests allocated to conservation (ha)	22,653,200		Annual rate of increase of population in 2003 ¹	3.0
Production forests (ha)	105,351,000		Individuals <15 years (% of total) in 2003 ¹	47.1
Annual net deforestation rate (%)		0.19	Individuals <15 years (% of total) in 2015 ¹	48.0
Annual degradation rate (%)		0.02	Urban population in 2004 (%) ²	32
Industrial logging			Rural population in 2004 (%) ²	68
Allocated forests (ha)	21,024,900		Mean ann. rate of urban change (%) (2000-2005) ³	4.43
Sustainably managed forests (ha)	0		Mean ann. rate of urban change (%) (2000-2005) ³	2.16
Certified forests (ha)	0		Life expectancy at birth, men (2000-2005) ⁴	51
Total number of concessions (N)	146		Life expectancy at birth, women (2000-2005) ⁴	54
Mean area of concessions (ha)	144,000		Economic trends	
Log production (m ³)	90,000	2004	GDP (million US\$) 2003 ¹	5,700
Log export statistics (m ³)	58,000	2004	GDP/inhabitant (US\$) 2003 ¹	107
Production/hectare (m ³)	0.004	2004	Annual increase rate of GDP/inh 1975-2003 (%) ¹	-4.9
Production of prim. transformation (m ³)	17,000	2004	Annual increase rate of GDP/inh 1990-2003 (%) ¹	-6.3
Exports of prim. transformation (m ³)	15,000	2004	External debt (millions US\$) 1990 ⁵	10,259
Number of species exploited	na		External debt (millions US\$) 2004 ⁵	11,841
Main species	na		Debt (% of GNI) 2004 ⁵	36
Contribution to GDP (%)	na		<i>Sources :</i>	
Employments in forests (N)	na		1. UNDP, Human Development Report, 2005.	
Employments in factories (N)	na		2. UN, Population Division, 2003.	
Conservation series in concessions (ha)	0		3. UN, Population Division, 2003.	
			4. UN, World Population Prospects, 2004.	
			5. World Bank, 2006.	

Forest national parks	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
1. Virunga (WH*)	780,000	1925	Virunga	implem.	na	2-5 yrs
2. Maiko	1,093,222	1970	Maiko-Tayna-Kahuzi	no	na	<2 yrs
3. Salonga (WH*)	3,656,000	1970	Salongo-Luk.-Sankuru	no	6.1	< 2 yrs
4. Kahuzi-Biega (WH*)	660,000	1970, 1974	Maiko-Tayna-Kahuzi	no	na	2-5 yrs
Other forest reserves	Area (ha)	Creation	Landscape	Man. plan	Staff/1000 ha	Funding
5. Okapi (faunal reserve, WH*)	1,372,625	1992	Ituri-Epulu	in prep.	15.4	< 2 yrs
6. Mangroves (nature reserve)	76,850	1990	Outside Landscapes			
7. Yangambi (botanical reserve)	250,000	1976	Outside Landscapes			
8. Luki (BR**)	33,000	1979	Outside Landscapes			
9. Bomu (strict nature reserve)	1,067,100	nd	Outside Landscapes			
<i>Total area (ha)</i>	<i>8,888,797</i>					

*WH: World Heritage; **BR: Biosphere Reserve

Annex E. Acronyms

ACDI	Agence canadienne pour le développement international	CFC	Conservation de la faune congolaise (RC)
ACPE	Association pour la connaissance et la protection de l'environnement	CFD	Caisse française de développement
ADB	African Development Bank	CFT	Compagnie forestière de transformation
ADIE	Agence intergouvernementale pour le développement de l'information environnementale	CGIAR	Consultative Group on International Agricultural Research
AEFNA	Association des exploitants forestiers nationaux du Cameroun	CI	Conservation International
AEFTAT	Association pour l'étude taxonomique de la flore d'Afrique tropicale	CIB	Congolaise industrielle des bois
AETL	Association des enfants des terres de Lossi	CIFOR	Center for International Forestry Research
AFD	Agence française de développement	CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
AFORNET	African Forestry Research Network	CIRMF	Centre international de recherches médicales de Franceville (Gabon)
AFVP	Association française des volontaires du progrès	CITES	Convention on International Trade of Endangered Species
AIDS	Acquired Immune Deficiency Syndrome	CNEARC	Centre national d'études agronomiques des régions chaudes
ALPICAM	Alpi Pietro et Fils Cameroun	CNES	Centre National d'Etudes Spatiales
ANAFOR	Agence nationale de développement des forêts	CNIAF	Centre national d'inventaires et d'aménagement des ressources forestières et fauniques
ANN	Alliance nationale pour la nature (RC)	CNPN	Conseil national des parcs nationaux
APDN	Association des pêcheurs artisanaux du département de Ndougou	CNRF	Centre national de la recherche forestière
APFT	Avenir des peuples des forêts tropicales	CoCoSi	Comité de coordination du site
APMEC	Associação dos Pequenos e Medios Empresarios de Cabinda, Angola	COMIFAC	Central Africa Forest Commission
ARCOS	Albertine Rift Conservation Society	CORAF	Conseil ouest et centre africain pour la recherche et le développement agricole
ASEMAR	Asesores Maritimos	COSREG	Compagnie Shell de recherches et d'exploitation du Gabon
ASF	Aventure sans frontières (Gabon)	COVAREFS	Comité de valorisation des ressources fauniques
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer	CPAET	Convention provisoire d'aménagement-exploitation-transformation
ATIBT	Association technique internationale des bois tropicaux	CRAL	Centre de recherche agronomique de Loudima
ATO	African Timber Organization	CRAP	Comite de réflexion de l'après pétrole (Gabon)
ATO	Africa Tours Opérateurs	CRCRT	Centre de recherche sur la conservation et la restauration des terres
AVHRR	Advanced Very High Resolution Radiometer	CREF	Centre de recherche en écologie et foresterie
AWF	African Wildlife Foundation	CRESA	Centre régional d'enseignement spécialisé en agriculture
BCI	Bonobo Conservation Initiative	CRESSH	Centre d'études et de recherche en sciences sociales et humaines (RC)
BEAC	Banque des états de l'Afrique centrale	CRFL	Centre de recherche forestière du littoral (RC)
BEST	Bureau d'études scientifiques et techniques (DRC)	CRFO	Centre de recherche forestière de Ouesso (RC)
BMZ	Bundesministerium für Zusammenarbeit (Germany)	CRHM	Centre de recherche hydrobiologique de Mossaka (RC)
BP	Before Present	CRSN	Centre de recherches en sciences naturelles de Lwiro (DRC)
BP	British Petroleum	CSA	Canadian Standards Association
BRAC	Bureau régional de l'UICN pour l'Afrique centrale	CST	Comité scientifique trinational
BRD	Berggorilla & Regenwald Direktion	CTI	Convention de transformation industrielle
BSG	Bois et scierie du Gabon	CTPE	Comité trinational de planification et d'exécution
C	Capacity	CTS	Comité trinational de suivi
CAR	Central African Republic	CTSA	Comité trinational de supervision et d'arbitrage
CARE	Cooperative for Assistance and Relief Everywhere, Inc.	CUREF	Proyecto Conservacion y Utilizacion Racional de los Ecosistemas Forestales
CARPE	Central African Regional Program for the Environment	DAFECN	Département des affaires foncières, environnement et conservation de la nature
CARPO	WWF Central Africa Regional Programme Office	DANIDA	Danish International Development Agency
CAT	Conventions d'aménagement et de transformation	DDT	Dichlorodiphenyltrichloroethane
CAWHFI	Central African World Heritage Forest Initiative	DF	Direction des forêts (Cameroon)
CBD	Convention on Biological Diversity	DFAP	Direction de la faune et des aires protégées (Cameroon)
CBERS	China-Brazil Earth Resources Satellite	DFGFE	Dian Fossey Gorilla Fund Europe
CBFP	Congo Basin Forest Partnership	DFGFI	Dian Fossey Gorilla Fund International
CBG	Compagnie des bois du Gabon	DFID	Department for International Development (England)
CBNRM	Community Based Natural Resource Management	DGF	Direction de la gestion forestière (DRC)
CBO	Community Based Organizations	DGIS	Directoraat-generaal Internationale Samenwerking (Netherlands)
CBV	Conservation Business Venture	DGRST	Délégation générale de la recherche scientifique et technique (RC)
CEB	Compagnie équatoriale des bois	DLH	Dalhoff Larsen & Horneman
CED	Centre pour l'environnement et le développement	DMC	Disaster Monitoring Constellation
CEFDHAC	Conférence sur les écosystèmes de forêts denses et humides d'Afrique centrale	DME-A	Diamètres minimaux d'exploitation -aménagement
CEFRECOF	Centre de formation et de recherche en conservation forestière	DME-L	Diamètres minimaux d'exploitation -légaux
CEMAC	Communauté économique et monétaire de l'Afrique centrale	DRC	Democratic Republic of Congo
CENAREST	Centre national de la recherche scientifique et technique (Gabon)	DSPi	Department of State: Partnerships and Initiatives (US)
CERAD	Centre de recherche et d'action pour le développement durable	DWAF	Department of Water Affairs and Forestry (South Africa)
CERGEC	Centre de recherches géographiques et de production cartographique (RC)	EC	European Commission
CERNA	Centre d'économie industrielle de l'école des mines de Paris	ECO SA	Eucalyptus du Congo
CERVE	Centre d'étude sur les ressources végétales (RC)	ECOFAC	Programme de conservation et utilisation rationnelle des écosystèmes forestiers d'Afrique centrale (EC)
CFA	Communauté financière africaine	EDF	European Development Fund
CFA	Compagnie forestière des Abeilles	EFC	Eucalyptus fibres Congo
CFAD	Concessions forestières sous aménagement durable		

EG	Equatorial Guinea	IFL	Industrie forestière de Lambaréné (Gabon)
ENEF	Ecole nationale des eaux et forêts	IFO	Industrie forestière de Ouessou (RC)
ENGREF	Ecole nationale du génie rural, des eaux et forêts	IGAD	Institut gabonais d'appui au développement
ENS	École normale supérieure	IGCP	International Gorilla Conservation Programme
ERAIFT	Ecole régionale post-universitaire en aménagement intégré des forêts tropicales	IGEFE	Inspection générale de l'économie forestière et de l'environnement (RC)
ERS	European Resource Sensing	IITA	Institut international pour l'agriculture tropicale
ESA	European Space Agency	IMF	International Monetary Fund
ETFRN	European Tropical Forest Research Network	IMU	Inventory and Monitoring Unit
ETM	Enhanced Thematic Mapper	INAP	Instituto Nacional de Areas Protegidas (Equatorial Guinea)
EU	European Union	INDEFOR	Instituto de Desarrollo Forestal
EXW	Ex Works	INEAC	Institut national pour l'étude agronomique au Congo (DRC)
FAO	United Nations Food and Agricultural Organization	INERA	Institut national pour l'étude et la recherche agronomique (DRC)
FCFA	Franc de la communauté financière d'Afrique	INS	Institut national des statistiques
FEC	Fédération des entreprises du Congo (DRC)	IPGRI	International Plant Genetic Resources Institute
FEM	Fonds pour l'environnement mondial	IPHAMETRA	Institut de pharmacopée et de médecine traditionnelle (Gabon)
FFEM	Fonds français pour l'environnement mondial	IPHG	Idriss Plantation Holdings Gabon
FFI	Fauna and Flora International	IRAD	Institut de recherche agronomique pour le développement (Cameroon)
FIGET	Fondation internationale Gabon éco-tourisme	IRAF	Institut de recherches agronomiques et forestières (Gabon)
FLEGT	Forest Law Enforcement, Governance, and Trade	IRD	Institut de recherche pour le développement (France)
FOB	Free on Board	IRET	Institut de recherches en écologie tropicale (Gabon)
FODEX	Fonds d'expansion et de développement des petites et moyennes entreprises	IRGM	Institut de recherche géologique et minière (Cameroon)
FORAFRI	Forestière d'Afrique	IRM	Innovative Resources Management
FORCOMS	Forest Concession Monitoring System	IRMPM	Institut de recherches médicales et d'étude des plantes médicinales (Cameroon)
FORINFO	Formation et recherche pour l'appui au développement durable du secteur forêt-environnement en Afrique centrale	IRS	Indian Remote Sensing Satellite
FORNESSA	Réseau pour la recherche forestière en Afrique sub-saharienne	IRSAC	Institut de recherche scientifique en Afrique centrale
FOSA	Forestry Outlook Study for Africa	IRSH	Institut de recherches en sciences humaines (Gabon)
FOT	Free on Truck	IRT	Institut de recherches technologiques (Gabon)
FPP	Forest People Project	ISDR	Institut supérieur de développement rural
FRCF	Fonds de reconstitution du capital forestier	ISO	International Standards Organization
FRM	Forêt Ressources Management	ITTO	International Tropical Timber Organization
FRT	Foresterie rurale tropicale	IUBioma	Instituto Universitario de Biodiversidad y Medio Ambiente
FSC	Forest Stewardship Council	IUCN	International Union for the Conservation of Nature and Natural Resources
FUG	Faculté universitaire de Gembloux	IUFRO	International Union of Forestry Research Organizations
FZS	Frankfurt Zoological Society	JAXA	Japan Aerospace Exploration Agency
GD	Gestion durable	JERS	Japanese Earth Resources Satellite
GDP	Gross Domestic Product	JRC	Joint Research Center (EC)
GEB	Gabon export bois	KFW	Kreditanstalt für Wiederaufbau
GEF	Global Environment Facility	km ²	Square Kilometer
GEIE	Groupements européens d'intérêt économique	LAFICO	Libyan Arab Foreign Investment Company
GEOSS	Global Earth Observation System of Systems	LIL	Low Impact Logging
GEPAC	Gestion participative en Afrique centrale	LUTO	Laboratoire universitaire des traditions orales
GERDIB	Groupe d'étude et de recherche sur la diversité biologique (RC)	LWRP	Lukuro Wildlife Research Project
GFBC	Groupement de la filière bois au Cameroun	LWRS	Lukuru Wildlife Research Station
GFW	Global Forest Watch	m ³	Cubic Meter
GIB	Gabonaise industrielle des bois (Gabon)	MAE	Ministère des affaires étrangères (France)
GIC	Gilman International Conservation	MAECECD	Ministère des affaires étrangères, du commerce international et de la coopération au développement (Belgium)
GIS	Geographic Information System	MBG	Missouri Botanical Garden
GLC2000	Global Land Cover 2000	MECNEF	Ministère de l'Environnement, Conservation de la Nature, Eaux et Forêts (DRC)
GNI	Gross National Income	MEDD	Ministère de l'écologie et du développement durable (France)
GPS	Global Positioning System	MEF	Ministère des eaux et forêts (Gabon)
GRASP	Great Ape Survival Project	MEFCPE	Ministère des eaux, forêts, chasse, pêche, chargé de l'environnement (CAR)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit	MEFE	Ministère de l'économie forestière et de l'environnement (RC)
GWZ	Houthandel Gebroeders Wijma & Zonen BV	MEFEPEPN	Ministère de l'économie forestière, des eaux, de la pêche, chargé de l'environnement et la protection de la nature (Gabon)
ha	Hectare	MEFEPPN	Ministère de l'économie forestière, des eaux, de la pêche, et des parcs nationaux (Gabon)
HELP	Habitat écologique et liberté des primates	MERIS	European Medium Resolution Imaging Spectrometer
HFC	Hassan forestière de Campo	MFD	Minimum Felling Diameter
HIV	Human Immunodeficiency Virus	MGVP	Mountain Gorilla Veterinary Project
HR	High Resolution	MIKE	Monitoring the Illegal Killing of Elephants
IBA	Important Bird Area	MINEF	Ministère de l'environnement et des forêts (Cameroon)
ICCN	Institut congolais de conservation de la nature (DRC)	MINEFOR	Ministere de l'environnement et des forets (RC)
ICRAF	International Center for Research in Agroforestry		
IDR	Institut de développement rural		
IFA	Institut facultaire d'agronomie		
IFB	Industrie forestière de Batalimo		
IFIA	Interafrican Forest Industries Association		
IFK	Industrie forestière du Komo (Gabon)		

MINEP	Ministère de l'environnement et de la protection de la nature (Cameroon)	SEGC	Station d'études des gorilles et des chimpanzés
MINFOF	Ministère des forêts et de la faune (Cameroon)	SESAM	Société d'exploitation forestière de Sangha-Mbaéré
MNHN	Muséum national d'histoire naturelle	SFH	Société forestière Hazim
MODIS	Moderate Resolution Imaging Spectroradiometer	SFID	Société forestière et industrielle de la Doumé (Cameroon)
MPI	Max Planck Institute	SFM	Société forestière de Makokou
na	Not available	SGBF	Société gabonaise Bescos et Fils
NASA	National Aeronautics & Space Administration	SGS	Société générale de surveillance
NBG	Négoce des bois du Gabon	SHM	Société de la Haute-Mondah
nd	No data	SI	Smithsonian Institution
NGO	Non-Governmental Organization	SIBAF	Société industrielle des bois africains
NP	National Park	SIDA	Swedish International Development Agency
NTFP	Non Timber Forest Product	SIFORCO	Société industrielle et forestière du Congo (DRC)
OCDN	Organisation centrafricaine pour la défense de la nature	SMEs	Small and Medium Sized Enterprises
OCFSA	Organisation pour la conservation de la faune sauvage en Afrique	SNBG	Société nationale des bois du Gabon
OCIPEF	Oficina de Control, Información y Protección de las Especies Forestales	SNV	Stichting Nederlandse Vrijwilligers
ONADEF	Office national de développement des forêts	SOCOBELAM	Société congolaise belgo-américaine pour la transformation des bois au Congo
ONE	Office national pour l'emploi	SODEFOR	Société de développement forestière (DRC)
ONF	Office national des forêts	SoF	State of the Forest
ORTPN	Office rwandais du tourisme et des parcs nationaux	SOFOKAD	Société forestière de la Kadei
OSFAC	Observatoire satellital des forêts d'Afrique centrale	SPDC	IUFRO Special Programme for Developing Countries
PA	Permis associés	SWOT	Strengths, Weaknesses, Opportunities, Threats
PA	Protected Area	SYGIAP	Système de gestion d'information pour les aires protégées
PADDN	Programme d'appui au développement durable du département de Ndougou	SYNFOGA	Syndicat des producteurs et industriels du bois du Gabon
PARAC	Plan d'action régional pour l'Afrique centrale	TED	Turtle Excluder Device
PARFISH	Participatory Fish Stock Assessment	TEF	Transformation et exploitation forestière
PFA	Permis forestier associé	TFAP	Tropical Forestry Action Plan
PIL	Promotion des initiatives locales	TFF	Tropical Forestry Foundation
PNNN	Parc national de Nouabalé-Ndoki	TM	Thematic Mapper
PPD	Pre Project	TNS	Sangha Tri National
PPG	Projet protection de gorilles	TREES	Tropical Ecosystem Environment Observation by Satellites
PROGECAP	Projet de gestion et conservation des aires protégées	TTS	Transformation Tropicale du Sud
PROGEPP	Projet de gestion des écosystèmes périphériques du parc national de Nouabalé-Ndoki	UCL	Université catholique de Louvain (Belgium)
PROPARCO	Société de promotion et participation pour la coopération économique	UFA	Unités forestières d'aménagement
PS	Planet Survey (Cameroon)	UGADEC	Union des associations de conservation des gorilles pour le développement communautaire à l'est de la République démocratique du Congo
PSFE	Programme sectoriel forêts et environnement	UICN-BRAC	Union Mondiale pour la Nature - Bureau Régional pour l'Afrique Centrale
PSVAP	Projet sectoriel de valorisation des aires protégées	UMD	University of Maryland
RAAF	Réseau africain d'action forestière	UN	United Nations
RAN	Rainforest Action Network	UNDP	United Nations Development Programme
RAPAC	Réseau des aires protégées d'Afrique centrale	UNEP	United Nations Environment Programme
RC	Republic of Congo	UNESCO	United Nations Education, Science and Culture Organization
RCLT	Research Centre for Linguistic Typology	UNF	United Nations Foundation
REFADD	Réseau des femmes africaines pour le développement durable	UNFPA	United Nations Population Fund
REM	Ressources Extraction Monitoring	UNICONGO	Union patronale et interprofessionnelle du Congo
REPALEAC	Réseau des populations autochtones et locales pour la gestion durable des écosystèmes forestiers d'Afrique centrale	UNOPS	United Nations Office for Project Services
REPAR	Réseau des parlementaires pour la gestion durable des écosystèmes forestiers d'Afrique centrale	UNSO	United Nations Sudano-Sahelian Office
RFA	Redevance forestière annuelle	UOB	Université Omar Bongo (Gabon)
RIFFEAC	Réseau des institutions de formation forestière et environnementale d'Afrique centrale	US	United States
RIL	Reduced Impact Logging	USA	United States of America
RMCA	Royal Museum for Central Africa	USAID	United States Agency for International Development
RSDS	Réserve spéciale de Dzanga-Sangha	USD	United States Dollars
SAB	Société africaine des bois	USDA-FS	United States Department of Agriculture-Forest Service
SABM	Société africaine des bois du Mbam	USFWS	United States Fish and Wildlife Service
SADEC	South African Development Community	USTM	Université des sciences et techniques de Masuku
SB	Slovenia bois	UWA	Uganda Wildlife Authority
SBB	Société de bois de Bayanga	VICA	Vicwood
SBL	Société des bois de Lastoursville (Gabon)	VIR	Visible Infra Red
SCAD	Société centrafricaine de déroulage	WB	World Bank
SCD	Société de conservation et de développement	WCBR	Wamba Committee for Bonobo Research
SDSU	South Dakota State University	WCMC	World Conservation Monitoring Center
SEAF	Société d'exploitation et d'aménagement forestier	WCS	Wildlife Conservation Society
SEBC	Société d'exploitation des bois du Cameroun	WRI	World Resources Institute
SECA	Société d'éco-aménagement	WWF	World Wide Fund for Nature
SEEF	Société équatoriale d'exploitation forestière	ZICGC	Zone d'intérêt cynégétique à gestion communautaire
SEEG	Société d'eau et d'énergie du Gabon	ZOP	Ziehl Orientierte Projektprüfung
SEFCA	Société d'exploitation forestière centrafricaine	ZSL	Zoological Society of London
		ZSM	Zoological Society of Milwaukee

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