



## Challenges for forest conservation in Gabon, Central Africa

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### Abstract

In recent decades, large expanses of tropical rainforest in central and western Africa have been cleared, logged, fragmented, and overhunted. In contrast, extensive forest in Gabon has survived in a relatively intact condition because the country has a sparse population and substantial petroleum and mineral deposits that have reduced economic pressures on forests. Unfortunately, Gabon's petroleum reserves are dwindling. As a direct result, industrial logging is expanding rapidly; nearly half of the country's forest is currently in timber leases, and this could increase to over 75% of the remaining forest during the next decade. Mechanized logging has important ecological impacts on forests, but the most severe effects are indirect, because loggers create labyrinths of roads that greatly increase access to forests for hunters and slash-and-burn farmers. Declines of forest wildlife from overhunting have been severe in much of tropical Africa, and are likely to rise sharply in Gabon as physical accessibility to forests increases.

The Gabonese government is eager to consider alternative strategies to augment economic development, including promotion of an ecotourism industry. This commitment is evidenced by the government's recent designation of 13 new national parks that comprise over a tenth of the country's land area. Efforts to develop ecotourism face substantial challenges, however, including the high profitability of exploitative land uses like logging, the illegal encroachment of loggers and hunters into nature reserves, political instability in the surrounding region, and limited infrastructure for tourism. Nevertheless, these and other efforts to promote more-sustainable development should be strongly supported, as Gabonese forests have among the highest levels of species diversity and endemism in tropical Africa and are likely to play a critical future role in biodiversity conservation. Published by Elsevier Ltd.

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## 1. Introduction

Tropical rainforests sustain a large fraction of the world's biological diversity and are vanishing more rapidly than any other biome [1,22]. In Africa, tropical rainforests are mainly confined to an equatorial belt of varying width, with the largest block of forest in the Congo Basin and adjoining lower Guinean area, and a smaller block in West Africa. Rainforests also persist on scattered mountaintops in eastern Africa [49]. Because of their high biological diversity and uniqueness, African rainforests are a top global conservation priority [18,36].

Africa's tropical rainforests and wildlife have been severely degraded in recent decades by a bevy of threats, including industrial logging (Fig. 1), slash-and-burn farming (Fig. 2), overhunting, and increasing infrastructure development. In the Democratic Republic of Congo (formerly Zaire), for instance, vast timber leases have been granted to Zimbabwean, German, Malaysian, and Chinese corporations. The largest lease, totaling some 34 million ha in area, is about 1.5 times the size of Great Britain [24]. Cameroon has likewise seen an enormous increase in timber operations, which now encompass over 80% of all forests outside a few protected areas [14]. Timber-cutting operations have also grown dramatically in many other tropical African countries (e.g. [11,53]) and are slated to increase even further in the future. Selective logging has important impacts on tropical ecosystems and wildlife [15,17,26,28], but its most alarming effects are secondary; by



Fig. 1. During selective-logging operations, bulldozers can cause heavy forest disturbance and the resulting labyrinths of roads greatly increase access to forests for hunters, miners, and colonists (photo by W.F. Laurance).



Fig. 2. Slash-and-burn farmers in southern Gabon (photo by W.F. Laurance).

creating labyrinths of roads and bulldozer tracks, logging greatly increases physical access to forests for hunters, miners, and farmers that can destroy or severely degrade forests [25,53,55].

Well over half of all African rainforests have been cleared and fragmented, mainly from slash-and-burn farming (Fig. 2). Forest loss has been most severe in West Africa, which currently has <12% of its original rainforest (declining from 1.25 to 0.15 million km<sup>2</sup>), and in eastern Africa, which has 8% of its original rainforest (declining from 0.36 to 0.03 million km<sup>2</sup>), according to recent estimates [31]. Central African forests still comprise about 59% of their original distribution (declining from 3.13 to 1.86 million km<sup>2</sup> [31]). Forest destruction has been fueled by rapid population growth and by extensive road building for logging, oil, mineral, and infrastructure projects, which have greatly increased access to forests [31,52].

As the human population has increased, hunting and other forms of traditional exploitation like fuelwood gathering have grown sharply. Few remaining areas of forest are inaccessible to hunters given expanding road networks and shrinking forests [54]. The efficiency of hunters has also increased as shotguns and cable snares have replaced traditional crossbows, spears, and nets [20,29,33]. Populations of hunted wildlife, especially larger-bodied species like duikers (forest antelope), bushpigs, elephants, and diurnal primates, decline sharply within 10–15 km of villages and roads [6,12,20,21,54]. In addition, commercial hunters use hunting and logging camps to penetrate deep into remaining forest tracts [20,53,54]. Both rural and urban populations in tropical Africa rely

heavily on protein from wild meat, which drives a burgeoning commercial bushmeat trade [29]. In West Africa, chronic overhunting and forest loss has led to a near-collapse of the bushmeat trade and the likely extinction of a primate species [35]. Of 57 mammal, bird, and reptile species hunted in the Congo Basin, 60% are being exploited unsustainably [13]. The total harvest of wildlife in the Afrotropical region is estimated to be about 5 million tons annually, making it the most intensively hunted tropical region in the world [13].

Finally, recurring wars, political instability, and endemic corruption have also created serious impediments for forest conservation. In recent years, nearly a third of the 42 sub-Saharan countries in Africa have been embroiled in international or civil wars [46]. For example, in a desperate effort to combat rebels in the eastern half of the country, the vast Democratic Republic of Congo has bartered unprecedented access to timber, gemstones, and minerals to Zimbabwe, Uganda, Rwanda, and Burundi in exchange for military support [46]. Armed conflicts in Rwanda, Uganda, and Congo have killed millions of people with associated impacts on forests, wildlife, and national-park staff and infrastructure. Moreover, corruption can be a serious impediment to conservation and is so rife in the tropical timber industry that a recent report commissioned by the



Fig. 3. Gabon and its cities, in central-west Africa (source: Ref. [8]).

European Community recommended a complete moratorium on logging in five African nations—Congo-Brazzaville, Cameroon, Central African Republic, Equatorial Guinea, and the Democratic Republic of Congo [23,40]. Corruption is also prevalent in segments of the oil industry; for example, the chairman and other high-ranking officials of the French oil company Elf were recently jailed for making large cash payments to political leaders in Gabon, Cameroon, Congo-Brazzaville, and Angola [16].

Fortunately, the nation of Gabon (Fig. 3) has largely escaped many of the social and environmental pressures facing other African nations. Favored with substantial oil and mineral deposits and rich timber resources, the country has enjoyed a relatively high degree of political and social stability and a per-capita income that is 4–6 times higher than most other sub-Saharan countries [8]. Moreover, much of Gabon's forests—among the richest and most biologically important in Africa—are still substantially intact, and for this reason could play a key role in future conservation strategies [18]. In coming decades,

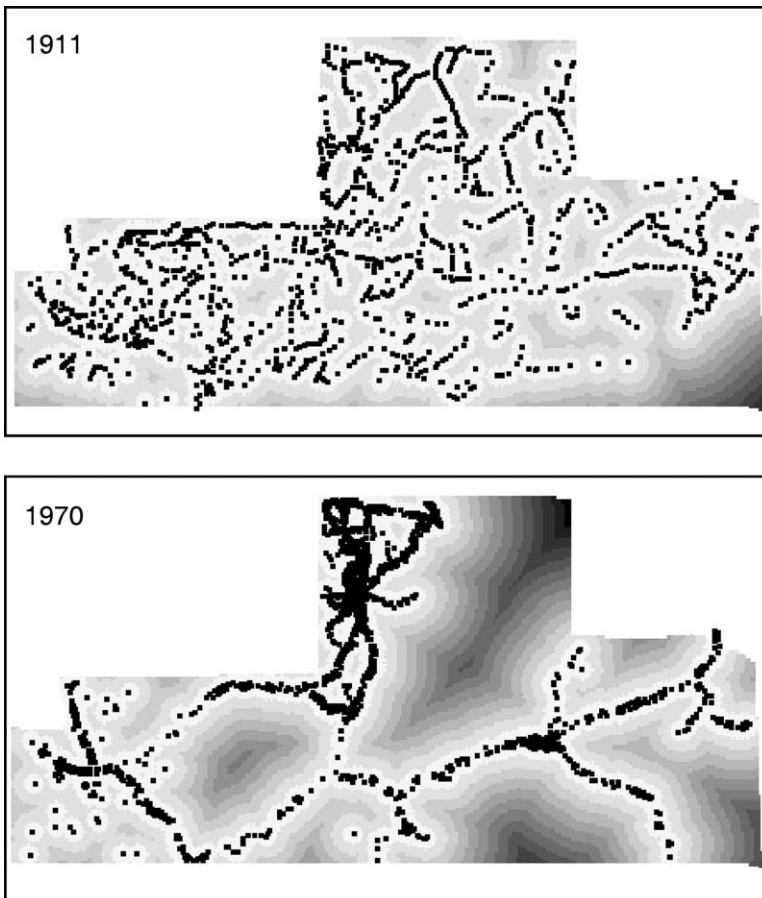


Fig. 4. Concentration of villages (dark points) along major roads and rivers in northern Gabon during the 20th century, as a result of the French colonial policy of 'Regroupement' (modified from Ref. [47]).

however, Gabon and its forests are likely to face dire challenges. Here, we summarize these challenges and highlight some fledgling but vital initiatives to promote forest conservation in this developing nation.

## 2. Background on Gabon

Gabon is a nation, the size of Italy (268,000 km<sup>2</sup>) that straddles the equator and is juxtaposed between the Gulf of Guinea to the west, Cameroon and Equatorial Guinea to the north, and the Congo Basin to the east (Fig. 3). It is part of the extensive Guineo-Congolian phytogeographic region, which includes the Congo Basin and adjoining forests to the west [49]. Dense lowland rainforests predominate near the Gabonese coast, with forests gradually becoming more seasonal and semi-deciduous further inland. Swamps, mangroves, steppes, and savannas comprise about 15% of the land area [20].

Gabon was initially colonized by the French, who established their first settlement there in 1839. The capital city, Libreville, was founded by freed slaves in 1849. The country was initially established as part of French Equatorial Africa in 1910, and achieved national independence in 1960. The official language is French, and most of the population is Christian or animist, with a small Muslim minority [8,20].

Gabon is among the least densely populated countries in Africa, with less than 5 people per km<sup>2</sup> on average [8]. Historically, a high incidence of diseases such as cerebral malaria, arboviruses, waterborne pathogens, and, more recently, AIDS, has helped to maintain sparse human populations (e.g. [27,47]). The population is strongly concentrated in cities and along major roads and rivers. This partly resulted from an active policy of ‘Regroupement’ during the last century by the former French colonial administration (Fig. 4), which relocated entire villages along major roads and rivers to increase the profitability of plantation crops such as cacao [20].

The Gabonese population has been further concentrated by a post-colonial shift from plantation agriculture to natural-resource extraction [47]. The country has considerable oil, manganese, and uranium deposits and large areas of forest that can be exploited for timber. In the 1960s, there was a rapid build-up of the petroleum industry in coastal areas, especially in the Gamba Complex in southwestern Gabon. Exports of crude oil now account for more than 40% of the country’s gross domestic product and around 60% of the government budget [8]. Construction of a transnational railway in 1987 also increased exports of manganese and timber from the country’s interior. In 1994, devaluation of the regional currency (which lowered the price of exports) further promoted an export-based economy. This economic transformation has promoted intense urbanization, with people moving from villages to cities and to oil, logging, and mining towns. From 1950 to 2000, the rural population of Gabon declined by half while the urban population rose 20-fold [47].

Until recently, Gabon’s sparse population, high degree of urbanization, and wealth of oil and mineral resources have all tended to reduce pressures on its forests. From 69 to 80% of Gabon’s original forest cover remains, although much forest is being selectively logged [11]. Hunting has been intense in populated or accessible areas, where marked declines of wildlife have been documented [6,21], but forest tracts with very low human densities and little hunting still survive in inaccessible parts of the country.

### 3. New pressures on forests and wildlife

Gabon is a nation with low economic diversification. Its four major exports, petroleum, manganese, uranium, and timber, account for the lion's share of its gross domestic product. As such, the national economy is highly vulnerable to swings in production and commodity prices. For example, a single tree species, Okoumé (*Aucouméa kleineana*), which is prized for making plywood, constitutes 73% of all timber exports. This species is being overexploited throughout most of its range in Gabon [11] and may become scarce in the future. The global decline in oil prices since 1986, and the Asian economic crisis of the 1990s, which reduced demand for timber exports [7], have had large impacts on the economy and sharply increased unemployment [20].

Gabon's greatest near-term economic challenge is that its income from petroleum exports is falling, and is likely to decline even further in the future. For example, Shell Oil Corporation, until recently the largest oil producer in Gabon, has seen its daily production decline from 240,000 to 90,000 barrels (Fig. 5). Production is expected to fall to just 50,000 barrels per day by the year 2007 [43]. Unless major new oil deposits are discovered—which is considered unlikely—Gabon's oil production is likely to drop sharply over the next decade.

As oil revenues have declined, the Gabonese government has become increasingly reliant on timber exports [7]. This has led to an explosive growth in logging. In 1957, about 1.6 million ha of Gabon's forests were in logging concessions (long-term timber leases). By 1999, this figure had grown to 11.9 million ha—representing 45% of the country's total land area (Fig. 6) and two-thirds of the remaining forest [11]. In the 1990s alone, timber

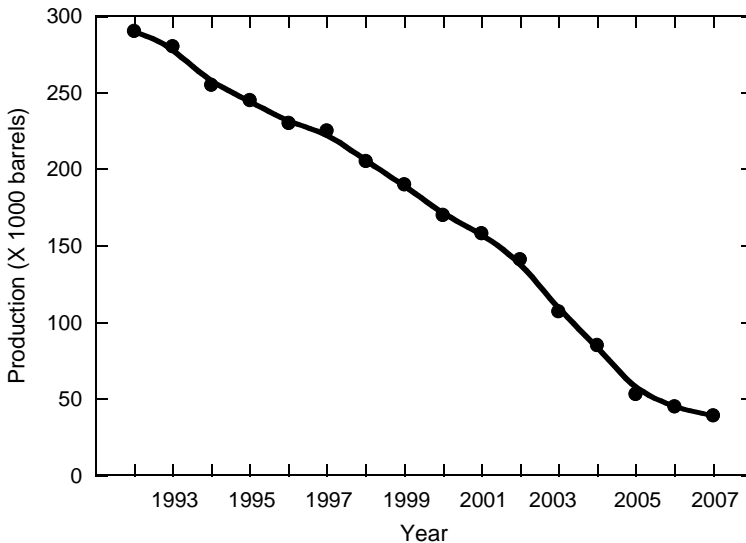


Fig. 5. Forecasted daily petroleum production for Shell Oil Corporation in the Gamba Complex in southwestern Gabon (source: Ref. [43]).

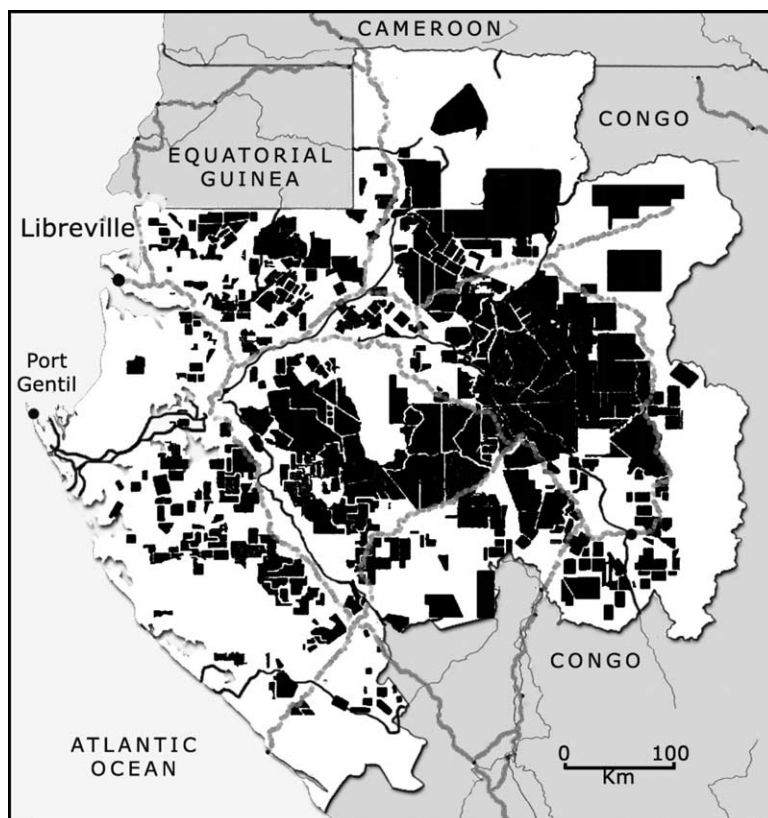


Fig. 6. Documented logging concessions in Gabon in the late 1990s (source: Ref. [11]).

exports more than doubled (Fig. 7), with half of all logs being sold to Asian countries, especially China. In another decade, it is expected that three-quarters or more of Gabon's forest will be in logging concessions. Much of the logging is by multinational corporations, especially from France. A third of all Gabonese logging concessions is controlled by five logging companies that is largely or wholly foreign-owned [11].

Logging in Gabon is often poorly regulated, leading to excessive environmental damage (Fig. 8). Although variable, up to half of the forest canopy can be disturbed in a typical commercial logging operation [48], causing large forest-structural changes, microclimatic alterations, soil compaction, and erosion [15,17]. Even in the absence of hunting, many species of disturbance-sensitive wildlife, such as chimpanzees [51] and understory-insectivorous birds [38], decline in logged forests. Only a tiny fraction (< 3%) of the 221 registered logging companies in Gabon, have completed management plans, as required by law. Gabon's Ministry of Water and Forest Resources, which manages logging operations, has only 100 field agents in the entire country, most of which have insufficient vehicles and housing. On average, each agent is responsible for over 860 km<sup>2</sup> of active concession area. In addition, non-governmental organizations working in Gabon have



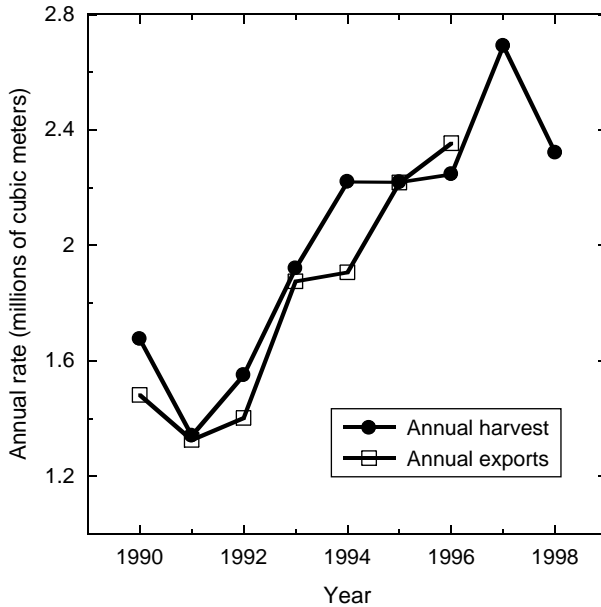


Fig. 7. Estimated annual harvests and exports of timber from Gabon during the 1990s (source: Ref. [11]).

located dozens of illegal logging operations outside concession areas, often within parks and other protected areas [11].

The rapidly changing conditions in Gabon have had a dramatic impact on hunting. Initially, the French-colonial Regroupement policy created a series of large, lightly settled forest tracts where hunting pressure was relaxed (Fig. 4) and where wildlife achieved high population densities (e.g. [45]). Since then, however, hunting has increased sharply in many areas, especially with the advent of large-scale logging, oil, and mineral developments. Logging, in particular, leads to a dramatic rise in commercial hunting, by providing hunters with greater access to unexploited wildlife populations and lowering the cost of transporting bushmeat to market [53,54]. The logging-company workers themselves are often avid hunters, with bushmeat sales providing up to 40% of their annual income [55]. Loggers also rely on wildlife for food; for example, employees at a single large logging camp in central Gabon consumed up to 80 tons of bushmeat per year [2].

As economic conditions and unemployment worsen, Gabonese farmers that once relied on bushmeat for subsistence are increasingly turning to commercial hunting. Commercial hunters frequently hunt in logging concessions, where newly constructed roads and concession vehicles provide them with ready access to previously un hunted forest far from villages. To increase efficiency, they take a diversity of prey, killing not only the small animals that tend to persist in hunted areas (e.g. blue duiker, brush-tailed porcupine) but also vulnerable, large-bodied animals such as apes and forest buffalo [30,33,34,47]. They also hunt intensively, killing virtually all the animals in an area then moving on to a new area. Demand for bushmeat in Gabon continues to rise not only because the population is growing (at a mean rate of about 2.5% per year [8]) but also because salaried



Fig. 8. Heavy soil erosion in logged rainforest in southern Gabon (photo by W.F. Laurance).

timber, oil, and mining workers can pay for more meat per-capita than local villagers can afford [42,54].

Inevitably, increased road construction from timber, mining, and oil companies and an expanding network of government roads and railways are increasing the rate and extent of deforestation, principally from slash-and-burn farming. In southwestern Gabon, for example, farming plots are proliferating along new government-sponsored laterite roads (Fig. 2). Intrinsic population growth, especially in rural areas, also contributes to forest loss. Gabon has already lost an estimated 20–30% of its original forest cover [11] and this figure will surely rise as roads and population pressures increase. In coming years, an anticipated rapid rise in foreign investments in transportation and energy infrastructure, mining, timber, and fisheries, most notably from China [3–5], could further increase pressures on natural resources in Gabon.

#### 4. Hope for the future: new parks and ecotourism

Gabon has among the richest wildlife (Fig. 9) and plant communities in Africa, and up to 20% of its species are endemic to the country [39]. Roughly 40% of the world's gorillas are thought to live in Gabon [47]. As such, it is likely to play a critical role in future conservation strategies for the Guineo-Congolian region [18], which comprises over 90% of Africa's remaining tropical rainforest. This is especially the case given the higher rates



Fig. 9. Gabon supports spectacular wildlife such as forest elephants, which are rapidly declining elsewhere in Africa (photo by W.F. Laurance).

of deforestation, logging, and overhunting and recurring eruptions of political and social instability elsewhere in the African humid tropics.

Today, the Gabonese government, with much international aid and encouragement, has begun a major effort to develop a viable, large-scale ecotourism industry. This effort has been closely linked to a new regional initiative for environmental conservation. In 1999, Gabon and six other Central African nations (Democratic Republic of Congo, Chad, Cameroon, Central African Republic, Republic of Congo, Equatorial Guinea) signed the Yaoundé Declaration, which created a 'Congo Basin Forest Partnership' that contains important commitments for forest conservation and sustainable management. The declaration, which involved integrating strategies from local communities, logging companies, and non-governmental conservation organizations, includes plans to establish 10% of each nation's forests in protected areas [18]. A stated goal of the declaration is to adopt forest eco-certification to help promote more-sustainable logging practices in the region (<http://www.panda.org/forestsummit/>).

The Yaoundé Declaration has spawned a key bioregional planning effort in Central Africa. In an expert workshop in 2000 initiated by the World Wide Fund for Nature-US, nearly 80 biologically important areas were identified in the Guineo-Congolian region, which were then consolidated into 11 priority landscapes, encompassing 700,804 km<sup>2</sup> [18]. The priority-landscape strategy has since been adopted as a blueprint for conservation planning by governments and non-governmental organizations in the region.

In Gabon, the new bioregional planning efforts have led to a major re-evaluation of the national protected-area network. Remarkably, in 2002 the country established 13 national parks (including five former faunal reserves that previously enjoyed only limited protection) that encompass about 30,000 km<sup>2</sup>, 11% of the country's land area (Fig. 10). The protected-areas network, which was designed with considerable input from leading biologists in Gabon, encompasses most of the important terrestrial, coastal, and marine ecosystems in the country.

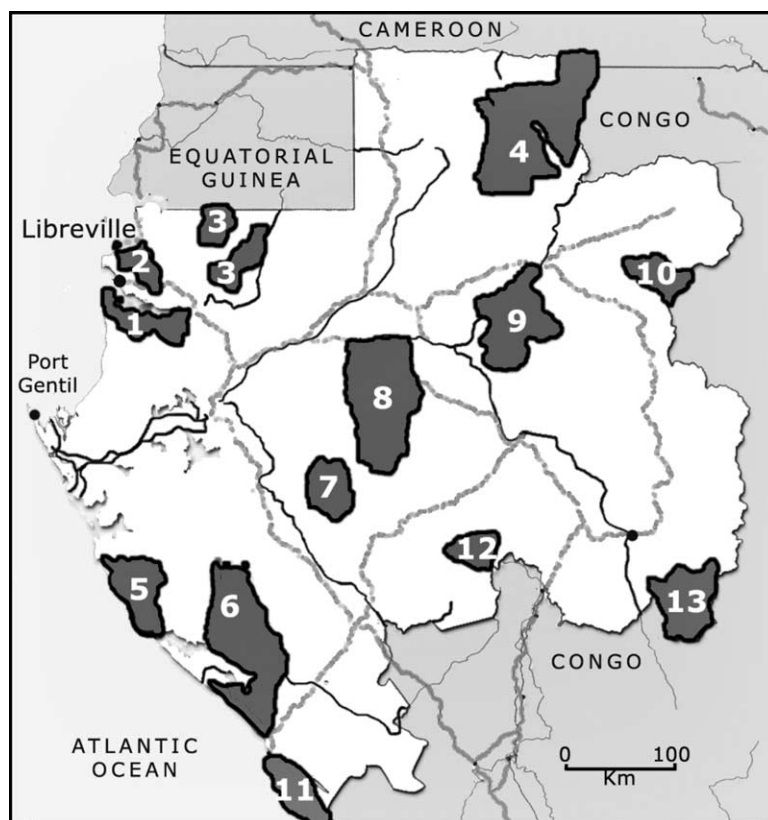


Fig. 10. Thirteen newly designated national parks in Gabon. Wavy gray lines are major roads whereas wavy black lines are major rivers. (National parks: 1 = Pongara; 2 = Akanda; 3 = Monts de Cristal; 4 = Minkebe; 5 = Loango; 6 = Moukalaba-Doudou; 7 = Waka; 8 = Lopé; 9 = Ivindo; 10 = M'wagne; 11 = Mayumba; 12 = Birougou; 13 = Plateaux Biteke).

For the Gabonese government, a major impetus for establishing the new parks is the prospect of developing a viable ecotourism industry [9,39]. The influential President of Gabon, Omar Bongo, who has led the country since 1967, has shown considerable enthusiasm for the new parks and ecotourism strategy. It is uncertain, however, whether the eventual successor to President Bongo (who will be 70 years old in 2005) will share his interests. This uncertainty has created a real sense of urgency among those interested in promoting ecotourism and conservation planning, and who believe that rapid progress is needed to quickly establish a viable tourism industry in Gabon, while political circumstances are favorable. Thus, although they are being guided by a long-term vision, conservation planners in Gabon are frequently focusing on short-term targets (i.e. over the next 5–10 years).

Gabon clearly has outstanding potential for ecotourism [37]. It contains a great diversity of environments, including marine, island, coral-reef, coastal, lagoon, swamp, rainforest, steppe, and grassland ecosystems. It is relatively socially and politically stable. In support of its ecotourism initiatives, it is receiving financial backing from foreign governments, including the US, which committed up to \$53 million for conservation programs among the seven Yaoundé-Declaration countries, as well as France, Germany, and Japan [39]. It is also receiving diverse logistical and planning support from environmental or scientific organizations such as the Wildlife Conservation Society, World Wide Fund for Nature, Conservation International, ECOFAC, and the Smithsonian Institution.

Gabon's ecotourism initiative is timely from an economic perspective. Worldwide, the travel and tourism industry generates over \$4 trillion in economic activity each year, and is projected to grow at an annual rate of 4.6% over the next decade [57]. Tourism to natural areas has increased dramatically, rising from just 2% of all tourism in the late 1980s to about 20% in the late 1990s [32]. Large, charismatic wildlife, such as gorillas and forest elephants, which are a major attraction for nature-loving tourists [44], are relatively abundant in Gabon.

However, Gabon's quest also faces daunting challenges. Its 13 newly established parks are in reality little more than lines on a map; few have even basic infrastructure and staff, and many are difficult to access. With the exception of Lopé National Park, which has some excellent interpretive materials (e.g. [50]), the new parks generally lack field guides, maps, and other basic resources for tourists that can take years to compile. Moreover, many parks overlay existing logging concessions (Fig. 6), which must be purchased by the government, and some experience rampant poaching of wildlife (P.D. Walsh, pers. comm.). Even if the parks can be adequately protected, many will be virtual islands surrounded by a sea of logging leases. Without effective buffer zones, hunting in the surrounding lands could be a serious threat to wildlife in the parks, creating population sinks that increase the likelihood of local extinction [56]. A further challenge lies in building capacity among Gabonese workers, which generally speak only French and local Bantu dialects, and have little experience in a service-oriented industry like international tourism.

In an effort to build a foundation for ecotourism, the Gabonese government has implemented planning initiatives to develop, for each park, designs for tourist lodges, staff headquarters, and trail networks as well as guidelines for tour operators, waste and water

management practices, and other practical issues (e.g. [10]). The government also plans to develop a training program for wildlife guides and park guards, which will include a field component at Lopé National Park and a theory component taught in Libreville. Some park guards will also be sent to Kenya for anti-poaching and park-management training (A.J. Coates, pers. comm.). Finally, the US Trade and Development Agency has initiated a program to help improve vitally needed road, air, and railroad infrastructure for Gabon's fledgling tourism industry [41].

Can Gabon realistically hope to create a large-scale tourism industry? Achieving this will require surmounting some important misconceptions. For example, tourists are extremely sensitive to perceptions of physical danger, and Central Africa is generally regarded as a dangerous place, despite the fact that Gabon is politically and socially stable. Another misperception is that Gabon will provide easy viewing of large, spectacular wildlife—as in eastern and southern Africa—when in fact its lush jungles and stunning coastal vistas are better suited to a 'whole-nature experience,' not just an animal-watching experience. Equally important is that the proponents of ecotourism should not assume that it is a panacea for nature conservation [19]. Other initiatives, such as efforts to control illegal logging and poaching, public education programs, international conservation treaties, and strategies to limit the impacts of new transportation projects on forests and wildlife, are also crucial—although a viable tourism industry in Gabon could help to generate political and public support for such initiatives.

Finally, the Gabonese must understand that a thriving tourism industry will require many years and much commitment to establish, and even then is likely to be modest in scale. Ecotourism will probably never yield the dramatic windfalls that rapid oil extraction and rampant logging have provided, but it could provide sustainable revenues and employment indefinitely. Given its great wealth of biodiversity, Gabon's visionary efforts clearly merit the support of international donors and organizations, for they probably provide the best prospects for nature conservation in Central Africa.

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