

LARGE MAMMALS AT FOREST CLEARINGS IN THE ODZALA NATIONAL PARK, CONGO

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INTRODUCTION

The Parc National d'Odzala (PNO; 0° 23' - 1° 10' N; 14° 39' - 15° 11' E) covers 284 000 ha., representing 19 % of the Congolese total protected area surface. Enjoying a status of protection since 1935, P.N.O. and in particular the North of the park has kept much of its integrity. Nevertheless, efficient park management had to await the initiation of the EEC-funded project ECOFAC launched in 1992.

A first synthesis of P.N.O. describes the rich diversity of habitats (primary forest both on *terra firma* and inundated soils, Marantaceae forest, clearings and savannas) and the rich variety of large mammals including forest species such as gorillas (*Gorilla g. gorilla*) and savanna species such as lions (*Panthera leo*; Hecketsweiler *et al.*, 1991; Dowsett & Dowsett-Lemaire, 1997). The density of gorillas is the highest recorded today in Central Africa (Bermejo, 1995). Concentrating large mammals attracted by the mineral rich soils and plants (Ruggiero & Fay, 1994; Turkalo & Fay, 1995), forest clearings largely contribute to the faunal interest of PNO. Census showed that the park harbours one of the densest populations of forest elephants (*Loxodonta africana cyclotis*; Fay & Agnagna, 1991) which were found to adapt their movement according to the distribution of Marantaceae forests and the location of forest clearings (Vanleeuwe & Gautier-Hion, 1998).

In the light of park management and the potential development of ecotourism, this study was undertaken in order to locate and explore forest clearings, and to identify potential observation points for tourists. Preliminary observations of 36 clearings allowed to gain an overview of the diversity and density of large mammal species visiting them, and identify potential factors influencing the rate of mammal activity. We provide some recommendations for the conservation of forest mammals in northern Congo.

METHODS

Maps of the park and its northern surroundings drawn from the INTERA radar images and the completed SPOT satellite images (provided by the ECOFAC

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programm, EEC) show that forest clearings are concentrated in the northern region and the majority are situated in proximity of the Mambili River and its tributaries (Fig. 1). The Mambili, representing the east and north park boundaries, has functioned from past until present as the only access route to this area. Our study site covered the upper Mambili region and field work was initiated from the camp

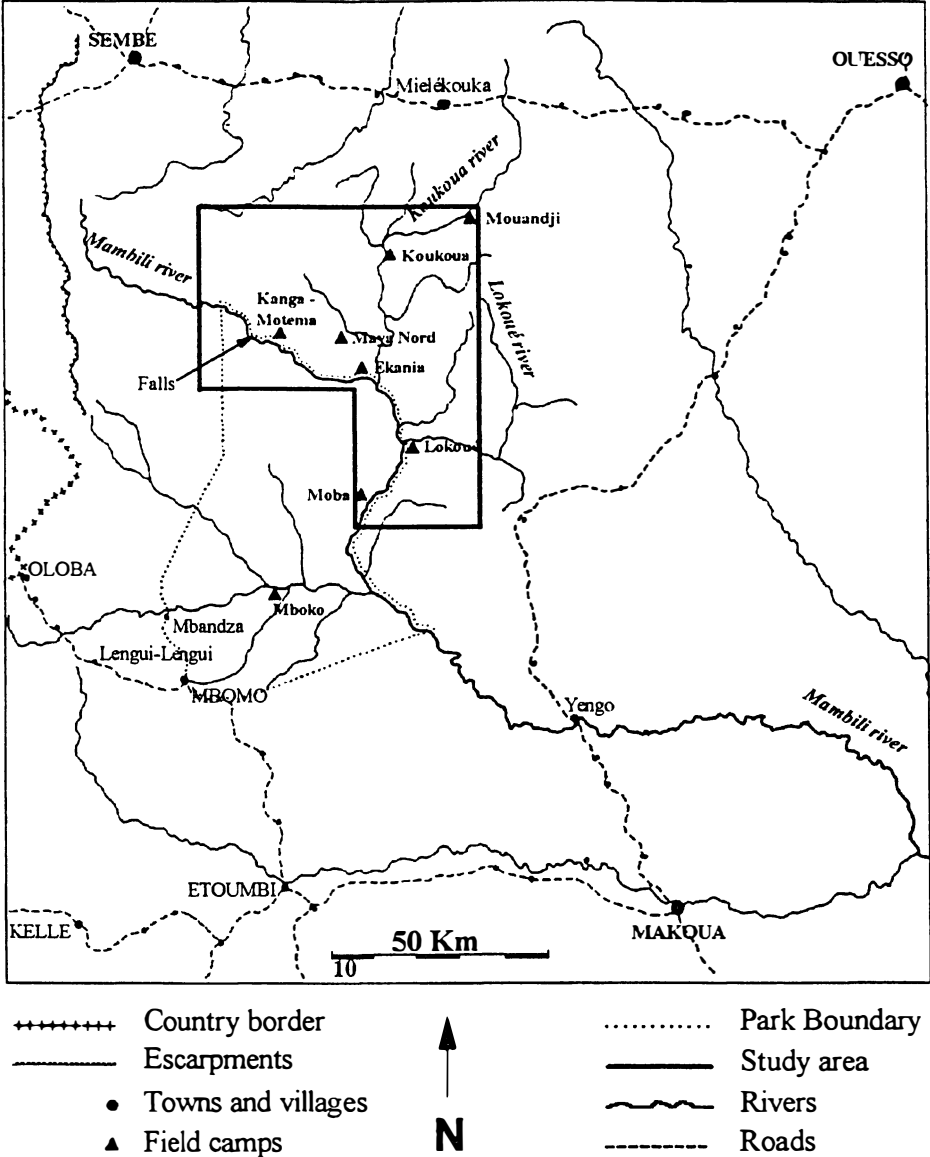


Figure 1. — The Odzala National park and the study area.

Ekania, an ancient hunting and fishing camp (Fig. 1). Clearings were located on maps and were attained by boat and by foot, following animal trails and old poaching tracks.

Thirty six clearings were explored in June, July, and August 1995, and from December 1995 to May 1997. Their distance to the main rivers was recorded and their size estimated using maps. Direct observations during the day and indirect activity signs (fresh footprints and/or faeces) of large mammals were recorded on each visit. The duration of visits varied from one to several hours. Only the number of species present at a given clearing on our arrival was used to compare clearings. The presence of elephant carcasses was also noted. Potential factors influencing mammal presence were examined for the 15 clearings having been subject to at least five visits. The vegetation of ten clearings was described. More systematic observations were conducted on one clearing (Maya Nord) over a period of one year (from December 1995 to December 1996) in order to quantify the duration of presence of the visiting mammals. The behaviour in which the majority of adult individuals per species were engaged was noted.

RESULTS

A total of 199 observer-visits spread over 36 clearings (range: 1 to 20; Tab. I) were conducted. Thirteen species of large mammals were recorded; the number of species observed at a given clearing varied from 0 to 11. They include elephants, buffaloes (*Syncerus caffer nanus*), common forest hogs (*Potamochoerus porcus*), and giant forest hogs (*Hylochoerus meinertzhageni*), gorillas, sitatungas (*Tragelaphus spekei*), colobus monkeys (*Colobus guereza*), hyenas (*Crocuta crocuta*), otters (*Aonyx congica*), mouse deer (*Hyemoschus aquaticus*), bongos (*Tragelaphus euryceros*), hippopotamus (*Hippopotamus amphibius*) and leopards (*Panthera pardus*).

Species which leave very evident spoor, were with certainty recorded in one visit. We may as such reliably conclude that elephants and buffaloes frequent 89 % and 83.5 % of the 36 clearings respectively (Tab. I). The fresh footprints of hippopotamus and bongos were also noted in 22 % and 28 % of cases respectively.

For the species which leave less evident spoor, data are underestimated. Nevertheless, gorillas were seen on 58.5 % of clearings, followed by sitatungas (44.5 %), giant forest hogs and hogs (30.5 % each). Other species, namely the colobes, mouse deers, or the carnivores such as hyenas, otters or leopards were rarely observed (Tab. I).

Groups of buffaloes, elephants, and gorillas visiting the clearings reached up to 40, 100 and 40 individuals respectively. Most visits of hogs also concerned groups including up to 40 forest hogs and 11 giant forest hogs. The majority of visits by sitatungas were made by one or a few individuals; at Maya Nord clearing however, a resident group including 14-19 individuals was present (Tab. I).

We found a positive correlation between the number of species observed and the number of visits (Spearman Rank correlation, $p < 0,001$). In order to compare clearings and to analyse the factors influencing mammal activity, we used the data derived from direct observations only and we deal with the 15 clearings that were submitted to at least 5 visits.

The maximum number of species present at once varied from 2 to 6 for clearings situated far from rivers and from 0 to 4 for clearings situated near rivers

TABLE I

The clearings and their visitors. The minimum and maximum number of individuals seen is indicated for every species and clearing. Indirect evidence are indicated by + (1 individual), or ++ (several individuals).

				Mammalian Species												
Regions	Clearings	N° of visit	N° of species	bongo	buffaloe	colobus	elephant	forest hog	giant f. hog	gorilla	hippopotamous	hyena	leopard	mouse deer	otter	sitatungas
Moba	Abandza	5	4		++	7	++			1-6						
	Avoué	1	2		+		+									
	Louamé	1	1				++									
	Moba	5	4	++	1-5		++					+				
	Moba A	4	3		++		++			++						
	Moba B	3	2							1-7				1		
	Moba N.	1	1				++									
Lokoué	Lokoué 1	2	6	++	++		++		+		++		+			
	Lokoué 2	1														
	Lokoué 3	1	2			14	+									
Ekania	Mbaya	2	3	+			++				+					
	Hippos	3	3		++		++				++					
	Moung. A	17	9		2-20		1	++	++	1-3	++	+			+	1-2
	Moung. B	4	4		++		3	+	+							
	Moung. C	12	5		1-3		1-3			1	++					1
Maya	Ossassanga	20	7		3-12		++	++	++	1		+				1-2
	Tragos	7	4		1-4		++			+	++					
	Maya S.	20	9	+	1-37		2	2	2-10	1-16		++	+			1-3
	Maya C.	20	10	+	1-36	3	1-6	2-6	1-11	1-27		1-2	+			1-3
Koukoua	Maya N.	20	11	++	1-25	11	1-100	1-40	1-9	1-40		1	+		1	14-19
	Obandaka	5	5	+	++		1-21			1						++
	Amberre	10	7	++	8-30		1	1	2-6	1-5						1-2
Kanga-Motéma	Bauge M.	1	1							2						
	Gorilleunda	1	3		++		1			4						
	Koukoua 1	1	4		++		++			++						2
	Koukoua 2	1	4		++		++			1						++
	La Capital	5	5	+	12-40		++			1-6						1-4
	Mouandji	4	7		++		++	++	++	++		++				++
	Mouang. N	1	1		++											
	Satellite	2	3		++		++									1
	Banane	1	2		++		++									
	Liboulou	5	7		++		++	+	1	+	+					1
4000	Ngonda N.	5	5		1-3		3	7		++						1-2
	Ngonda S.	2	3		3-12		++									1
	Odiba	5	8	+	1		6	+	+	+	+				1	
	4000	1	2		++		++									
% of clearings visited			13	28	83,5	8,5	89	30,5	30,5	58,5	22	19,5	11	2,5	8,5	44,5

TABLE II

Mammalian presence at clearings, in relation to clearing location and size.

Clearings	Size (ha.)		Dist. of river (m)		N° of species/visit		
	x < 10	y > 10	x < 500	y > 500	\bar{x}	min.	max.
Abandza	2	–	–	1 100	1,2	1	2
Amberre	–	20,5	200	–	1,8	1	4
La Capital	–	25,4	0	–	1,6	0	2
Liboulou	–	19,5	150	–	0,2	0	1
Maya Sud	–	29,6	–	5 000	2,8	1	4
Maya Centre	–	25,9	–	7 000	2	1	4
Maya Nord	–	22	–	12 000	3,8	2	6
Moba	6,4	–	0	–	0	0	0
Moungali A	–	42	0	–	0,8	0	1
Moungali C	–	23,2	0	–	0,2	0	1
Ngonda Nord	9,7	–	–	1 200	1,4	1	2
Obandaka	4,8	–	–	6 000	1,6	1	2
Odiba	–	35,1	–	600	0,8	0	2
Ossassanga	2,1	–	100	–	0,4	0	1
Tragos	0,3	–	0	–	0,2	0	1
n = 15	6	9	8	6			

(Tab. II). The average number of species per observation visit was significantly less for clearings situated near rivers than for those situated at more than 500 meters of rivers (0.65 and 1.9 respectively; Mann-Whitney U test, $p = 0.002$; Table II). We did not find significant differences in the rate of mammal presence when comparing the small clearings (< 10 ha) and the largest ones (> 19,5 ha; 0.767 vs 1.55 respectively; Mann-Whitney U test, $p = 0,173$).

Dominant herbaceous species covering clearings differ according to their distance from rivers (Tab. III). The Cyperaceae *Kyllinga* sp. and *Rhynchospora*

TABLE III

Dominant vegetation at clearings in relation to their location from rivers.

Clearings	Dist.of river(m)	Size (ha)	<i>Cleome afrospina</i>	<i>Kyllinga pungens</i>	<i>Mimosa pigra</i>	<i>Panicum vibrijucum</i>	<i>Paspalum conjugatum</i>	<i>Rhynchosp. corymbosa</i>
Moungali A	0	42	xxxx	xxx	xxxx		xx	xxx
Moungali C	0	23	xxxx	xxx	xxxx			xxx
Tragos	0	0.4	xxxx	xx	xxxx	xx	xx	xxx
Ossassanga	100	2.1	xxx		xxxx			xx
Liboulou	150	19	x	x	xxx			x
Amberre	200	20	xx	xx	xxx	x	xx	xxx
Odiba	600	35	x	x	xxx	x		xxx
Maya Sud	5 000	29		xxxx			xxx	xxxx
Maya Centre	7 000	26		xxxx		x	xxx	xxxx
Maya Nord	12 000	22		xxxx		xxx	xxx	xxxx

corymbosa occur in all clearings but are more frequent at clearings far from rivers. Clearings near rivers are dominated by the Mimosaceae *Mimosa pigra* and the Cappariaceae *Cleome afrospina*. In addition to these differences in vegetation, clearings elongating rivers are partly or entirely surrounded by periodically inundated forest and they are frequently flooded. Away from the rivers, clearings are surrounded by both forests on hydromorphic soils and terra firma; they are only flooded for short periods during the wet seasons.

Elephant carcasses were found at all but the Obandaka and Maya Nord clearings (both located far from the Mambili River; Tab. II); they were more numerous near rivers, and hundreds of carcasses including very recent kills were found at the Mouandji clearing (Fig. 1). Similarly, remains of camps of hunter-fishers (betrayed by the presence of cultivated plant species such as palm nut, lemon, papaya, and cassava) were only found near rivers. Clearly, the most accessible clearings - those situated in proximity of the Mambili and its larger tributaries - have been more subject to poaching than clearings situated away from rivers.

The case of Maya Nord

Maya Nord was remarkable by the absence of signs of poaching and of past presence of human activity, the number of species of animals visiting it (a total of 11 species), the size of visiting groups (cf. Tab. I) and the fact that, contrary to the majority of clearings, elephants were regularly observed during the day. Two hundred and sixteen hours of diurnal observations were conducted at this clearing. The clearing was characterized by the presence of a resident group of 14 to 19 sitatungas (Fig.2). Buffaloes (including large groups of 25 individuals) were present for 71 % of the total observation time, elephants (up to 100 individuals) for 37 %, giant forest hogs and common forest hogs for about 10 %, and gorillas for 34 %. Up to three family groups of gorillas (a total of 40 individuals) were observed feeding at the same time on the clearing.

Buffaloes, gorillas, and hogs mainly entered to feed on herbs. Sitatungas performed all their activities at the clearing. When entering the clearing, elephants mainly head for the stream situated in the centre where they drink and feed on soils (Fig.3 a et b). Doing so they dug tunnels with their trunk: these tunnels can be relatively deep (up to 1.20 m). Groups of colobus monkeys (3 to 11 individuals) were observed eating herbs or soil on the clearing, and an otter was seen twice. Solitary hyenas were witnessed to enter the clearing for predator activities three times; once unsuccessfully hunting a sitatunga, once being chased by an elephant cow protecting her calf, and once feeding on an elephant bull who died from wounds inflicted during a nocturnal bull fight (Gaston Punga, pers. comm.).

DISCUSSION

A great variety of large mammals (a total of 13 species and a maximum of 11 species at a same clearing), including flag species such as elephants or gorillas, and typically savanna species such as hyenas, regularly visit clearings. The number of species visiting clearings situated far from the main rivers is greater than those visiting clearings close to rivers: this could be due to differences in vegetation composition, in past poaching pressure, as well as to differences in accessibility.

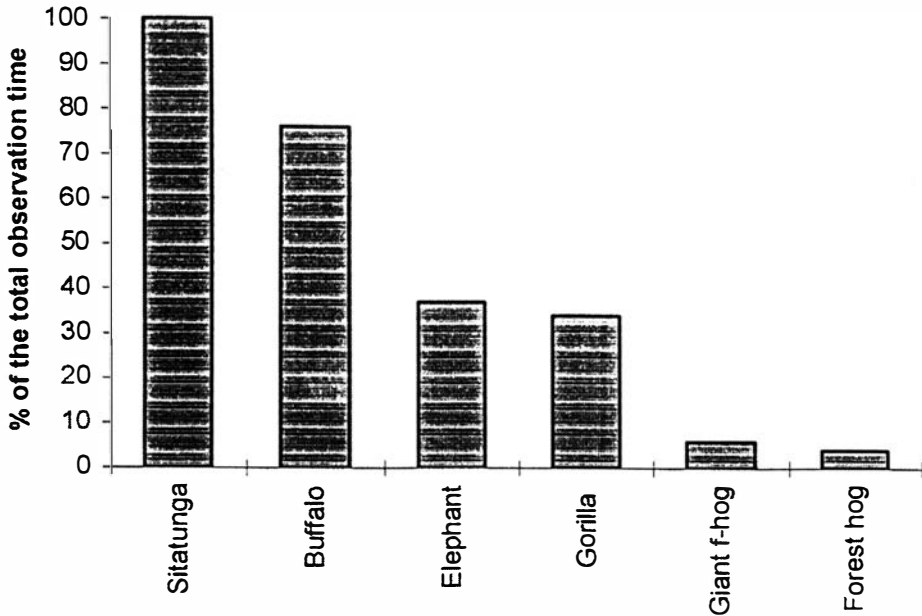


Figure 2. — The diurnal presence of large mammals (% of observation time, n = 216 h) at the clearing of Maya Nord.

Clearings situated near rivers are more prone to be flooded and during the wet seasons, some of them are commonly navigable. Flooding implies the drowning of the vegetation, and possibly the dilution of mineral salt concentration. At these periods, both mammals visiting clearings to feed on mineral salts and those visiting clearings to forage on herbs will favour unflooded clearings.

The quality of vegetation probably does not influence elephants which hardly feed on herbaceous vegetation at clearings. For unselective grazers such as buffaloes, the availability of resources and thus simple total surface of herbaceous may regulate their visits. In fact, buffaloes are commonly present at most clearings. For selective grazers, such as sitatungas, and gorillas, the herbaceous composition of forest clearings may be more important. Detailed observations have shown that gorillas mainly feed on *Rhynchospora* sp. and sitatungas feed on gramineae (F. Magliocca and Sophie Querouil, pers. comm.); these species are more abundant in clearings far from rivers.

Past poaching pressure may also influence the number of mammals observed at clearings. The river Mambili and its tributaries Koukoua and Lokoué are known to be frequented until 1990 by hunter-fisher populations of the Makoua region (Fig 1). Poachers travelled by boat and were more prone to hunt close to the river. The many carcasses of elephants found especially at clearings near rivers and the fact that elephants visit clearings almost exclusively at night, with the exception of Maya Nord and Obandaka where evidence of poaching is absent, provide proof of the important past hunting pressure they endured.



Figure 3. — (a) Elephant, buffaloes and a sitatunga adult male at Maya Nord; (b) a group of elephants drinking and eating soil; in the background, gorillas are eating herbs. (photographies by Florence Magliocca and Sophie Querouil).

CONCLUSIONS

Forest clearings are an important mineral and nutrient source for large mammals. Their conservation is probably fundamental to maintain the high population densities of species like gorillas or elephants. For the latter, we showed that clearings play a major role in population movements (Vanleeuwe & Gautier-Hion, 1998). Being excellent observation sites, forest clearings, and especially Maya Nord, are of great value for the future development of ecotourism at the P.N.O. Hence, their ecological and economic values are vulnerable because they are equally ideal sites for organized hunting. Today, the area north of the park (including Maya Nord, Obandaka, and Mouandji) remains accessible for human populations living along axe Ouesso-Sembe (Fig. 1), who may go beyond 50 km for ivory hunting. This area is not presently included within the limits of the park. Extending the park boundaries is a priority in the light of conservation of large mammals.

ACKNOWLEDGEMENTS

This study was carried out as part of the EEC project ECOFAC (Conservation et utilisation rationnelle des écosystèmes forestiers en Afrique Centrale; DGVIII), in the light of Park management and conservation. Extra financial support was given to H. Vanleeuwe by the Nicolas Hulot Foundation. Material support and supervision was provided by J.M. Froment, park manager. The aid of the field assistants J.B. Lépalé, A. Okondza, R. Ngounga, and A. Atebo have been indispensable throughout the study. We thank Mr. Tsila, Director of the DFF of the 'Ministère des Eaux et Forêts', Dr. C. Aveling, ECOFAC Research co-ordinator, and all members of the 'Ministère des Eaux et Forêts, Congo.

SUMMARY

After having been located on maps, 36 forest clearings were explored and the presence of large mammals was recorded in the Northern area of the Parc National d'Odzala, Congo. 13 species of large mammals were observed. Elephants, buffaloes, gorillas, sitatungas, bongos, forest hogs, and giant forest hogs were the most common visitors. At the Maya Nord clearing, the rates of presence of buffaloes, elephants and gorillas were particularly high (71 %, 37 % and 34 % of the observation time respectively) while a group of sitatungas was resident.

Differences in the rates of clearing frequentation was found to result from several factors including the past hunting pressure on elephants. Forest clearings constitute an important food source for large mammals which enter clearings for mineral salts contained in soil, water and herbaceous vegetation. They are of great value to maintain the population densities of mammals as well as to develop ecotourism. However, they are also ideal sites for ivory poaching. The richest clearings we explored are not included within the limits of the park: extending these boundaries is a priority.

RÉSUMÉ

Nous avons exploré 36 clairières incluses dans les forêts du Parc National d'Odzala au Congo. Treize espèces de mammifères y ont été observées, dont les

plus fréquentes étaient les éléphants, les buffles, les gorilles, les sitatungas, les bongos, les potamochères et les hylochères. Sur la clairière de Maya Nord, les taux de présence des buffles dans la journée était de 71 %, celle des éléphants de 37 % et celle des gorilles de 34 %. Plus de 100 éléphants ont été dénombrés simultanément, ainsi qu'un groupe de 25 buffles tandis que la présence simultanée de deux groupes de gorilles a été observée à plusieurs reprises et qu'un groupe de 17 sitatungas résidait en permanence sur la clairière.

Les différences dans le taux de fréquentation des clairières résultent pro parte de l'influence du braconnage des éléphants qui touche plus fortement les clairières situées à proximité des rivières. Les clairières sont essentiellement visitées par les animaux pour la collecte des sels minéraux trouvés dans l'eau, le sol et les végétaux. Elles jouent sans doute un rôle fondamental dans le maintien des fortes densités de populations observées dans la région notamment pour les éléphants et les gorilles. Elles constituent en outre des sites d'observation remarquables. Elles sont cependant des sites idéaux pour le braconnage. Les clairières les plus riches se trouvant hors des limites du PNO, l'extension de ces limites semble une priorité.

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