

15. Dja-Odzala-Minkébé (Tridom) Landscape

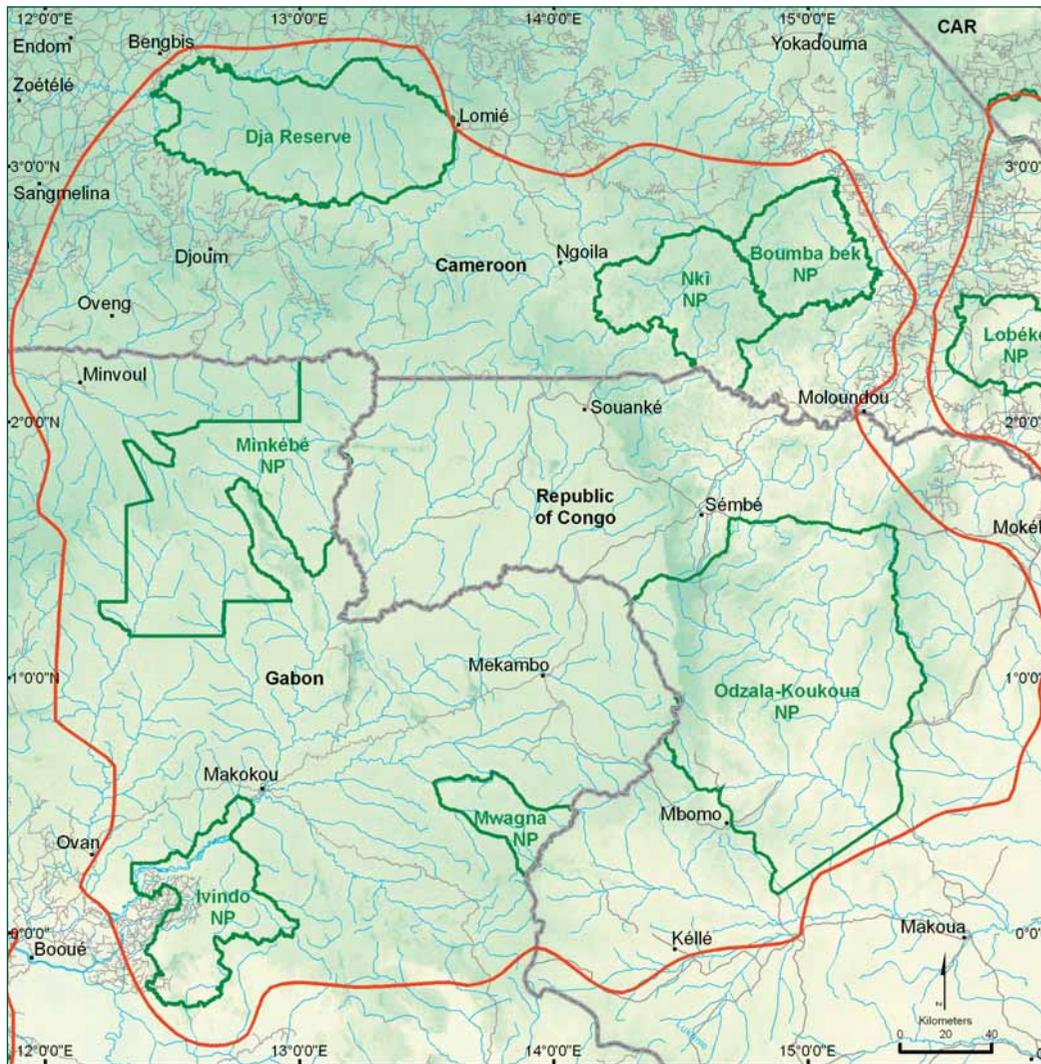


Figure 15.1. Map of Dja-Odzala-Minkébé (Tridom) Landscape (Sources: Atlas of Cameroon, GFW/WRI, CARPE, JRC, SRTM, WCS-Congo, WCS-Gabon, WWF-Jengi).

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

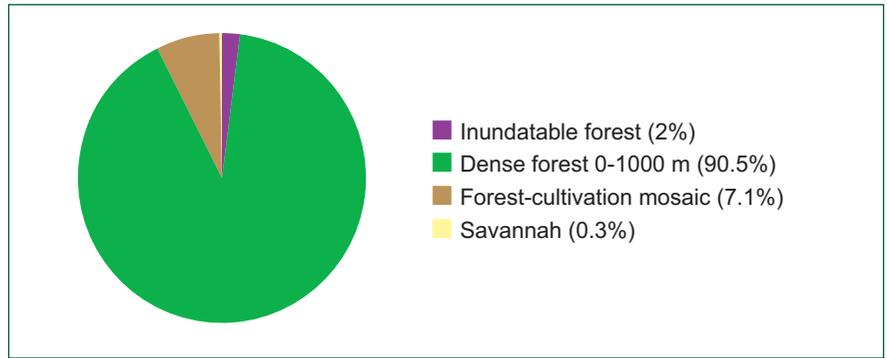


Figure 15.4. The main vegetation types (Source: JRC).

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 Mitzié. 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.

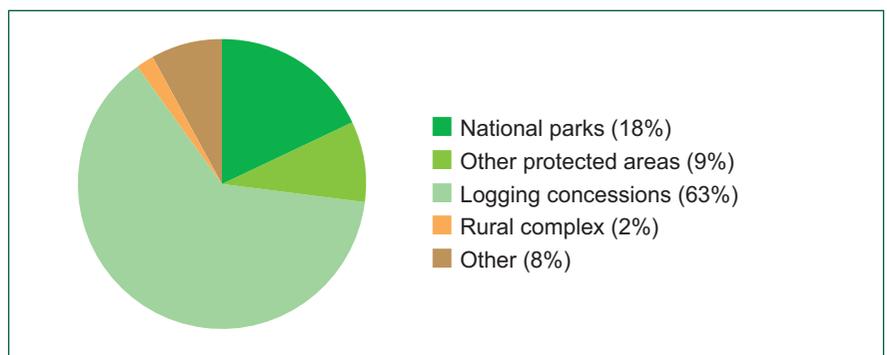
(5) Trade

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.