

Introduction

Connie J. Clark and John R. Poulsen

Nicholas School of the Environment, Duke University,
Durham, NC

The end of an era

Tropical rainforests harbor roughly 50% of the world's biotic diversity and provide globally critical ecosystem functions, including 40–50% of the global net primary productivity of terrestrial vegetation (Malhi & Grace, 2000; Houghton, 2008). They also provide valuable products and services to support the livelihoods of rural people. More than 1.6 billion people depend on forests for their livelihoods (Eba'a Atvi *et al.*, 2009). Forest cover continues to decline at a rate of 11.5 million hectares per year however, an area larger than Iceland or Liberia (Hansen *et al.*, 2010). Deforestation and forest degradation are causing an unprecedented loss of biodiversity and ecosystem function (Chapin *et al.*, 2000; Thomas *et al.*, 2004) and are contributing 15–20% of the atmospheric CO₂ that is the primary driver of global climate change (IPCC, 2007).

For the last century, forest conservation has focused largely on the establishment of protected areas where resource extraction is mostly prohibited. Although 113 million hectares has been protected, this amounts to only 8.6% of remaining tropical forests¹ (Nelson & Chomitz, 2009). By itself, the existing system of protected areas is inadequate to prevent continued loss of biodiversity or to protect all ecosystem services (Pimm & Lawton, 1998; Soule & Sanjayan, 1998; Fagan *et al.*, 2006).

¹ This estimation edges over, 20% when multi-use management zones, such as those described in this book, are included in protected area calculations.

Outside of protected areas, the image of tropical forests as endless expanses of remote wilderness is, for the most part, an illusion. With few exceptions, tropical forests today are heterogeneous landscapes bisected by roads, dotted with villages and towns, and exploited by smallholders and big businesses for ranching, agriculture, mining, oil and logging (Figure 1.1). Most tropical and high biodiversity forests lie in developing nations whose governments are either unable or unwilling to manage the forest estate sustainably, particularly when large-scale extractive industries generate significant revenue

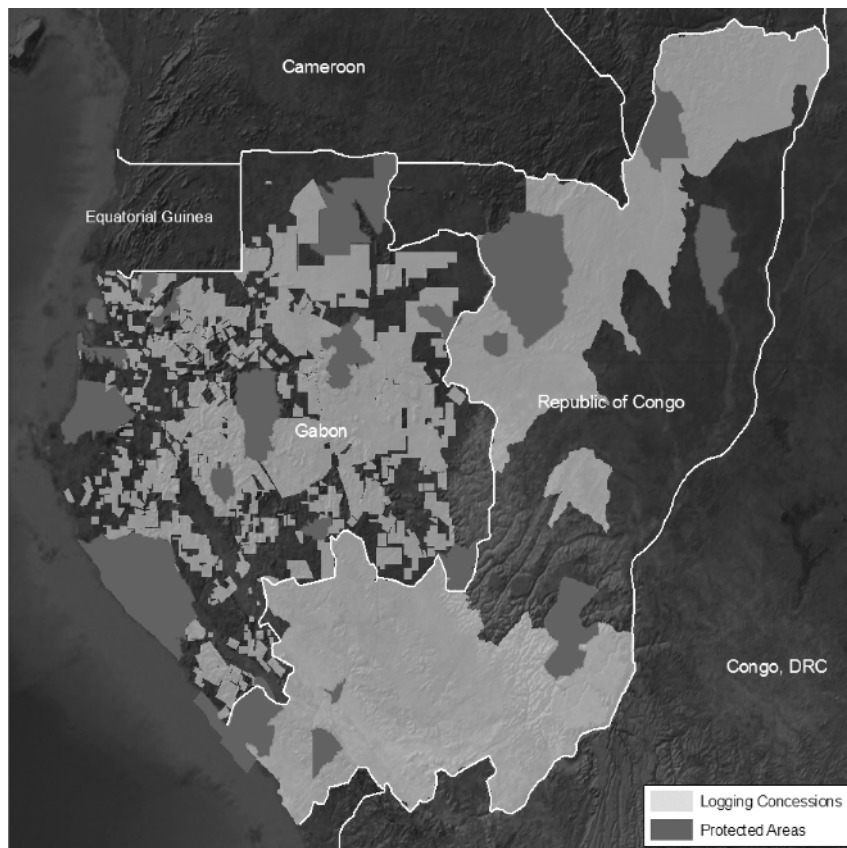


Figure 1.1 Map of the Republic of Congo and Gabon with Protected Areas represented in dark gray and logging concessions represented in light gray. Data provided by WRI. Map created by Greg Fiske, WHRC.

(Barrett *et al.*, 2001; Milner-Gulland *et al.*, 2003; Smith *et al.*, 2003). When poor nations must rely on forest exploitation as a source of revenue to build their economies, the possibility of setting aside protected areas vanishes². We must therefore extend conservation efforts beyond protected areas to include places where economic considerations prevail. An obvious place to start is that part of the forest estate dedicated to timber extraction.

Extending the conservation estate to production forests

In addition to protected areas, community forests and production forests are major land uses in tropical forests. Companies leasing logging concessions control significant areas of tropical forest. Managing production forests for biodiversity and ecosystem services could vastly increase the conservation estate. Worldwide, nearly 30% (350 million hectares) of natural tropical forests are destined for logging. The demand for timber is expected to increase from 1.6 billion m³ to 1.9 billion m³ during 2010–2015 (Kirilenko & Sedjo, 2007). Demand for fuel wood is also expected to greatly increase pressure on forests in coming decades (Raunikar *et al.*, 2009). With timber plantations occupying only 3% of forested lands, demand for wood in the short term will entail opening up frontier forests (Laporte *et al.*, 2007) or intensifying harvest in already logged forests (FAO, 2009).

The history of logging is one of poorly organized operations and destructive harvests that leave behind a sea of residual damage, rendering forests susceptible to drought, fire and conversion to other uses (Holdsworth & Uhl, 1997; Nepstad *et al.*, 1999; Laurance, 2000; Putz *et al.*, 2000; Asner *et al.*, 2006). The extraction of large, commercially valuable trees creates gaps and modifies the structure of forests for decades to come. Timber harvest can cause widespread collateral damage to remaining trees, subcanopy vegetation, soils, and hydrological processes, resulting in increased erosion and fire, and decreased carbon storage, flora and fauna (Holdsworth & Uhl, 1997; Nepstad *et al.*, 1999; Laurance, 2000; Putz *et al.*, 2000; Asner *et al.*, 2006). Logging operations also

² Within the UN Framework Convention on Climate Change (UNFCCC), negotiators are designing a mechanism for compensating developing (largely tropical) nations that succeed in reducing carbon emissions from deforestation and forest degradation, known by the acronym from reducing emissions from deforestation and degradation (REDD) (Gullison *et al.*, 2007). This program may incentivize governments to conserve forest by providing revenues to keep forests standing.

open roads into once-remote forests (Figure 1.2). This allows hunters and slash-and-burn farmers to penetrate into forests, resulting in defaunation and further deforestation (Robinson *et al.*, 1999; Wilkie *et al.*, 2000; Asner *et al.*, 2006; Peres *et al.*, 2006; Poulsen *et al.*, 2009).

Many of the impacts of logging are obligate attributes of the industry (e.g., tree extraction, road and skid trail construction; Box 1.1). While they cannot be avoided, their impact can be reduced (e.g., Putz *et al.*, 2008). Indeed, a growing number of companies are committed to adopting reduced-impact logging (RIL) techniques. RIL consists of technologies and practices that are designed to minimize the environmental impacts associated with industrial timber harvesting operations. These include, among other things, pre-harvest inventories and mapping of individual trees, the planning of roads, skid trails and landings and the use of controlled felling and bucking techniques. RIL is an essential component of sustainable timber harvesting prescriptions where operations occur on slopes of less than 40° (Putz *et al.*, 2001; Sist & Ferreira, 2007). RIL can be both profitable and renewable, while maintaining much of the carbon stock and biodiversity (Asner *et al.*, 2006; Azevedo-Ramos *et al.*, 2006; Putz *et al.*, 2000, 2008; Clark *et al.*, 2009).

Box 1.1 **Direct and indirect threats of logging**

The threats of anthropogenic activities on the forest and on biodiversity are both direct and indirect. Direct threats are the result of the activity and include: (1) fragmentation of the forest by logging roads; (2) opening of canopy through timber extraction; (3) depletion of timber species; (4) removal of aboveground biomass; and (5) erosion from roads and skid trails.

Indirect threats are often unintended consequences of an activity (e.g., increase in hunting levels because logging roads open access to frontier forest). The indirect threats of logging are somewhat more diverse in their impact. They can be ecological: (1) changes in abundances of animals; (2) loss of biodiversity; and (3) changes in ecological functions (e.g., seed dispersal, regeneration dynamics, etc.). They can also include socio-economic impacts: (1) migration and population growth; (2) increase in levels of hunting and poaching; (3) development

of markets for natural resources; (4) encroachment of agriculture; and (5) impacts on human health. The indirect threats that drive overhunting in the tropics are not unique to logging. Without active management, large-scale operations of other extractive industries such as mining, oil exploitation, and industrial agriculture can lead to overhunting, local extinction of some species and the loss of ecosystem services.

These direct and indirect threats combine to contribute to two linked phenomena: the harvest of bushmeat and the loss of biodiversity. The 'bushmeat crisis' refers to the enormous impact that commercial hunting for the meat of wild animals is having on wildlife populations around the world. Commercial hunting has become the most significant immediate threat to the future of wildlife. This threat to wildlife is a crisis because it is rapidly expanding to countries and species which were previously not at risk. The bushmeat crisis is also a human tragedy: the loss of wildlife threatens the livelihoods and food security of rural populations dependent on wildlife as a staple or supplement to their diet. The related 'biodiversity crisis' refers to the rapid loss of species that make up biodiversity – the full complement of species that inhabit an area. Many biologists believe Earth is entering a sixth mass extinction event, one that is the direct consequence of human activities including over-exploitation, habitat destruction and introduction of alien invasive species and pathogens.

Ironically, some of the most devastating impacts of the logging industry on tropical forests are non-obligate and could be avoided with appropriate management practices, including the implementation of mitigation strategies. These secondary, non-obligate impacts of logging include: the unsustainable harvest of non-timber forest resources and, in particular, wildlife; the expansion of destructive slash-and-burn agriculture that results from access to previously inaccessible lands; inequitable distribution of wealth; and poor placement of roads, logging camps and sawmills (e.g., building them near ecologically sensitive areas). Mitigating these non-obligate impacts of logging are traditionally outside of the perceived responsibilities of logging companies, because they are not directly related to logging techniques and operations. Moreover, the conservation community has not pressed for mitigation.

Extending conservation efforts to production forests provides an opportunity to reduce numerous threats to tropical forests, biodiversity and ecosystem services (Box 1.2). In theory, given the large size and varied habitats of logging concessions, logging operations that mitigate both their obligate (direct) and non-obligate (indirect) impacts could help to protect and preserve forest integrity and biodiversity across a landscape. This strategy would contribute in particular to the conservation of wide-ranging species that cannot be contained within the borders of protected areas (Sanderson *et al.*, 2002; Elkan *et al.*, 2006; Blake *et al.*, 2007, 2008; Clark *et al.*, 2009; Stokes *et al.*, 2010).

Box 1.2 Can forestry be conducive to biodiversity conservation?

A number of initiatives relating to improved forest management address biodiversity issues. In recent years, both the International Tropical Timber Organization (ITTO) and International Union for Conservation of Nature (IUCN) emphasized the importance of biodiversity by calling for: (1) an enhanced role for tropical production forests as components of multi-functional landscapes that contribute to biodiversity conservation at different spatial scales; (2) improved understanding of the impacts of forest management on biodiversity; (3) adaptation of forest management practices at all spatial scales to favor the conservation of native biodiversity; (4) improved ecological processes in tropical production forests provided by the presence of locally adapted native biodiversity; and (5) improved practical forest management at all spatial scales aimed at retaining native biodiversity (IUCN, 2006).

Perhaps the best model of forest management that explicitly addresses biodiversity conservation and the preservation of ecosystem functions is that of the Forest Stewardship Council (FSC). The FSC's set of Principles and Criteria for forest management includes ten principles illustrated by a number of criteria, several of which directly address the indirect impacts of logging on biodiversity and ecosystem function. For example, Principle 6, Criterion 2 states: "Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be

established appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, trapping and collecting shall be controlled”.

While these initiatives emphasize the importance of biodiversity conservation and protection of ecosystem functions, they have been criticized for failing to specify standards or actions to mitigate biodiversity loss in production forests (Bennett, 2001; Poulsen *et al.*, 2009). Despite the development of principles and criteria that encourage the conservation of biodiversity and ecosystem processes in production forests, very few examples of well-managed forestry concessions exist in the Congo Basin.

A new paradigm: Private-sector partnerships for conservation

Extending conservation activities into production forests requires innovative strategies that look beyond a strict protection paradigm toward a conservation model that accommodates the resource needs and land-use practices of multiple stakeholders. These conservation strategies will need to integrate national governments, industry, conservation NGOs and local communities in partnerships that promote environmentally appropriate forest use and biodiversity conservation across multi-use landscapes.

It is our hope that this book will facilitate the development of partnerships to mitigate the non-obligate impacts of logging on biodiversity, ecosystem services and livelihoods of local populations, with particular emphasis on wildlife management. The processes, systems and methodologies presented in this book were developed and tested in forestry concessions in northern Republic of Congo, where the Congolaise Industrielle des Bois (CIB) logging company has concessionary rights over 1.3 million hectares of tropical forests adjacent to a protected area network (Figure 1.3). In 1999, the Wildlife Conservation Society (WCS), the Congo’s Ministry of Forest Economy (MEF)³ and the CIB formed a novel alliance to reduce the negative impacts of logging on wildlife and biodiversity in timber concessions adjacent to the Nouabalé-Ndoki

³ At the project inception, the ministry was named the Ministry of Forest Economy but in 2009 changed to the Ministry of Sustainable Development, Forest Economy and the Environment (MDDEFE). We use the more succinct acronym (MEF) throughout the book.



Figure 1.2 Pokola village from the air. Pokola is the headquarters for the *Congolaise Industrielle des Bois (CIB)* and an example of logging towns built in frontier forest. Photo by Kent Redford.

National Park (Figure 1.3). The partnership was formally called the *Projet de la Gestion des Ecosystèmes Périphériques au Parc (PROGEPP)*, which we have translated and shortened to the Buffer Zone Project (BZP). Throughout the development of the BZP, the partners sought to achieve seemingly contradictory goals: to conserve biodiversity and improve the livelihoods of rural people while promoting economic development through timber exploitation.

The BZP partnership is an example of an emerging conservation model, which we refer to as a private-sector partnership for conservation (PSPC), that extends the conservation estate while integrating the interests and needs of multiple stakeholders. There have been few previous attempts by non-governmental organizations (NGOs), governments, logging companies and communities to find common ground and work together for conservation (see Mayers & Vermeulen, 2002 for similar examples of community-company partnerships). Thus, very little information is available to guide the creation and implementation of PSPCs. The goal of this book is to fill this need using the BZP as a case study of how such partnerships might be structured and implemented. Although we subscribe to the conservation model developed by the BZP, we hold no misconception that it has been implemented perfectly or that the approach can fit all situations and solve all problems. It is our hope that

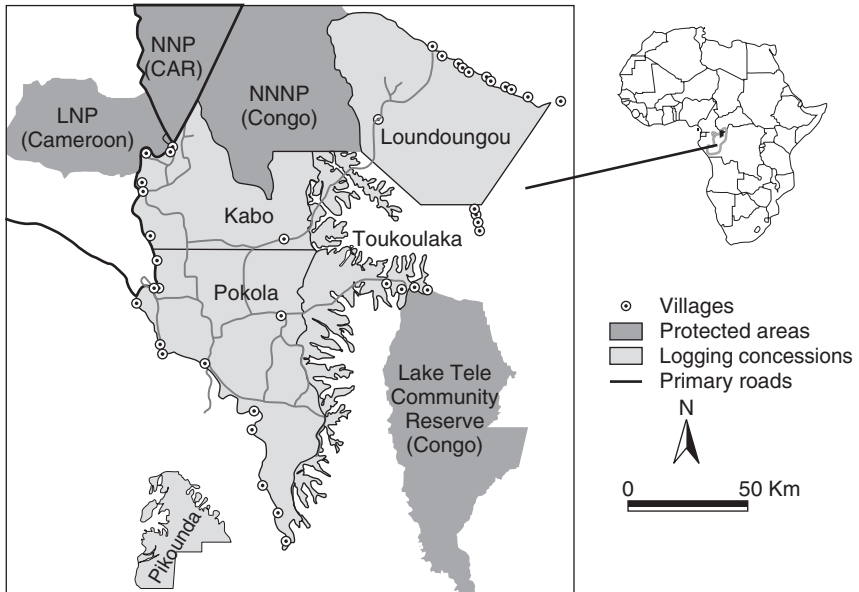


Figure 1.3 Map of the five logging concessions (Kabo, Pokola, Toukoulaka, Loundoungou and Pikounda; 1.3 million hectares) in northern Republic of Congo. The concessions lie adjacent to the Lake Télé Community Reserve (440,000 hectares) and the Sangha Tri-national Network (760,000 hectares) of protected areas, including the Nouabalé-Ndoki National Park (NNNP) in Republic of Congo, the Dzanga-Ndoki National Park (NNP) in Central African Republic and the Lobéké National Park (LNP) in Cameroon. Thick black lines indicate the borders between the three countries. Protected areas are shaded in dark gray, CIB concessions are shaded in light gray and unshaded areas are logging concessions operated by other companies or forest. Some roads outside the concessions are not shown.

the lessons learned from the BZP can help in the design and implementation of similar initiatives at other sites and with other industries, and that the BZP can be used as a demonstration platform for such new initiatives.

We wish to underscore that the effective conservation of tropical forests is not a task that can be tackled by conservation organizations alone. The inclusion of stakeholders in co-management projects may prove to be key to decreasing deforestation and forest degradation and the associated loss of biodiversity and ecosystem functioning. We hope this book will be of interest and use to any

business, community group, non-governmental organization, government agency or individual seeking to conserve and manage tropical forests.

Case study: Buffer Zone Project

The social, economic and historical context of any area under conservation determines, to some degree, its challenges, successes and failures. We therefore begin with an overview of the context in which the BZP was developed.

An overview of tropical forestry and conservation in the Congo Basin

The Congo Basin holds the world's largest area of tropical forest after the Amazon Basin. Whereas rainforests in West and East Africa have been reduced to 8–12% of their former extent, Congo Basin forests still encompass nearly 60% of their original distribution and include large tracts of contiguous forest (Naughton-Treves & Weber, 2001; Wilkie & Laporte, 2001). Even so, these forests are increasingly threatened by the expansion of extractive industries. Selective logging is the most extensive industry in the region: timber concessions occupy 30–45% of all remaining tropical forests and over 70% of forests in some countries (Global Forest Watch, 2002; Laporte *et al.*, 2007).

Forestry contributes to the national economy of Congo Basin countries by providing revenue and jobs (Table 1.1). Logging accounts for between 0.22% (Equatorial Guinea) to 6.3% (Central African Republic) of gross domestic

Table 1.1 Economic importance of logging in the Congo Basin. The contribution of the forestry sector to employment and gross domestic product in 2006 (FAO, 2009).

Country	Employment		Gross value added	
	1000	% Labor force	US \$ million	% GDP
Cameroon	20	0.3	324	1.9
CAR	4	0.2	144	11.1
Congo	7	0.5	72	1.1
DRC	6	0	186	2.3
Equatorial Guinea	1	0.5	87	0.9
Gabon	12	1.9	290	3

product (Eba'a *et al.*, 2009). It is second only to mining/oil extraction in the creation of employment (Congo Basin Forest Partnership, 2006; Congolaise Industrielle des Bois, 2006). By comparison, the oil industry accounts for up to 52% of GDP in some countries (Republic of Congo; <http://congo-brazzaville.org/economy>). Some experts estimate that depletion of oil stocks will occur within a decade, so tropical forestry is expected to grow in importance to national economies (World Bank Group, 2010). Although positive for economic development in the short term, logging is a challenge to conservation not only because of its direct impacts on the environment but also because it serves as a catalyst to other activities that severely threaten ecosystem services and the biological integrity of forest systems (Box 1.3).

Box 1.3 Logging, roads and bushmeat hunting (David S. Wilkie, Wildlife Conservation Society)

Looking at a Global Forest Watch map brings home the extent of Central Africa's forest estate allocated to timber companies (e.g., Figure 1.1). If loggers in Congo and Gabon were to clearcut their concessions, over 70% of the nation's land area would be deforested in 30 years. Thankfully (from a conservation perspective), timber companies active in this region are only interested in felling a few high-value species such as African mahogany (*Entandrophragma* spp., Meliaceae family) and Ocoumé, an excellent source for plywood (*Aucoumea klaineana*, Bignoniaceae family); rarely do they harvest more than 1–2 large trees per hectare.

In fact, high-resolution satellite images taken before and after logging in the northern Republic of Congo show almost no change in the forest (with the exception of a spider-web of roads). After logging, Central Africa's forests appear to be mostly intact; they are not however, because satellite images fail to show the true impacts. It is the roads that are the problem. Although necessary for getting the logs from the forest to regional and international markets, roads and the logging vehicles that traverse them provide easy access to pristine, frontier forests stocked with the highest wildlife biomass of any tropical forest.

Before the loggers arrived, local people throughout the forests of Central Africa were seldom connected to markets and therefore had

no history of growing commercial crops. When the timber companies arrive, they build roads; the steady stream of logging trucks traveling from the forest to urban centers and ports offer families their first opportunity to access markets. High-value export crops such as coffee or cacao take years to grow and low-value crops such as cassava and plantains are unprofitable as producers closer to markets have lower transportation costs and can sell for less. Bushmeat, on the other hand, is readily available and of high value. When loggers arrive, forest people find commercial bushmeat hunting to be the best short-term option for taking advantage of the situation. The problem is that such commercial hunting can strip a forest of its wildlife in a matter of months.

While logged forests may look relatively intact from a satellite orbiting overhead, they will be empty of wildlife if commercial hunting has not been controlled. This loss of wildlife is a disaster in the long-term for local communities. It may also be a disaster for the forests because it can change tree species composition and distribution. Large-bodied wildlife such as elephants, gorillas, chimpanzees, buffalo and pigs are no longer around to consume, spread and facilitate germination of the seeds of many tree species.

Consequently, the removal of logs is not the most important threat associated with the vast area of Central Africa's forests under forest concessions. The most important threat is uncontrolled hunting of wildlife for the bushmeat trade. Unless loggers learn how to manage wildlife in their concessions, and are provided the regulatory and economic incentives to do so, large-bodied wildlife may disappear from most of Central Africa's forests in the next 30 years.

Conservation efforts in the Congo Basin are largely focused on a network of 188 protected areas, comprised mostly of national parks⁴ (Eba'a Atvi *et al.*, 2009). These account for a little over 9% of the national territories of the six forest-rich nations: Cameroon, the Republic of Congo, the Democratic Republic of Congo, the Central African Republic, Gabon and Equatorial Guinea.

⁴ This figure does not include recreational hunting zones, hunting reserves and community reserves. With these, there are 341 protected areas representing 14% of the area of Congo Basin countries.

Northern Republic of Congo

The Republic of Congo's population is small (approximately 4 million people in 2010, or approximately 11.7 inhabitants per square kilometer), but it is increasing at an annual rate of 2.7% (<https://www.cia.gov/library/publications/the-world-factbook/geos/cf.html>, accessed October 18, 2010). Sixty-one percent of the population is concentrated in the urban centers of the capital Brazzaville and the primary industrial port of Pointe Noire; rural areas remain sparsely populated. For example, 648,000 people inhabit northern Congo at an average density of only 2 inhabitants per square kilometer. Low population density coupled with limited agricultural development in forested areas has historically kept both land conversion and biodiversity loss to low levels relative to other forested tropical countries.

Over the past 20 years logging has opened up Congo's forests, allowing hunters to penetrate deep into previously remote areas (Figure 1.4). The meat of wild animals, killed for subsistence or commercial purposes throughout the humid tropics, is commonly referred to as bushmeat. With logging, the scale of the bushmeat trade has increased dramatically (Box 1.3). Because wild game provides local and indigenous populations with a substantial portion of their protein and economic resources (Chapter 6), uncontrolled hunting threatens game species along with biodiversity. Local extirpation of game species would



Figure 1.4 A village man heading out to hunt with his shotgun. Hunters gain access to once remote forests by roads opened for logging. Photo by Michael Riddell.

leave some people with few alternative sources of protein, turning wildlife conservation into a food security issue.

Protected areas are the core of Congo's policy for ensuring long-term protection of natural resources and biodiversity. In total, Congo's 15 protected areas cover 3.7 million hectares and represent 10.8% of the total surface area. In the northern part of the country, protected areas cover over 2 million hectares and include the Odzala-Koukoua National Park (OKNP), Nouabalé-Ndoki National Park (NNNP) and the Lac Télé Community Reserve (LTCR) (Figure 1.1). These protected areas are relatively intact and are rich in plant and animal diversity. Much of Congo's wildlife occurs outside of protected areas, however, and most of it is within the logging concessions that cover some 79% of the forest domain (Global Forest Watch, 2002). Properly managed production forests could therefore offer important opportunities for increasing the scope of forest conservation activities in Congo. Apparently recognizing this opportunity, the government has passed a series of laws that, if implemented, would serve as a springboard for the extension of conservation activities within production forests (Box 1.4). The CIB forestry company was the first to meet the criteria for well-managed production forest as outlined in Congolese law; others are following their lead.

Box 1.4 Management principles in the Congolese Forest Law pertaining to biodiversity conservation and the rights of local people

1. *Land-use planning.* National Forestry Management Directives include five types of land-use categories: (1) production zones set aside for logging operations and economic production; (2) conservation zones established to conserve biodiversity, wildlife and landscapes; (3) protection zones to safeguard fragile habitats such as watersheds and watercourses; (4) community development zones reserved for use by local populations to exploit natural resources for their livelihoods and community development; and (5) dedicated research zones.
2. *Multi-resource inventories.* Inventories are required to plan extraction cycles as a function of the estimated regenerative capacity of the entire forest resource base. The main focus of resource inventories is

valuable timber species, but surveys of wildlife and other non-timber forest products should also be included.

3. *Participatory management with local communities.* Legitimate interests and rights of local communities must be incorporated into the management planning process. However, national directives do not detail how the policy on participatory management should be implemented. Socio-economic surveys are needed to understand traditional and current patterns of land use by local communities.
4. *Enforcement of hunting laws.* The 2002 Congolese forestry law requires logging companies to pay for a law enforcement unit (*Unité de Surveillance de Lutte Anti-Braconnage* or USLAB) to enforce hunting and wildlife laws within their concessions.

Nouabalé-Ndoki National Park and the Buffer Zone Project

The Nouabalé-Ndoki National Park represents one of the last ‘untouched’ protected areas in Central Africa. The park has never been commercially logged, although hunter-gatherer populations have inhabited the region for approximately 40,000 years. Evidence of iron smelting and burning sites has been found dating as early as 1240 BP (Lanfranchi *et al.*, 1998; Zangato, 1999; Brncic *et al.*, 2009)⁵. Although originally designated as a logging concession, the park was officially created in 1993 and has since been actively managed through a partnership of the Ministry of Forest Economy and the Wildlife Conservation Society. It preserves 426,000 hectares of tropical forest and contains a diversity of habitats, including a large block of semi-deciduous forest, swamp forest and mono-dominant *Gilbertiodendron* stands believed to have been unaltered by humans for centuries. Many species of globally endangered mammals whose numbers have been drastically reduced at other sites across the Congo Basin by habitat loss and hunting inhabit these forests, including forest elephants, lowland gorillas, chimpanzees, bongo, buffalo, leopard and giant forest hogs (Laurance *et al.*, 2006; Blake *et al.*, 2007). The park also harbors many common species including six species of duiker,

⁵ Note that the last human settlements in the park date back to 900 years ago, and there is no evidence that people inhabited the park in the last century (Curran *et al.*, 2009; Eves & Ruggiero, 2000).

eight species of diurnal monkeys, sitatunga and the red river hog. More than 300 bird species and 1000 plant species have been recorded within the borders of the park, and the reptiles, amphibians and insects have yet to be comprehensively surveyed.

The Nouabalé-Ndoki National Park forms part of the Sangha Tri-National Network of protected areas. To its west and northwest are the neighboring Lobéké and Ndoki national parks (Figure 1.3). On the Congo side, logging concessions surround the Nouabalé-Ndoki National Park making it the last block of undisturbed forest in the northern part of the country. Selective logging has occurred in the area since the 1960s. Operations were relatively limited until the end of civil war in 1999 which resulted in a rapid expansion of the sector, opening of concessions and construction of roads by large commercial operators. The Kabo (300,000 hectares) and Pokola concessions (560,000 hectares) to the south have been the sites of commercial timber exploitation since the 1970s. Loundoungou (386,000 hectares) to the east and Mokabi (375,000 hectares) to the north were attributed to international timber companies in 2001. The increase in logging activity in northern Congo in the late 1990s and early 2000s opened the park to new threats.

The Buffer Zone Project was created to combat the direct and indirect threats of logging to this area (Box 1.5). The project helped protect the park by managing wildlife, conserving biodiversity and reducing the impact of logging to the forest in the logging concessions near and around the park (Kabo, Pokola, Loundoungou⁶ and Pikounda). These concessions formed a buffer zone around the park that also contributed to the conservation of the Sangha Tri-national Network (Figure 1.3).

Box 1.5 Pre-project situation (Richard G. Ruggiero, US Fish and Wildlife Service)

In the early 1990s, life on the Sangha River continued as it had throughout much of the 20th century. Local residents still relied on forests that were increasingly penetrated by foreign logging companies and the flood of workers, hunters and traders. Logging camps became

⁶ In 2009 the Toukoulaka and Loundoungou concessions were merged into a single concession and renamed 'Loundoungou'.

towns with thousands of workers and their families (Figure 1.2). The cash economy produced lucrative markets for bushmeat. Entrepreneurs (both locals and outsiders) who could afford firearms, wire snares and transportation took advantage of open access to harvest wildlife to sell locally at the logging camps and in 'export markets' throughout Congo and beyond.

The history of wildlife exploitation for export is rooted in the colonial concessionary system (Hardin, 2011). The recent advent of large-scale industrial logging and the concomitant roads, infrastructure and human populations has resulted in unsustainable levels of hunting. The ease of hunting due to modern technology, accessibility using logging roads and the market demand in distant cities quickly demonstrate the disparity between the demand for bushmeat and the forest's relatively meager capacity to supply mammalian biomass. As was plainly evident, the collapse of wildlife populations was bringing an impoverishment of biodiversity and the decreased ability of local people to sustainably utilize wildlife for subsistence and as an important source of revenue.

In light of this, conservationists from the WCS Congo program focused attention on the production forests of the Kabo and Pokolo concessions to the south of the Nouabalé-Ndoki National Park. Instituting the necessary change in what at the time was an enormous, uncontrolled, illegal industry was challenging. Obtaining the legal mandate and practical wherewithal to work with the Congolaise Industrielle des Bois, local communities and government officials required both vision and inventiveness. Resistance to change was enormous, particularly among those who were heavily profiting from the illegal trade.

By dint of hard work, coupled with a grasp of the socio-economic foundations of the trade, the first functional system for the control of illegal bushmeat in a Central African forestry concession was launched.

The results of collaboration with stakeholders, enforcement of laws and the promotion of alternative protein sources were quickly apparent. Before the WCS conservation project was established in Bomassa and the subsequent creation of BZP, huge expanses of production forests could be traversed with only rare sightings of wildlife. After just a few years of recovery from the effects of unregulated hunting, forests and the natural clearings were again revealing the presence of elephants,

gorillas and diverse ungulates. Community hunting zones around small villages on the periphery of the concessions once again began yielding sustenance. Some villages, with the greatest compliance with hunting regulations, showed hunting returns that approached long-term sustainability (Eves & Ruggiero, 2000). A model was born: one with many parents among conservationists and local people, but also one with detractors who preferred short-term profit. The realization among local communities and a logging operator, that the otherwise inevitable pattern of destruction could be avoided and that biodiversity conservation was possible where utilization was regulated and common interests respected, was however taking root.

The Buffer Zone Project was founded and implemented on the basis of four principles: (1) partnership with the private sector for conservation; (2) landscape conservation to link protected areas with the sound management of the multi-use forests surrounding them; (3) a multi-pronged approach to management based on responses to diverse threats; and (4) research-based, adaptive management (Elkan & Elkan, 2005; Elkan *et al.*, 2006; Poulsen, 2009).

Private-sector partnership for conservation is the partnering of companies and conservation organizations, public agencies and/or local communities to promote adoption of business practices that conserve habitat and biodiversity and secure the livelihoods of local people dependent on natural resources. *Landscape conservation* is the idea that protected areas are typically too small to ensure the long-term conservation of populations of wide-ranging animals and that considering social, cultural and economic needs is critical to conserving biodiversity in lands outside of protected areas (Box 1.6). Landscape conservation can enhance the conservation success of parks, reserves and the biodiversity they are meant to protect by addressing threats from human activity in the surrounding multi-use forests. A *multi-pronged approach* to conservation is one that recognizes that the threats to biodiversity are diverse and that no single action (silver bullet) can mitigate them all: law enforcement must be combined with awareness raising and the promotion of alternative economic activities. *Research-based, adaptive management* is the concept that we need to learn by evaluating how well or how poorly we are doing over

time. Threats to biodiversity will evolve; adaptive management structures must be in place to allow conservation actions to evolve with them. Management initiatives must therefore be coupled with research and monitoring programs that facilitate the identification of new conservation threats and challenges and provide solutions to meet each challenge. Monitoring efforts also serve as an important means to verify the successes and failures of management activities.

**Box 1.6 The WCS landscapes species approach to conservation
(David S. Wilkie, Wildlife Conservation Society)**

Getting the spatial scale right

If we want to conserve biodiversity and all other ecosystem services within an area, we need to act at a spatial scale that matters to the species that rely on that area. To do this, we first need to be explicit about what we are committing ourselves to conserve and understand clearly the habitat needs of these species and the threats to them.

The Wildlife Conservation Society has developed an approach to defining the spatial extent and configuration of landscapes and seascapes focused on wildlife, which is sufficient to ensure that functional ecological relationships among species remain intact over the long term. This landscape-species approach facilitates the conservation of full assemblages of native plants and animals within an area.

Our landscapes-species approach focuses conservation actions on a suite of marine or terrestrial wildlife species that together rely on all primary habitats and are adversely affected by all key threats to biodiversity in the area. These landscapes and seascapes species make conservation goals explicit. By protecting habitats and abating threats, we can create a ‘conservation canopy’ that confers protection to most plant and animal species in the landscape or seascape, in addition to the target species.

To implement the landscapes-species approach we have developed a series of technical tools and accompanying training manuals, available on our website (<http://conservation-support.org/ResourceLibrary/tabid/4103/Default.aspx>).

The following chapters describe the inception, implementation and lessons learned while applying each of these principles of conservation. Chapter 2 discusses the formal institutional organization of the BZP. It examines the roles of the CIB, MEF and WCS, as well as their motives for entering into the collaborative relationship. Chapter 3 describes how communities are integrated into the co-management approach of the project and the development of land-use planning and access regulations for landscape conservation. Chapter 4 explains the nitty-gritty of implementing a multi-pronged approach to conservation, taking a look at project activities such as law enforcement, alternative activities, community conservation and awareness-raising and adaptive management. Chapter 5 and 6 examine results of the research and monitoring activities that are the backbone of adaptive management. Chapter 5 highlights the biological research that has been conducted over the past several years, assesses the results to date and offers ideas of how biological monitoring can be integrated into forest inventories. Chapter 6 summarizes the socio-economic research conducted in the concessions, defining methodologies for collecting rigorous data and evaluating the impact of logging on human communities. Chapter 7 presents the lessons learned to date from the project, in view of replicating it across other industries or in other forestry concessions in the tropics.