Has the final countdown to wildlife extinction in Northern Central African Republic begun?

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Abstract

The wildlife populations of Northern Central African Republic experienced precipitous declines during the 1970s and 1980s. While anecdotes coming out of the region indicate that the wildlife populations remain under serious threat, little is known about their status. An aerial sample count was carried out in the Northern Central African Republic at the end of the dry season in June 2005 and covered an 85,000 km^2 complex landscape containing national parks, hunting reserves and community hunting areas. Results show a dramatic decline of wildlife since the previous survey in 1985. In 20 years, large mammals' numbers decreased by 65%, probably because of poaching and diseases brought by illegal cattle transhumance. Elephant (*Loxodonta africana*) and Buffon kob (*Kobus kob*) populations showed the greatest decline (over 80% each), while buffalo (*Syncerus caffer*), roan antelope (*Hippotragus equinus*) and Giant Lord's Derby Eland (*Taurotragus derbianus*) populations seem stable or increasing over these last 20 years. The analysis of the wildlife population distribution by status of the different types of protected areas (national parks, hunting areas) showed that individual encounter rates of elephant and buffalo were lower in national parks than in neighbouring hunting areas, while those for roan, giraffe (*Giraffa camelopardalis*) and Buffon kob were higher in the national parks.

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Résumé

Les populations de faune du Nord de la République Centrafricaine subissent un déclin rapide depuis les années 1970 et 1980. Alors que des annecdotes en provenance de la région indiquent que les populations de faune sont sérieusement menacées, leur statut reste peu connu. Un inventaire aérien par échantillon a été réalisé dans le Nord de la République Centrafricaine à la fin de la saison sèche en juin 2005 et a couvert un complexe de 85000 km^2 comprenant des parcs nationaux, secteurs de chasse et zones de chasse villageoise. Les résultats montrent un déclin dramatique de la faune depuis l'inventaire précédent en 1985. En 20 ans les effectifs de grands mammifères ont chuté de 65%, probablement a cause du braconnage et des maladies transmisent par le bétail transhumant illégal. Les populations d'éléphant (*Loxodonta africana*) et de cobe de Buffon (*Kobus kob*) ont fait l'objet du plus grand déclin (plus de 80% chacune), alors que les populations de buffle (Syncerus caffer), hippotrague (*Hippotragus equinus*) et éland de Derby (*Taurotragus derbianus*) semblent stables ou en augmentation ces 20 dernières années. L'analyse de la distribution des populations de faune en fonction du statut des différents types d'aires protégées (parcs nationaux, zones de chasse) montrent que les taux de rencontre d'individus d'éléphant et de buffle sont inférieurs dans les

parcs nationaux à ceux obtenus dans les zones de chasse voisines, alors que ceux d'hippotrague, girafe (*Giraffa camelopardalis*) et cobe de Buffon sont supérieurs dans les parcs nationaux.

Introduction

The north of the Central African Republic (CAR) is a huge, isolated expanse of natural habitat with very low human population (<0.5 inhabitant sq km^{-1}) (Roulet, 2005), which seemed at first to be sufficient to guarantee quiet and security for wildlife. However, since the second half of the 19th century, wildlife has suffered from a continuous uncontrolled exploitation process (Froment, 1985; Delvingt & Lobão Tello, 2004; Roulet, 2005). Beginning around 1850, Arab slavers and ivory traders raided the region from Chad and Sudan and established the Dar El Kuti Sultanate, a vassal Sudanese power with its capital at Ndélé (Delvingt & Lobão Tello, 2004; Roulet, 2005). A majority of the people living in northern CAR have Chadian and Sudanese origins (Roulet, 2005) and still maintain strong links with Chad and Sudan. Historically, people from Darfur or Salamat have considered the Northern CAR as a reserve of natural resources (ivory, pasture, meat…) or slaves for their benefit. During the colonial period, and after the creation of the current National Parks in the 1930s, the French administration was not able to control Sudanese poaching for bush meat and ivory in this huge area (Delvingt & Lobão Tello, 2004). As a consequence, one of the largest northern white rhino (*Ceratoterium simum cottoni*) populations vanished in the mid 20th Century (Roulet, 2004).

Originally subsistence agriculture and hunting were the local communities' main activities. The drought that has affected the Sahelian strip since the early 1970s has profoundly changed the socioeconomic dynamic in the region. The consequences have been: (i) the Southward extension of cattle transhumance (originally limited to the Sahelian strip in Sudan or Chad) in search of better pastures (Haessler, Djimadoum & Duteurtre, 2003; Roulet, 2005; Jullien, 2006; UNEP 2006), (ii) the uncontrolled exploitation of natural resources by foreign poachers (first for ivory and rhino horns, next for bush meat, fish, honey, etc.) (Ruggiero, 1984; Froment, 1985; Spinage, 1986; Delvingt & Lobão Tello, 2004). Finally, some human populations from Chad and Darfur came to live permanently in CAR creating alliances as well as ethnic conflicts (Roulet, 2005). Related political problems and armed conflicts have increased insecurity in the northern region, notably as a result of the proliferation of light automatic rifles (Ruggiero, 1984; Delvingt & Lobão Tello, 2004). This low populated area has been used as a refuge for multiple rebellions from CAR or the neighbouring countries.

As in many other countries in Africa, (Douglas Hamilton, 1983, 1984), the ivory trade in CAR peaked during the years 1975–87 as a result of high international prices. Many people (villagers, businessmen, rebels, diamond traders and others) in CAR have contributed to the elephant (*Loxodonta africana*) massacre by trading ivory (Froment, 1985). The quasi absence of state authority and the very low human density left huge areas free of control, which favoured illegal activities (P. Bouché, personal observation, Roulet, 2005).The black rhino (*Diceros bicornis longipes*) population was still so large in this area 40 years ago that visitors paid them little attention. Fifteen years later, its status became critical (Douglas Hamilton *et al.*, 1985). Despite the warning given in the early 1980s to save CAR's black rhinos, the population collapsed, dropping from 3000 to 0. The last black rhino was seen there in 1986 (Delvingt & Lobão Tello, 2004).

In 1985, an aerial survey (Douglas Hamilton *et al.*, 1985) assessed the wildlife status of Northern CAR. That study highlighted the negative pressure of poaching and illegal cattle transhumance on wildlife populations as well as the consequences of the ivory trade. The results of this survey helped to justify the intervention of the European Commission through the Programme de Développement de la Région Nord (PDRN), which began operating in the area in 1988. It also led to the registration of the elephant on Appendix I of the CITES (Western, 1989).

The European Union programmes (PDRN and then ECOFAC: Conservation et Utilisation Rationelle des Ecosystèmes Forestiers d'Afrique Centrale) combine law enforcement and rural development activities. They launch and support a community hunting areas system to reduce the local illegal hunting pressure. Local people rent community hunting areas to professional hunting guides who attract safari hunting clients from abroad. Safari hunting fees and taxes are paid directly to communities. A portion is remitted to municipalities and the state. This system provides a significant amount of money directly to local communities (around 150,000 Euros per year to the six active community hunting areas), which has been invested in social services (schools, health centres, pensions, employ-

ment, etc.) (Boulet, Ouamoudjou & Mbitikon, 2003). In 2005, another survey was carried out (Renaud, 2005) to evaluate the situation and to relaunch conservation programmes, which had been temporarily suspended.

The purpose of this study was to assess wildlife population changes over the last 20 years and to compare relative changes in different land use categories in the ecosystem.

Material and methods

Study area

This study was conducted in North-eastern CAR, mainly in the Chari Basin. It covered an area of 85,000 sq km in Bamingui Bangoran and Vakaga prefectures. The study area is part of the 125,000 sq km northern CAR savannah ecosystem that extends to the north into Chad. This area is a patchwork of national parks (Bamingui Bangoran and Manovo Gounda Saint Floris), wildlife reserve (Vassako Bolo), hunting sectors and community hunting areas (Fig. 1). Bamingui Bangoran National Park is a Biosphere Reserve and Manovo Gounda Saint Floris National Park is a World Heritage site. More than 80% of the area of both prefectures is gazetted as a conservation area (national park, wildlife reserve or hunting area). Several rivers and streams cross the area. The most important are the Bamingui, Manovo, Gounda, Vakaga, Ouandja, Aouk and Kameur. All of them are tributaries of the Chari River, which feeds Lake Chad.

The climate is characterized by three seasons: a cold dry season from November to end of February, a hot dry season from March to April and a rainy season from May to November. During the cold dry season, the Harmattan, a dry, cold wind blows from the Northeast that dries out vegetation. In the rainy season, the monsoon wind blows from the Southwest. Annual rainfall varies between 600 mm in the north of the study area and 1200 mm in

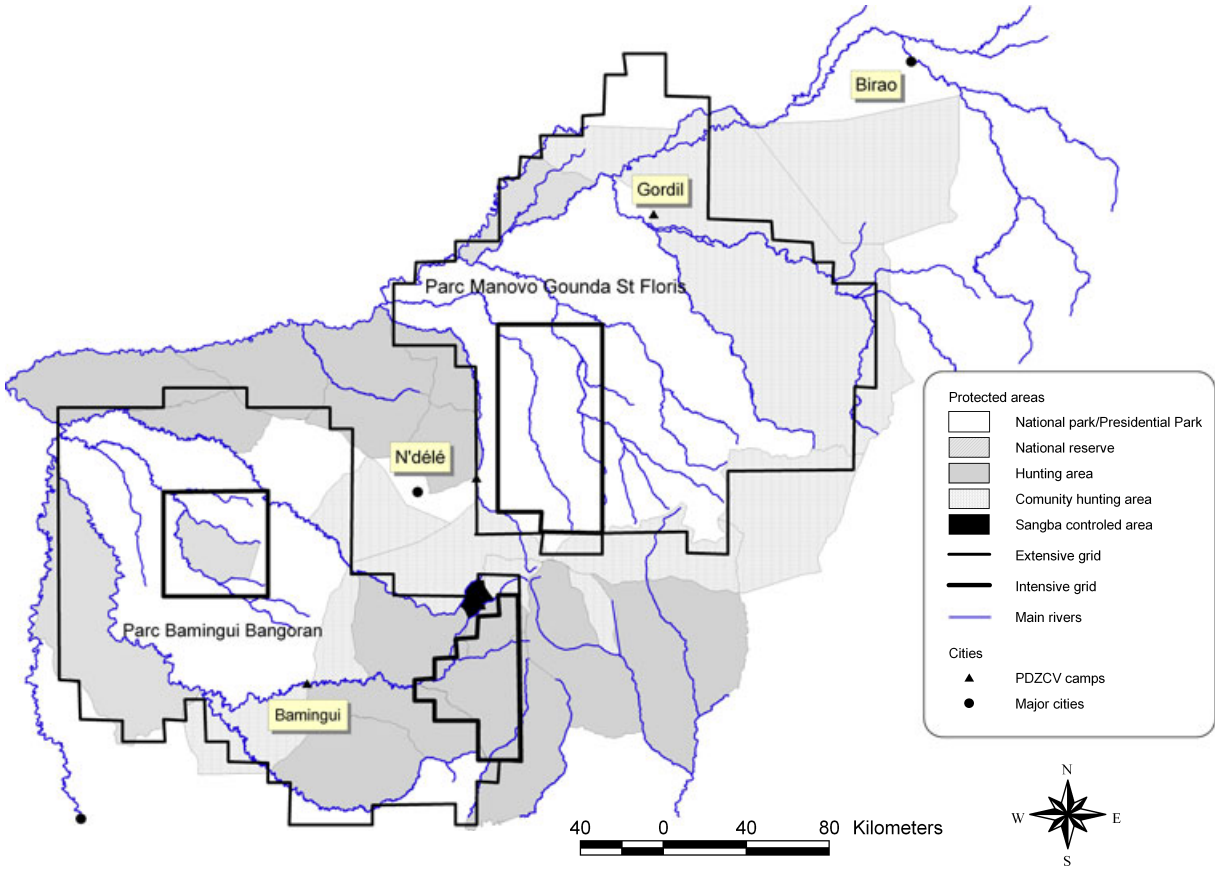

Fig 1 Northern CAR ecosystem and study area

the south. Mean annual temperature varies between 25 and 30°C with extremes of 17 and 45°C. Habitat is mainly composed of bushy to woodland savannah with *Vittelaria paradoxa*, *Combretum* spp., *Acacia* spp., *Anogeissus leiocarpa* Guill. & Perr., *Afzelia africana* Persoon, *Burkea africana* Hook., *Isoberlinia doka* Craib & Stapf, *Terminalia* spp. and by forest galleries of *Danielia oliveri* (Rolfe) Hutch. & Dalziel, *Terminalia* spp., *Anogeissus leiocarpa* Guill. & Perr., *Khaya senegalensis* A. Juss., *Rafia sudanica*, and *Borassus* spp along main rivers.

Counting

An aerial sample count (Norton-Griffiths, 1978) was carried out in April–May 2005. A high-wing Cessna 185 was used. Flight height was maintained at 91 m above ground level, thanks to a radar-altimeter. The pilot navigated with a GPS. The front seat observer took charge of data recording and used another GPS for animal locations recordings. He was also equipped with a high resolution digital camera for counting groups. Two rear seat observers were in charge of spotting and counting animals. All wild and domestic animals observed were recorded as well as human activities.

Strip width calibration

Strips were calibrated to define a 200-m width on each side of the aircraft at an altitude of 91 m above the ground level. Strip widths on each side of the aircraft were calibrated by 12 repetitions of the count of a series of drums spaced 20 m apart along the airstrip. Each observer counted the number of drums in the strip when the aircraft crossed it perpendicularly at an altitude of 91 m above ground level.

Sampling plan

To facilitate comparison, a sampling plan similar to the one designed for the earlier survey in 1985 (Douglas Hamilton *et al.*, 1985) was used. It covered the two national parks and part of community hunting areas and hunting sectors (Fig. 1). A low intensity sampling block (4% sampling intensity) covered the whole study area including Manovo Gounda Saint Floris National Park and Bamingui Bangoran National Park and part of some hunting areas with 10 km parallel spaced transects. There were also three high intensity sampling blocks (15% sampling intensity) with 2.5 km parallel spaced transect. The three blocks were named Manovo/Koumbala located, in the Manovo Gounda Saint Floris National Park; Rhino Triangle, covering hunting sectors; and Vassako-Bollo, a Wildlife Reserve in the heart of Bamingui Bangoran National Park. High and low intensity sampling areas did not overlap. The high intensity sampling blocks were designed to count areas where animals were believed to be more numerous and where black rhino were supposed to live in 1985 (Douglas Hamilton *et al.*, 1985). In total, 125 transects representing 10,260 km of flight yielded a total sample of 4164 sq km. A total of 90 : 51 hours were flown, of which 63 : 06 hours were necessary to cover the flight plan. The cover rate was 65.99 sq km h^{-1} at an average ground speed of 162.6 km h^{-1}.

Data analysis

Aerial count data analysis was performed according to the Jolly II method (Norton-Griffiths, 1978). Data of low and high intensity sample blocks were analysed separately. Comparisons with 1985 results (Douglas Hamilton *et al.*, 1985) were made with a *d* test (Norton-Griffiths, 1978; Bailey, 1995) for the entire study area.

Data were converted to a kilometric abundance Index for individuals. A Kruskal–Wallis test, with a *post hoc* test using SAS (no date) software, tested and separated indexes that were significantly different to distinguish the conservation status of some species with respect to the protection status of different protected areas (National Parks, hunting sectors and community hunting areas).

Results

Large mammal populations

There were a total of 1756 contacts with live or dead animals, comprising 15 wild species and five domestic species (Table 1). The density of each wild species was globally low in each block (Table 1). Bamingui Bangoran National Park harbours a higher density and a larger number of wild animals than Manovo Gounda Saint Floris. This is particularly the case for elephant, eland (*Taurotragus derbianus*) and buffalo (*Syncerus caffer*) populations. The number of recent elephant carcasses was higher in Manovo Gounda than in Bamingui Bangoran. Domestic animals and humans were more numerous in Manovo

Table 1 Results of estimate (est.), density (*D*) and coefficient of variation in per cent (%) for various wild species, domestic livestock and people observed in the Manovo Gounda Saint Floris, Bamingui Bangoran low sampling intensity blocks (4%) and in the Manovo Koumbala, Rhinos Triangle and Vassako-Bollo high sampling intensity blocks (15%)

	Low sampling intensity blocks (4%)						High sampling intensity blocks (15%)								
	Manovo Gounda St Floris			Bamingui Bangoran			Manovo Koumbala			Rhino Triangle			Vassako-Bolo		
Species	Est	*D*	CV%	Est	*D*	CV%	Est	*D*	CV%	Est	*D*	CV%	Est	*D*	CV%
Baboon	3598	0.11	31%	2565	0.08	34%	504	0.10	27%	151	0.06	50%	356	0.14	45%
Buffalo	1489	0.05	64%	5886	0.18	48%	976	0.20	63%	3999	1.48	31%	812	0.32	61%
Bushbuck	397	0.01	33%	928	0.03	31%	12	0.003	64%	22	0.01	53%	100	0.04	21%
Eland	149	0.005	80%	3346	0.10	47%	423	0.09	81%	201	0.07	84%	6	0.002	84%
Elephant live	74	0.002	96%	708	0.02	57%	25	0.01	92%	122	0.05	57%	0	0	0%
Elephant dead	397	0.01		0	0	0%	31	0.01		0	0	0%	0	0	0%
Giraffe	223	0.01	75%	269	0.01	55%	31	0.01	66%	0	0	0%	12	0.005	92%
Common duiker	2804	0.09	16%	2394	0.07	21%	81	0.02	31%	50	0.02	31%	262	0.10	15%
Hartebeest	769	0.02	31%	1930	0.06	31%	671	0.14	26%	3999	1.48	31%	250	0.10	52%
Buffon kob	1464	0.05	53%	49	0.002	97%	1380	0.29	24%	7	0.003	95%	0	0	0%
Oribi	992	0.03	19%	391	0.01	45%	99	0.02	29%	29	0.01	62%	37	0.01	45%
Red flanked duiker	174	0.01	34%	391	0.01	27%	6	0.001	91%	50	0.02	32%	25	0.01	42%
Reed buck	347	0.01	39%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Roan	1538	0.05	40%	1832	0.06	30%	323	0.07	40%	165	0.06	70%	187	0.07	77%
Warthog	4441	0.14	15%	3688	0.12	24%	914	0.19	16%	452	0.17	22%	0	0	0%
Waterbuck	0	0	0%	244	0.01	64%	37	0.01	77%	22	0.01	90%	0	0	0%
Total	18,856	0.58		24,620	0.77		5514	1.16		9269	3.44		2049	0.82	
Domestic livestock															
Camel	99	0.00		0	0	0	0	0	0	0	0	0	0	0	0
Cattle	146,668	4.53		74,378	2.32	0	0	0	0	0	0	0	3313	0.10	
Sheep/goat	26,843	0.83		267	0.008	0	0	0	0	0	0	0	0	0	0
Total	173,610	5.36		74,645	2.33266	0	0	0	0	0	0	0	0	0	0
Human															
Persons	5408	0.17		1408	0.04	0	0	0	0	0	0	0	0	0	0

Gounda Saint Floris than Bamingui Bangoran. The highest wild animal population densities were recorded in Rhino Triangle. Reduncini (waterbuck *Kobus ellipsiprimnus defassa*, Buffon kob *Kobus kob* and reedbuck *Redunca redunca*) show particularly low densities everywhere. The higher density of Buffon kob in Manovo Gounda Saint Floris can be explained by the fact that floodplains are the preferred habitat of this species (Table 1).

Large mammal encounters according to protected area status

In low intensity blocks (Table 2) the individual encounter rates, for baboon and roan, were higher in Bamingui Bangoran National Park. Giraffe (*Giraffa camelopardalis*) and kob individual encounters were significantly higher in Manovo Gounda Saint Floris National Park than elsewhere.

In high intensity blocks (Table 2), the individual encounter rate for elephant, buffalo and red flanked duikers was significantly higher in hunting areas (Rhino Triangle) than in parks. Individual encounters of bushbuck (*Tragelaphus scriptus*) and common duikers (*Sylvicapra grimmia*) were significantly higher in Bamingui Bangoran National Park.

Discussion

1985–2005 Large mammal population trends

Between 1985 and 2005, large mammal population decreased about 65%, averaging a decline of 3.25% year^{-1} (Table 3). If the current situation persists, the countdown seems launched for the extinction of large mammals in Northern CAR. The irregular presence of law enforcement as a consequence of interruptions of funds between the different project phases (PDRN 1998), combined with the absence of state authority in this region (Roulet, 2005) largely explains this result. Elephant and reduncini (waterbuck, Buffon kob) saw declines of more than 80% (Table 3). Elephant is the main target of foreign poachers (mainly Sudanese) exclusively for ivory (P. Bouché, personal observation, Froment, 1985; Delvingt & Lobão Tello, 2004). Meat was in all cases abandoned (P. Bouché, personal observation). In Manovo

Table 2 Individual encounter rates for several species in different protected status areas in low and high intensity blocks, and Kruskal–Wallis test (NS: test not significant)

	Low sampling intensity blocks				High sampling intensity blocks			
Species	Bamingui Bangoran	Manovo Gounda St Floris	Hunting areas	Kruskal–Wallis test	Vassako Bolo	Manovo Koumbala	Rhino Triangle	Kruskal–Wallis test
Baboon	0.55	0.51	0.18	8.10 $P = 0.017$	0.29	0.41	0.07	NS
Buffalo	0.08	0.18	0.53	NS	0.65	0.79	3.51	28.78 $P < 0.0001$
Bushbuck	0.12	0.04	0.08	NS	0.08	0.01	0.02	23.51 $P < 0.0001$
Eland	0.39	0.02	0.14	NS	0.01	0.34	0.17	NS
Elephant		0.01	0.07	NS		0.03	0.06	4.95 $P = 0.026$
Giraffe	0.03	0.04	0.01	5.32 $P = 0.07$	0.01	0.03		NS
Common duiker	0.40	0.5	0.27	NS	0.21	0.07	0.07	27 $P < 0.0001$
Hartebeest	0.12	0.1	0.19	NS	0.20	0.54	0.47	NS
Buffon kob		0.17	0.01	5.88 $P = 0.015$		1.11	0.01	8.30 $P < 0.004$
Oribi	0.03	0.13	0.13	NS	0.03	0.08	0.01	NS
Red flanked duiker	0.04	0.03	0.06	NS	0.02	0.01	0.05	8.94 $P = 0.011$
Reedbuck		0.01	0.05	NS				NS
Roan	0.35	0.32	0.05	13.83 $P < 0.001$	0.15	0.26	0.18	NS
Warthog	0.56	0.5	0.38	NS	0.31	0.74	0.34	NS
Defassa waterbuck	0.03		0.01	NS		0.03	0.01	NS
Camel			0.01	NS	1.4			NS
Cattle	5.29	5.47	46.34	NS				
Donkey			0.01	NS				
Sheep/goat	0.09	1.16	9.66	NS				

Table 3 Comparisons of mean numbers (numbers), coefficient of variation (in %) (CV%), trends (in %), value of *d* test and probability (*P*) at level 0.05 for selected species on the total study area during aerial sampling counts in 1985 and 2005

	1985		2005		Trend	*d*	*P*
Species	Numbers	CV%	Numbers	CV%	%	Test	At level 0.05
Elephant	4803	27%	929	45%	−80.7	2.865	$^{*}P < 0.01$
Buffalo	19,040	18%	13,162	25%	−30.9	1.212	NS
Giraffe	1750	22%	535	42%	−69.4	2.762	$^{*}P < 0.01$
Lord Derby's eland	1212	26%	4125	40%	240.3	1.755	NS
Roan	3495	20%	4045	21%	15.7	0.502	NS
Hartebeest	34,171	10%	7619	19%	−77.7	7.326	$^{**}P < 0.001$
Waterbuck	2719	29%	303	53%	−88.9	2.996	$^{*}P < 0.01$
Buffon Kob	28,446	14%	2900	29%	−89.8	6.092	$^{**}P < 0.001$
Total	95,636	4%	33,618	20%	−64.8	7.948	$^{**}P < 0.001$

Note that Derby Eland shows a significant difference between mean numbers of 1985 and 2005 with a probability at level 0.10.
*Significant **highly significant.

Gounda Saint Floris, the recent carcass ratio is 5.3%. Even if the total number of carcasses is lower than in 1985 (5840 carcasses estimated in 1985 versus 397 in 2005), the recent carcass ratio is more than double that recorded in 1985 (ratio of 2.1% Douglas Hamilton *et al.*, 1985). According to the carcass age criteria (Douglas-Hamilton & Hillman, 1981), it seems that poaching pressure has been constant for the last 4 years. Most of the ivory is sold in Omdurman and Khartoum, long known as major ivory markets in Africa (Martin & Hillman-Smith, 1999; Martin & Stiles, 2005; CITES 2007). However, a part of the poached ivory was also smuggled by some local authorities (Froment, 1985; P. Bouché, personal observation). In 2007, hunting guides discovered about 200 elephant carcasses in hunting areas and community hunting areas. The total number of elephants poached was estimated at three times this figure (Chardonnet & Boulet, 2007).

The decline of more than 80% of reduncini (Table 3) could be attributable to the fact that these species are very vulnerable to poaching because their habitat restrictions and behaviour make them easy to hunt (personal observation). Furthermore, reduncini may also suffer from food competition with cattle in the floodplains of main rivers. Cattle herders lead their cattle illegally into the parks (Table 1, Roulet, 2005) to graze *Echynochloa stagina* and *pyramidalis* swamp grasses that have a high nutritional value and grow on the main floodplains (Delvingt & Lobão Tello, 2004). In addition, in the period 1960s and 1983–85, the wild bovid population suffered from rinderpest imported by illegal transhumant cattle. Rinderpest could have played a role in the decline of several bovid species (Loevinsohn, 1977; Delvingt & Lobão Tello, 2004).

Only Lord Derby's eland and roan antelope are stable or increasing in the area surveyed (Table 3). Despite their massive size (Lord Derby's eland is the largest African antelope and Roan is the fourth-largest), these antelopes are quite shy and more difficult for hunters to approach than reduncini (P. Bouché, personal observation). The stability of these populations could be a positive effect of the community hunting areas system that returns a part of the safari hunting benefits to the communities. Furthermore, most anti-poaching activities occurred around Sangba controlled area, where most hunting concession is concentrated. Far Northern or Western zones are barely visited by anti-poaching units. On the other hand, the massive reduction in elephant, reduncini and hippo (*Hippopotamus amphibius*) populations these last decades has caused the habitat to become progressively denser and more wooded even in the plains (P. Bouché, personal observation), where in the past, the reduncini and the hippopotamus (both strictly grazers) played an important role in maintaining the grasslands (Eltringham, 1999). This phenomenon could favour Lord Derby's eland and roan, which are mainly browsers during the dry season (Delvingt & Lobão Tello, 2004). Field observations also show that forest-dwelling species (bongo *Tragelaphus euryceros*, yellow-backed duiker *Cephalophus sylvicultor*, giant forest hog *Hylochoerus meinerthzageni*, leopard *Panthera pardus*, etc.) are more commonly seen in the hunting areas (hunting safari guides personal communication).

Buffalo could be considered statistically stable (Table 1) even if in reality it is possible that the population has decreased. It is surprising that this species did not suffer from poaching. To some extent, the increasingly closed habitat could favour this species to some extent. Positive effect of community hunting area systems in conserving key hunting species could also have contributed to this stability.

Local hunting pressure for bush meat remains high even though they are generally only equipped with muzzle loader and 12 gauge calibre shotguns. Little meat is produced in CAR from domestic livestock. Meat from domestic animals remains unaffordable for common people (Fargeot, 2004). This explains why most people in CAR consume bush meat rather than domestic livestock meat (Fargeot, 2004). In addition to local consumption, there are bush meat trades from CAR to Sudan and Chad.

Large mammals' encountering variability according to protected area status

This survey showed that animal distribution was not homogeneous. Some species encounter rates varied with protection status (Table 2). The higher individual encounter rates of Giraffe and Kob in Manovo Gounda Park in low intensity blocks most likely occur because this area covers most of the preferred habitats for Kob (flood plains along the major rivers) (Estes, 1991), while Giraffe never strays far from water (Estes, 1991). On the other hand, it was quite surprising to encounter roan more often in National Parks than in hunting areas (Table 2). While national parks are less controlled than hunting areas because they are so large and not visited, the higher presence of roans in them may be a consequence of heavier hunting pressure on this species in hunting blocks by safari hunters and/or local poachers. In high intensity blocks, the individual encounter rate for Kob was significantly higher in Manovo Koumbala Area (Table 3) probably as a function of the suitable habitat for this species, as described above.

National Parks are managed by the Ministry in charge of Environment with the support of the ECOFAC Programme (Delvingt & Lobão Tello, 2004). In contrast, hunting areas are managed by private operators with some help from ECOFAC, notably in terms of anti-poaching, road salt licks and water ponds maintenance at the time of the survey. They are located far from international borders and thus from foreign intrusions (Fig. 1). During the dry season, hunting areas concentrate far more management activities (road maintenance, safari hunting activities, anti-poaching) in a smaller area than National Parks (P. Bouché, personal observation; Roulet, 2004). National parks are huge, located along the borders and thus more vulnerable to foreign incursions from Darfur and Chad (Fig. 1), with sparse road networks and insufficient guard forces. No tourist has visited either park for two decades. Over the years, EU funds have been reduced and more targeted on community hunting areas than on the parks (PDRN 1998, Boulet, Ouamoudjou & Mbitikon, 2003). The parks are effectively open to both local and foreign poachers. The greater control in hunting areas could partially explain the better encounter rates for elephant and buffalo (species that are very sensitive to disturbance) in those areas (Bouché *et al.*, 2004; Bouché, 2007).

While anti-poaching and community based wildlife programmes (in community hunting areas) have a positive impact on local poaching, they do not prevent international intrusions. Giving CAR the possibility to secure its own territory is thus crucial for biodiversity conservation in this area. If sub-regional armed conflicts are not tackled and CAR's national borders secured, biodiversity will continue to decline. The wildlife recovery is possible only if a strong regional political commitment is expressed and implemented in the field. The state, through land use planning and strong commitments, must take responsibility to recover security and biodiversity.

In the short-term, following information campaigns on local radio waves in local languages to inform everybody in the region, military operations are necessary to restore security, to show the presence of the state and to reassure communities, safari operators and their clients, who are the base of the single legal economy of the Northern CAR. The presence of the national army must be permanent in the Northern CAR to establish and maintain discipline and security.

At the same time, management actions (anti-poaching, water, burnings and relation with local communities) should be pursued and should concentrate first on areas harbouring larger animal densities. These activities could be progressively extended to neighbouring areas according to the resources available (human, logistic and financial) and the lease of other hunting sectors or CHA. The huge wilderness areas with low human population densities that span the boundaries of Chad, CAR, Democratic Republic of Congo (DRC) and Sudan suffer from the same problem of wildlife decline. Raddom National Park, Southern National Park and Lantoto National Park in Sudan (UNEP 2006), Garamba National Park and Bili Uere Game Reserve in

DRC (Martin & Hillman-Smith, 1999), Zemongo Game Reserve in CAR (Roulet, 2004) and to a lesser extent Zakouma National Park in Chad (Potgieter *et al.*, 2009) are parks that are facing the same problems. Each state has tried with varying levels of success to tackle the problem within its borders, neglecting the crucial regional dimension.

It is the recommendation of the authors that a transborder security and development agenda through a conservation programme including Chad, Sudan, DRC and CAR should be launched with the help of donors like the EU, World Bank and conservation NGOs and should be supported by the lobbying of international institutions (IUCN-the World Conservation Union; UNEP-United Nation Environment Programme or others Institutions) towards the governments. Although complex to manage and implement, a project of this kind could help the governments make the coordinated conservation decisions and actions that are necessary to prevent the wholesale extinction of the region's wildlife.

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