Pachyderm

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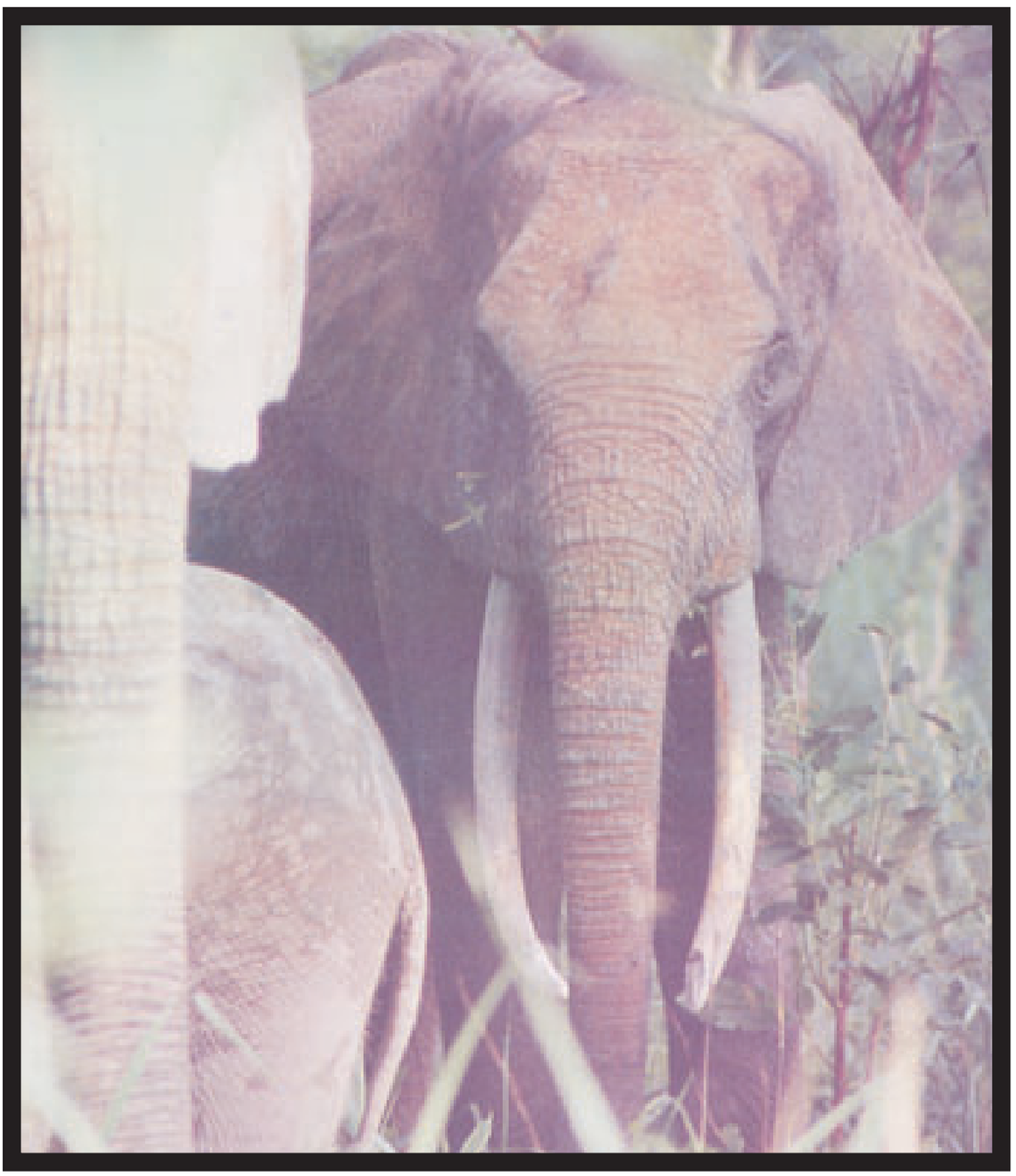

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Cover Photo:
Hybrid *L. a. oxyotis x L. a. cyclotis,* in a gallery forest of the Koumbala River in the Gounda-St Floris National Park, CAR.

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A notice to contributers

Pachyderm is a biannual publication of the African Elephant and Rhino Specialist Group (AERSG), one of the specialist groups of the Species Survival Commission (SSC) of IUCN. *Pachyderm* offers information, news and opinions about issues related to conservation and management of elephants and rhinos with especial reference to Africa.

We welcome articles written in a popular style and research papers. Contributions, which should normally be no longer than 2,000 words, are acceptable either on disk, in any usual format, or as manuscripts, which should be double spaced with a wide left-hand margin. References should only be for verification. Illustrative materials such as graphs, maps, black and white photographs must be included and should be kept simple in order to make the message clear. The deadline for articles for inclusion in the next issue is 15 June 1991.

Contributions do not reflect the views of AERSG, SSC or IUCN.

C.G. Gakahu
Chairman, Editorial Board

Pachyderm

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Acting Chairman's Report

C. G. Gakahu

Members of the African Elephant and Rhino Specialist Group (AERSG) are people selected for their knowledge and technical capabilities, not for their opinions on wildlife philosophy or policy. Their responsibility is to identify the problems, needs, and priorities of securing the welfare of pachyderms. To achieve this goal there must be general agreement on activities and methods: members of AERSG must be headed in the same direction for the group to remain coherent.

The highly contested ban on ivory trading hurt AERSG to some extent. This might partly explain why few members seem prepared to answer quantitative questions on the populations' status, poaching, and ivory movement and trade within Africa. Of course, there are other issues of elephant conservation but none as basic and important as these. During the next CITES meeting in Japan, AERSG will be expected to be a major source of advice on such matters.

If some members feel aggrieved it will be difficult, if not impossible, to reach consensus on a united strategy for the conservation of elephants and rhinos. One may ask whether consensus is necessary. I believe it is, in order to cater as far as possible for the different opinions and diversity of wildlife philosophies and management practices in Africa. Most AERSG members operate under conservation authorities with defined policies. Some formulated the policy themselves. However, they should remember that the role of AERSG is continental and the conservation of elephants and rhinos demands more than the capabilities of one individual or single management authority. Personal convictions coupled with an unbending stand will make our task even more taxing.

Despite the above observations AERSG has remained one of the most active groups of the Species Survival Commission (SSC). Members who were attending the IUCN General Assembly held in Perth in December, 1990, held an informal meeting to discuss future goals and missions.

A continental survey of black and white rhinos has just been completed and is reported in this issue of *Pachyderm.* A questionnaire prepared under the auspices of AERSG in collaboration with UNEP, the Elsa Wild Animal Appeal (EWAA) and Wildlife Conservation International (WCI) was sent out in January, 1991, to gather data and information for the African Elephant Data Base at UNEP. Data will be analysed to give new estimates of country and continental African populations.

AERSG is also playing a leading role in two proposed major studies. One will review the status of and trends in elephant populations, estimate current levels of poaching and assess African ivory markets. The other study will be of the possible effects on rhino conservation of resuming trade in white rhino horns.

Since the ban on trading, Asian ivory business has fallen by 80%. The reduction in demand should cause a price drop such that killing elephants becomes uneconomic for the poacher. But periodically we get press reports on poaching. For example, in December 1990 ten elephants were poached in Kenya bringing the year's kill to *50;* in the same month 24 raw tusks were impounded in Namibia, 387 in Tanzania and a consignment of illegal ivory worth Rand 500,000 was impounded in Swaziland. There were almost certainly many more unknown or unreported ivory poaching incidents. If poaching is continuing, where is the ivory? Are traders in Africa stock-piling it for speculative purposes?

Civil and liberation wars have greatly contributed to the decline of elephants and rhinos in Uganda, Sudan, Mozambique, Somalia and elsewhere. The wars often arise from demands for political change. While commending Southern Africa's elephant populations, healthy enough to have a surplus for harvesting, and risking being called a pessimist, I would caution that the same region is undergoing drastic political change. The current satisfactory status can only be guaranteed as long as the current regime together with it's management policy persists. We should be prepared for the possibility of a citizenry that will feel deprived and try every means to use resources they fought for.

Most range states are under considerable economic, social and political pressure, and nearly all available resources have to be directed to the improvement of human welfare. While donations for the conservation of pachyderms are always welcome, often the donor has designated the use of the money with little or no input from the recipient country or management authority. As a result many NGOs in the range states have busied themselves with projects which, at best, are peripheral to the mainstream conservation effort and, at worst, run counter to it. It was in recognition of this inefficiency, among other issues, that the African Elephant Conservation Co-ordinating Group (AECCG) was formed to co-ordinate the securing of funds and technical assistance for elephant conservation in Africa. Under the auspices of AECCG donor countries have declared their collective commitment to elephant conservation, and it now remains for the oft rescheduled meeting of range states to actually take place for donor funds to be pledged.

A full AERSG meeting will be held in April of this year. The status of populations of elephants and rhinos; poaching; the intra-African ivory and rhino horn trade; local, national and international education and awareness campaigns; incentives to local communities to increase their participation in wildlife conservation; which conservation policy worked and which failed and, more importantly, why; all these will be topics for discussion and exchange of views. I have no doubt that the common concern of members for the welfare of pachyderms will ensure the meeting's successful outcome.

Forest Elephant Populations in the Central African Republic and Congo

J. Michael Fay and Marcellin Agnagna

Introduction

The ivory trade is estimated to have reduced the wild population of the African elephant by half in the past decade. Since the revelation at the 1987 CITES (Convention on International Trade in Endangered Species) meeting, that as little as 30% of the estimated 800 tons of ivory leaving Africa in 1986 was traded within the framework of the CITES quota system, efforts to contain the trade's decimating effects have been stepped up.' In the United States this culminated in June, 1989, with a ban on the importation of most forms of elephant ivory under the authority of the African Elephant Conservation Act of 1988.

Until recently almost nothing was known of the elephant population in the Congo and there was a dearth of data about the situation within other central forest areas. To remedy this, and because of the great concern about the status of elephants in Africa, the European Economic Community (EEC) and the World Wide Fund for Nature (WWF) jointly commissioned studies of elephant populations in central Africa. Presented here are the results of surveys carried out in the Central African Republic (CAR) and the People's Republic of Congo (Congo), two of four countries surveyed between January and June 1989 by Wildlife Conservation International.

The Method of Counting

The method used in these studies follows that outlined by Barnes et al. for estimating elephant density in African forests.[2] Foot surveys of line transects run on a compass bearing were carried out at each site by a minimum of two observers and a maximum of four. Transect lengths and locations varied due to forest density and distance from camps. An attempt was made to survey at assorted distances from human population centres. Transect lines were also directed perpendicular to watershed drainage in an endeavor to obtain a sample from varied habitats. Along each transect all elephant spoor were noted, as were dung piles, trails, feeding and rubbing sites and water holes.

Only those dung piles seen by the principal observer(s) (Fay or Fay and Agnagna) from the transect line were counted. Dung of all ages was included even if at an advanced stage of degradation. Distance along the transect was recorded using two pedometers per observer, these were calibrated daily using a topofil at a rate of 10% of total transect distance. Other data collected during the census included notes on the vegetation, human disturbance and hunting pressure, and spoor observations of all other large mammals.

Density

Dung densities are estimated by extrapolation from linear correlations between actual dung density and the number of 1/2 km sectors along a transect in which dung is recorded. Two different equations were used depending on the percentage of sectors found to contain dung, as follow:

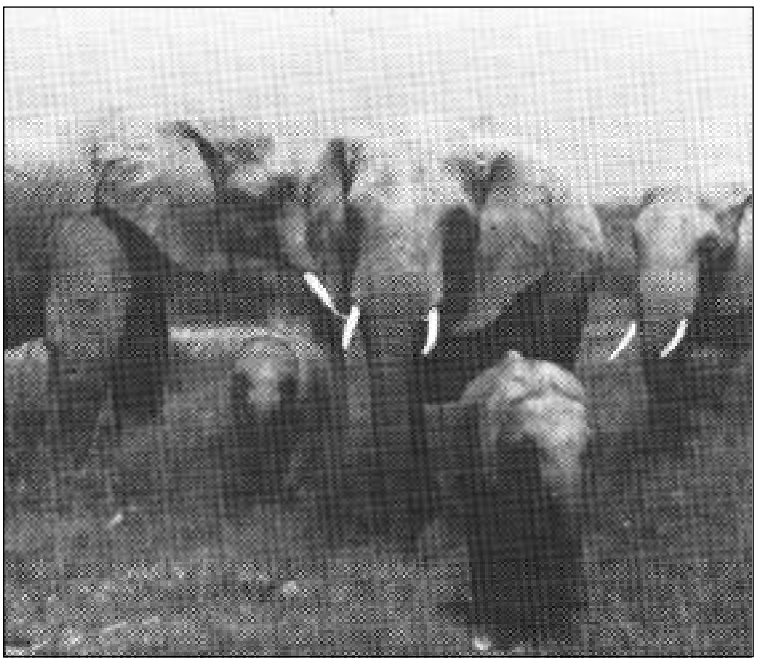
for transects with <75% of _ km sectors containing dung,
D = 6 + 703p (r = 0.83 +64%)

Where *p* = proportion of sectors containing at least 1 dung pile and *D* is dung density

for transects with ≥75% of _ km sectors containing dung,
D = 110 + 1576p *(r* = 0.94, ± 22%)
where *p* = proportion of sectors containing at least 3 dung piles and *D* is dung density

These equations were derived from data collected in Gabon and we believe that conditions in Congo and CAR were similar to those in Gabon.[3] Although the first equation has a greater margin of error than the second, it is employed here because of the low dung densities found in some transects.

To extrapolae elephant density from dung density a conversion factor of 0.0018 is used,[4] based on the assumption of a dung decay rate of 0.03 and a defecation rate of 17 piles per elephant per day.[5,6] Three numbers are estimated in calculating elephant density: dropping density, mean number of droppings produced per elephant per day, and mean decay rate of droppings. Barnes et al. suggest that these estimates introduce a margin of error in elephant density calculations of about 25% and that values obtained using this method should therefore be viewed as mere approximations in lieu of more accurate density data.



A family scene in Amboseli. Kenya

The Central African Republic

J. Michael Fay

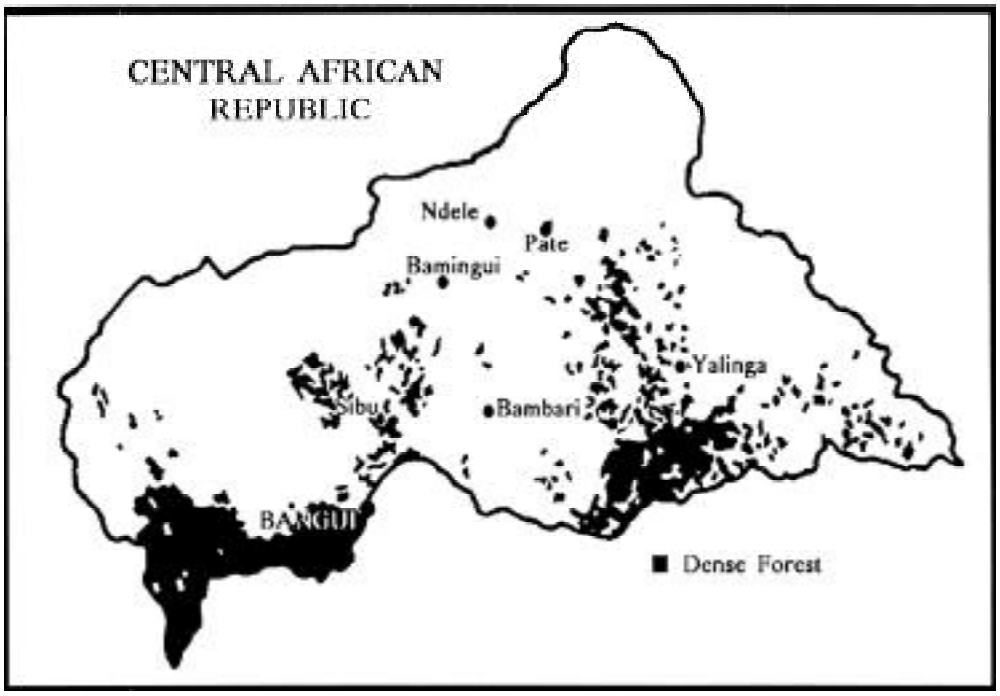


Figure I. Map of the Central African Republic showing the dense forest areas

The Central African Republic is a country nearly as big as Texas but with only about a qurarter of the population; on average, each of its 618,135 km^2 area supports four people. Much of the eastern half is uninhabited and elsewhere the population is concentrated along the roadsides. If forest outliers, gallery forests and dry forests are included, 92,500 km or 15% of the country, is covered by forest. The southwest and southeast of the country has a continuous lowland tropical forest covering approximately 40,200 km^2 .

Some 20,000km^2 of the 35,000 km^2 of forest in the southwest is occupied by current logging concessions. The forests in the southeast of the country are not commercially exploited but there are several roads through the area and many plantations and slash and burn farms.

Until the early seventies the CAR was home to a very large population of elephants but then, in a few years, poachers killed 80% of the animals of the savannah zone[7'8]. This level of poaching is largely attributable to the incursion by hordes of Sudanese and Chadian horsemen over the last 15 years. These poachers, well armed with automatic rifles and wide, thrusting elephant spears, arrive in large caravans of horses and camels. In the past the exclusive activity of these bands was elephant and rhino poaching; in the early eighties several caravans were ambushed with over 100 tusks in their possession. Usually the bands stay in CAR territory most of the year killing elephants with impunity. They usually leave at the height of the wet season when hunting on horseback is difficult. At any one time there are probably several tens of these caravans working the eastern CAR,[9] In the years since 1985, as the rhino has become more or less extinct and the number of elephants greatly reduced, these poachers have resorted to hunting for meat and even honey but, of course, when they see signs of elephants they continue to pursue them. The continuous pressure will probably be enough to reduce the elephants of the savannah areas of the CAR to virtual extinction in the next five years.

In addition to Sudanese and Chadians there has been a significant number of elephants killed by Central Africans. Three northern tribes are well known for their elephant hunting: Rounga, Goula and Sara; These men account for many elephant casualties in the more specialized habitats such as the gallery forests of northern CAR and the forests of the southeast, where it is not easy to gain access by camel or horse.[10,11] Government employees have played a not insignificat role in the reduction of elephant populations in the CAR. During the Bokassa era large numbers of elephants were killed, and their products funnelled through "La Couronne". This poaching activity was probably centred around Bangassou where there were many large-tusked elephants. More recently a large amount of ivory has been leaving the country through the Bangui market as worked products. Currently there are 27 artisans and 41 dealers licensed by the government to deal in ivory products. For a number of reasons much of the ivory that they deal in is unaccounted for and has illegal origins. The ivory trade is alive and well in the Central African Republic.

Study Sites

In May and June, 1989, three areas of the CAR were selected for transects intended to determine the elephant populations. The three study areas corresponded to the main forest blocks found in the CAR. Two of these are in the southwest of the country, bordering on the People's Republic of Congo and Cameroon, and the third is located in the southeast.

Site 1 was in the Ngoto forest on the eastern side of the southwestern forest. The transects at this site were run north-south in the largest remaining block of contiguous forest, southeast of the town of Bambio in the Bambio, Ngoundi, Kenengue triangle; This area is currently being considered as a reserve for an EEC forest conservation project. The most easterly part of this forest block was not surveyed because no elephants have been recorded there for some years.

The vegetation in Site 1 is primarily semi-deciduous dense forest with large areas of'*Raphia* spp. swamp along the Mbaere and Bodingué rivers which border the area on the north and south. The human population is relatively dense and there are two major

towns, Bambio and Mbaiki. Much of this forest has already been selectively logged, especially the eastern sector, because it is the forest area closest to the capital and contains the highest density of exploitable *Entandrophragma* spp. trees in the country.

The single greatest influence on the area has been the construction of the '4th Parallel Road'. This is a major highway that has been built in the last four years and runs east-west, bisecting the forest. The road has altered the socio-economics of the area and brought in many settlers who not only live by slash and burn agriculture along its sides but also do a significant amount of poaching. Slash and burn farming is also consuming large tracts of the densest *Entandrophragma cylindricum* stands in the entire country. When complete the road will be the major thoroughfare from Cameroon to the CAR and this will compound the already disastrous effects.

In addition to the '4th' the numerous logging roads in the area have provided vehicular access to most of the forest, in turn bringing a great deal of poaching. The Bodingué and Ngote logging roads are particularly important in this regard.

Site 2 was located in the extreme southwest of the country in the proposed Dzanga-Sangha reserve area. This area was studied extensively in 1986 and 1989 when over 600 km of transect surveys were completed. [12,13] 'Therefore qualitative observations were made and only one transect laid out in the central part near Ngoubunga, an area of high elephant density. The vegetation is primarily dense semi-deciduous forest with *Raphia* spp. swamp forest along the minor rivers, *Guibourtia demeusii* flooded forest along the Sangha river and *Gilbertiodendron dewevrei* forest along upland watercourses. The forest in the northern section, centred on Bayanga, was selectively logged, at a rate of 0.4 stems per ha, from 1972-1987. There are approximately 1,000 km^2 of secondary forest in the study area. The human population density is fairly high with four large towns, Nola, Bayanga, Salo and Lindjombo.

Site 3 was centred around Bangassou which is in the forested region of the southeast of the country. The transects were run in two different parts of the forest, the first on the northwestern side, north of Ndanda, and the second to the northeast, north of Fodé. These two areas were chosen because they represented the more isolated and natural forest in the region. Based on interviews in Bangassou it seemed reasonable to assume that the forests surrounding the town contained very few elephants and these were therefore not surveyed. While the Bangassou forest has never been exploited commercially for lumber, since colonial times it has contained numerous coffee plantations and roads, and has always had a fairly high human population. There are three north-south and two east-west roads running through the area, cutting the forest into wide strips. The forest is not continuous as it includes large areas of laterite shield that carry a short grass savannah vegetation.

The dense forest in this area is generally on shallow soils and in many cases has a dry forest physiognomy dominated by *Anogeissus leiocarpus* and *Margaritaria discoidea*. It contains a low density of exploitable trees and, coupled with the many areas of laterite shield, is not an area to attract commercial endeavour. The human population density in this area is fairly high, centred in the town of Bangassou, with a population of over 15,000. In the past ten years the more remote villages have been abandoned with the result that many of the roads through the forest are all but unused.

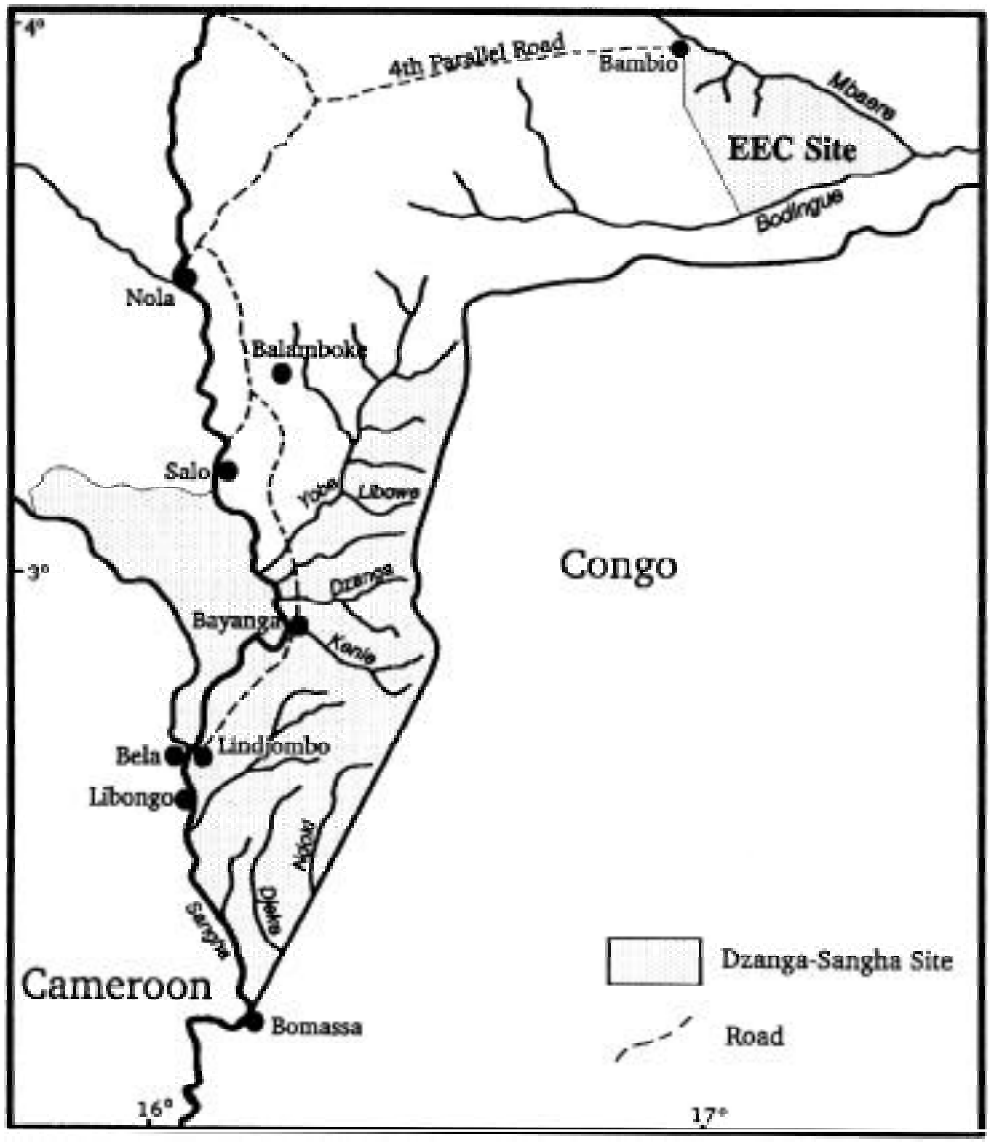


Figure 2. Map of Sites 1 and 2 and the important geographical locations in southwestern CA

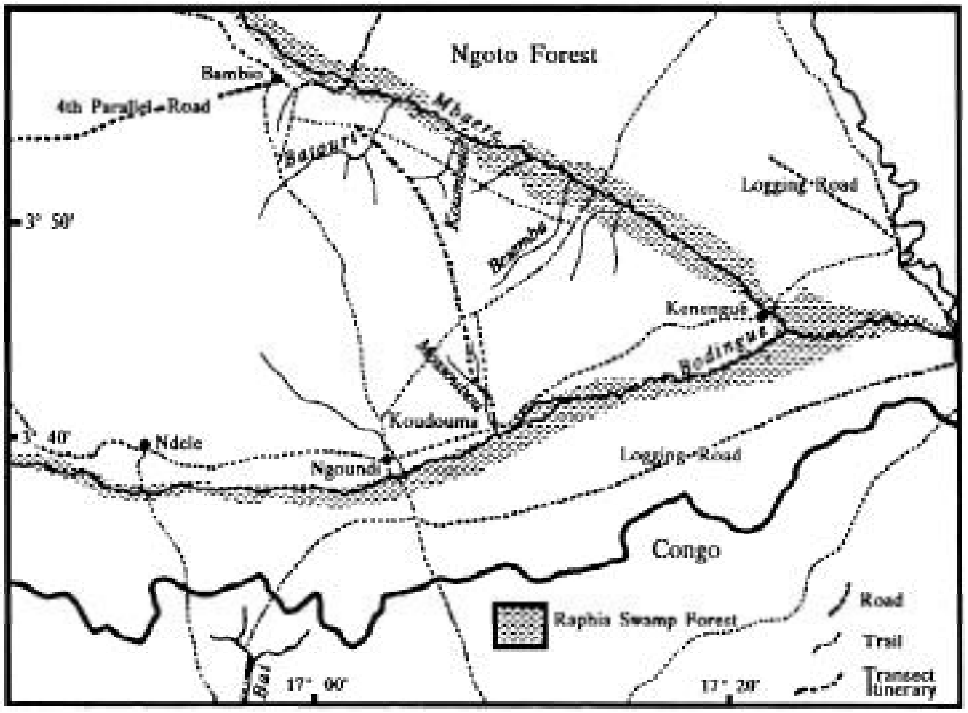


Figure 3. *Map of Site 1 in the Ngoto Forest region of southwestern Central African Republic*

Results

Fourteen transects totalling 147.0 km were completed for the survey countrywide. Dung was recorded in 110 of 294 1/2 km sectors. The overall elephant dung density was estimated to be 266 piles per km^2 and this yields an extrapolated denisity of 0.48 elephants per km^2. The average distance of all transects from the nearest village was 21.29 km. The lowest dung density of the three areas surveyed was in the Ngoto forests of Site 1 where no piles were found. The average distance of the transects from a village at this site was 12.33 km. The highest dung density was found to be that in the single transect in the proposed Dzanga-Sangha Reserve with an overall dung density of 1,166 piles per km^2 and an extrapolated elephant density of 2.10 per km^2 . The distance of this transect from a village was 25 km. Site 3, in the southeast, was found to have an intermediate dung density of 336 piles per km^2 for an density of 0.61 elephants per km^2. The average distance of the transects in this study site from a village was 23.6 km.

When elephant dung density for each transect is plotted against distance from the nearest village a significant positive linear correlation results withr=0.69 and $p<0.01$

Table I. Raw data for all elephant survey transects

Transect No.	Date	Location	Length of transect	No $^1/_2$ km segments	No $^1/_2$ km segments with dung	Proportion with dung, p	Dung density	Elephant density	Distance from village
Site 1 (Bambio) southwestern CAR.									
37	19 5	Batouri Riv.	9.0	18	0	0.00	0	0.00	11
38	205	Koumbela Riv.	11.0	22	0	0.00	0	0.00	16
39	21 5	Besamba	13.5	27	0	0.00	0	0.00	10
Site 1 (Bambio: 3 transects)		**33.5**	**67**	**0**	**0.00**	**0**	**0.00**	**12.33**	
Site 2 (Bayan a southwestern CAR.									
42	25 5	Bai Hokou	6.0	12	8*	0.67	1166	2.10	25.00
Site 3(a) (Ndanda) southeastern CAR									
43	07 6	Ndanda	16.0	32	0	0.00	0	0.00	8
44	086	NE of Ndanda	15.0	30	8	0.27	196	0.34	20
47	116	N of Ndanda	11.5	23	7*	0.30	583	1.05	24
48	126	N of Ndanda	11.5	23	12	0.52	372	0.67	22
Site 3a (Ndanda: 4 transects)		**54.0**	**108**	**38**	**0.35**	**252**	**0.45**	**18.50**	
Site 3(b) (Fodé) southeastern CAR.									
52	186	Baketekpala	8.5	17	7	0.41	294	0.53	26
54	196	Bavougba	4.5	9	6*	0.67	1166	2.10	33
55	206	Bavougba	11.0	22	15	0.68	484	0.87	34
56	216	Bavougba	15.0	30	16	0.53	379	0.68	33
57	226	Bananzi	10.5	21	13	0.62	442	0.80	21
58	23 6	Bananzi	4.0	8	3	0.38	273	0.49	15
Site 3b (Fodé: 6 transects)			**53.5**	**107**	**63**	**0.59**	**421**	**0.76**	**27.00**
Site 3 (Bangoassou: 10 transects)			**107.5**	**215**	**101**	**0.47**	**336**	**0.61**	**23.60**
All Sites (14 transects)			**147.0**	**294**	**110**	**0.37**	**266**	**0.48**	**21.29**

*1/2 km sectors with three or more dung piles

Site Results

Site l. A total of 33.5 km of transects was completed at this study site. Elephant dung was not observed on any transect but spoor was seen in 25% of the 67 1/2 km sectors. These consisted of very old tracks, found for the most part in the areas farthest from villages. No fresh elephant sign was seen.

Fifty-seven and a half kilometres of non-transect trail was walked in this study site. This consisted for the most part of walking on hunting trails and on the 34.5 km between the villages of Bambio and Ngoundi on a heavily used footpath. Three elephant tracks were seen on these trails between Ngoundi and Bambio. One track, almost at the midway point between Ngoundi and Bambio, was fresh.

On the east side of the Koudouma savannah, near the Bodingué river, the location of elephant dung was known to a local pygmy. About ten dung piles were found in the vicinity of an old village site and along the Bodingué. The guide indicated that this was a major concentration point for elephants of the region. They came to feed on the oil palm nuts that are in abundance there in March-April. Judging from the dung and track density in the area of the old palm plantation, it was estimated that there had been a modest concentration of elephants there about two months previously. No other evidence of concentration of elephants was seen in the transect study area.

During the survey a total of five poaching camps were encountered. Reached by a network of trails, the camps in this area are frequently semipermanent and well used, although often located in areas where the only water to be found is from lianas and *Musanga cecropioides* trees. During the last transect, on the Koudouma savannah, a very large, active camp of villagers and Bayaka pygmies was found. There were at least 15 families in the group at what was primarily a meat and palm wine camp. However, they also had a 9.3 mm elephant gun which they said had been used seven times in the past two weeks to wound, but not kill, three different elephants. These poachers indicated that there was still a good deal of poaching of elephants in the local area. They were hunting primarily to the north of the BodinguÈ in the proposed EEC reserve area. The gun was said to belong to a police sergeant residing in Bangui. Just west of this large camp another was found. This was primarily a buffalo, *Syncerus caffer,* hunting camp. Snares, rifles and shotguns are used for this activity. Indeed, it was here that a rather high density of buffalo tracks was noted. The inhabitants of this camp said they would not hesitate to shoot an elephant should the opportunity present itself.

No elephant carcasses were found during the survey at Site 1 either on or off the transects.

Area analysis: Site l. En route to the start of the transect survey the new 4th Parallel highway was taken. This road is intended to be the major trade route between Bangui and Douala where most imported goods originate. Thus far it has been half completed, going from the main Berberati-Nola road in the west to the town of Bambio; much of its bed was cut through virgin forest. The major problem, as is always the case with new roads, is that it has paved the way for settlers. On the older parts of the road there is an almost continuous band of slash and burn plots and several villages whose *raison d'être* is hunting. It can be conservatively estimated that this road has increased the hunting pressure in the vicinity several hundred-fold particularly to the south where there were relatively high game densities. The road has just been completed to Bambio providing quick and easy access from Berberati and Nola.

Bambio is a town of over 1,000 inhabitants. For many years it was isolated by the poor state of the roads and was probably loosing population. The economic mainstays have been coffee growing and hunting but game is now scarce in the immediate area. The fact that many of the camps used by the inhabitants of Bambio are without water is an indication that game populations along the streams have been reduced to levels no longer viable for hunting.

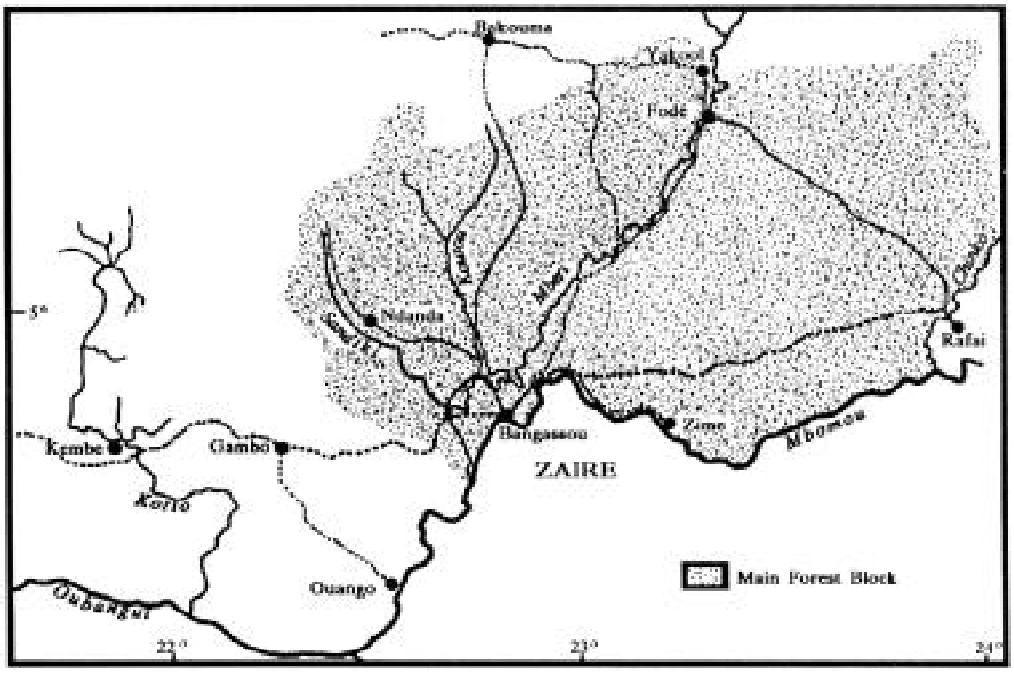


Figure 4. *Map of Site 3 in the Bangoussou dense forest region of southeastern Central African Republic*

There is a group of elephants that feeds in the fields close to Bambio and apparently frequent the area around the town. This is said to be a relatively recent phenomenon. It is believed these elephants came from the south, probably seeking refuge from hunting pressure there. It was also said that there were many elephants on the Mbaere river upstream from Bambio, but this was not confirmed.

The other main centre of human habitation that affects this site is Ngoundi. This is a large village of over 100 huts just north of the Bodingué river. No road reaches this village. It would appear that

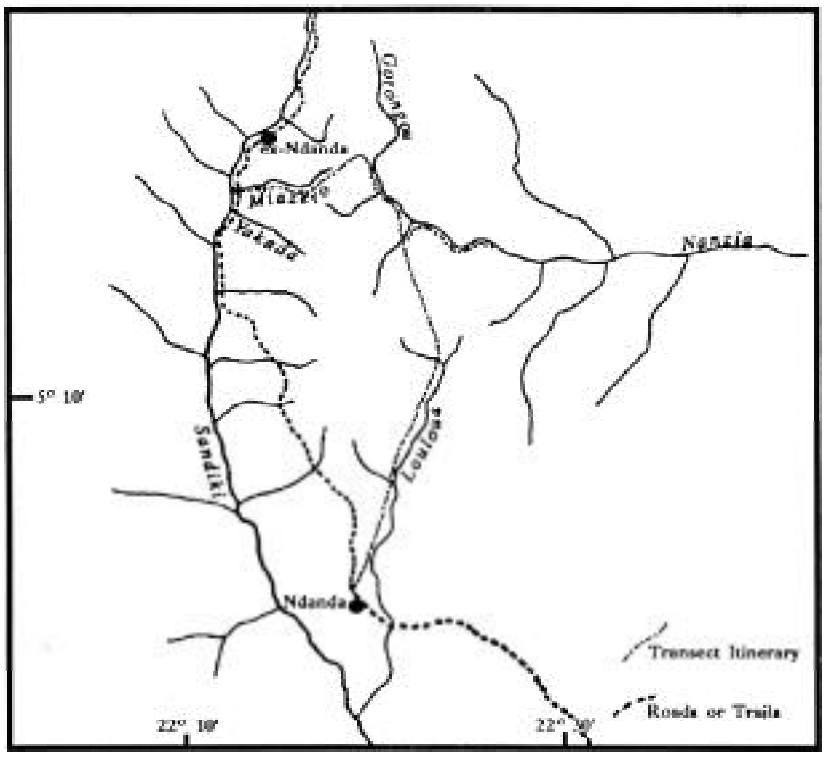


Figure 5. *Detailed map of the Ndanda study area of Site 3 in the southeastern CAR*

the main activity is poaching; many of the bush-camps seen were of Ngoundi origin. Most of this hunting is for small game such as duikers, pigs and monkeys but there are elephant guns in the village. People from Ngoundi also frequently hunt in the Congo, commonly on the Mbai river just to the south of the CAR village of Ndele. There is an active meat trade in the area because of a new logging road that reaches the Bodingué just south of Ngoundi. This has given very easy access to the markets of Mbaiki and Bangui; from Bangui one can reach the end of the road in about three hours. The entire region has always been an important source of meat for the Mbaiki market and the road has eliminated the only check that remained on poaching, transport. The inhabitants of Ngoundi indicated that the greatest concentration of elephants in the area was on the headwaters of Mossoubou Creek to the northwest of the village, but there was not enough time to go there.

There is no doubt that the game populations in the proposed EEC reserve area are very low. The elephant population is extremely depressed, as is that of buffalo. No sign of bongo, *Tragelaphus euryceros,* or sitatunga, *Tragelaphus spekii,* were noted. The sign of gorilla, *Gorilla gorilla gorilla,* gave the impression of highly disbanded groups that are probably heavily poached. There was little sign of chimpanzee, *Pan troglodytes*, but they do exist; duikers and monkeys are the objects of the greatest hunting pressure.

Site 2. A single transect of six km was completed in the Ngoubunga area just to the west of the Congolese border and within the proposed Dzanga-Sangha Reserve. The elephant density here is extremely high. An indication of this is the large proportion of $^{1}/_{2}$ km sectors in the transect with three or more dung piles. Large elephant trails are common and, for the most part, heavily used. The area contains many clearings that are created in part by elephants.

Two other areas in the proposed Dzanga-Sangha Reserve were surveyed qualitatively. A foot survey of the southern part of the proposed Ndoki park area was done in May. Much elephant sign was noted along and up to ten km east of the Djeke river, and along the Kenié Creek. Traveling west, elephant density drops off significantly at about 3.5 km from the Sangha river and becomes negligible along that river.

The other area surveyed was around the Dzanga clearing where several days were spent observing elephants. They appeared every afternoon at about 3:00 pm, were very calm and often accompanied by bongo, buffalo, hylocheres *(Hylochoerus meinertzhageni)* or potamocheres *(Potamochoerus porcus).* There would be several family groups working the saline on any one afternoon. The total number of elephants at the salt varied between 36 and 87 and included five to eight large bulls, some with tusks of over 20 kg. The number of small elephants was high and, overall, the population appeared to have a normal age structure. There was no evidence of poaching.

During the survey Mr Alain LeFol, a safari hunter, was hunting just north of the Dzanga clearing along the Libowé river. Along the reek he found a large bull elephant dead with several bullet holes in the head. It probably had been shot the previous week. The elephant had escaped the poachers but later died. The tusks were not weighed but appeared to be about 20 kg each. Mr LeFol indicated that the elephant population along the Libowé is very high.

Area analysis: Site 2. The proposed Dzanga-Sangha Reserve area is very large, about 4,500 km^2. Because of the border nature of the reserve area it is subject to a number of different influences. Traditionally there have been five elephant poaching centres within the CAR that would affect the reserve area: Nola, Salo, BalambokÈ, Bayanga and Lindjombo. The guns in all these have two primary sources, Moslem merchants and government employees. In most of the region there is a lot of diamond trading and so there is a good deal of money about; there is also a well-established, clandestine trade in diamonds. It is very easy for Moslem traders to buy an elephant gun and hire Bayaka to shoot elephants.

Since the establishment of the World Wildlife Fund/US project the amount of poaching has significantly decreased around Bayanga. The now protected, core area lies east of the Sangha and between the Libowé and Kenie rivers and has the highest density of elephants in the proposed reserve. However it is evident that illegal hunting is still practised on a large scale from Nola, Salo and Balamboké to the north and several elephant guns operate out of Lindjombo poaching in the southern area. The project has had virtually no effect on these. In addition there are Moslem traders in the villages of Libongo and Bela, across the river in Cameroon, who employ people to hunt in the proposed Ndoki park. Bomassa, a Congolese village, also provides an important base for poachers.

Site 3. A total of 107.5 km of transects was completed at this study site. The transect survey encompassed two different areas,

Ndanda and Fodé. Both of these are located at the northern edge of the Bangassou forest and probably contain the highest relative elephant densities in the region. The Fodé study area showed a higher elephant density than Ndanda with extrapolated elephant densities of .76 and .45 elephants per km^2 respectively. The average distance from a village of the Fodé transects was 27.00km and that of Ndanda was 18.50 km.

Transects which crossed savannah or laterite plain accounted for 19.07% of the total distance but only 2.97% of the dung found. The density of elephant dung was found to be approximately seven times greater in the forest than in the savannah areas, 55 piles per km^2 for savannah and 400 piles per km^2 in the forest.

At the Ndanda site four walks were taken totaling 48.5 kin, two along dry *Raphia* swamp creek beds northwest of Ndanda and the others along the footpath that connects ex-Ndanda with present day Ndanda. The creek beds had very many dung piles, indicating an elephant density of 1.70 per km^2, but there was no elephant dung at all along the entire trail from ex-Ndanda to Ndanda.

The creek beds were frequented by elephants both to feed on *Raphia* hearts and for water. There was very much evidence of the presence of other species of large mammals, including buffalo, bongo, potamocheres and hylocheres.

At the Fodé site a total of 61.0 km of non-transect trails was walked. In general, these were hunting trails but the now abandoned Rafai road was also traversed. These paths contained overall a very low estimated elephant dung density with 34 piles per km^2. Much of the non-transect trail traversed the laterite shield areas and thus represents a largely non-forest sample.

Elephants were twice heard feeding in the *Raphia* swamp vegetation in the Ndanda survey area. They were not seen but on both occasions they sounded like small groups. One striking aspect of the elephant tracks seen here was the very large size of some of the individuals. The tracks of at least two of the individuals seen were of enormous elephants.

No elephant carcasses were found during the transect survey at this site.

Area analysis: Site 3. At the Ndanda site the level of poaching was found to be rather high. Three nights were spent at an elephant poachers' camp. There are a number these camps on the old Ndanda road and also several in the interior forming a chain all the way to the Kourou river. During the dry season, when the creeks in the interior disappear, most of the poachers congregate in camps along the Sandiki river because this has permanent water. Two hunters were already in the camp, one a Goula and the other a Sara, and both owned .375 Winchester rifles. They had been in the Bangassou district for several years, hunting elephants most of the time, primarily in the areas between the Kotto and the Kourou rivers. They said that elephants were no longer very common around the Kotto; more were to be found to the east of the old Ndanda road west of the Kourou. The hunters gave the impression that they shoot any elephant they encounter. There is no season for elephant hunting; it continues all year long. At least three different parties of porters passed through this poachers' camp in three days. They were transporting meat from a camp about ten km farther north to the village of Ndanda. No elephants were shot during the stay in the camp. The people in Ndanda act as brokers for much of the meat and ivory that comes out of the area north of their village. Most of the active inhabitants are involved in the meat trade in some way. A select number of people are elephant specialists. According to local informants the Sudanese had not yet reached this area, only far to the north along the Bakouma Road.

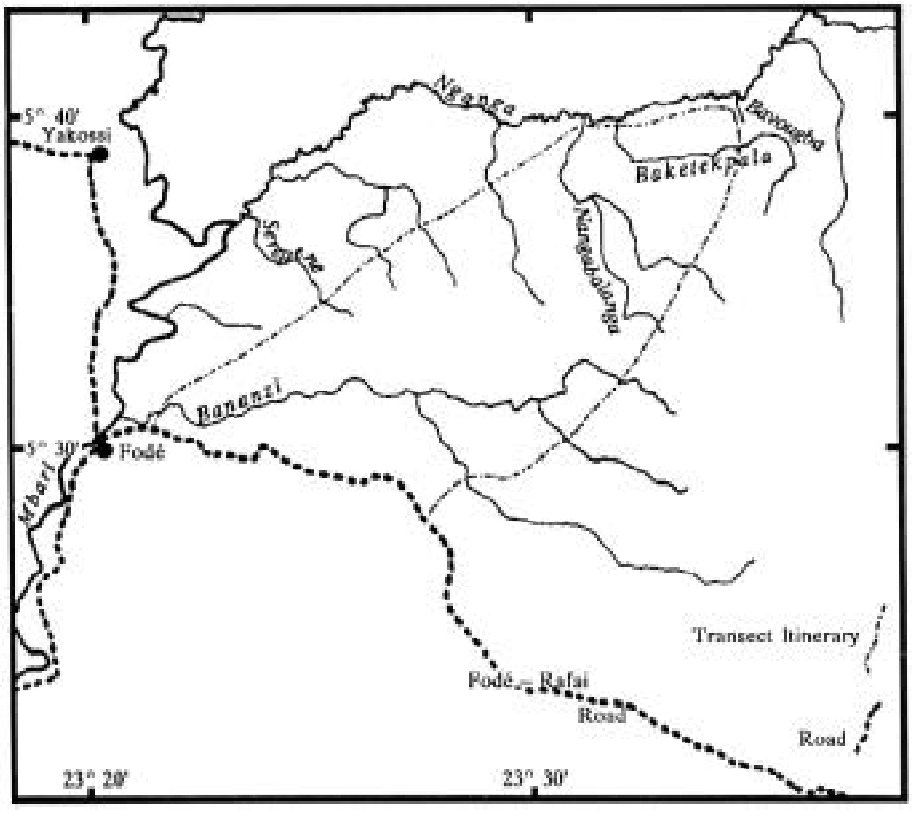


Figure 6. *Detailed map of the FodÈ study area of Site 3 in southeastern Central African Republic*

In the Fodé area the elephant poaching situation paralleled that of Ndanda. Along the semi-abandoned road to Fodé, several small seasonal villages were encountered. In most of these villages there were at least a couple of shotguns and in several there were high-powered rifles. Two nights were spent in one of the camps to get an impression of the level of poaching in the area. The first night there was only a single Nzakara man from Bangassou there. Armed with a 12 gauge shotgun and a .458 elephant gun, he was spending a few months hunting. He had yet to kill an elephant but had shot a hippo in the Mbari about a week previously. He was to leave the next day for a ten-day trip in search of elephants and said he was almost assured of shooting one. The man offered for sale two tusks of 9 kg each which were in his house in Bangassou, the result of his last hunting trip. The next morning another hunter was met as he was passing by on his bicycle. This individual had a shotgun, a leopard skin and two tusks. He

Table 2. Raw data for all elephant survey non-transects

Transect No.	Date	Location	Length of transect	No 1/2 km segments	No 1/2 km segments with dung	Proportion with dung, p	Dung density	Elephant density	Distance from village
Site 3 (Ndanda) southeastern CAR.									
45	096	Nanzia	9.5	19	10*	0.53	945	1.70	20.0
46	106	Gerengou	6.5	13	7*	0.54	961	1.73	21.0
46a	106	Ndanda Foot.	4.5	9	0	0.00	0	0.00	23.0
49	136	Ndanda Foot.	28.0	56	0	0.00	0	0.00	12.0
Site 3 (Ndanda: 4 transects)			**48.5**	**97**	**17**	**0.17**	**129**	**0.23**	**19.0**
Site 3 (Fodé) southeastern CAR.									
50	169	Serepene	17.5	35	0	0.00	0	0.00	6.5
51	17 9	Nganga	17.0	34	3	0.09	69	0.12	13.0
53	199	Baketekpala	7.5	15	1	0.07	55	0.10	31.0
59	23 9	Rafai Road	19.0	38	1	0.03	27	0.05	8.0
Site 3 (Fodé: 4 transects)			**61.0**	**122**	**5**	**0.04**	**34**	**0.06**	**14.6**

*1/2ß km sectors with three or more dung piles

offered to sell the leopard skin for 7,500 CFA and the tusks, which weighed about 9 kg each, for 7,000 CFA per kg. The hunters said that tusks that weighed more than ten kilos were purchased in Bangassou for 8,000-10,000 CFA per kg and smaller tusks sold for 4,000-5,000 CFA per kg. Leopard skins were becoming very difficult to sell since Moslem traders did not readily buy because of the difficulties in smuggling them out of the country.

The village of Fodé is much smaller than it once was. It was created as an adjunct to a coffee plantation that has been abandoned since 1975. At present the main occupation is hunting and there are many shotguns and several high-powered rifles in the village. The surrounding bush has an extensive trail system leading into isolated hunting camps. The guide for the survey knew the surrounding area extremely well and recounted many tales of elephant hunting as practised around the village. There are merchants that wait in Fodé for an elephant to be shot. Then, when word is sent of a successful hunt, they hire porters to carry the meat back to the village. Porters are generally paid 500 CFA per piece of meat delivered. The average man can carry five or six pieces and make one round trip in three or four days. The merchants then haul the meat to Bangassou by bicycle. The tusks are either sold in FodÈ or transported to Bangassou to be sold to Moslem merchants. No Moslem traders were seen in either Fodé or Ndanda.

The residents of FodÈ said that Sudanese horsemen had reached the region several years previously and continued to penetrate the area in large numbers. Even in forest-laterite areas they cut passages through the forest for their camels. They also told of large numbers of Goula and Sara men, saying that these have been hunting in the Mbari and Chinko areas for a long time and have taken a very heavy toll of the elephant population. They said that the elephant population had diminished quite noticeably in the past ten years. Big tusks are no longer a common occurrence.

In Bangassou elephant meat is sold in fair quantity in the public market everyday; it would seem that elephant is the meat of choice in this town. A survey of all of the smaller markets in the town revealed that elephant meat products were sold universally. Another commodity that is in ready supply in Bangassou is ammunition. All of the hunters spoken to said that the purchase of ammunition was extremely easy, all on the black market of course. Almost any calibre of rifle cartridge is readily available for between 4,000 and 7,000 CFA apiece, depending on the season. Shotgun shells cost 350 CFA each and are in abundant supply, both of Congolese (M.A.C.C.) and Central African (Jaguar) manufacture.

Many of the hunters in the Bangassou region have handmade shotguns. These are fabricated in Sudan, Zaire and the CAR. Rather simple, single-shot 12 gauge shotguns, the barrel is made from the steering column of a Land Rover. Many hunters kill elephants with these home-made guns. Normally they make slugs by melting lead into a 14mm socket spanner and then, after double charging a 12 gauge shell, insert the slug. This is sufficient to kill an elephant if the hunter is close enough.

In making a general survey of the Bangassou forest region a drive east along the Mbomou river to the village of Zime was taken. Inquiries about elephants in the area elicited that, while there were a good number on the Zaire side, to the north, all the way to the Bangassou-Rafai road, there were few if any. Some safari hunters suggested that further to the east there was still a significant number of elephants and spoke of an annual transhumance from Zaire. To the southwest of Bangassou, in the forests around Ouango, a few elephants continue to exist[14] and in the not too distant past elephants were present around the village of Gambo to the west of Bangassou.[15]

Discussion

Overall the forest elephant population in the CAR is fairly high and compares favourably with that in surrounding countries.

As in the Congo[16] and Gabon,[17] the overriding factor that controls elephant populations and distributions in the forests of the CAR is human hunting pressure. There was a significant positive correlation between "distance of transect from village" and elephant density. This relationship should be viewed as particularly robust because the conditions in the three study sites were very different.

A rather striking conclusion that may be drawn from the results of this study is that elephants know and avoid human trails. Elephants rarely cross these even when they cut access routes to a prime resource, such as the Sandiki river at Site 3a. It is unusual to find elephant dung on a human trail where poaching is occurring. Related to this is the fact that in the Bangassou forests elephants seem to avoid open laterite plain areas despite high elephant density in the surrounding forests. The poachers often joke about the elephants knowing the exact location of camps and trails and how they consciously avoid them.

The first study site, where no elephant dung was recorded in the transects, has been particularly hard hit in recent years by human encroachment and also has a long history of relatively high human activity. The population of elephants in the entire Ngoto forest probably does not exceed 200. Today, with forest exploitation and the 4th Parallel Road, the impact on the remaining, scant elephant population will increase exponentially and will most likely drive the elephant population to extinction in the near future. There are large numbers of guns and hunters. Systematically, when a fresh elephant track is encountered by hunters it is followed and the elephant is eliminated if discovered. There is absolutely no selection because present populations are already so low.

The one hope in this region is the possibility of the establishment of a reserve in the Bambio, Ngoundi, Kenengue triangle. This project is currently being considered by the EEC. Because the area is well defined and bordered on two sides by swamp forest it is afforded natural protection and is small enough to be relatively easy to protect even with the high density of humans in the surrounding area. It would, of course, require patrolling guards. The proposed reserve area still holds important remnant populations of all of the large mammals originally found there; with three to four years of protection the populations of many mammals would probably return to reasonable levels. It would take somewhat longer for gorillas, chimpanzees and buffalos, but it is believed that the populations of these species are viable and would benefit greatly from the establishment of a reserve. The elephant population would be difficult to maintain because of the large home range it needs. If hunting pressure was great enough on the outside elephants might remain inside the reserve on a permanent basis and, if this were the case, a small population of elephants could possibly be maintained.

Until the early seventies Site 2 was virgin forest. There were a few villages along the Sangha river and undoubtedly some elephant poaching. After Slovenia-Bois started operations in the early seventies and a road was opened providing access to the large population centres of the north, the village of Bayanga grew into a small town of several thousand people. Bayanga was then in the centre of one of the densest populations of elephants left on the continent. Throughout the late seventies and especially in the early to mid-eighties poachers started to make inroads into the elephant population with poaching probably reaching a peak in 1984-1986. At that time the average elephant population density was estimated at 0.6 elephants per km^2 while, for the area in which the transect in this study was done, Carroll obtained an elephant density figure of 2.63 elephants per km^2, ,a figure similar to the present result.[18,19]

In 1987 the World Wildlife Fund/US funded a conservation project based in Bayanga providing, in principle, protection for over 4,000 km^2 of forest. Since then security has been effective in much of the reserve area, especially the part with high elephant densities to the east of Bayanga. If the area in which the project currently provides patrols expands to encompass the entire reserve the elephant populations should start to increase, mostly because of compression from areas outside the reserve but also hopefully through natural growth. If progress can be made on establishing a reserve on the east side of the Dzanga-Sangha Reserve in the Congo, and to the west in Cameroon (Appendix I) the elephant population in this area should be on a sound footing for the future. Certainly in the past two years the change in the number and comportment of the elephants in the Dzanga area has improved dramatically.

The most significant result of this survey was proof of a high elephant population in Site 3. Because of the high poaching pressure that the area has experienced in the past 15 years it was logical to assume that the elephant population in the area had all but disappeared. There are several possible reasons for the remaining, relatively high density of elephants in the Bangassou forests. Forests in general have retained a greater percentage of their original elephant populations in the past ten years because it is much harder to hunt in forests; elephants are generally killed there on a one by one basis. Human population density is lower in forests than in surrounding savannah areas, thus forests have a lower intrinsic poaching rate. Another factor of importance in the forest area around Bangassou has been compression. On the west, and primarily caused by Goula and Sara men from the Ndele region, hunting pressure has been high along the Kotto river for a number of years. In 1980 elephants were still fairly common along the Kotto (Fay. pers. obs.); today elephants are rare there. On the eastern and northern sides of the area Sudanese raiders have been poaching for years. As little as 15 years ago many elephants in the 40kg tusk weight range were still coming out of the area just east of the Fodé study area, along the Chinko river. Taken all together, these activities have pushed the elephants from east, west and north into their present concentration.

Certainly the remaining elephant population in the Bangassou region is heavily poached. During this study many elephant hunters were encountered. The infrastructure is in place to traffic the products from this illicit activity which is not overly covert in the region. Perhaps a reserve is not the solution in the Bangassou region because the elephant range is repeatedly divided by human population and activity. Because the inhabitants of the town of Bangassou seem particularly fond of elephant meat and tusks represent a fortune to them, it is going to be impossible to eliminate elephant poaching in the area. However, regulating the trade in arms and ammunition, curbing the sale of elephant meat and tusks and controlling transport on public roads would make it much more difficult for elephant poachers to operate. This would obviously only slow the rate of

poaching but might bring it more into line with the natural rate of increase of the elephant population.

It is difficult to estimate the population of forest elephants in the CAR. If the data obtained in this and earlier studies are used for each of the three study areas taken separ-ately, an estimated total of 6,240 elephants is obtained. , This figure does not include CAR forests assumed to have very low elephant density, and also applies average extrapolated densities to large blocks of forest. The estimate must therefore be treated with great caution, and is perhaps better viewed as an order of magnitude.

As in many elephant habitats, poaching in the CAR is common. If the present rate of poaching continues there will be very few elephants left in the country in another five years. Although laws exist to protect elephants there is still a good deal of ivory leaving the country. Much greater control on the ivory trade out of Bangui should be exercised. Since much ivory is legally exported this should be a relatively easy task. It is recommended that the collection of ivory and hunting of elephants in the CAR remain outlawed.

Table 3. Extrapolated population of forest elephants in the Central African Republic

	Surface Area of Forest	Elephant Density	Population
Site 1	5,000km^2	0.00	0
Site 2	6,000km^2	0.60	3,600
Site 3	5,500km^2	0.48	2,640
Total	165,000km^2		6,240

The People's Republic of Congo

J. Michael Fay and Marcellin Agnagna

Introduction

With an area of 342,000 km^2 the Congo is about the size of Germany but contains only some 2,000,000 people and, especially as half of these live in the towns and cities, the countryside is relatively unpopulated. Forests cover 222,300 km^2, nearly two thirds of the country, and elephants were found throughout them in the 1950s Since then the country has experienced an influx of capital and an improved transportation infrastructure which has encouraged forest explotation in isolated areas. These factors, coupled with an explosion in the number of firearms and the rise in the price of ivory, caused the level of elephant hunting in the country to increase dramatically.[22] In 1988 Hecketsweiler reported that elephants were disappearing from southern and central Congo and suffering increasing poaching in the north; between 1970 and 1980 an average of 1,675 elephants were killed each year. [23,24]

Figure 7. Map of northern Congo showing the three study sites and important geographical details

Study Sites

Three areas of northern Congo were selected for transects to determine elephant densities. They were examined between February and May of 1989. The south of the country was not surveyed because we believed that the elephant population there was low due to high human population density and intense forest exploitation since the early 1900s.25 The three sites surveyed differed politically, in vegetation and in human impact on mammal populations as summarized below.

Site 1 was located in the vast swamp forests of northeastern Congo found between the Oubangui and Sangha rivers. The soils here are generally permanently saturated, with up to one metre depth of standing water at some times of the year. The swamps are accessible for only a few months during the

dry season, affording natural protection against poaching. Human population density is low, less than one per square kilometre, and concentrated along the rivers. People generally do not venture very deeply into the swamp. Transects were run to the south of the Likouala aux Herbes river near Lake Mboukou in an area where a spit of *terra firma* forms a peninsula into the surrounding swamp forest.

Site 2 was located in the forest block in the northeastern part of the country bordered on west and north by the Central African Republic. The vegetation is primarily semi-deciduous forest with large areas of *Raphia* swamp along the major rivers and *Gilbertiodendron dewevrei* forest along upland water courses. As at Site 1, the human population is low and concentrated along the major watercourses. Transects were run between the villages of Makao and Berandjoko which lie half-way up the two principal rivers in the region, the Motaba and Ibenga.

elephant activity in these areas during our dry season survey. Local inhabitants said that the elephants left the swamp forests in the wet season.

At the forest edge east of Lake Mboukou a large water hole showed no recent sign of elephants, only three very old elephant skeletons. The local inhabitants admitted that hunting had been a major activity in the area in the past 15 years and that the elephant population had decreased significantly. They said that Lake Mboukou used to draw large numbers of elephants but that now it was rare to see one on the lake's edge. The Batanga river still holds an important elephant population.

Most of the elephant feeding sites in the swamp forest consisted of *Raphia* spp. and *Pandanus* spp. with *Aframomum angustifolium* being the third most important food item. These are also the three most important gorilla *(Gorilla gorilla gorilla)* foods in the area.

Table 4. Calculated dung and elephant densities for all survey transects, northern Congo

Transect location	Length of transect	No. $^1/_2$ km segments	No. $^1/_2$ km segments with dung	Proportion with dung, p	Dung density	Elephant density	Distance to village
Mbomo-Sembe	95.5	191	131	0.69	491	0.88	37.3
Mboukou	63.0	126	30	0.24	175	0.31	5.6
Likouala	141.5	283	126	0.45	319	0.57	23.9
All transects	**300.0**	**600**	**287**	**0.48**	**343**	**0.62**	**23.3**

This area was of prime importance because we believed it to hold significant densities of forest mammals. It is, however, extremely vulnerable in that it contains enormous reserves of exploitable timber, most notably *Entandrophragma cylinridricum.* The entire region has been surveyed and sub-divided into UFAs (Unité Forestière en Aménagement), many of which are open to lease by logging concerns. There are four companies that have started logging in the northeastern and southwestern parts of the region. In the next ten years roads will reach most of the now inaccessible parts of this forest.

Site 3 was located in a large tract of virtually uninhabited forest in northwestern Congo bordering Gabon, northwest of Odzala National Park. This dense forest contains few exploitable trees and is also quite hilly, two factors which will help to conserve the area. On the southern edge of the study area is a road which has been abandoned for over thirty years. The roadside vegetation is secondary, a result of the more than one thousand inhabitants who used to live there and were largely employed in the collection of wild rubber. North of the Ekoutou river the vegetation is primary. The few humans now in this area are concentrated in the two towns at either end of the study area.

Results

A total of 300.0 km of line transects was completed during the survey. Dung was recorded in 287 of the 600 1/2 km sectors. The overall elephant dung density was estimated to be 343 piles per km^2 implying a density of 0.62 elephants per km^2.

The lowest dung density of the three areas surveyed was on Site 1, the swamp forest of the Likouala aux Herbes, which gave an elephant density of 0.31 per km^2. At this site the average distance of the transects from a village was 5.64 km. The highest dung density was found in the area close to the Gabon border, Site 3, indicating 0.88 elephants per 2, and here the average distance of the transects from a village was 37.27 km. The northeastern Site 2 had an intermediate dung density leading to an estimate of 0.57 elephants per km while the transects averaged 23.9 km from a village.

An ANOVA for unequal sample sizes showed the mean elephant dung densities and mean distance from village to be significantly different ($p<0001$) in the three study sites.

When elephant dung density is plotted against distance from the nearest village for each transect, a significant positive linear correlation results with $r=0.85$ and $p<0.001$.

Site Results

Site 1. Surveyed: 7 transects totalling 63 km; 175 piles per km^2. Elephant dung densities were greatest along the Batanga river west of Lake Mboukou. There was also substantial elephant feeding activity in the swamp forest especially in the northern transects. The peninsula *of terra firma* to the west of the lake had a low density of elephant dung.

A total of 15.5 km of trail was walked from the Likouala aux Herbes to Lake Mboukou. No elephant spoor was recorded on the trail, which was located between the two areas of transects, although we noted many, large, abandoned elephant trails. Throughout the survey we never ventured more than eight km from the *terra firma* into the swamp forest. There was a lot of

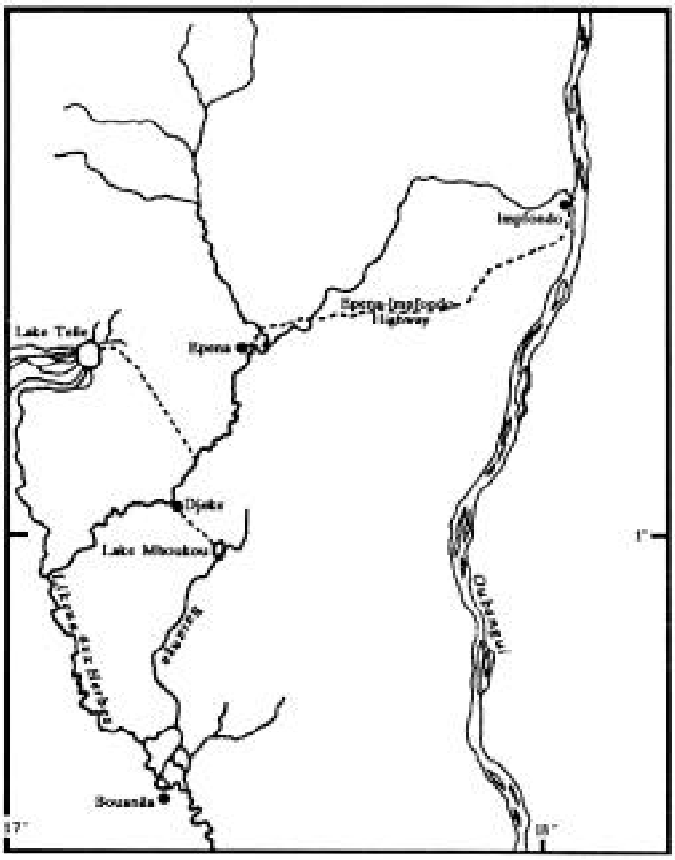


Figure 8. Map of Site 1 in the swamp forests of the Likouala aux Herbes

We did not see any live elephants during our survey at Site 1 but a total of six carcasses were found. Only one of these was fresh, the remainder all being several years old. The size and age distribution of the skeletons would seem to indicate that the age curve of the elephants has decreased significantly in recent history.

Site 2. Surveyed: 15 transects totaling 141.5 km; 319 piles per km^2.

The transect survey was worked from a footpath that connects the two villages highest on the Motaba and Ibenga rivers, Makao and Berandjoko respectively. Elephant activity was most common in the centre of the study area, far from these two villages. Transects were concentrated in two areas, Djemo Creek and the Ipendza river. The Ipendza area showed a slightly higher extrapolated density than did the Djemo, with 0.61 and 0.50 elephants per km^2 respectively. The average distance from a village for the Ipendza transects was 28.8 km while that for the Djemo transects was 19.8 km. Locally the areas of greatest concentration of elephants were bottom-lands with a high density of *Cyperaceae* and many water holes.

A total of 73 km of non-transect trail was walked from Makao to Berandjoko and elephant sign was infrequent. Only between Djemo Creek and the Ipendza river did we record elephant dung. Close to the villages elephant sign disappeared completely.

We saw a single bull elephant during the survey, a rather small individual with tusks of six to eight kg. On another occasion we encountered *a* small group of three or four females and sub-adults near the Ipendza river. One individual was seen, a mature female with tusks of one or two kg. These all appeared to be typical forest elephants.

Four elephant carcasses were found in this study area, one freshly killed, the rest dead in the last five years. The carcasses were all of adult males with relatively large tusks.

A cursory survey by Fay in December 1988 on the head-waters of the Motaba indicated that this area holds the highest density of elephants in northeast Congo, comparable to that found in the adjacent Dzanga area in the Central African Republic.[26,27] The Bonye river possesses many mineral water holes with abundant elephant activity. The elephant trails in the area are sometimes three metres wide and are used regularly.

Site 3. Surveyed: 11 transects totalling 95.5 km; 491 piles per km^2.

The transect survey in this area was conducted parallel to a trail that goes from the town of Mbomo to Sembe, a distance of some 150 km. This area holds many elephants. The maximum density was found in the 40 km between the Ekoutou and Mambili rivers where there are very many heavily used elephant trails. Proceeding north and south of this core area the elephant densities become progressively lower.

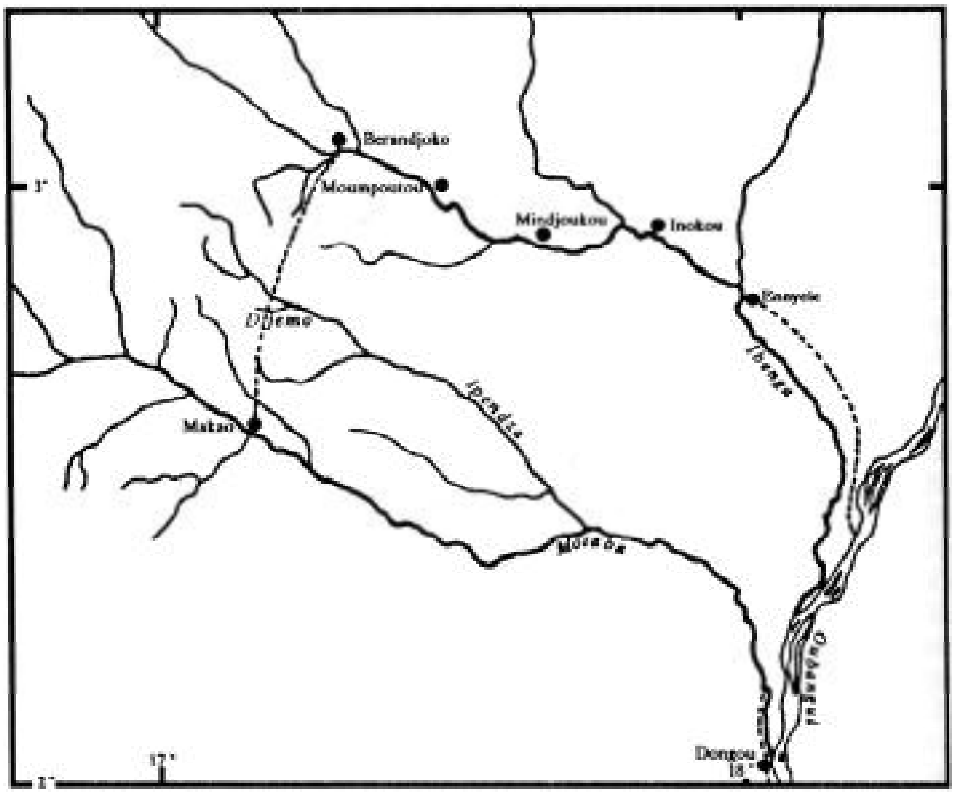


Figure 9. *Map of Site 2 in the dense forest area of northeastern Congo*

Figure 10. Map of Site 3 in the dense forest area of northwestern Congo along the Gabonese border

A total of 104 km of non-transect trail was walked between Mbanza and Sembe and showed similar results to transects. Elephants were found to be very abundant near the Ekoutou river where we recorded estimates for dung densities of 477 and 551 piles per km , or 0.86 and 0.99 elephants per km^2. The two non-transects at either end of the survey near Mbanza and Sembe had no elephant dung. On the Sembe side elephant dung disappeared from the trail at 38.5 km away from the village. Dung was first encountered on the Mbanza side at 19.5 km from the village.

During the survey we observed three solitary bull elephants on the same day in the Loungou river area. They were all relatively old males with estimated tusk weights of 10-15 kg. These were probably not exceptional for the area and appeared to be typical forest elephants. A single small (M3) carcass was found in the southern part of the study area.

Discussion

The data presented in this paper show for the first time that there are many forest elephants remaining in the People's Republic of Congo. Elephant densities in northern Congo compare favourably with those of surrounding countries; only in Gabon does one find a denser forest elephant population. Elephants were found in all three study sites although the extrapolated figures for the three areas were significantly different. The primary factor was distance of transect from village. This was clearly demonstrated both when using individual transects for the entire survey and when the pooled data for each of the three study sites were compared. The relationship of distance from village to elephant population has also been demonstrated in [28,29] Gabon. The qualitative data showed human hunting pressure to be the major factor determining elephant density, not habitat destruction. At Site 1 elephant poaching started earlier than for the other sites and, coupled with low elephant density, we found very large abandoned elephant trails, unused salt licks and progressively smaller elephant carcasses. Site 2 was found to have a great deal of current poaching activity, an intermediate elephant population and generally large carcasses. Site 3 held numerous elephants, showed little indication of active poaching and very few carcasses. Although the sample size was far from significant, live elephants seen during the study supported the observed trend.

If we extrapolate the relationship of elephant density to human population for the entire north of the country we find that there are potentially six areas of very high elephant density in northern Congo. We avoid using these extrapolations to derive a total population figure for the north of the country but, even so, estimate that there could be 25,000 elephants left there.

It was evident during our study that elephant poaching is proceeding on a grand scale throughout the range of the species in northern Congo. Only those areas that are far from human populations are relatively undisturbed Based on the size distribution of tusks exported from the Congo it appears that they come from a population with a fairly normal age curve. For ivory sold between 1986 and 1988 the mode weight was six to seven kg and the mean 12.6 kg.[3]0 However, if hunting continues on the scale at which it is now practised, on the basis of our stratified data we can only conclude that elephant populations in the Congo will decrease dramatically in the coming decade.

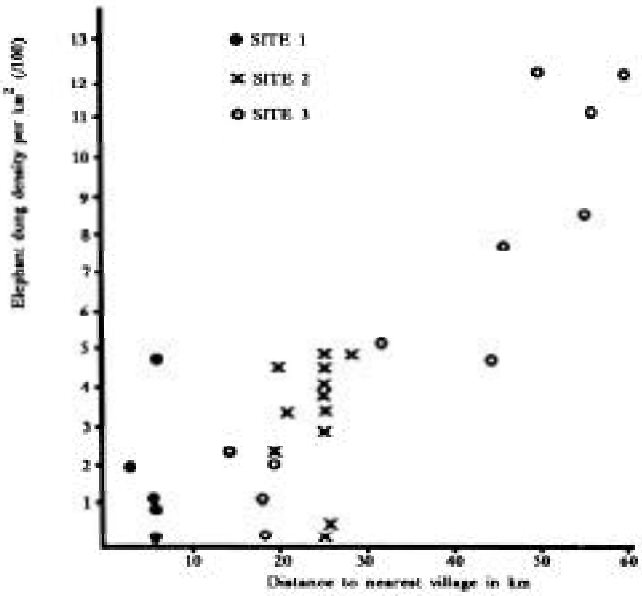


Figure 11. Plot of elephant dung densities versus distance from village for all transects

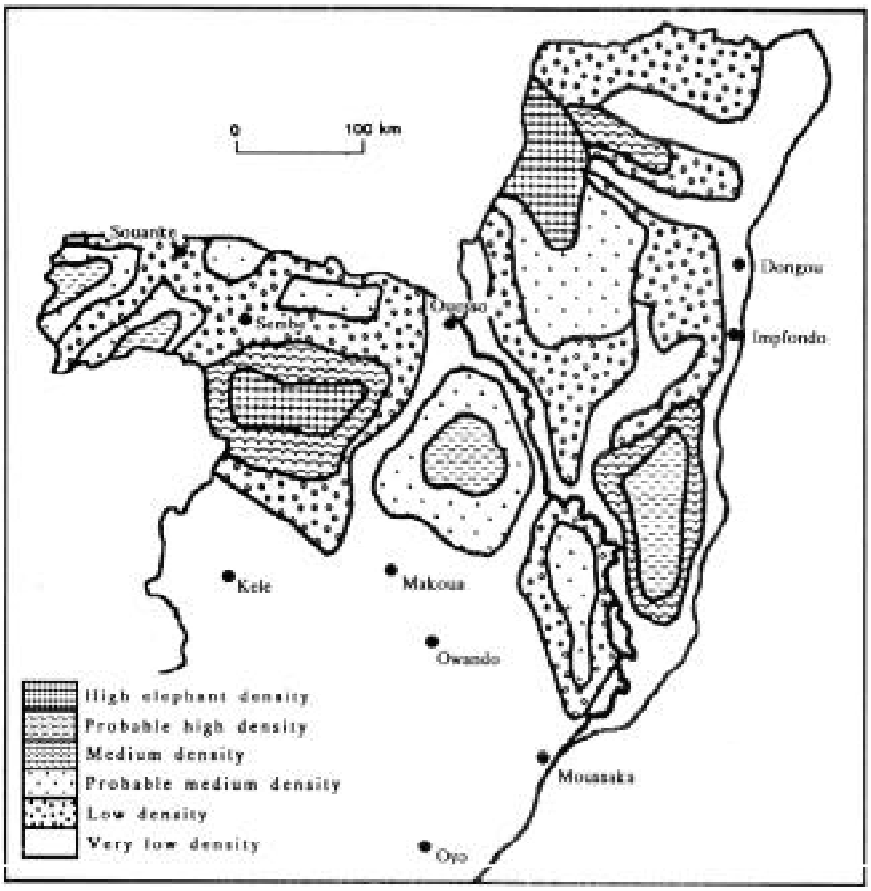


Figure 12. Known and putative elephant populations in northern Congo

Table 5. Forest elephant densities reported for different parts of Africa

Location	Density	Reference
Bia Park, Ghana	0.3	Short[31]
Tai National Park	0.2	Merz[32]
Korup, Cameroon	0.2	Wildlife Cons. Interntl.[22]
Southeast Cameroon	0.2	Wildlifc Cons. Internl.[22]
Extreme SECameroon	1.8	Wildlife Cons. Interntl.
Southwest CAR	0.6	Carroll[18]1988, Fay[13]
Southeast CAR	0.3	Fay 1989[27]
South Equatorial Guinea	0.1	Alers and Blom[33]
Northeast Gabon	0.4	Wildlife Cons. Interntl.[29]
North Congo	0.6	Fay and Agnagna 1989[16]
Salonga Park, Zaire	0.2	Wildlife Cons. Intcrntl.[22]

Notes on the dominant forest species

The forests in the CAR sites were composed of:

Site 1: *Entandrophragma* spp, *Polyalthia suaveolens, Pachyelasma tessmannii, Autranella congolensis, Pterocarpus soyauxii, Piptadeniastrum africanum, Combretodendron macrocarpum, Celtis* spp. , *Canarium schweinfurthii, Stroinbosia* spp., *Irvingia* spp., *Funtumia elastica* and *Eiythrophleum suaveolens.*

Site 2: *Entandrophragma* spp., *Polyalthia suaveolens, Pachyelasma tessmannii, Triplochiton scleroxylon, Eribroma oblonga, Albizia* spp., *Klainedoxa gabonensis, Terminalia superba, Gambeya* spp., *Autranella congolensis, Pterocarpus soyauxii, Piptadeniastrum africanum, Combretodendron macrocarpum, Celtis* spp., *Canarium schweinfurthii, Strombosia* spp., *Irvingia* spp., *Funtumia elastica*, *Eiythrophleum suaveolens* and *Dialium* spp.

Site 3: *Triplochiton scleroxylon, Afzelia africana, Aubrevillia kerstingii, Albizia coriaria, Erythrophleum suaveolens,Parkia filicoidea, Berlinia grand ifolia, Khaya grandifolia, Blighia unijugata, Chaetacme aristata* and *Klainedoxa gabonensis* .[34]

In the Congo:

Site 1: *Raphia* spp., *Trichilia* spp., *Lophira alata, Guibourtia de≠meusii, Uapaca* spp. , *Mitragyna stipulosa, Garcinia* spp., *Symphonia globulifera, Manilkara* spp. *Alstonia congensis, Klainedoxa* spp., *Pandanus* spp., *Aframomum angustifolium* and *Lasiomorpha senegalensis:* the terra firma carries: *Pentaclethra macrophylla, Tetrapleura tetraptera, Macaranga spp.,Angylocalyx pynaertii, Milicia exclesa, Milletia* spp., *Klainedoxa spp.* and *Panda oleosa.*

Site 2: *Entandrophragma* spp., *Polyalthia suaveolens, Pacyelasma tessmannii, Autranella congolensis, Pterocarpus soyauxii, Piptadeniastrum africanum, Combretodendron macrocarpum, Celtis spp., Canarium schweinfurthii, Strombosia spp., Irv≠ingia* spp., *Funtumia elastica* and *Eiythrophleum suaveolens.*

Site 3: *Klainedoxa gabonensis, Coula edulis, Irvingia spp., Daciyodes* spp., *Parkia* spp., *Pachyelas-ma tessmannii, Daniellia* spp. and is; *Zanthoxylum macrophylla, Pentaclethra macrophylla, Uapaca spp., Macaranga spp., Tabernaemontana crassa, Tetrapleura tetraptera, Lophira alata, Pycanthus angolensis, Barteria fistulosa, Megaphrynium macrostachyum, Aframomum angustifolium, Haumania leonardiana, Sarcophiynium prionogonium* and *Hypselodelphys violacea.*

Acknowledgments

These surveys were carried out under difficult conditions in a short amount of time. They could not have been accomplished without the help of Dr. Richard Barnes (Wildlife Conservation International) and the many individuals and institutions in the two countries as listed below:

Central African Republic: Ministre Mbitikon, Directeur Générale Mordomti, Inspecteur Bini, Directeur Doungoubé (Ministrère des Eaux, Forêts, Chasses, Pêches et du Tourisme), and Bayaka tracker Mbutu CIément.

People's Republic of Congo: Dr. Ndinga Assitou, M. J. Mokoko Ikonga, M. D. N'Sosso (Ministrère de l'Economie Forestiere, Brazzaville), M. Joseph Boukindi (Directeur Regional de l'Economie Forestiere, Impfondo).

We also gratefully acknowledge the local government and Party officials, guides, porters and paddlers, all of whom worked extremely hard to make the mission a success. The projects were carried out by Wildlife Conservation International under contract to the World Wide Fund for Nature as part of the EEC/WWF African Elephant Programme.

Appendix

Nouabale Brief: An Outline for Conservation of Wildlife and Bio-diversity in Northeastern Congo The Nouabale Site Quesso District Sangha Region. People's Republic of Congo

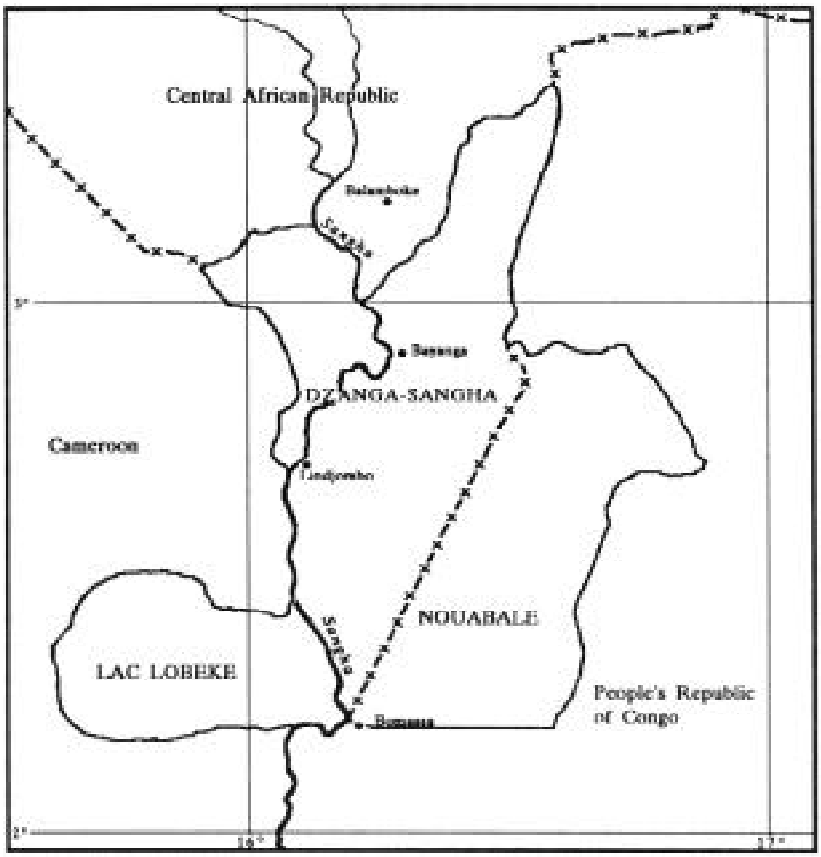


Figure 13. *Map showing the location of the three contiguous reserves*

In his National Report to the European Economic Community under the umbrella of the project "Conservation and Rational Utilization of Forest Ecosystems in Central Africa", Ph. Hecketsweiler described twelve areas in the People's Republic of Congo (PRC) which have significant conservation potential but currently have no legal status as such.[35]

In this brief the Nouabale Site in northeastern Congo is discussed. As described by Hecketsweiler, this site is located in the largely unexploited forest block of northeastern Congo, encompasses 458,000 ha on the border with the Central African Republic, and is contiguous with the proposed Dzanga-Sangha Reserve. It contains a part of the Unité Forestière en Aménagement (UFA) of Kabo and the entire Nouabale UFA. At present the site has no legal status as a protected area.

Hecketsweiler lists three reasons for proposing this site for protection:

1) Congo currently has no reserve north of the first parallel in the vast northeastern forest block.
2) Forest exploitation in the area has not yet reached much of the northeastern block.
3) The Central African Republic is considering the creation of a reserve adjacent to the Nouabale site and the combination of these two would assure the protection and conservation of a large forest block of some 725,000 ha.

During the course of an inventory of fauna, carried out under the auspices of the EEC and completed in May 1989, a preliminary evaluation of the Nouabale area was made. 36 In March 1989 a team headed by J. Michael Fay and Marcellin Agnagna of the Ministry of Forest Economy, PRC, reached the upper Motaba region to survey the fauna and, subsequently, Fay visited the western part of the Nouabale Site.

This initial reconnaissance of the area has shown without doubt that the Nouabale Site possesses some of the highest densities of forest elephant, gorillas, chimpanzees, bongo, and leopard in the greater central African forest block. Based on observations in the Nouabale Site as compared to the adjacent Dzanga-sangha site, where quantitative surveys have already been carried out,[37] I estimate an elephant density in the Nouabale Site of 0.9 per km^2 , gorilla densities of 1.0 per km and high densities of chimpanzees, bongo, buffalo and leopard, There are also high densities of a minimum of eight species of monkeys and six species of duikers, sitatunga, giant forest hogs, and potamocheres.

At present there is no inventory of the fauna nor has a management plan for the Nouabale Site been written.

Conservation potential. The Nouabale site is not imminently threatened by forest exploitation or excessive poaching and has great conservation potential.

Forest. The Nouabale Site possesses a rich, varied and, to all intent, virgin forest habitat which includes superb examples of *Sterculiaceae-Ulmaceae* semi-deciduous forest (with a high density of *Entandrophragma* spp., *Gilbertiodendron dewevrei* forest and *Raphia* spp. swamp forests.

Fauna. The Site is one of the few areas in the entire central African forest region with an intact fauna. The densities of all species present are probably close to the maximum attainable in a completely undisturbed situation, Proper management could insure the long-term survival of all species within the reserve at levels close to those currently existing.

Dzanga-Sangha Reserve. Because it is located on the CAR border where there will soon be a reserve established that includes a national park of 140,000 ha and a reserve of 300,000 ha, the Nouabale Site is ideally situated. A WWF/ US funded project in the proposed Dzanga-Sangha reserve, in place since 1968, has had a dramatic effect on the level of poaching in the area.

Tourism. With the enormous and growing public interest in rain-forests over the past few years, tropical forest parks have great tourism potential. The Nouabale Site is particularly well suited for this purpose as the forest normally has a rather open understorey that presents the primeval image of jungle: huge buttressed trees, abundant lianas, epiphytes and filtered sunlight. The fauna of the area is unparalleled. There are very few sites that have the combination of elephants, gorillas, chimpanzees, bongo and numerous species of monkeys in such numbers.

A unique feature of this area, including Dzanga-Sangha, is that it possesses a large number of the forest saline clearings essential for viewing mammals. For example, in the Dzanga-Sangha elephants are rarely seen in the forest but in the Dzanga clearing it is a daily occurrence to see over eighty elephants accompanied either by bongos, itatungas, buffalos, or bush pigs. Another factor in tourism potential is the presence of Bayaka pygmies in the area. These people are of great interest to tourists, and serve as unparalleled forest guides; tourism could improve their current status as servants to the Bantu population.

Human Impact. At present there is no permanent human habitation within the proposed Nouabale Site. Forest exploitation has not started in the region which possesses virgin forest. There are five points where humans gain access to the region: Bomassa and Makao in the Congo, and Bayanga, BalambokÈ and Lindjombo in the CAR.

Bomassa is a small village along the Sangha river very close to the border with the Central African Republic. As a village of about three to four families, the inhabitants of Bomassa do not represent a threat to animals in the Nouabale Site. But Bomassa does pose a threat as a staging point for elephant hunters that originate in Kabo and Ouesso, and Libongo and Bela in Cameroon. A number of Senegalese, Chadian and Congolese ivory collectors use this village to get into the Nouabale Site; there are logging roads and footpaths that allow relatively easy access from Bomassa or from Beau Coin, a camp higher up the Sangha.

Makao is the last village going up the Motaba river and is located not far from the proposed eastern border of the Nouabale Site. This is a large village of several hundred inhabitants actually composed of two villages, Makao and Iganga, and several pygmy settlements. Makao is a major staging post for elephant hunters and ivory collectors in the northeastern region. When we arrived at this very isolated spot in March, we found Senegalese and other Moslem traders known to be engaged in the ivory trade. Hunters come from as far away as Brazzaville and Bangui via the Motaba river which joins the Oubangui river at Dongou and, during the wet season, carries regular barge and tug traffic. There are over 20 villages along the Motaba all of which are involved in ivory poaching to some extent. From our brief visit to Makao it would seem that wildlife exploitation is the sole reason for its existence, much of which centres on the ivory trade. Because of the river the inhabitants of Makao can gain easy access to the eastern part of Nouabale Site and poach a significant number of elephants.

Lindjombo, Bayanga and Balamboké are located in the CAR. Each of these three small towns has trails that lead into various parts of the Nouabale Site. For the most part these trails are used by Bayaka people in their hunting and collecting forays but we have information that elephant poachers also take advantage of them to reach the Nouabale area. This activity is largely underwritten by Moslem traders and government employees in the CAR.

Forestry. Undoubtedly forest exploitation will reach the Nouabale region in the not too distant future. The Nouabale Site, more or less as proposed by Hecketsweiler, has the greatest potential for conservation of wildlife and bio-diversity in the entire region due to the undisturbed nature of the forest and fauna and the absence of any permanent human settlement. If the forests of northeastern Congo are to be exploited it is essential to establish a reserve in the area to protect a portion of this vast region in its natural state.

Development and Management. The procedure for setting up a reserve in the Nouabale region might follow that for the Dzanga-Sangha area in adjacent CAR.

Initial quantitative survey. An in-depth, quantitative survey of animal populations should be carried out throughout the area. This would enable a definitive evaluation of the resource that exists, and should be carried out in the near future. Methods would follow those used by Carroll, Fay and Wildlife Conservation International.[38] The survey would concentrate on the populations of elephants, gorillas, chimpanzees, monkeys and bongo.

Comprehensive management plan. A plan similar to that fashioned for the Dzanga-Sangha Reserve should be produced. This document would outline the results of the wildlife survey, suggest the borders of the reserve and describe a plan for its management. It would be desirable to set up a multiple-use reserve such as that proposed in Dzanga-Sangha. A section could be established that would be open to sustainable forest exploitation and agro-forestry, preserve hunting and gathering rights for the Bayaka, protect watersheds, and provide facilities for big-game hunting and tourism. A core park area could be established which would serve as a protected resource of bio-diversity and allow both long-term research on forest ecology and tourism.

Gazetting of reserve. A legal document should be produced delineating the borders of the various components of the reserve, their legal status and the management objectives of each. This document would be presented to the national government for ratification.

Conservation project. A conservation project would be established to achieve the management objectives of the reserve. The project would work in concert with local people and government, the central government, private investors, and international funding and conservation organizations.

Regional objectives. Because of the value of forests to the economies of the countries of the central African region, it is unrealistic to expect any one country to protect completely a huge area. Also wildlife populations, most notably elephants, cross international borders. In this light it is extremely important to approach conservation regionally and the Nouabale Site is perfectly suited to this end. There are three neighbouring countries all of which contain ideal sites for conservation. The CAR has taken the lead but, as it now stands, the proposed

Dzanga-Sangha Reserve has little chance of long-term success if the adjacent areas in Congo and Cameroon are opened to large scale forest exploitation.

If the three countries can work in concert to form a reserve/park system encompassing a very significant block of the most important wildlife habitat in west Africa, the potential for long-term conservation of wildlife and bio-diversity would be enormous. Cameroon has established, or will establish, a reserve in the Lac Lobeke area that has conservation potential equal to that in Nouabale and Dzanga-Sangha. If the borders of this reserve could be extended to the Sangha river and the Nouabale Reserve could be set up, these, together with Dzanga-Sangha, would form an integrated whole spanning three countries and enclosing over 1,000,000 ha.

In trying to establish the regional approach it would be highly desirable to hold a tripartite conference of government officials to discuss the feasibility of an integrated reserve. This conference might well be held in Bayanga, CAR, the headquarters of the Dzanga-sangha project, where the representatives of Cameroon and Congo could see the type of management that might be desirable in their countries.

This brief is intended to be a guide to planning for conservation in northeastern Congo. For the reasons outlined above, it is believed that the Nouabale Site is the best suited in the entire region for conservation of wildlife and bio-diversity. In view of the role the World Bank is already playing in the forestry sector in the PRC it is logical that they pursue the initial recommendations in this brief.

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Yemen Stops Being a Major Buyer of Rhino Horn

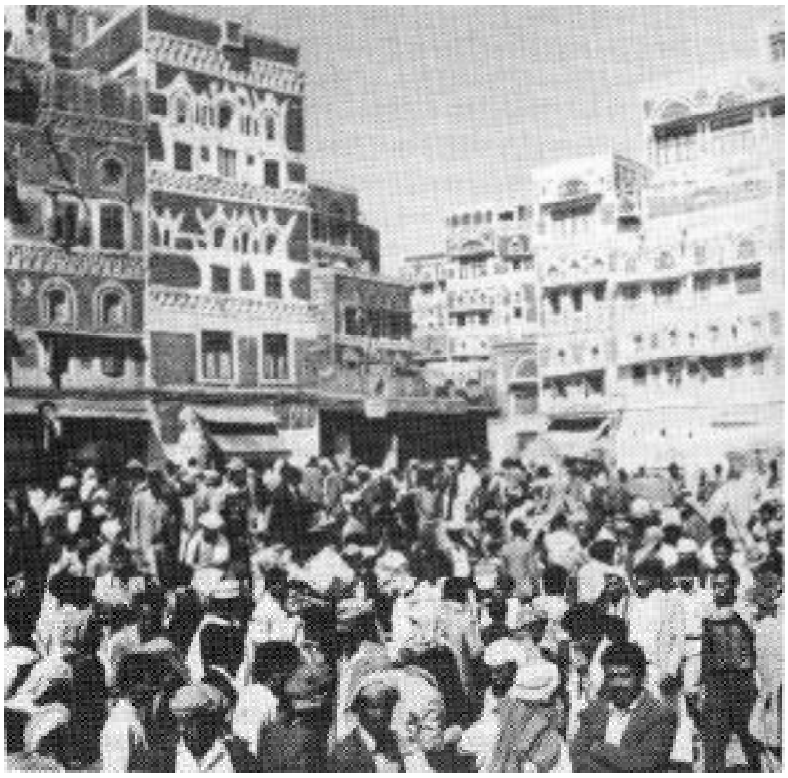
Lucy Vigne and Esmond Bradley Martin

Four years had elapsed since our last survey of the trade in North Yemen proved rhino horn was still being imported into the country despite the 1982 ban - albeit down to some 500kg from the average 3,000 kg per annum bought in the 1970s. During our October, 1990, visit we found out what has happened to Yemen's rhino horn trade today.

Along two dark alleyways of the old souk in Yemen's capital city, Sanaa, we still found hilts for daggers being carved from African rhino horn. On our first afternoon there, before suspicions of our investigations were aroused, we watched two dagger craftsmen at work in separate workshops, one sandpapering a rhino horn handle in the early stages of making, and the other, with great care, polishing an almost completed hilt. We were told, quite openly, that these were made from rhino horn. They were indeed a paler brown than the common water buffalo horn hilts and we could see the distinctive hair follicles which create a granular effect within the handle. Another craftsman even beckoned us into his workshop and unlocked a small cupboard to show us proudly two full African horns and five rhino horn hafts in the process of being carved.

The last remaining rhino horn trader in the souk told our interpreter that he had been buying about 20 kg of rhino horn annually, usually from returning Yemeni Ethiopians or Sudanese immigrants, for US$ 1,360 a kilo for a large horn weighing up to five kg. He blamed conservationists for having virtually put an end to rhino horn smuggling. We found that of 87 dagger makers we counted in the souk, two or three were at work on rhino horn each day. As it takes two and a half days to complete one handle, we estimated that about 120 kg of horn (the equivalent of about 40 rhinos) are carved a year, less than a quarter the amount used in the mid-1980s. Some of this is no doubt from old stocks, but by no means all.

Yemen is undergoing an economic recession. This is due to large cut-backs in donor aid following the invasion of Kuwait by Iraq, and, since then of course, because of the war against Iraq. It is also due to the loss of lucrative jobs in Saudi Arabia by more than 700,000 Yemenis who had to return home because of new Saudi restrictions imposed after the unification of North and South Yemen in 1990. With rising inflation and devaluation of the local currency, the trade in rhino horn daggers has suffered. Not only is rhino horn more expensive to buy, but Taiwanese traders will pay 50% more for it than their Yemeni counterparts, making it very difficult for the Yemenis to compete. Also, Indian water buffalo horn is hard to import due to lack of foreign exchange. Resourceful craftsmen are carving many more hilts from plastic, a substitute that was introduced only in the mid-1980s and has proved



The Sanaa souk where most of Yemen's jambiyahs are made, is situated in the old town, unique with its traditional architecture

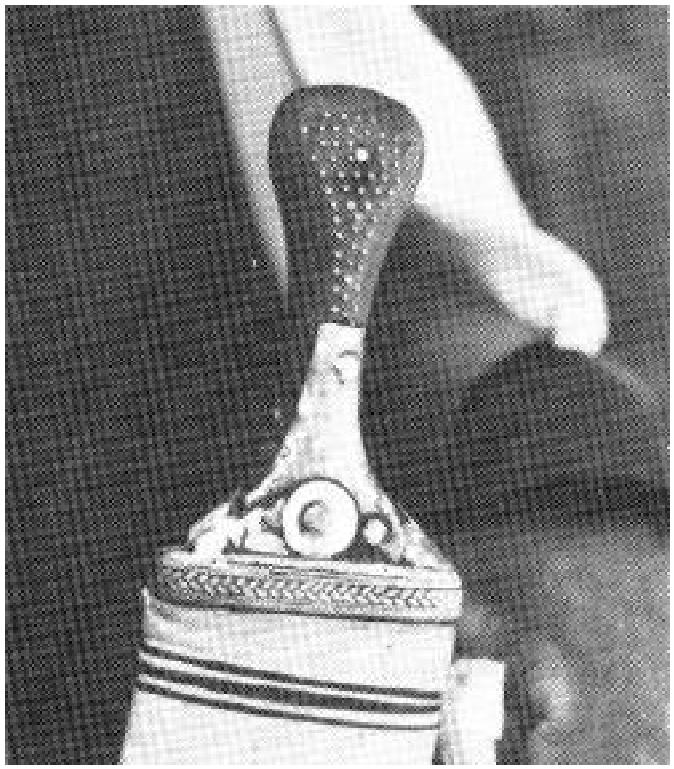
In 1990, a craftsman in Sanaa souk displayed two full black rhino horns for us to see and reluctantly let us photograph them

extremely popular with poor Yemenis and tourists. In the town of Dhamar, the handful of craftsmen remaining in business have started to use cheap camel hooves as their raw material.

Yemen's economic crisis cannot be relied upon to hinder the rhino horn trade for very long as more oil is likely to be discovered in the country in the near future. It is vital to reduce further the demand for rhino horn hilts. This is especially so as more Yemenis than ever before are wearing jambiyahs south of Sanaa, emulating the traditions and fashion of that power centre. It is also possible, since unity, that Yemenis in the far south may follow this trend.

With all this in mind, we had meetings with the Minister of State and the Foreign Minister, kindly arranged for us by the British and American ambassadors. Both ministers were anxious to eliminate the last trickle of rhino horn trade in Yemen in order to aid the recovery of rhino numbers in Africa and also to improve the country's image on this sensitive conservation issue. A new Environmental Protection Council has been formed in Yemen, which is a very positive step for conservation in the region. It was agreed that the Council, which is chaired by the Minister of State, would hold a meeting with the traders and dagger craftsmen to discuss the problems of the rhino horn trade. The Foreign Minister said he would talk to the Governor of the Central Bank about allocating hard currency to enable traders to import water buffalo horn to help the dagger industry with this cheap substitute. Perhaps most importantly, the government is to ask the principal trader, who is well known in Sanaa, to carry out a stock-take of his rhino horn. If the government marked these horns individually, inspected the stock regularly and gave a time limit within which it must be sold, the trader would be prevented from mixing new illegal horns in with old supplies and indefinitely claiming to be dealing in legal stock. We wait to hear if this action is underway. We are fairly confident that these measures will be carried out, since an action-plan we drew up in late 1986 for the government was nearly all effected despite economic andpolitical pressures on the government.

Perhaps the most effective way of curtailing demand for rhino horn is with the help of Yemen's highly respected Grand Mufti, the spiritual leader of this very religious country. In what was very nearly our last hour in Sanaa, the American ambassador brought us to meet this venerable figure in his traditional house in the old town. He was extremely willing to help us and agreed to issue *a fatwa*, or religious edict, which could be published in the newspapers, stipulating that it is against God's will to cause the extinction of an animal species, specifically the rhinoceros.



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The granular-look, as shown in this dagger hilt, is very popular and reveals the origin to be rhino horn

We left Yemen with high hopes that if these final efforts are implemented by the government and the Grand Mufti, the trade in rhino horn in the country would almost be wiped out, but not at the expense of the dagger industry, a unique element in the cultural heritage of Yemen and one which is very likely to live on in that country of many ancient traditions.

Copyright Esmond Bradley martin

A retailer displays his shining daggers to potential buyers in Sanaa souk

Distribution and Status of the Forest Elephant in the Ivory Coast, West Africa

G¸nter Merz and Bernd Hoppe-Dominik

Introduction

Among all terrestrial ecosystems the tropical rain-forest is the most heavily influenced by human activities. Severe changes caused by logging, agricultural use and agro-industrial projects lead to extensive destruction of this habitat and therefore to the loss of a source of tremendous biological and genetic diversity.

Based on present climatic conditions in Africa, about 66% of Central Africa, 19% of West Africa and 11% of East Africa could be covered with evergreen moist forests, summarized as rain-forest; the actual sizes of the rain-forest are 37%, 5% and 3% respectively.[1] About 4% of the total of existing forest area is declared as protected, but West Africa contributes less than its share with only about 2.8% of the forest legally secured.[2] Some 18 million hectares are covered with tropical lowland forest, semi-deciduous forest and mountain rain-forest; of these 4.6%, 4.9% and 0.1% respectively have a certain status of protection.[3] Of this, National Parks amount to 3% of the evergreen forest formations and 4% of the semi-deciduous forest while the remainder is Wildlife Reserve or Forest Reserve.

The Guinea Forest Block, stretching along the coast from the 0˚ meridian to a longitude of 13˚ West and a latitude of 8^0 North, has been more intensely influenced by man than any other rain-forest region of the world. Official statistics verify a decline in the primary rain-forest of about 72% up to 1975. Those forests still in existence are subject to continual land-use reform. The consequence is a further decline in forested area and the creation of isolated forest patches. A great number of such islands are already too small to serve as real refuges for most animal species.

Fifty-one percent of the larger mammal species occurring in the Guinea Forest Region are so dependent upon the existence of the rain-forest that they will disappear if their habitat is irreversibly changed.[4] In a broader sense the African Forest Elephant is numbered among them. Even if the elephant is easily able to adapt himself to certain modifications of the environment, his survival is nonetheless dependant upon the conservation of intact tropical forests.

Parallel to the decline of forest area, a transformation of intact habitats into ecologically valueless cultural land often takes place. The elephant reacts, but is unable to survive. The behaviour, distribution and number of elephants changes drastically.

Forest elephants - so-called round-eared elephants - once populated the whole West African and northwest African regions[5,6] and until the end of the 19th century elephants could be found in all parts of the West African forest zone.[7] In the Ivory Coast, where the rain-forest originally covered 157,00 km^2, or about half of the country, the forest elephant lived in large numbers.[8,9] Depending upon the structure of the habitat and the availability of fodder plants, considerable differences in population densities occurred. The animals were not regularly dispersed but concentrated in suitable locations while other areas were avoided.

The elephant area became smaller the more intensively man exploited the forest. In 1956 39,000 km^2 ,25% of the forest, had already been destroyed. By 1974 tropical forests covered only 54,000 km^2 ; 66% had disappeared. During the 1980s, clearing continued at a great rate until, by 1985, more than 90% of the forest had been obliterated; less than a tenth of the original resource remained. Now, the last intact primary rain forest is largely restricted to the Tai National Park which is near the border with Liberia and covers a mere 3,300km^2.

While various general surveys of mammals in the Ivory Coast had been [10,11,12,13,14] the first nation-wide elephant census was carried out in 1979 and 1980.[15] The forest elephant estimated at 3,050 over an area of population was 29,420 km^2 of which 7,285 km^2 (25%) were National Parks or Wildlife Reserves, 14,080 km^2 (48%) had the status of a Forest Reserve and 8,053 km^2 (27%) were not legally protected.

In 1988 and 1989 a second census of forest elephants was organized in the Ivory Coast. This census was based mainly on surveys of statistically selected, different forest areas and enquiries made to local populations, agricultural societies and government agencies engaged in nature conservation such as Controle Forestier, Conservation de la Faune and Parcs Nationaux et Peche du Ministere des Eaux de la Peche et des Fôrets.

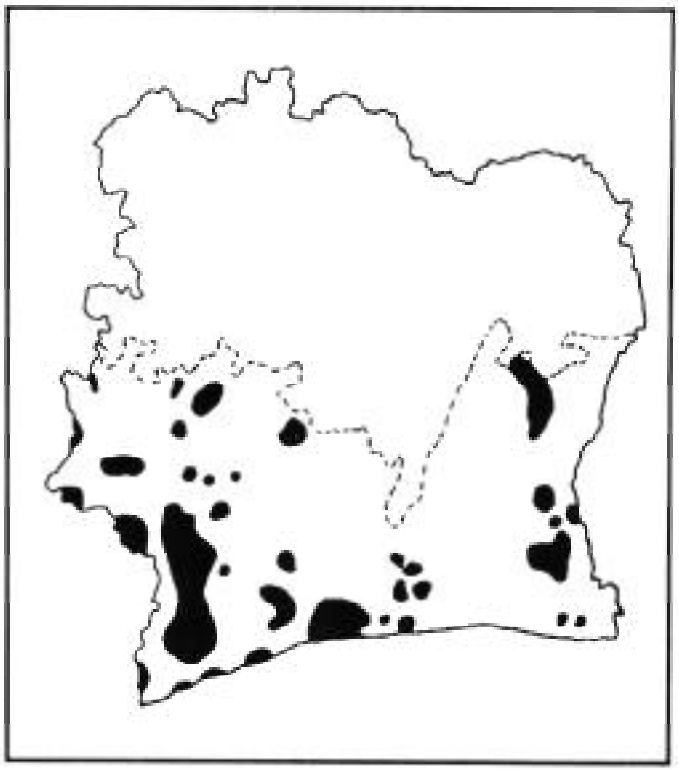

Figure 1. *Distribution of the forest elephant in Côte d'Ivoire in 1980 (Roth' et al., 1984)*

Table. Distribution and density of forest elephants in the Côte d'Ivoire

No	Name of area	Date Founded	Initial area km²	Forest area Km²	and %	Forest elephant Population	Forest Elephant Density
1	Keregbo		213	213	100	30	0.14
2	NP Marahoué		1,010	757	75	70	0.07
3	Haut Sassandra	1974	1,024	898	88	50	0.04
	Mont Tia	1974	163	138	85		
4	Duekoué	1976	536	413	87	15	0.03
5	NP Sangbe		950	900	95	30	0.03
6	NP Mont Peko		340	340	100	20	0.06
7	NP Tai	1972	3,400	3,400	100		
	Zone de Protection	1977	660	462	70		
	WR N'Zo	1972	730	730	100	800	0.11
	Hana		350	280	80		
	Rapide Grah		1,000	600	60		
	Haute Dodo	1973	1,094	845	77	70	0.04
8	Goin-Cavally	1978	560	522	93		
	Goin-Debe	1978	1,330	1,061	80		
9	Niegré	1975	1,056	692	69	50	0.05
10	Scio	1972	1,338	796	60	30	0.02
11	Tiapleu		380	228	60	10	0.03
12	Bolo		88	51	58	5	0.05
13	Davo		126	126	100	20	0.16
14	Okromodou	1973	945	432	46	50	0.05
15	Go-Bodienou	1978	600	217	36	20	0.03
16	NP Azagny		200	200	100	45	0.22
17	Songan	1952	310	258	83		
	Tamin	1952	463	206	45	150	0.09
	Mabi	1929	631	359	57		
	Yaja	1935	294	244	83		
18	Beki-Bossematie		389	233	60	30	0.07
19	Djambamakrou		274	164	60	30	0.07
20	Tene		4	4	100	5	1.25
	Total		**20,458**	**15,769**		**1,520**	**0.07**

Results

The total population of forest elephants in the Ivory Coast summarized in the table is estimated at 1,520 animals split up into 20 isolated sub-populations. These units consist of from five to 70 animals, except in the forest reserves of Songan, Tamin, Mabi and Yaja which contain an estimated 150 elephants, and the forest reserves of N'Zo, Hana, Rapide Grah and Haute Dodo with a total population of 800 individuals. In a personal comment, Boesch has said that the situation in the Tai National Park is very bad. A tremendous increase in poaching activities has reduced the number of elephants to about 100. This means a decline of 25% per year from the estimated population of 800 animals given by Merz in 1982.[16] Ignoring the natural rate of increase, the total loss of elephants in the Tai National Park approaches 90% of the population.

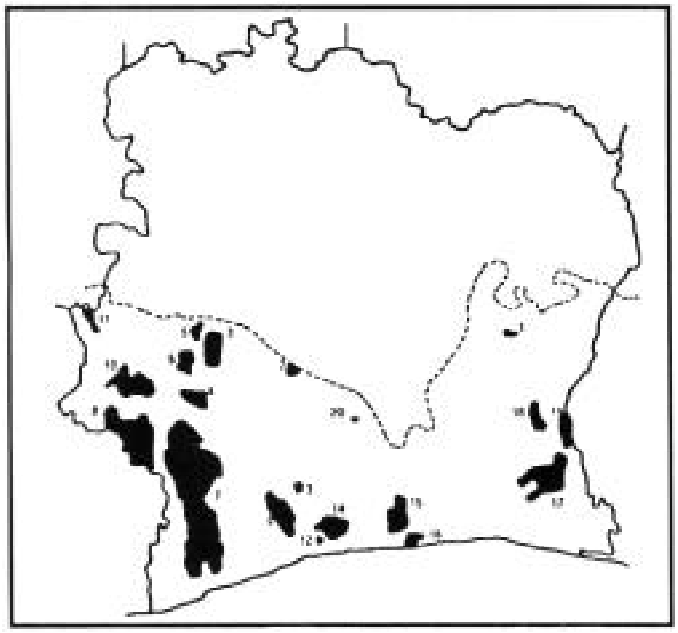

Figure 2. *Map of Côte d'Ivoire showing areas referred to above*

Contacts between different sub-populations do not exist. The mean density is estimated at 0.07 elephants per km² 'fluctuating between 0.22 animals per km in the Azagny National Park and 0.02 per km² in the Scio Forest Reserve. In the Tene Forest Reserve, a small forest patch completely surrounded by forest plantations, a group of about five elephants has been able to survive until now, even at the very high density of 1.25 animals per km². In 11 areas where Roth *et al.* proved the existence of elephants, animals could no longer be found.[17] The presence of elephants is largely concentrated on legally protected forest areas such as National Parks, Wildlife Reserves or Forest Reserves. But even such a status, resulting from de jure protection, is no guarantee for the survival and conservation of elephants.

Discussion

Over a period of nine years the habitat of the forest elephants in the Ivory Coast has been reduced by 40%. In the same time the number of forest elephants fell by 50%. Eleven elephant ranges have lost their entire elephant populations. A dramatic increase in human population has taken place, caused by a high birth-rate and a high immigration rate of allochthone ethnic groups. In the course of human expansion forest was increasingly cleared for settlements, pasturage, agriculture and logging. The consequence has been a decrease in wildlife habitats which, in turn, has caused various land-use conflicts between man and animal.

The elephant, as one of the most successful animals ever to have lived on earth, accepts certain alterations in habitat caused by some kinds of extensive logging. In the tropical rain-forest the elephant even seems to appreciate the secondary bush and forest vegetation which grows in clearings and supplies a rich variety of palatable fodder plants. If the changes allow a complete regeneration of vegetation the elephant is able to coexist with man. However, any transformation of the forest into ecologically dead areas excludes elephants. Such transformation is caused by a combination of selective logging and shifting cultivation, by agro-industrial plantations and by commercial hunting for meat or trophies. In nearly all elephant areas ivory poaching is the most serious hazard to the survival of the forest elephant. The deeper man penetrates into the last, closed forests the more illegal hunting for ivory with the aid of modern firearms and automatic pistols decimates the elephant population.

The annual death rate is estimated at 16%, comprising a natural mortality rate of 3% and a hunting rate of 13%. [18] The annual increase in forest elephants is estimated at 4% to 6%,[19.20.21] less than half of the animals killed in the same period. Thus, allowing for the birth rate, the decrease in forest elephants in the Ivory Coast is about 10 - 12% per annum.

National Parks and integrally protected Nature Reserves play a decisive role in the conservation of the forest elephant. These areas will soon be the last refuge for wild animals. The nationwide survival of the forest elephant in the Ivory Cast can only be ensured if, after basis populations in suitable forest areas have been defined, adapted wildlife measures are developed to realize an efficient, de facto protection. Such measures aim at effective control of the areas and an eradication of poaching, an activity which has become well organized.

Simultaneously, appropriate public relation work has to be carried out. Conservation measures will fail so long as the rural population is unaware of the problem and unready to support the conservation efforts.

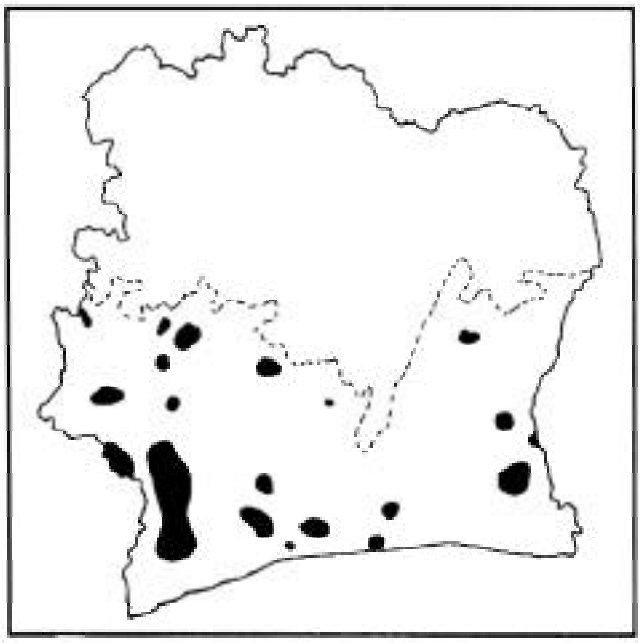

Figure 3. *Distribution of the forest elephant in Côte d'Ivoire in 1989*

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South Korea Re-Visited: The Trade in Rhino Horn and Ivory

from a Report by Tom Milliken

South Korea continues to be a major consumer of rhino horn in Asia. A domestic ban has not effectively curtailed availability according to surveys conducted by TRAFFIC Japan in late 1988, and as there is no regulation of domestic sales it is likely that smuggling continues. TRAFFIC has already made two visits to South Korea concerning this situation; the current trip continued past activities.

Dim Prospects for Registration of Rhino Horn

During a visit earlier this year, the Ministry of Health and Social Affairs (MHSA) had requested TRAFFIC Japan for specific examples of what other governments in the region have done to control domestic trade in rhinoceros horn and derivative products. At a meeting with MHSA officials on 9 August 1990 copies of *The Evolution of Legal Controls on Rhinoceros Products in Hong Kong*, a report prepared by TRAFFIC Japan in response to South Korea's request, were presented together with a briefing on the situation in Taiwan where authorities are currently registering rhino horn. Officials argued that under existing MHSA laws it is impossible to require registration or introduce possession licences for rhino horn: they stated that action could only be taken if South Korea joined CITES and introduced a new law providing such measures. While TRAFFIC has not yet obtained copies of relevant legislation to confirm whether current laws are insufficient, this contradicts what was said by MHSA in April, 1990. At the same time, officials pointed out certain practical differences with Hong Kong, mainly that South Korea is a large, diverse country where a general registration would be an overwhelming task.

MHSA further suggested there was no need to take exceptional measures to control the rhino horn trade because the seven-year-old import ban means that only a negligible amount of horn remains in the country and what does could be regarded as 'contraband'. Increased prices proved the shortage of rhino horn and TRAFFIC's 1989 survey had exaggerated its availability MHSA argued.

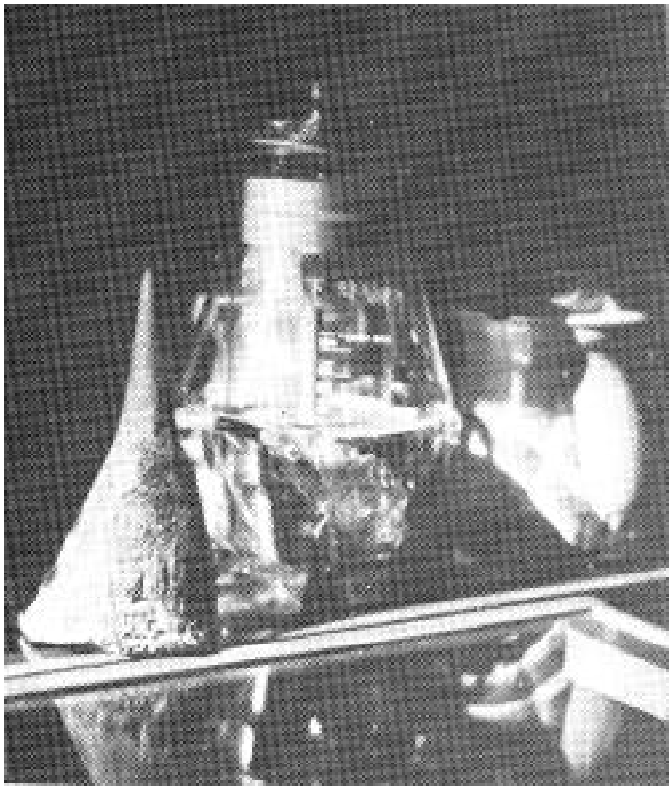
TRAFFIC pointed out that, in fact, 40% of shops surveyed in Seoul produced actual horn for inspection. Moreover, Taiwan has had similar price increases and increase in supply.

Concerning the legality of rhino horn possession, officials admitted that holding horn traded before the import ban could not be considered illegal. They countered the proposition that dealers could claim all stock as pre-1983 by saying that imports could be monitored because all foreign commodities entering Korea require licences. This, of course, fails to deal with rhino horn held by retailers who are not licensed importers, the problem of importers using old licences to justify present stocks, or the possibility of smuggled horn. Only a legally-mandated registration scheme and possession licences would solve these difficulties.

MHSA has, however, issued an official notification to six associations which possibly deal in rhino horn. On 3 April 1990 they sent to the Korean Pharmaceutical Association, Korean Herbal Medicine Doctors, Korean Association of Pharmaceutical Importers/Exporters, Korean Medicine Association, Pharmaceutical Manufacturers' Association and Pharmaceutical Wholesalers' Association the following, unofficially translated, letter:

> The world-wide trend is for the protection of endangered species. Thus, importation of rhino horn as an ingredient for medicinal purposes was prohibited in 1983. However, some herbal medicines still use rhino horn as an ingredient and smuggling is still prevailing.
>
> We especially request cooperation to stop the use of smuggled rhino horn and not sell it. In case rhino horn is used as an ingredient in herbal medicine, we wish to remind you that such practice could (would) be a violation of existing law and subject to strong legal action.

MHSA officials said there had been no particular response from industry sources to their letter. Other letters were sent to Customs Administration, requesting diligent implementation of the import ban, and to municipal and provincial governments, requesting enhanced surveillance to discover illegal transactions and the possible flow of contraband trade.



***A** black rhino horn on the counter of a pharmacy in Seoul*

While these actions are to be praised, there is little legal backing for MHSA's stance and, apparently, insufficient legal basis to take the measures required to deal with the problem.

Ivory Trade: South Korea's ivory trade has assumed international importance following the world-wide ivory trade ban. Evidence that imports of worked ivory from Hong Kong increased dramatically in late 1989 have fuelled concerns that South Korea, a non-party to CITES, or the country's Free Trade Zones might become new regional bases for illegal trade in ivory products to neighbouring countries, especially Japan. South Korean Customs statistics record imports of worked and raw ivory. Annual imports from 1985 to May 1990 are presented below:

Year	Worked Ivory	Raw Ivory
1985	124kg	0kg
1986	560kg	555 kg
1987	358kg	600kg
1988	294 kg	2,249 kg
1989	28,828 kg	800 kg
1990(Jan/April)	2,129 kg	0 kg

These statistics demonstrate that South Korea's ivory trade was for the most part negligible until 1988 when the commodity was deregulated as a luxury item subject to import controls. Trade greatly increased that year, partially stimulated by the Seoul Olympic Games. Worked ivory imports soared to record heights the following year. In mid-1989 the prohibition on importing raw ivory was re-enforced and there has been no trade reported after June 1989. Imports of worked ivory, which remain unregulated, have continued in 1990 and the most-recently published Customs data for the first four months of the year show trade volumes significantly higher than those prior to 1989.

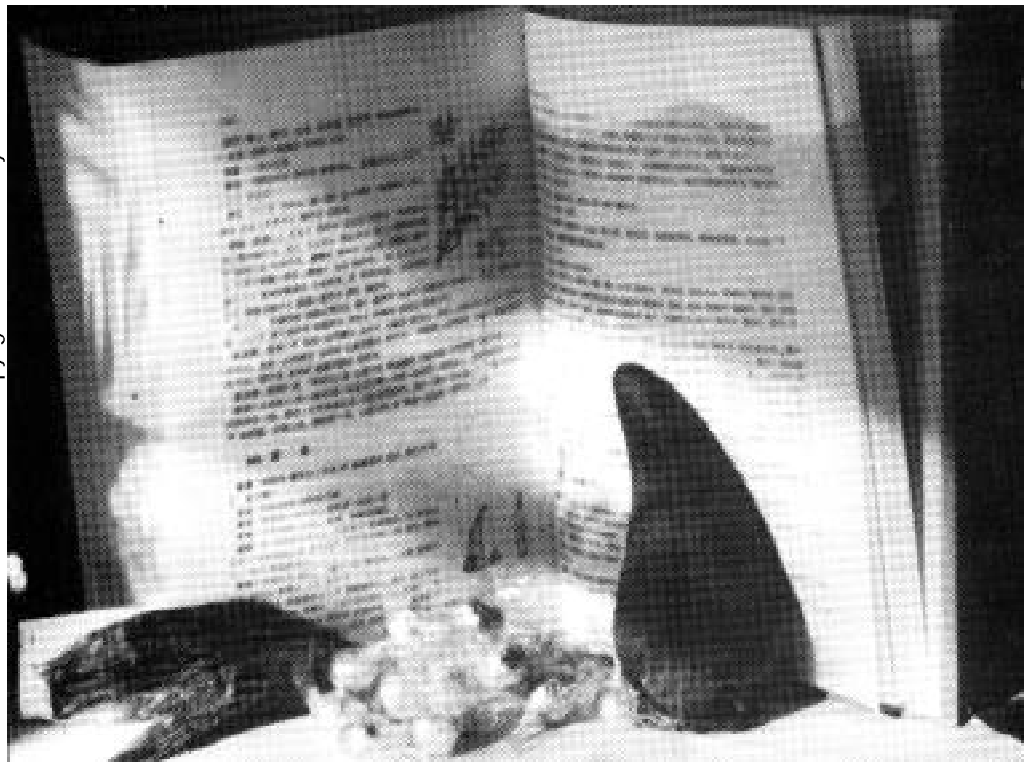
In the first four months of 1990, imports of worked ivory have been recorded from:

Cameroon	347 kg
Hong Kong	1,382 kg
Taiwan	400 kg

Imports from Cameroon were received in January and April, 1990. If the January transaction occurred before 18 January when the international import ban under CITES took effect, it probably was legal under the terms of the Convention; April imports are likely to have been in contravention of CITES. Taiwan imposed a ban on the import and export of raw and worked ivory in August 1989, so the legitimacy of that trade is questionable. Although Hong Kong placed a reservation on the African elephant and continued trading worked ivory until 17 July 1990, the reply to a Parliamentary question in the UK House of Commons said that only 214.6 kg of raw and worked ivory had been legally exported to South Korea between 18 January and 31 May, 1990.

Raw Ivory Trade Policy

As from 8 March 1989 commercial import of raw ivory into South Korea was restricted under the Wildlife Protection and Hunting Law to cases involving re-export, scientific research, or trade for zoos; scientific research is the only classification officials are prepared to sanction trade under and this is said not to have happened. Implementation of the law, specifically the issuing of licences, falls under provincial and municipal authorities. Importing ivory as personal effects, a form of trade not regulated under the original measure and apparently used as a means of evasion, was banned in June 1989.



In front of a Korean traditional medicine book describing their uses, lie two rhino horns and a packet of Chung Sim Won balls which contain some horn as an ingredient

It was learned that the South Korean interpretation of raw ivory follows the international Harmonized System established under the Customs Cooperation Council. Ivory is referenced under 0507.10-1000 in trade statistics and encompasses all forms of raw ivory, including powder and waste. South Korea's current prohibitions are comprehensive and do not show any obvious loopholes.

Worked Ivory Trade Policy

In talks with the Forestry, the Environment, and the Customs Administrations it was pointed Out that the almost hundred-fold increase to nearly 29 tonnes of worked ivory imports in 1989 had caused international anxiety as to future Korean trading intentions. Also, at least two Korean nationals had recently

been implicated in an attempt to smuggle 70 kg of raw and worked ivory from Hong Kong where there is a large volume of unaccounted for ivory.

Forestry Administration officials said they were seriously mulling over the imposition of a total ban on worked ivory imports later in the year, and were currently engaged in discussions on the matter with the Ministry of International Trade and Industry. Customs agreed with a ban, but pointed out that they merely implemented, and did not make, import policy.

There is a possibility that ivory imports for 1989 have been incorrectly recorded. The 28,700 kg of worked ivory received from I-long Kong in May 1989 has a recorded worth of US$ 26,218, less than a dollar a kilo. Most other worked ivory imports were valued at about US$ 100 per kilo. Possibly only 287 kg were imported, or the price was mis-recorded, or the consignment grossly undervalued. In any case, an official of the Forestry Administration said that they were treating the figures as correct and using them to support their endeavour to ban imports of worked ivory.

Forestry Administration also said that there was resistance to imposition of tighter regulations from one or two companies. A case which had been reviewed entailed the authorization by the Chollabuk-do Provincial government on 17 April, 1989, of the export to Japan of 7,062 pieces of worked ivory totaling some 311 kg. These were thought to have been unfinished name seals. Japanese Customs records show 140 kg in May as the only imports from South Korea in the year.

Free Export Zones

There are two 'Free Export Zones' (FEZ) in South Korea, the well-known one at Masan in Kyongsangnam-do Province, and a newer zone at Iri, Chollabuk-do Province. Since FEZs are not regarded as South Korean territory they are not under normal regulation but, although raw materials enter and manufactured products are exported freely, all imports remain subject to Customs inspection. FEZs in the United Arab Emirates have been used by certain Hong Kong dealers to process illegally traded ivory. The rise in South Korea's worked ivory imports has led to fears that similar operations might be set up there.

Masan FEZ was established in 1970 and currently contains 71 companies primarily engaged in the manufacture of electrical and electronic products, and machinery. Two-thirds of these involve Japanese investment; the rest are Korean, American, Hong Kong, Finnish and Singaporean owned, many involving joint funding. Officials of this FEZ said no companies were engaged in making jewellery or related products and they doubted any ivory entered the zone. Before a company is allowed to operate in the FEZ they must register and, in so doing, identify the types of raw materials they will use. The Director General said that he would not accept any concern dealing in ivory. The situation at the FEZ in Iri, established in 1973, is very much the same. Of the 26 occupants, most are engaged in manufacturing textiles, leather goods and electrical and electronic equipment.

However, Iri also boasts two other special domestic economic development areas called 'Industrial Estates' which offer tax and other incentives to entrepreneurs. One of these is a special Jewellery Estate where some 76 companies have facilities. These establishments do deal in ivory and, indeed, Iri's promotional pamphlet lists ivory as a material used in manufactures. Custom's officers said they were already monitoring and prohibiting trade in raw ivory and would be aware of any ivory brought into the Jewellery Estate. The one known importer of ivory, the Dabo Gem & Metal Mfg. Co., claimed to have halted importation.

Availability of Ivory Products

Ivory is not commonly found in Seoul shops. In the fashionable Myong-dong shopping district few ivory accessories were on display; the huge Lotte department store featured various ivory items as part of a special promotional display of Hong Kong products, but the quantity was limited and demand insignificant. Sales personnel mentioned that Korean women, unlike Japanese, do not like the colour of ivory and prefer brighter accessories. Indeed, very few middle-aged women are seen wearing ivory jewellery.

A number of shops selling name seals were visited but ivory seals were rarely displayed or found in significant numbers; wood and stone predominated. Although the tourist bazaars in Itaewon were more or less devoid of ivory, in Pusan, around the Pusan and Tower hotels, souvenir shops were offering Hong Kong-made ivory accessories and other products. Probably their best customers are the many Japanese visitors in this area. It seems that South Korean domestic consumption is limited, and current local demand is unlikely to cause a rise in imports.

CITES Ratification

Little has been done towards either making the intra-departmental agreements or formulating the policies which are needed for CITES ratification, despite repeated assurances over the last five years that there is no fundamental opposition to South Korea becoming a member. Major changes in the personnel of the Nature Conservation Division of the Environment Administration have not helped progress. There appears to be a lack of both motivation and any sense of urgency to overcome the particular problems that exist with respect to CITES issues as a result of the fragmented and decentralized system of government.

Recommendations

1. **Rhino Horn** The South Korean government should continue to be pressed to legislate that all rhino horn stocks currently in the country be registered and possession licensed.

2. **Ivory Trade**

(a) The current effort by the Forestry Administration to obtain a ban on imports of worked ivory should be supported.

(b) South Korea's trade in ivory should continue to be monitored to identify sources, the level of trade, and possible violations under CITES.

3. **CITES** Ratification An international campaign should be instigated to publicize South Korea's failure to ratify CITES and her continuing trade in endangered species. Enough pressure should be exerted to force the pace of South Korean progress towards ratification; the global impact of South Korean trade in endangered species is sufficient to warrant considering action on a par with the US governments sanctions against Singapore several years ago.

The Collapse of India's Ivory Industry

Lucy Vigne

For over 2,000 years Indian traders legally imported ivory from East Africa - until January 1990. They had been among the largest ivory importers and manufacturers in the world until independence in 1947. In order to increase revenue at that time, the new government introduced import duties on ivory, duties which gradually increased, causing a slow decline in the ivory industry. Annual average imports fell from 246 tonnes in the late 1940s to only 13 tonnes in the mid-1980s. By the late 1980s there were severe regulations on the trade: everyone involved needed an annual licence and had to submit monthly returns to India's CITES Management Authority with full details of their ivory stocks. It was this added paperwork and harassment that drove illiterate craftsmen away from the trade, not to mention ivory shortages and higher prices. In 1978 there had been about 7,200 ivory carvers but by early 1989 nearly three-quarters of them had deserted the craft.

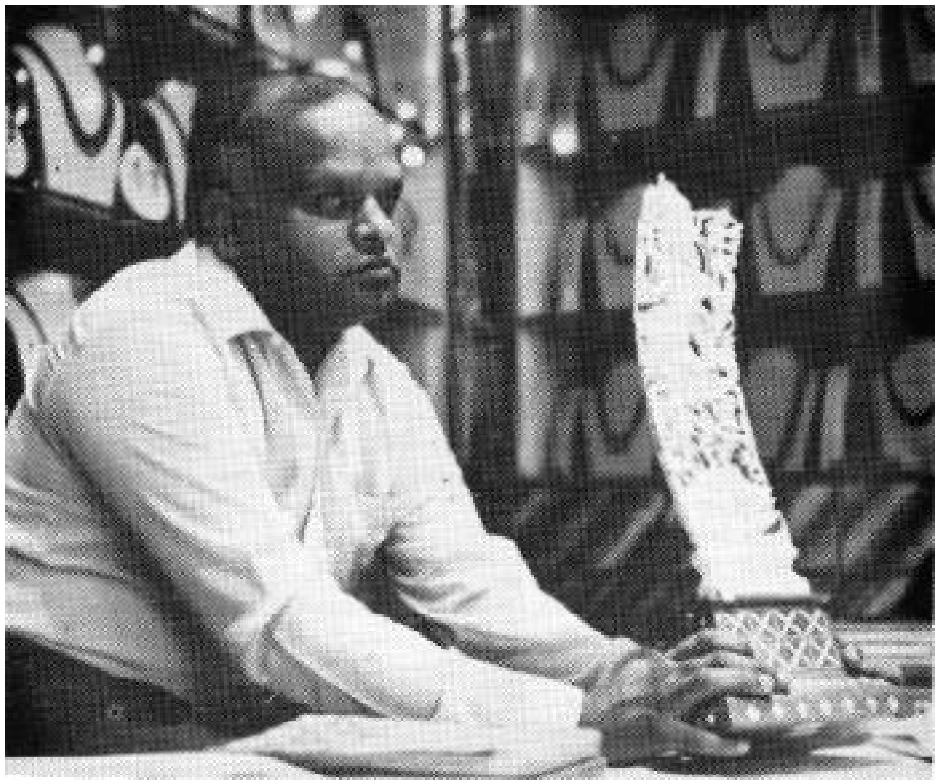
During 1989 came the international outcry against ivory trading, followed by a world-wide reaction. Kenya and Tanzania banned ivory exports. Worked ivory was made a prohibited import in North America, Western Europe and Japan. The new CITES restrictions came into force, stopping all commercial ivory trading between member states, except for the few countries which took out reservations.

As a result, in 1989 Indian traders imported 6,763 kilos of raw ivory and legally exported a mere 590 kilos of carved ivory; they could find very few wholesale markets for their exports. From 18 January 1990, all imports were banned. The price of raw ivory in India at that time was US$200 a kilo, 15% less than the previous year. Dealers simply saw no point in buying it. In order to help carvers and traders dispose of their stocks, the new Indian government submitted to CITES a reservation which would have allowed exports for six months more. However, the document arrived at the CITES headquarters in Switzerland a few days after the final date of 18 January 1990 and therefore the reservation could not be granted. In fact it takes many years to sell large ivory carvings, so a few extra months would not have greatly helped the dealers.

During 1989 over half of the remaining ivory craftsmen changed jobs or were made redundant. Some have turned to carving wood, but the pay is around half that for working ivory. There are no major re-training schemes, so the carvers have little opportunity of starting new careers. In contrast, the rich ivory dealers did not suffer financially. They simply turned their attention to other handicrafts and are selling brassware, carpets, embroidery, jewellery, silks, silver and wood carvings very successfully. Ivory carvings are still on display as the domestic market remains legal. Since September 1989, however, retail sales have fallen by 85**%.** Negative publicity and international trade bans have worked; foreign tourists no longer want or dare to buy ivory except perhaps for tiny pieces of jewellery and miniature paintings on ivory which are easily hidden.

Dealers have not reduced their prices, as they realize that high costs are not the reason for the decline in sales. Only a few rich Indians choose to purchase ivory carvings for decoration or worship, preferring statues of Hindu gods and goddesses. So dealers envisage having to put many of their large ivory pieces, which they will not be able sell, into their own little family museums, but they are mostly rich enough to indulge in this. It is the ivory craftsmen in India who are distraught; they can only hope that some trade will re-open after the next CITES conference in 1992.

The international ivory ban has been extremely successful at crippling the ivory industry in India but not in reducing the price of raw ivory. The big question which remains is whether the collapse of the ivory industry in Asia will in time be reflected in the price of ivory and what effect this will have on African elephants and poaching. This important question must be addressed before the success of the ivory trade bans can be fully judged, and the answer must deeply affect future decisions on the world ivory trade.



Salesmen in India are depressed that during the last few months they have been unable to sell their ivory carvings

Who Gets the Food?

Fred K. Waweru

The Surroundings

Within the 01 Jogi Ranch in the Laikipia district of Kenya is a ring-fenced area of some seventy-three square kilometres, or 18,000 acres, which is the 01 Jogi Game reserve. This private reserve contains a number of shallow dams and, until recently, ample woody vegetation to feed all the animals within its bounds. Secure from hunters and with ample water and food, the animal populations have all been growing larger. Until 1988 this increase was assisted by 'traps' which encouraged individuals to enter the reserve but made it difficult for them to leave.

The reserve is on the eastern side of the ranch and separated from it by the Nanyuki-Doldol road. It includes the scenic Lodaika Mountains which rise to over 2,200 m above sea level, the Pyramid hills, and the Ilpollei plains which are at an altitude of 1760 m. Rainfall is about 500 mm a year if both the April-June and October-December rainy seasons are good, but the latter is somewhat unreliable.

The Problem

Over the past few years the woody vegetation inside the reserve has been seen to be deteriorating in quality and quantity, particularly *Acacia drepanolobium,* one of the major browse plants for both rhinos and giraffes. Both the management of the reserve and the Kenya Wildlife Service became concerned that, especially in view of the increasing number of rhinos, there might be some risk to future food supplies.

In addition to the rhinos and giraffes, another 2,400 herbivores from 20 species live in the reserve; there are five species of carnivore. There are no lions and the three cheetah are tame, so the eight leopards, 32 hyenas and 50 jackals represent the only natural predators in the area. Without the usual predator-prey population control and with the current security and food supply, it is quite easy to have a very rapid expansion in numbers of fast breeding herbivores. Buffaloes and giraffe already account for some 65% of the total animal biomass. If the situation is allowed to continue unaltered there is a strong probability that the present diversity of animals will decrease as poor competitors starve. The ecosystem of the reserve is delicately balanced; the unreliable rains do not help.

Before any rational plan could be made it was obviously necessary to discover the total mass of animals living in the reserve, precisely which plants grew there and, in particular, which of these supplied rhinos and giraffes with the bulk of their food.

Methods and Results

Plant samples were collected from all over the reserve, pressed, and later identified by the East African Herbarium; a list of the 101 species from 37 families is given in Table 1. Eleven transects each of at least 100 m in length were sampled using the Point Centred Quadrat technique and the data analysed for density and above-ground biomass.

Table 1. Checklist of plants in Ol Jogi Game Reserve

Family	Species	Species
Acanthaceae	*Barleria eranthemoides*	*Barleria acanthoides*
Agavaceae	*Sansevieria intermedii*	
	Dracaena floribundum	*Sansevieria rajfillii*
Amaranthaceae	*Aerva lanata*	*Psilotrichum elliotii*
	Achyranthes aspera	*Pupulia lappacea*
Amaryllidaceae	*Scadoxus multiforus*	
Anacardiaceae	*Rhus natalensis*	
Apocynaceae	*Carissa edulis*	*Acokanthera schimperi*
Araliaceae	*Cussonia holstii*	
Asllepiadaceae	*Grampocarpus stenophyllus*	*Sarcostemma viminale*
Balanitaceae	*Balanites glabra*	*Balanites aegyptiaca*
Boraginaceae	*Cordia ovalis*	
Burseraceae	*Commiphora schimperi*	
Capparidaceae	*Boscia angustifolia*	*Maerua triphylla*
Commelinaceae	*Commelina benghalensis*	*Commelina africana*
Compositae	*Erlangea cordifolia*	*Helichrysum schimperi*
	Helichrysum glumaceum	*Felicia muricata*
	Aspilia mossambicensis	*Conyza volkesii*
	Gutenbergia boranensii	*Volutaria lippii*
	Conyza floribunda	
Convolvulaceae	*Convolvulus sagittatus*	*Ipomea blepharaphylla*
Crassulaceae	*Kalanchoe densiflora*	
Curcurbitaccae	*Cucumis aculeatus*	
Ebenaceae	*Euclea divinorum*	
Euphorbiaceae	Croton dichogamus	
Gramineae	*Pennisetum mezianum*	*Pennisetum stramenium*
	Engrostis temifolia	*Chloris virgata*
	Aristida adoensis	*Themeda triandra*
	Panicum maximum	*Sporobolus fimbriatus*
	Harpachne schimperi	*Chloris roxburghiana*
	Emeapogon schimperiana	*Sporbolus helvolus*
	Rhynchelytrum repens	*Hyparrhenia papillipes*
	Aristida mutabilis	
Iridaceae	*Gladiolus natanensis*	
Labiatae	*Fuerstia africana*	*Plectranthus latiflorus*
	Ocimum suave	*Plectranthus cylindrica*
	Plectranthus tenniflonis	*Jasminium floribundum*
	Dombcya rotundifolia	
Liliaceae	*Asp haragus falcatus*	*Aspharagus buchananii*
Malvaceac	*Sida ovata*	*Hibiscus aponeuris*
	Abutilon mauritaneum	*Abutilon fruiticosum*
	Hibiscus flavifolius	*Hibiscus lunarifolius*
Mimosaceac	*Acacia nilotica*	*Acacia drepanolobium*
	Acacia mellifera	*Acacia etbaica*
	Acacia brevispica	*Acacia xanthophloea*
	Acacia tortilis	
Nyctaginaceae	*Boerhavia dijfusa*	
Papilionaceae	*Indigofera arrecta*	*Dolichos oliveri*
	Indigof era bogdanii	
Portulacaceae	*Portulaca quadrifida*	
Rhamnaceae	*Rhamnus staddo*	*Ziziphus mucronata*
	Scutia myrtina	
Rubiaceac	*Xeromphis keniensis*	*Rytigynia toronthifolia*
	Pavetta gardenifolia	*Tarenna graveolus*
Sapindaceae	*Dodonaea viscosa*	
Solanaceac	*Solanum incanum*	*Monechma debile*
	Solanum hastifolium	
Sterculiaceae	*Dombeya rotundifolia*	
Tiliaceae	*Grewia bicolor*	*Grewia tembensis*
Umbelliferae	*Diplolophium africanum*	*Heteromorpha trifoliata*
Verbenaceae	*Clerodendrum myricoides*	
Vitaceae	*Roicissus tridentata*	*Cyphostema orondo*

Giraffes were observed from a distance and, with the aid of binoculars, the species they ate noted. Rhino feeding tracks were followed to discover their diet; shoots that have been bitten by a rhino are easy to identify.

Diets

The records show rhinos eating from a total of 26 species with *Acacia etbaica* the most important. Giraffes utilized 15 species, 11 of them in common with the rhinos, and their favoured food was *Acacia mellifera*. This was also eaten by the rhinos but not so often as *Acacia nilotica, Acacia drepanolobium* and *Grewia* spp. Second and third choices for giraffes were *Acacia drepanolobium* and *Euclea divinorum* **.**

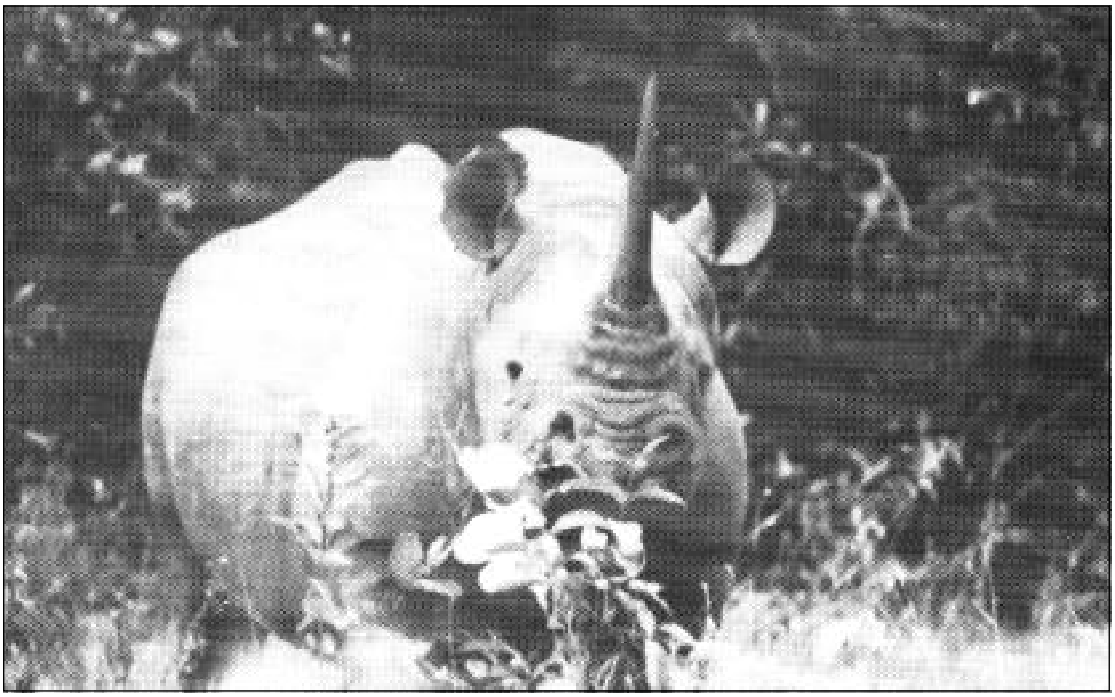
The full dietary breakdown for the two species is given in Table 2 and show a 42% overlap between them. *Acacia drepanolobium* is known to be preferred by rhinos but in the reserve is not readily available to them. However, this is not to imply that the giraffes have cornered the supply. There is no direct competition between the two animals as rhinos are solitary eaters of whole shoots at a height of 1.0±0.7 m while giraffes feed in groups off the non-lignified parts of plants growing at a height of 2.2±1.0 m.

The Food Supply

The above-ground biomass and density was computed from the data obtained during vegetation sampling and are expressed in kg/km^2 and stems/km^2 in Table 4. The results indicate that in the traps, outside the reserve, species diversity was lower but the densities and biomass values higher. Species which are indicators of poor range trends such as *Solanum incanum* and *Hibiscus* spp. are common within the reserve and in some cases absent outside. The higher biomass densities in the reserve's surrounds can be attributed to the healthier forest canopy which exists there compared to that inside the reserve. It is worthy of note that none of the dead *Acacia drepanolobium* seen in the reserve were only of rhino eating level height; they had been high enough for giraffe to have used them for food.

Table 2. Dietary Composition in the Reserve

Species name	% composition	
	Rhinos	Giraffes
Acacia etbaica	36.6	4.9
Acacia nilotica	10.5	6.6
Acacia drepanolobium	9.9	16.5
Grewia spp.	8.8	0.9
Acacia mellif era	8.6	21.0
Rhus natalensis	4.9	6.4
Commiphora schimperi	2.7	-
Solanum incanum	2.7	0.6
Clerodendrum myricoides	2.4	-
Barleria spp.	1.9	-
Hibiscus aponeuris	1.5	5.3
Plectranthus cylindrica	1.5	-
Carissa edulis	1.3	-
Olea africana	1.3	-
Sansevieria spp.	1.1	-
Justicia flava	0.9	-
Achyranthes aspera	0.6	-
Acacia brevispica	0.6	-
Balanites spp.	0.4	5.1
Euclea divinorum	0.4	9.4
Ziziphus mucronata	0.2	-
Kalanchoe densiflora	0.2	-
Phyllanthes spp.	0.2	-
Sarcostemma viminale	0.2	-
Maerua triphylla	0.2	3.6
Scutia myrtina	-	6.2
Ilibiscus flavifolius	-	4.5
Acokanthera schimperi	-	4.2
Acacia xanthophloea	-	3.0
Total %	**99.6**	**98.2**



Does a l. 7m tall photographer classify as rhino browse?

The Chances of Hunger

Using the East African regression for rainfall bio-mass relationship, the expected animal stocking rate for the reserve is 5,155 kg of animal weight per square kilometre. With an area of 48.4 km^2 the theoretical mass of animals the reserve can support is thus 249,502 kg. Presently, Table 3 shows an estimated 581,285 kg of animals to be living there, 2.3 times the theoretical amount.

Kilimanjaro elephant after dining out in Amboseli

Table 3. Checklist of Game Animals in Ol Jogi

Name	Species	Number counted in 1989	Biomass kg
Herbivores			
Baboon	*Papio cynocphalus*	300	5,400
Gerenuk	*Litocranius walleri*	60	2,100
Giraffe	*Girrafa camelopardalis*	142	109,340
Greater Kudu	*Tragelaphus sdtrepsiceros*	38	11,400
Black rhinoceros	*Diceros bicomis*	11	11.0
Bland	*Tragelaphus oryx*	95	35,485
Buffalo	Syncerus caffer	540	270,00
Dikdik	*Madoqua guentheri*	30	150
Duiker	*Cepherlophus callipygus*	6	90
Grants gazelle	*Gazella granti*	102	5,100
Hartebeeste	*Alcelaphus buselphus*		
Impala	*Aepyceros melampus*	400	18,000
Klipspringer	*Oreotragus oreotragus*	32	64,000
Oryx	*Oryx gazella*	50	8,350
Reedbuck	*Redunca fulvorufula*	40	1,200
White rhino	*Ceratetherium simum*	3	6,000
Steinbok	*Raphicerus campestris*	6	120
Warthog	*Phacochoerus*	79	1,975
Waterbuck	*Kobus elltpsiprymnus*	120	14,400
Wildebeest	*Connochaetes taurinus*	11	1,815
Burchell zebra	*Hippotigris quagga*	260	61,880
Grevy zebra	*Hippotigris grevyi*	31	8,680
Total			581,285
Carnivores			
Cheetah	*Acinoryx jubabus*	3	
Leopard	*Panthera pardus*	8	
Spotted hyena	*Crocuta crocuts* }	32	
Striped hyena	*Hyaena hyaena* }		
Jackal	*Caris*	50	

At first sight this would appear to be an insupportable situation but it must be remembered that the theoretical figure is a general one for the East African region and would only be ideal when estimating for large areas. It is, however, the only one available and does provide a rough guide to the stocking rate for a given location. Nevertheless, it would appear that the enhanced breeding has resulted in a rather larger herbivore population than the reserve can support on a continuing basis and this is confirmed by the presence of the poor-range species. It looks as if some of the giraffe, buffalo and zebra will have to go, to benefit both the remaining animals and the vegetation.

Table 4. Densities of above-ground woody biomass

Species Name	Inside the Reserve		Outside the Reserve	
	Density stems/km²	Biomass kg/km²	Density stems/km²	Biomass kg/km²
Barleria spp.	3,491	34.9		
Hlibiscus spp.	12,950	2,072.0	25,200	4,962.2
Grewia spp.	10,360	4,246.6	6,126	7,825.0
Acacia drepanolobium	19,031	175,085.2	14,201	130,649.0
Euclea divinorum	3,829	59,732.4	21,720	584,268.0
Rhus natalensis	3,941	59,903.2	7,936	95,232.0
Aspilia mossambicensis	1,013	91.2	14,201	11,787.0
Aerva lanata	901	9.0		
Scutia myrtina	1,126	49,994.4	7,101	418,959.0
Psiadia punculata	113	0.6	2,367	24.0
Asparagus spp.	5,856	5.9	8,075	8.4
Justicia flava	901	0.03	975	1.0
Clarondedrum myricoides	450	4.5	418	13.0
Solanum hastifolium	1,013	2.0		
Solanium incanum	15,089	75.4		
Jusrninum spp.	338	0.7	4,316	49.0
Phyllanthes spp.	563	1.1		
Abutilon mauritianum	4,730	14.2		
Indigofera arrecta	563	0.6	975	195.0
Sansevieria rafillii	1,577	9.5		
Achyranthes aspera	901	18.0		
Acacia etbica	4,955	294,327.0		
Sida ovata	450	0.9		
Acacia mellifera	5,293	494,366.2	418	3,344.0
Lippia javanica	338	3.4		
Balanites aegyptiaca	1,802	1,585.7	975	1,141.0
Cordia ovalis	450	12,780.0		
Dracaena spp.	113	0.7		
Pavetta spp.	113	6.8		
Acacia nilotica	113	2,452.1		
Plectranthus spp.	1,013	8.1		
Croton microstychs	113	3.4		
Kalanchoe densifolia	113	0.6		
Ocimum suave	113	2.3	418	4.2
Maerua triphylla	1,013	445.7	1,949	39.0
Acacia xanthophloea			975	877.5
Sarcostema viminiale			1,949	195.0
Xeromphis keniensis			418	42.0
Rhamnus staddo			1,949	58.0
Lantana triphylla	450	4.5	4,734	95.0
Carissa edulis	113	1,021.5		
Cucummis spp.	113			
Commiphora schimperi	1,577	29,221.8		
Totals		1,158,310.3		1,259,768.3
Total density	1.07×10^5		1.27×10^5	

A Report of the Laikipia Elephant Count, 1990

Chris Thouless

A total count of elephants in Laikipia District and the adjoining parts of western Isiolo and southern Samburu Districts was carried out on the weekend of 15-16 September 1990 as part of the Kenya Wildlife Service's Laikipia Elephant Project. Eleven aircraft covered approximately 10,000 km^2 including all the private ranches of the Laikipia plateau, settlement areas in the south of the district, the Mukogodo reserve, pastoralist areas in Isiolo District as far north as the Ewaso Nyiro river, and the Samburu and Buffalo Springs Game Reserves. In the preceding week a sample count was carried out by the Department of Resource Surveys and Remote Sensing (DRSRS), and, in several forest areas where counting from the air was known to be difficult, additional ground counts were conducted.

The count was carried out by a wide range of people including members of Kenya Wildlife Service (KWS), local ranchers and representatives of various conservation organizations. Many of the participants had also taken part in the 1988 and 1989 Tsavo counts which used the same methods. A substantial contribution was made by private individuals who donated their time and use of aircraft; KWS provided three aircraft.

Introduction

The Laikipia Plateau of north-central Kenya lies between the highlands of Mount Kenya and the Aberdares. On the east it is bounded by an escarpment down to Samburu country and on the west joins the Lerochi Plateau south of Maralal. Much of Laikipia still consists of large-scale private ranch-lands and it is in these areas that Kenya's second largest elephant population has found refuge from the poaching further north. The presence of these elephants has caused many management problems, and to tackle some of these the Laikipia Elephant Project was started by the KWS in May 1990. A priority for the project was to establish how many elephants there were in the area. Although KREMU (now DRSRS) has conducted a number of sample counts, the clumped distribution of elephant herds means such counts do not give accurate figures and for this reason it was felt necessary to carry out a total count.

In the past Laikipia appears never to have contained large numbers of elephants. It is thought there was a seasonal movement south from Samburu into the district by elephants following the major river systems of the Ewaso Ngiro, Ewaso Narok and Mutara. After a brief stay, they would return north.

From the mid-1970s, however, the elephant population in Laikipia increased and showed a tendency to remain in the area for most of the year. It is very likely that this change was due to widespread poaching in Samburu District. The private ranches of Laikipia provided the security missing in the northern part of the elephants' range as well as sufficient food and water. An indication of this is given by the ratio of live to dead elephants as counted by DRSRS for the two districts in 1977. The estimate for Laikipia was 2,093 live elephants to 51 dead (41:1), while in Samburu it was 710 live to 2,793 dead (1:3.9).

Although elephants were tolerated on many of the Laikipia ranches, they interfered with ranching operations, ruining fences, breaching dam walls, and pulling up water piping. On ranches such as Ol Pejeta, well-established fencing systems for running cattle in paddocks were almost completely destroyed by elephants.

Another problem was that the southern movement of elephants brought them into contact with the northern expansion of small-scale farming on government and private settlement schemes. The farmers in these areas did not have the capital resources available to large scale ranchers and were powerless to keep the elephants off their plantations of maize and other crops, which could be destroyed overnight by a herd of elephants. Most of Laikipia is extremely marginal for farming, and the presence of elephants further reduces the possibility of successfully producing a harvest.

Several attempts were made in the late 1970s to drive the elephants back north. In March 1978 300-500 were driven from the region of Tharua/Solio down the Ewaso Ngiro to El Karama using 25 men, four ground vehicles, a helicopter, and fixed wing aircraft. A second drive attempted to move elephants out of the Rumuruti area but had little success. In 1979 similar methods were used to push elephants out of Rumuruti and from the Lariak Forest. Although it was possible to move the animals, it was very difficult to stop them from breaking back, and overall the operation was considered a failure.

In late 1981 the Senior Warden (Planning), Peter Jenkins, and the Senior Biologist, Patrick Hamilton, were charged with investigating this situation in order to find a solution. After consultation with the local community they produced a report in March 1982 recommending that an electric fence be built across Laikipia, running 162 km from the Baringo escarpment in the west to the Loldaiga Hills in the east. After the elephants had been driven north, this would have separated ranchers who were prepared to accept elephants on their land from ranchers and small farmers in the south who did not want them. The fence was never built, largely due to lack of funds but also because of the realization that failure to maintain the fence along any section would undermine the whole exercise.

Since 1982 there has been no improvement in the situation and, as a result of the continued sub-division for settlement of what was previously ranch-land, the zone of intense conflict has increased. Some ranches have abandoned the attempt to maintain internal fences and consequently have been forced to adopt less efficient management practices, while others such as Mogwooni and Tharua have become completely fenced with near total exclusion of wildlife. Laikipia is now a patchwork of areas where elephants are tolerated and places where they are regarded as a nuisance.

The KREMU estimate for the number of elephants in Laikipia District has ranged from 1,927 in 1978 to 4,106 in 1980, and was 2,492 for 1987.[1] However, little confidence can be attached

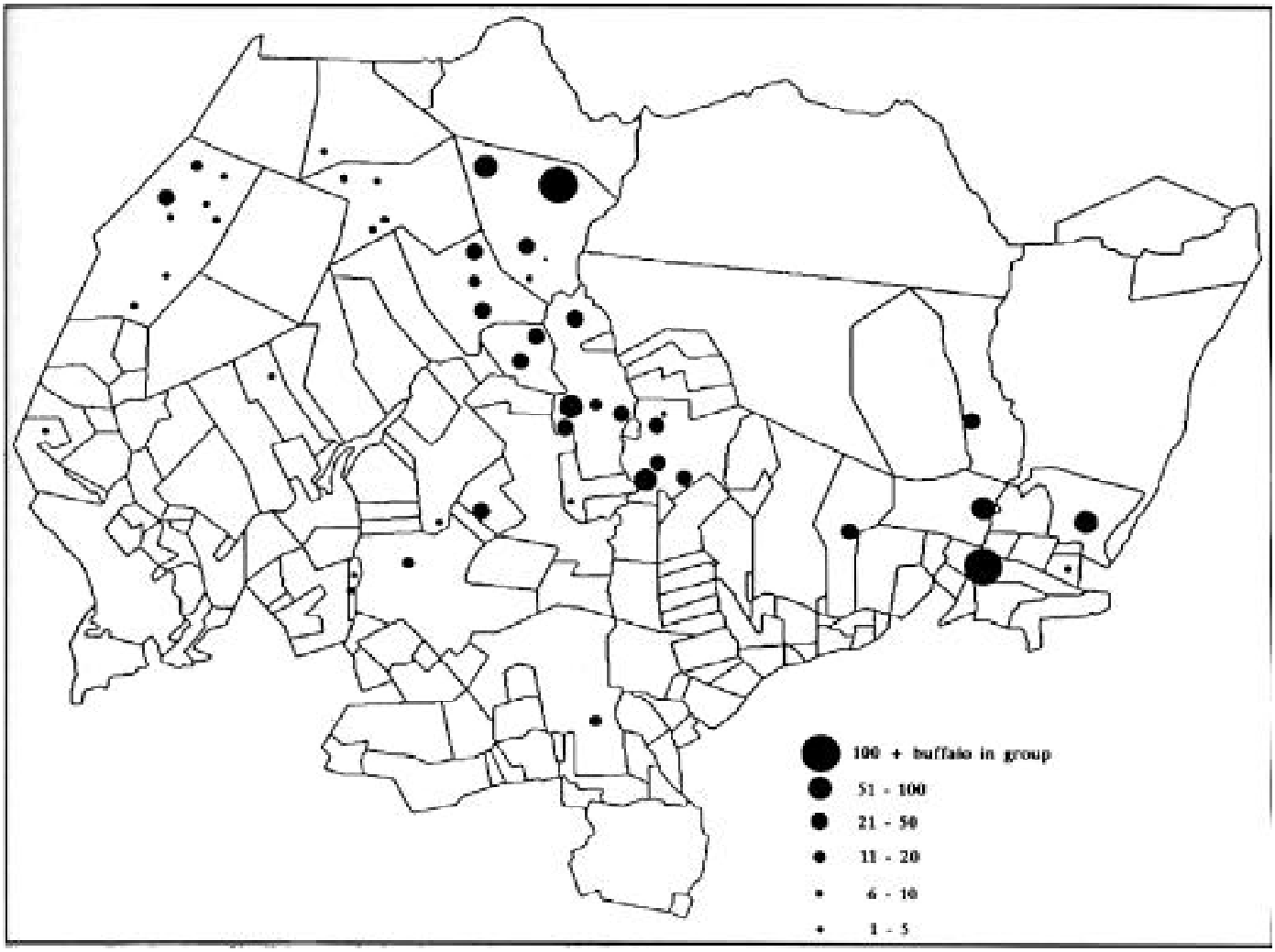


Figure l. Distribution of buffalo seen during the aerial survey of Laikipia on 15-16 September, 1990

to these figures since standard errors are over 50% of the total. This means that total counts, although expensive, are the only adequate way to monitor changes in numbers. The principal objective of the present census was to count Laikipia's elephants, both live and dead, in order to establish an accurate baseline from which to monitor future changes in the population.

Methods

Total aerial counts rely heavily on the experience of those involved. Many of the team had taken part in the 1988 and 1989 Tsavo counts which used the same techniques, and the observers and pilots included some of the most experienced in East Africa. As far as possible, crews of aircraft were chosen to blend experienced with inexperienced observers and most included people with detailed knowledge of the areas over Which they were flying.

The date chosen for the count was towards the end of the dry season when vegetation is least thick and before many elephants have moved north into Samburu country. Since little is known about the movements of the different sub-populations in the area, any time chosen has its disadvantages, but it is thought that this is the period when the largest proportion of elephants using Laikipia during some part of the year are actually present. Since there had been recent reports of elephants around Kipsing and in the Samburu/Buffalo Springs Reserves, these areas were included in the count. It was not considered worthwhile extending further north since elephants in Lerochi and the Mathews Range were likely to be in dense forest where they could not be counted easily from the air.

The area covered was divided into 19 discrete counting blocks, bordered by usually well-defined features such as roads, rivers, ranch boundaries, etc. Each team covered one or two blocks each day. Individual crews were allowed to decide on the precise flying pattern to be followed, depending upon the typography of their block and the wind direction, but in general blocks were counted by flying along transect lines separated by approximately one kilometre. At the ends of transect lines aircraft flew into adjoining blocks for a distance of two to three km to get an overlap in coverage. In aircraft with four person crews, the two rear-seat observers were responsible for spotting animals and calling them out to the front-seat observer who did the recording, navigating, and photographing of groups of more than 25 elephants. In two- and three-seater aircraft the observer was responsible for both observing and recording.

When a group of over 25 elephants was seen, an estimate of the group size was made and a set of photographs taken with a 35mm camera and 400ASA film following methods described by Norton-Griffiths.[2] After the census the animals in these herds

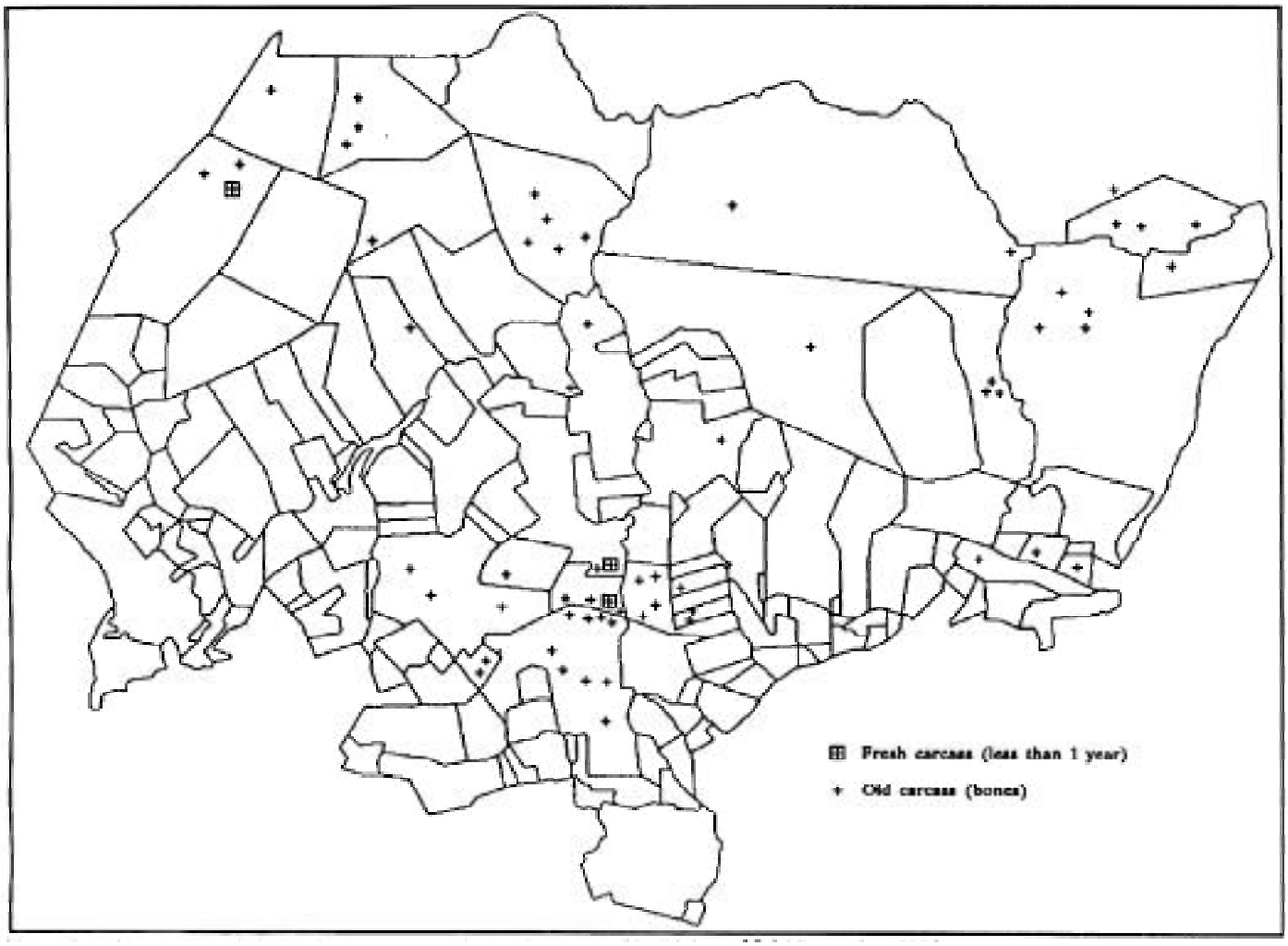


Figure 2. *Distribution of elephant carcasses seen during the survey of Laikipia on 15-16 September, 1990*

were counted as accurately as possible from the resulting photographic prints. Group sizes for large herds of buffalo were only estimated. Dead elephants were divided into four categories by the Criteria used in the Tsavo counts.[3] These were:

l. **'Fresh'**, in which the carcasses still have flesh beneath the skin giving the body a rounded appearance, where vultures are probably present, and where a liquid pool of putrescent body fluids is still moist on the ground. This category applies to carcasses thought to be no more than three weeks old.

2. **'Recent'**, in which carcasses less than one year old may be distinguished by the presence around the body of a rot patch which has killed and discoloured the vegetation. Skin is usually present and the bones are relatively un-scattered except in areas of high predator density.

3. **'Old'**, in which carcasses have usually decomposed to a skeleton with bright white bones clearly visible, but where the rot patch has disappeared or where vegetation is beginning to grow once more. The skin may still be present in arid areas but will have disappeared in wetter zones. This categoric applies to elephants that died more than one year previously.

4. **'Very old'**, in which the bones are beginning to crack and turn grey. From the air the skeletons no longer stand out as distinct entities and are difficult to see.

For the purpose of analysis, these four categories were condensed into two: those less than a year old which were collectively called 'Recent' and those more than a year old, called 'Old'.
Flight paths were marked on a map and the locations of animals were numbered serially on data sheets. After a day's flying this information was transferred to clean maps and data sheets.

The whole count took two days, and involved approximately 60 hours of observation for the main count plus some time for repeat counts. Count rates for blocks varied from 88 to 587 km per hour with a mean of 178 km^2 per hour; this compares with a mean of 256 km^2 per hour on the 1989 Tsavo count. On the first day, when the blocks with the highest density of elephants were counted, only three of the [2] eleven blocks were covered at a rate of more than 200 km^2 per hour.

Results

Elephants. The number of elephants counted was 2,312 of which 2,045 were in Laikipia district. This figure includes ground counts, of adults only, in the Ngare Ndare and Mukogodo Forests and one group of eight bulls on Laikipia Ranching which was seen by security patrols on the ground but not from the air. If different figures were noted for a group of elephants seen by two aircraft then the higher number was taken. This was also the case when a precise number given by an observer varied from a photographic count. However, if the visual figure was an approximation then the photographic count was used.

The total given is a minimum estimate, and it is probable that the true figure for the area is several hundred more. Total counts of elephants typically understate the actual value by a factor of 10%[4] though this will vary according to the time taken for the count, the skill of the observers and pilots, and the thickness of the vegetation. Underestimation results from failing to observe some herds and from under-counting the number of animals. Many females had given birth during the months preceding this count and it is particularly easy to miss young calves, especially if they respond to the sound of an aircraft engine by moving under their mothers belly.

In an attempt to establish the level of these errors parts of blocks were flown twice in the same day to ascertain how many elephant groups were seen by one set of observers but not by the other. Few conclusions could be drawn from this since, in the few hours between flights, groups moved and split up to the extent that it was difficult to identify the original sightings.
Comparison of observer estimates of elephant group size with counts from photographs showed that the latter gave a lower figure. In five cases of precisely counted groups of between 29 and 87, all the corresponding photographic counts were lower by an average of 20%. In 13 cases where group sizes were assessed at between 16 and 440, seven had lower photographic counts and five were higher; estimates averaged 10% higher than photographic counts. The largest group was reckoned to be between 420 and 600 by different crews. The results from the first crew to see them have been used since the group was more tightly clumped then. In this case the photographic count was 442. The relationship between photographic count and true group size is likely to be affected by the altitude and angle at which the photographs are taken, the thickness of the vegetation, and the level of disturbance of the group. In general, the best photographs were those taken from above 400 ft and nearly vertical since this reduced the amount by which elephants were obscured by vegetation or each others bodies.

The sample count conducted the previous week by DRSRS gave a similar result to the total count. The population for Laikipia District was estimated at 1,881±6255 compared with the total count figure of 2,045.

Dead Elephants. Only 65 elephant carcasses were seen and of these three were 'recent' or less than one year old. There was considerable variation among blocks in the number of carcasses seen and it is clear that the experience of observers was a major factor. Very few carcasses were found during the sample count; and this produced an estimate of 18 old carcasses and no recent ones.[6]

The largest number of carcasses were seen in the southern ranches of 01 Pejeta, Vamalda and Erere, and in the vicinity of Samburu Game Reserve. All these areas were counted by the same experienced crew.

Considerable alarm was occasioned when a very experienced crew spotted a scene of great slaughter. Happily, it proved to be a film set dressed with plaster-of-Paris elephant carcasses. On close inspection these can be distinguished from the genuine article by the uniform white colour, lack of rot patch and, above all, the clean surface on a removed trunk.

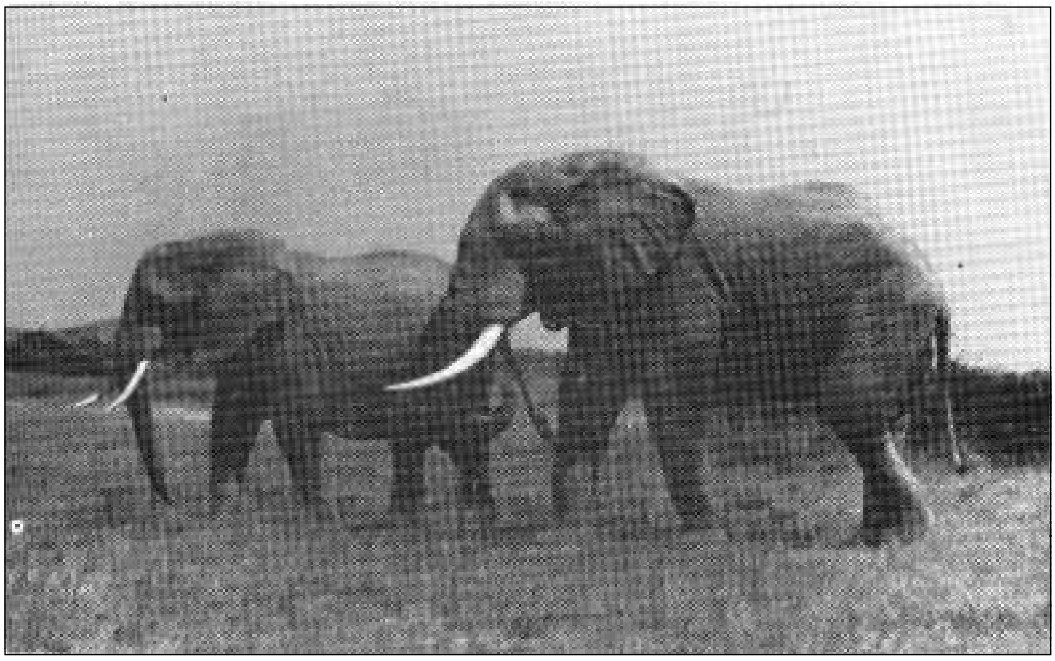
Buffalo. The total number of buffalo recorded was 1,387. This is certainly a considerable underestimate which can be attributed to the facts that buffalo were not the main focus of the count and the dense vegetation covering much of Laikipia makes it difficult for buffalo to be seen from the air especially during the middle of the day when they retreat into the shade of trees.

A much higher figure of 6,433±2,774 buffalo was estimated from the DRSRS sample count which was conducted between 8 and 11 am when buffalo are more visible.[7]

Discussion

This count confirms what had been suspected that the Laikipia elephant population is of major significance within Kenya, being the second largest in the country after the 5,000 animals within the Tsavo ecosystem. The fact that the Laikipia population is one of the few in Kenya that apparently has not declined considerably in recent years bears tribute to the success that private land-owners in the area have had in preventing poaching, and this is backed up by the low number of carcasses that were found.

In some areas there were fewer elephants than expected. For example it has been considered that there is a semi-resident population of 300 animals on Ol Ari Nyiro, but fewer than 200 were seen there. However, large herds were seen nearby on Mugie and General Lengees' farm.



An oestrous female is guarded by a musth male in Amboseli, Kenya

No elephants at all were seen on Colcheccio, which often has large herds, and the numbers on O1 Pejeta were also lower than expected. There were just over 100 elephants in Samburu and Buffalo Springs Game Reserve and another 50 in adjoining areas in comparison to the last published figure of 630.[8] However, the KREMU count on which this figure was partly based was carried out in February and there may have been a seasonal influx of elephants at that time.

No elephants were seen in settlement areas or in areas which have been subdivided but not yet properly settled, such as Two Rivers and Kimugandura. There are thought to be some persistent crop-raiders which hide in thick bush in the Ngobit gorge during the day but these were not seen during the count. The presence of elephants in the Rumuruti forest is particularly important, since crop raiding is a serious problem in settlement areas north of this forest.

The concentration of elephants in the central Laikipia ranches was remarkable, with one herd of over 400 animals, and more than 750 on just two ranches, O1 Jogi and Mpala. Good rainfall on O1 Jogi a few weeks earlier was a likely cause of this, but there is also some indication that elephants on these ranches tend to form larger herds before moving off to the north in October-November.

The results of the count indicate that the density in the whole area covered was 0.22 elephants per km and this figure rises to 0.27 per km^2 if settlements are excluded; ranch-land had 0.41 elephants per km^2. Although these figures are amongst the highest for any unprotected areas in Kenya, the density is similar to that existing today in Tsavo National Park after years of poaching, and merely a fifth of the value there when concern was expressed about destruction of habitat. It therefore seems likely, especially in view of the seasonal movement, that damage to vegetation caused by elephants in Laikipia is a local phenomenon, and the animals are not at a high enough density to make a serious impact over the whole area.

The lack of precision of KREMU counts makes it difficult to detect trends in population size. However, it is surprising there is not more evidence of an increase in numbers considering the low intensity of poaching in the area and a high rate of breeding in at least the last two years. It does appear that there have been around 2,000 elephants in the Laikipia area throughout the past decade. Assuming this lack of increase in the population is a real phenomenon, the cause may lie in the northwards movement of the Laikipia elephants. Possibly there has been heavy poaching every time they move north, but this seems unlikely in view of the normal age structure that exists. Another explanation is that more elephants are spending the whole year in the northern areas in response to reduced poaching pressure. If this is the case and the trend continues, the elephants return to their traditional home might well solve many of Laikipia's problems.

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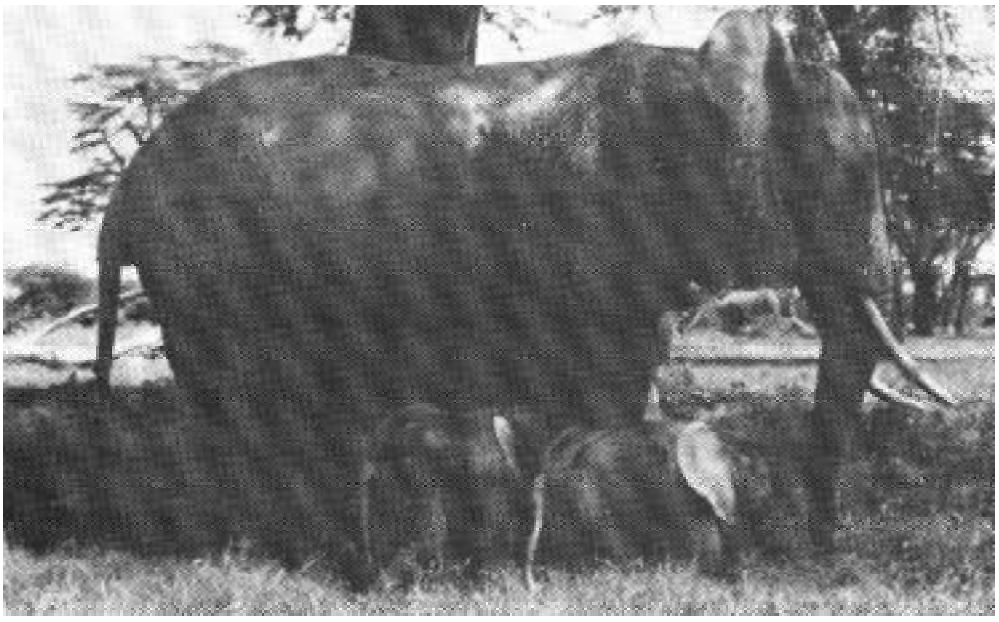

Estella with her twins, Equinox and Eclipse, in Amboseli

Acknowledgments

Large scale cooperative exercises such as this involve the help of very many people and I am profoundly grateful to the over fifty men and women who gave their time, expertise and material support so generously. Above all, thanks are due to the donors who enabled the count to take place: Mr Alec Wildenstein whose donation was channelled through the Gallmann Memorial Foundation, and the East African Wild Life Society represented by Mr Nehemiah arap Rotich.

Threats to Aberdare Rhinos: Predation versus Poaching

Claudio Sillero-Zubiri and Dada Gottelli

The black rhino, *Dicero.s bicornis,* once common in most sub-Saharan countries, has suffered a most serious decline since about the middle of this century and now faces extinction throughout its range. Until recently it was abundant in many parts of Kenya. During the 1970s, poaching, stimulated by the illegal trade in rhino horn, turned into a massive-scale operation. In 1985 Jenkins estimated less than 400 rhinos remained in Kenya in populations large enough for their management.'

Declining Trend of the Abedare Rhino Population

The Aberdare National Park (ANP) was famous in the past for its very high density of rhinos. This was particularly true for the Salient, a 70 km^2 wedge-shaped area of forest stretching down the eastern Aberdare slopes and separated from the densely populated farmland by a moat and electric fence. The then warden, F.W. Woodley, in a personal comment, estimated the rhino population of the entire Park to be in the order of 450 during the early 1970s. Sadly, they have been decimated by poachers during the last decade. The 1982 ANP census counted 132 rhinos in the area and the present population is well under 50. It is possible that the Salient rhino population alone has been reduced by as much as 80 percent of its former level.[2] We estimated a rhino population for the Salient of 30 in 1987, which agreed with the estimate by the ANP Rhino Surveillance Unit. Approximately five more occurred in northern ANP.[3]

Today, in spite of the dramatic decrease in rhino numbers, the ANP is probably the only National Park in Kenya with a genetically viable population of native black rhinos.[4] However, their numbers are already below the recommended threshold to minimize loss of genetic variability in a population.[5]

Rhino Sightings at Forest Lodges

The Salient with its two forest lodges, the Ark and Treetops, is one of the best places in Kenya to watch black rhinos. The records of animals seen at the lodges' salt-licks have proved useful in providing information on long-term trends in animal populations of the area. Rhino sightings indicate a dramatic reduction in numbers, especially at Treetops where up to 1978 an average of eight to ten rhinos visited the salt-lick every night. From 1979 to the present there has been a steady decline of sightings. An average of 1.48 rhinos were seen at the salt-lick on 31% of the nights between July 1986 and June 1987. All these sightings correspond to a male and a cow with calf making regular visits.

The Ark and its surroundings hold the highest concentration of rhinos in the ANP. Trends of rhino sightings at the Ark are less clear-cut, with daily records oscillating but totalling nearly 1,000 a year. At least 20 rhinos are frequent visitors to its salt-lick. The Ark area may have acted as a refuge for rhinos moving from places where poaching was heavy. Such an inflow of new animals may have kept the Ark records relatively constant, masking any significant decline of the population as a whole.

Predation in the Salient

Conservationists have expressed fears that spotted hyenas, *Crocuta crocuta* , could be killing rhino calves in the Salient. Since the late 1970s the Wildlife Conservation and Management Department (WCMD) has expressed concern about the effect that a high density of spotted hyenas might have on the herbivore species in the ANP forest, in particular on those endangered species such as bongo, *Tragelaphus eurycerosi* and black rhinos whose numbers have decreased rapidly in the last few years. The skyrocketing of hyena sightings at both forest lodges during the 1980s and the extent to which pack hunting became more conspicuous have also been a matter of concern. A field study was undertaken in 1986-87 to estimate the actual population of hyenas in the Salient and its effect on prey specres.[6]

Hyenas are the chief predator in the Salient. Although the Salient does not resemble the optimal habitat for hyenas as described in the literature, it harbours a density of 1.34 hyenas per km^2 ,second only to that of Ngorongoro. This may be a result of the high concentration of herbivores which itself is probably a consequence of a 'funnel effect' exerted by the physical boundary and the creation of secondary forest by elephants. Hyenas were found to feed mostly on medium-sized ungulates. They forage alone or in small groups more often than in packs. However, hunting packs of up to 17 hyenas were observed, which was unexpected in a forest habitat. Lions, *Panthera leo,* were rare in the ANP forest until 1983 when the lodges' records show a sharp increase in their presence, probably due to range expansion from other parts of the ANP. At least 12 different lions utilized the Salient during our study. Regular use of the area by lions would almost certainly lead to a decrease in the hyena population through interference and exploitation competition.

Predation on Rhino Calves

Rhinos can be killed by lions even when adult.[7] They also appear to be vulnerable to predation by spotted hyena up to the age of four months.[8] Four attempts by hyenas to pull down rhino calves were observed at the Ark salt-lick during this study, all of them unsuccessful (Table). Three attacks were made on male calf A12 when he was approximately one year old. In August 1986, two hyenas grabbed the calf by the flank, inflicting wounds. A12 was attacked twice again in 1986, and on both occasions the mother, who herself is missing half her tail, charged the hyenas after the calf emitted a distress squeal. In April 1987, a very young calf of unknown sex was harassed by two hyenas and presumably wounded. Again, the mother defended the calf by repeatedly charging the hyenas, and then mother and calf fled for cover. Both calves were seen again after the attacks in seemingly good condition.

Four out of nine individually recognizable calves observed in the Salient had scars on flanks or hind legs and one had neither ears nor tail (Table). Earlessness (i.e. lack of pinnae) in the black rhino has been reported from a number of populations in southern and eastern Africa [9,10] Although Goddard first suggested that a

genetic character could be responsible for a congenital deformity, Hitchins reviewed the subject and attributed the conditions to predation on rhino calves by spotted hyenas.[11]

Table. Known rhino calves in the Salient and evidence of pre-dation attempts. Age estimation follows Hitchins (1970)[12]

Calf	Age	Sex	Evidence of predation
A4	2.5 yr	F	none
A7	2yr	F	none
A12	1 yr	M	attacked by hyenas 3 times in 1986
A14	2.5 yr	F	no ears, no tail
A17	1 yr	F	wound right shoulder
A?	<1 yr	?	attacked by hyena in April 1987
A19	3.5yr	F	none
TT	3 yr	F	none
MM	2yr	M	none

Rhino calf survival

Attacks by hyenas on rhino calves in the Salient have been observed at the lodges' salt-licks for many years, although no successful attack has ever been reported. The high percentage of calves showing scars presumably inflicted by hyenas point to predation as a potential factor of infant mortality in the ANP. However, six out of eight known rhino cows regularly visiting the Ark salt-lick were accompanied by their calves. This gives a cow-calf ratio of 1:0.75 which is comparatively high; cow-calf ratios at Ngorongoro and Olduvai are 1:0.72 and 1:0.79 respectively.[13]

Poaching

Poaching has been the main and probably the sole cause for the depletion of the ANP rhino population. In 1982, 20 fresh carcasses were seen within one month in the Salient by S. Weller.[14] The last outbreak of organized poaching occurred in 1984.[15] During our study, six rhino skulls were collected and their age estimated using Hitchins' method.[14] Five were from animals less than 15 years old and were likely killed by poachers: the nasal region of three skulls bore signs of cutting by a sharp instrument, presumably utilized to remove the horns. The sixth, approximately a 29 year-old, was killed within 400 metres of one of the guard outposts, revealing the limited influence the Rhino Surveillance Unit was having in preventing poaching in the Salient. At least one elephant was killed in 1987 by poisoned arrow heads planted on the ground.[16]

Conclusions

Our study concluded that, in their present numbers, there is no reason to suppose that predators are detrimental to the rhinos and other herbivore populations in the Salient. Despite the high percentage of calves showing scars, no successful attack by hyenas on a newly-born rhino has ever been reported. Furthermore, since the end of the study there has been a remarkable decrease in hyena sightings throughout the Salient.[17]

The increase in the number of lions frequenting the Salient has been checked by limited control of trouble animals. It is uncertain whether culling of predators would enhance the survival rate of infant rhinos, a variable reasonably high in the Salient as proved by the cow-calf ratio recorded. The maintenance of the rhino population is most strongly related to poaching activity and its fate therefore lies with improving conservation. Resources allocated for the conservation of the species would be best directed towards anti-poaching and security activities.

The implementation of a Rhino Sanctuary in the ANP's Salient has been long recommended as a high priority.[18,19] Fortunately funds have been secured and fencing of the Aberdare Rhino Sanctuary is well advanced. Combined with an improved regime of foot patrols carried out from Headquarters and existing and planned outposts, the Sanctuary will provide appropriate protection for the black rhino and other wildlife.

Acknowledgements

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African and Asian Rhino Products for Sale in Bangkok

Lucy Vigne and Esmond Bradley Martin

Thailand continues to display a greater variety of rhino products on retail sale in its capital city, Bangkok, than are to be found anywhere else in the world. These products are from both the African and Asian rhino species. There is an urgent need to stop this trade once and for all.

This is a large traditional medicine shop in Bangkok selling an assortment of animal and plant products

Bangkok's Medicine Shops

Many Thai people of Chinese origin live and shop in Bangkok's China Town where there is a very large number of traditional Chinese medicine shops lining the crowded streets. Compared to those in Hong Kong and Singapore, these Bangkok pharmacies are less modernized and rather run-down, with poor lighting and usually no air-conditioning. On the walls are the typical lines of shelves carrying bottles, large glass jars and wooden boxes containing minerals, herbs and dried animals or animal parts. Particularly abundant are ginseng and deer antlers which are consumed as tonics and aphrodisiacs. African rhino horn, used by the Chinese to reduce fever (not as an aphrodisiac), is sometimes displayed in the window to attract customers, being much larger than Asian rhino horn. Under the glass counter in saucers, a larger selection of rhino products, usually from the Sumatran rhino, is often available. Most common today is skin, but occasionally nails and even dried penises are for sale. Sometimes at the back of the medicine shop can be seen on a small altar a statue of Buddha and a 'rhino' horn beside it for worship. These horns are not for sale and in fact they are usually fakes, characteristically shiny, with knobbly bases.

The 1990 Survey

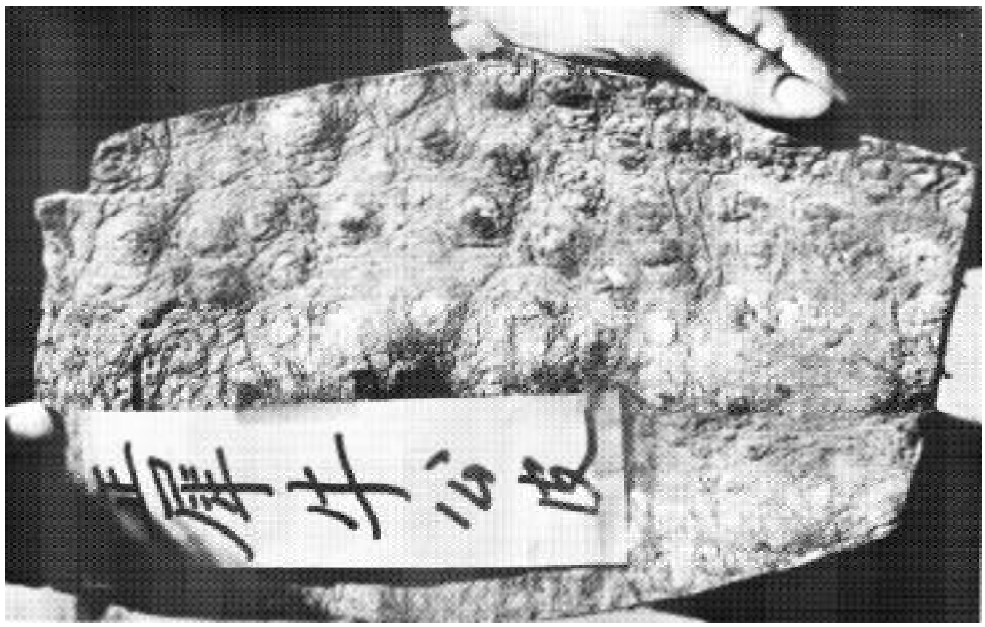
In early 1990, we carried out a survey of 46 such medicine shops in Bangkok, interviewing the owners, doctors and salesmen. The previous survey by EBM - which is reported in *Pachyderm* 11 - had been done two years before in early 1988. Since then, the prices had gone up a little, and overall, the amount of rhino horn in the shops had dropped slightly. ln the past, Asian horn had always predominated whereas now Asian and African horn were available in roughly equal amounts. As for Sumatran rhino hide, the number of pharmacies selling this had nearly tripled since early 1988. Obviously, there had been a new supply of both African rhino horn and Sumatran rhino hide since EBM's last survey.

Rhino products were displayed so openly that it was hard to believe that at least since 1972, the Thai government had banned international and internal trade in Sumatran rhino products, and being a member of CITES since 1983, the international trade in all rhino species' products since then was supposedly prohibited. Forest Department officials do not enforce these laws; they scarcely ever inspect the pharmacies for illegal wildlife products. Shopkeepers thus have little to worry about. Sometimes the pharmacists were suspicious of our survey, but usually they were very helpful and, if rhino products were not in the show cases, they would fetch them for us from the back of the shop so we could determine their authenticity. Or they would show us pictures of rhino horns they kept at home. Some owners allowed us to take photographs, and we even could carry the rhino products out on to the street for better light.

Although several shop owners claimed their rhino horns were over 20 years old or said their Sumatran rhino skin came from their fathers and grandfathers, others admitted to receiving rhino products in the past two years. or so. Many dealers and foreign smugglers sell rhino products in Bangkok as the demand for them there and the lack of law enforcement are well known. It is also where most of Thailand's rich Chinese live; elsewhere in the country, rhino products are not so easy to get.

Rhino Products from Africa

One shop owner, who is also a major trader and wholesaler, told us that these days more people offer him rhino horn from Africa than Asia; Asian horn has been hard to get these past two years. This helps to explain why the ratio of African to Asian horn has increased in the shops since 1988. ln April 1989, a German and a Tanzanian invited this trader to their rented house to see two cases holding 50 horns from Tanzania, weighing about 70 kilos. The trader would have been willing to buy a couple of rhino horns, but the partners wanted to sell all of them or nothing, so on this occasion he did not take any. The Bangkok trader believed about half the horns were fakes, probably made from bones as they were too sharp and too long. He thought they would have taken the horns to Macao in order to sell them to



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Indian rhino hide sells retail in Bangkok for over US$ 2,000 a kilo today, but hardly any African hide is available

China. African rhino horn, normally from the black rhino, is today available retail in Bangkok at an average of US$ 10,300 a kilo. African hide is far less common than Sumatran and sells for only US$ 230 a kilo retail, a reason probably why few people bother to smuggle it to Thailand, apart from the fact that not many poachers in Africa are aware of the demand for it.

Rhino Products from the Greater One - horned or Indian Rhino

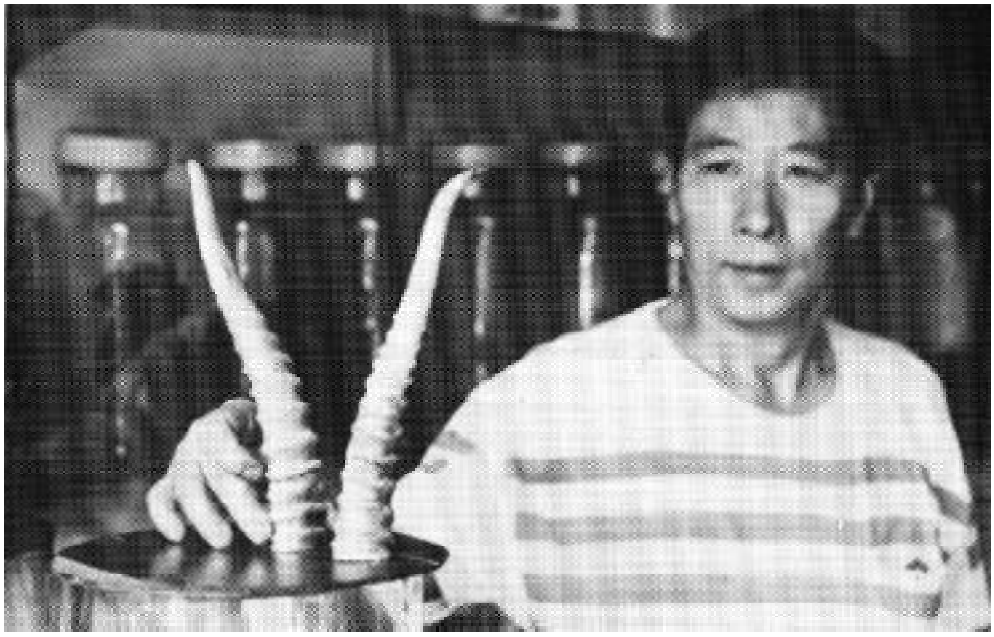
Of the eleven shops we saw displaying rhino horn only one sold Indian rhino horn, and this was for the highest price of all: US$ 36,500 a kilo. Of the 21 shops we found selling skin, only three offered that from Indian rhinos and at a cost of over US$ 2,000 a kilo retail. Of course, customers do not buy large amounts; it is priced to them per *liong*, which is 37.5 grammes, and customers usually buy only several grammes of horn at a time.

Trade in Sumatran rhino predicts: skin, horn, blood and penis

The main trader we interviewed said that he buys from Thai dealers, who come to sell Sumatran rhino products, whenever he can but sometimes obtains products directly from poachers. The last occasion for this was in 1988 when he travelled deep into the forest of Kanchanaburi Province in western Thailand on the Burmese frontier and bought some hide. Since then, poachers have been unable to find any Sumatran rhinos there although the trader believes that some 20 are left in that region of Burma. A whole rhino carcass including the horn is worth a fortune to the poachers, creating a great incentive for them to hunt out what soon will be the very last in the forest, unless something is quickly done to stop Thailand's trade and protect the rhinos.

The trader added that this visit to the Burmese border in 1988 had provided his last batch of rhino hide; none had been available since then. Presumably that hide entered the Bangkok market just after EBM's 1988 survey, when only 13% of the medicine shops he visited sold rhino hide, and that 1988 supply is still available in the shops today since nearly half the pharmacies we visited in early 1990 sold Sumatran hide. It may be easily distinguished from knobbly Indian hide as it is covered in short wiry black hairs and is smoother. The prices differ greatly, with shoulder skin worth over ten times the price of stomach skin, in line with the supposed healing power. Male rhino hide is reputedly more difficult to obtain and considered a stronger healing agent than female hide. Our survey showed that male skin sold retail for US$ *5,200* a kilo while female skin was a mere US$720 a kilo. On average, however, Sumatran rhino hide sold for US$ 1,700 a kilo retail. Another reason for the variation in price was that some, no doubt, was old stock.

The most expensive Sumatran rhino product in the shops is horn priced at an average of US$ 16,300 a kilo. Sumatran rhino nails are known as poor man's horn as they, too, are prescribed to treat fever. Nails cost some US$ 2,000 a kilo, about an eighth the price of horn, and several pharmacies offered them for sale. The main trader told us that he had been unable to buy Sumatran



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A pharmacist in Bangkok displays two saiga antelope horns. These are for sale in nearly all Bangkok's traditional medicine shops. Shavings from the horn are sold to reduce fever a substitute for rhino horn

rhino blood since 1988. He bought his last stock already dried and kept it in a refrigerator to avoid fungal attack. Wholesale, it costs US$ 78 a kilo, and retail it is US$ 156 a kilo, dried. Similarly, he had not had a chance to buy recently any new rhino penises, but said he would willingly pay up to US$ 400 for one. If it is fresh, he first dries it out and then sells it by weight. A complete penis weighs about 150 grammes when dry. In the last two years, he had sold four whole penises for about US$800 each to a Chinese from Hong Kong, a Korean, a Japanese and a Taiwanese. These customers all knew how to use them: the penis is cut into pieces and boiled in water with other ingredients, the resultant liquid is drunk as an aphrodisiac. This trader said he had two penises in stock. In another shop, there was in a saucer one full penis, two that were sliced in half, and four smaller pieces; these were US$ 156 for one *liong*, or about US$ 600 per penis. Of the 46 shops we surveyed, only these two were selling Sumatran rhino penises.

Manufactured Medicines containing Rhino Horn

Commonly available were febrifugal tablets and laryngitis pills both containing rhino horn and both manufactured in China. From Japan were Kyushin tablets made in 1983, according to the label. In October 1989 some government representatives from a Beijing pharmaceutical factory visited Bangkok to check the prices of rhino horn. No doubt on these occasions, the pharmacists receive Chinese medicines, perhaps even in exchange for a little rhino horn.

Present Trade Regulations

1. According to CITES regulations (and Thailand has been a member since 1983), no international trade is allowed in any rhino products since all five species are on Appendix 1. This prohibition on all imports and exports includes medicines containing rhino products.

2. The internal or domestic trade in Sumatran rhino products has been illegal since at least the early 1970s.

3. Although CITES in 1987, in Conference number 6.10, urged all member states to ban internal sales of all rhinoceros parts and derivatives, Thailand has not yet complied with this. So the internal trade in African and Indian rhino products is still legal, as is that for medicines containing rhino products.

Recommendations

1. In accordance with CITES, Customs officers need to check more rigorously to prevent illegal imports and exports of rhino products.

2. The Forest Department must carry Out an inventory of rhino products in Bangkok. Following this, the Department should grant a grace period of several months within which owners of rhino products must dispose of them within the local market. After a specific date, all internal trade should be prohibited.

3. Forest Department officials need to be trained to recognize rhino products and must regularly inspect medicine shops to ensure that no new rhino products appear for sale. After the internal ban, they must check that no rhino products at all are for sale.

4. The government must encourage pharmacists to use appropriate substitutes for rhino products such as saiga antelope horn which is readily available in Bangkok and costs US$ 2,000 a kilo retail only, and domestic water-buffalo skin, a good and cheap substitute for rhino skin.

5. A management plan is required to secure the future of Thailand's and Burma's few remaining rhinos. Such a plan must be implemented with adequate finances and manpower.

6. International pressure is essential in order to get the Thai government to act on these important matters.

It reflects badly on the Forest Department that this rampant trade in rhino products continues in Bangkok, threatening the last Sumatran rhinos in the area and putting pressure on African rhino populations. The need to bring it to an end is vital and the amount of effort required by government comparatively small. Stopping the commerce in rhino products would have, for both the country and the future of these threatened rhinos, beneficial results which must surely not be allowed to go by default.

Average Retail Prices of Rhinoceros Horn and Hide in Bangkok

Year	Total no.of pharmacies visited	Number and % selling horn		Type of hide	Average price per kilo in US$	Number and % selling horn		Type of hide	Average price per kilo in US$
1979	23	12	52%	Mostly African	3,654	—	—	—	–
1986	44	15	34%	Mostly Asian	11,629	8	18%	Sumatran	395
1988	52	17	33%	Mostly Sumatran	13,111	7	13%	Sumatran	1,254
1990	46	11	24%	Half Asian, half African	15,205	21	46%	Asian, most Sumatran African	1,717 220

Source: Surveys carried out by the authors

Thanks are due to WWF International for their financial support

African Rhinoceroses: Challenges continue in the 1990s

C.G. Gakahu

Despite the concern expressed and the measures taken by conservationists and wildlife authorities, the status of African rhinos has worsened during the last decade. The black rhino, *Diceros bicornis,* has continued to rapidly decline in number, resulting in further fragmentation and extinction of populations. Today most countries have fewer black rhinos than they had three years ago; the deaths represent a great loss of unique genes and adaptation to local environment. However, Kenya, Namibia, South Africa and Zimbabwe have stable populations and, although on the decline in Botswana and towards extinction in Mozambique, the southern white rhino *Ceratotirerium simum simum* has continued to show an overall increase. The northern white rhino *Ceratotherium simum cottoni* is now extinct in Sudan and Uganda but its 1984 population of 20 individuals in Garamba, Zaire, has gone up to 26.

Numbers, distribution and the trend of population, are vital data for conservation of rhinos. In 1981 Hillman provided the first scientifically-based continental estimates for African rhinos. These figures were updated by Western and Vigne in 1984, who estimated 8-9,00 black, 3,920 southern white and 20 northern white rhinos.[1] Another survey conducted in 1987 estimated 3,800 black rhinos, 4567-4635 southern white and 22 northern white.[2] The survey reported here looks at the fate and performance of African rhinos in the last six years. The survey was conducted by the African Elephant and Rhino Specialist Group (AERSG) of IUCN with funding from Wildlife Conservation International.

Surveys

Questionnaires were sent out to 30 individuals in rhino range states. The questionnaire requested information on numbers, distribution range, density, recent population trends, and aspects of rhino horn trade. Other information concerned overall management needs and problems. Population estimates data were ranked using the following categories:- A. aerial or ground census; B. non-scientific reconnaissance survey; C. informed guess.

Levels of reliability of data as percentages of all the returned questionnaires for the three species are as follows:

Species	A	B	C
Black	55	20	35
Southern White	68	16	16
Northern White	100	-	-

Category A estimates for black rhinos were all from southern Africa and Kenya in eastern Africa. The northern white rhino is extinct except for the single Garamba population in Zaire, hence the 100% score in category A.

Rhino Numbers

The national estimates and trends of black and white rhinos in Africa since 1980 are summarized in the Table. Black rhino numbers have dropped from 8,800 in 1984 to 3,390 in 1990, a 61% decline in 6 years or 20% per year. In some countries like Sudan, Uganda, Mozambique and Somalia the species has become extinct. These local extinctions had been predicted in surveys conducted within the last ten years.[3,4,5,6,7,8]

Another significant feature is the change in the location of the large populations. In 1984 Tanzania had the largest number of animals and accounted for 35.5% of the continental total; this has dropped to only 5.5%. Similarly Zambia's 18% in 1984 has become 1.2% today. A contrary change has occurred in southern Africa. South Africa and Zimbabwe accounted for 19% and 7.3% in 1984 while today their respective figures are 50.1% and 18.5%. This positive shift is not due to increased numbers but because of decline in most of the other African countries.

Regionally, in 1984, southern Africa represented 52%, eastern Africa 44% and west-central 3% of the continental total. These proportions have shifted to 82%, 17% and 1% respectively. Finally, it is worth noting that 90% of all remaining black rhinos are to be found in Zimbabwe, S. Africa, Namibia and Kenya. Alongside the drastic decline in numbers the species range has contracted considerably. This has isolated small populations in the once expansive and ecologically diverse black rhino range in Africa. However, it is worth noting that the overall continental rate of decline has dropped in the last three years as shown by the flexing of the curve in Fig.2.

The increase in southern white rhino reported by Western and Vigne in 1984 has been maintained in South Africa, Namibia and Kenya. The species population in Zimbabwe remained stable but declines were recorded in Swaziland and Botswana. South Africa, Zimbabwe and Namibia have 97% of the continental total. The introduced Kenyan population in sanctuaries has grown at the rate of 16% per annum from 25 to 65 individuals over the last 10 years. Southern white rhino total population in Africa now stands at 4,745 compared to 3,841 in 1980, an increase of *2.35%* per annum. The northern white rhino has decreased by over 97% in the last decade although the Garamba population, which had dropped to 20 individuals by 1984, now stands at 26.

Trends in Population Sizes

The size distribution of existing black rhino populations displays a larger proportion of even smaller populations than the 1984 survey. No population has more than 400 individuals. In 198075% of the continental populations had less than 100 individuals: this has gone up to 80% today. Fig 3. shows percentage cumulative frequencies of populations of various sizes in 1980 and in 1990. The two curves are significantly different (Kolmogorov-Smirnov 2-sample test: D=0.666, P=0.001, N=24), with the shift left due to an increase in the proportion of small size populations. The percentage frequencies of the number of black rhinos within various population sizes in 1980 and 1990 is shown in Fig 4. The difference between the two curves is also significant when subjected to the same test (D=0.666, P=0.001, N=24). Fig 4 shows that the 15% of all rhinos living in populations of 100 individuals or less in 1980

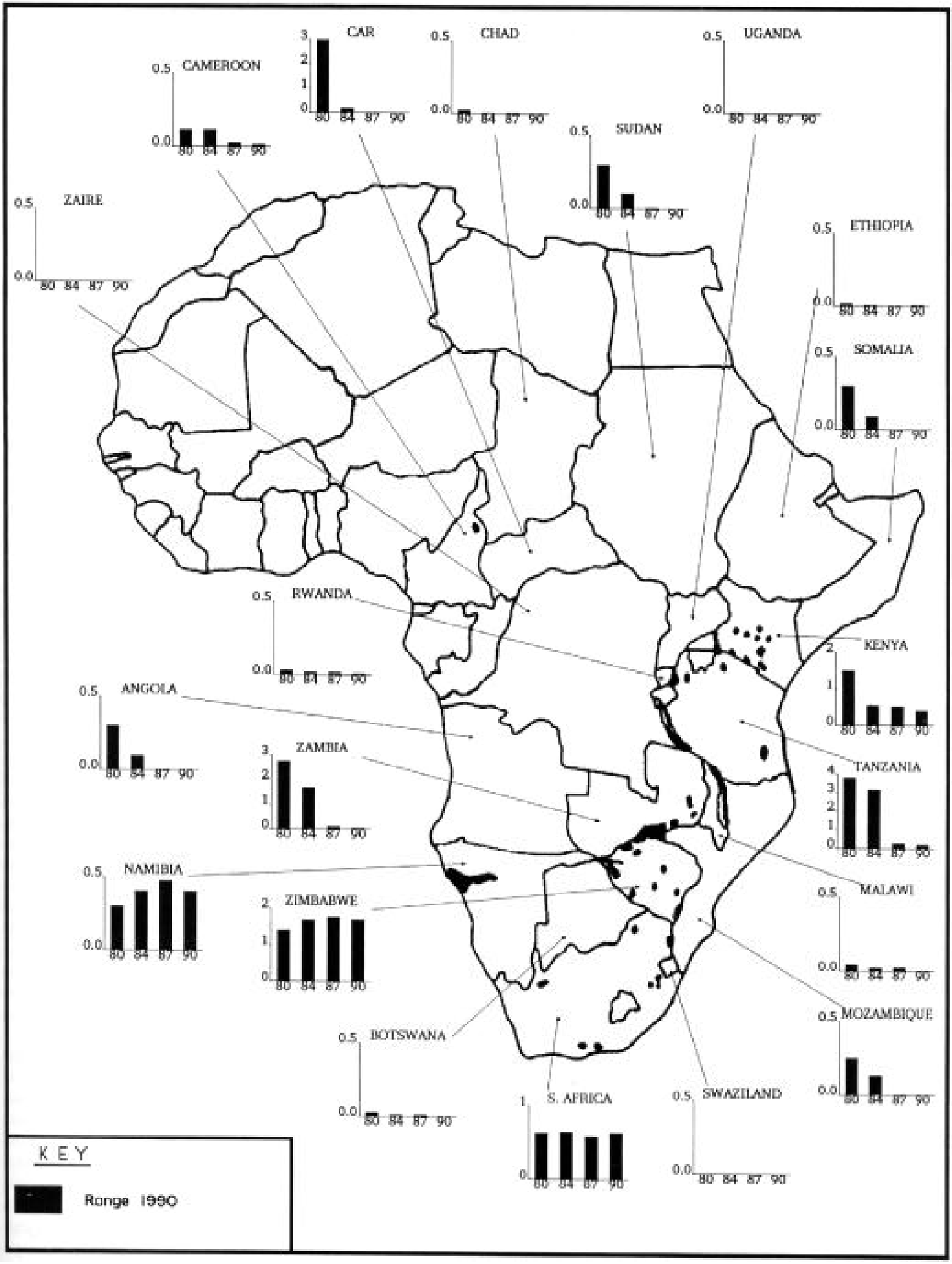

Figure 1. Black Rhino range and trends in 1990. Each graph covers 1980 ——1990: vertical axis in thousands

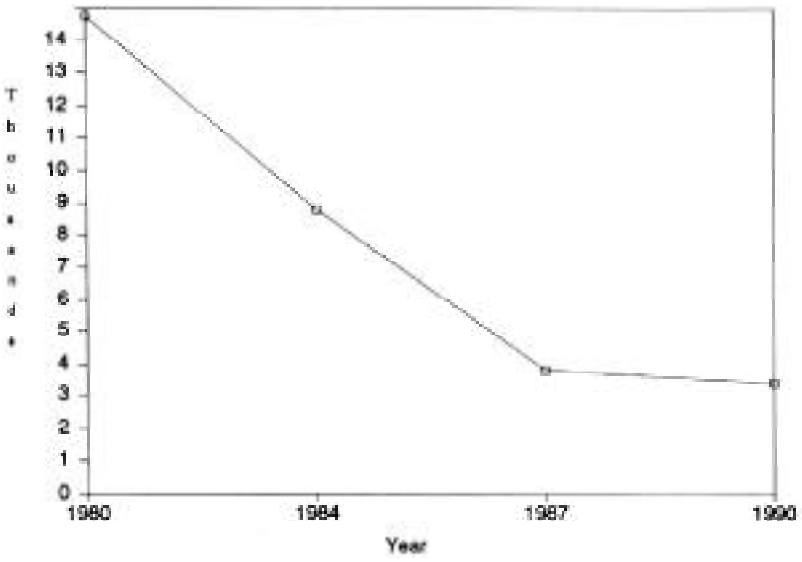

Figure 2. *Estimates of Black Rhinos in Africa between 1980 and 1990*

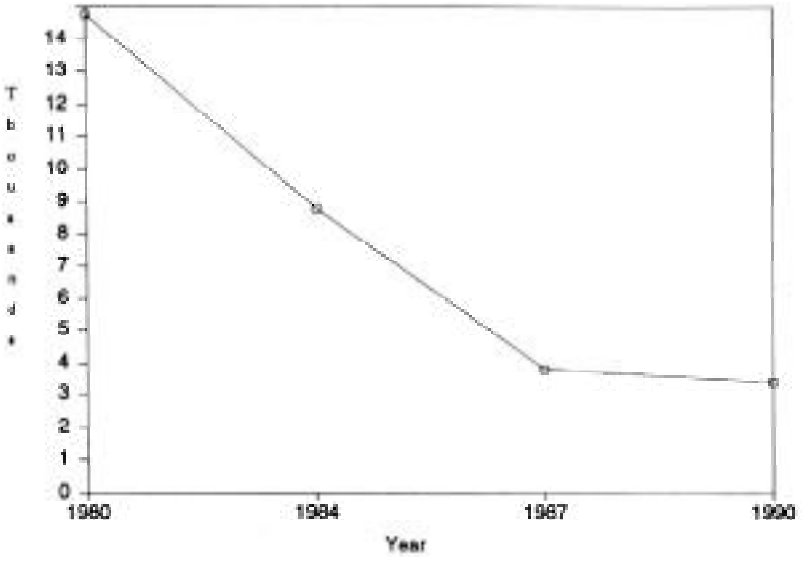

Figure 3. *Cummulative frequency curves of Black Rhino populations showing tire change between 1980 and 1990*

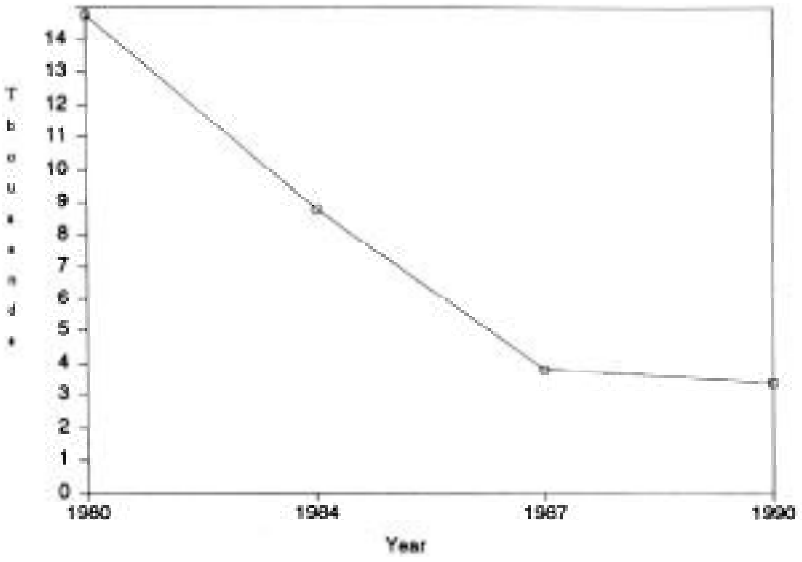

Figure 4. *Cummulative frequency curves of Black Rhino numbers in populations of various sizes, showing the change between 1980 and 1990*

has increased to 30% today. Similar figures for populations of 400 individuals are 32% and 80% respectively. A significant factor that has contributed to the shift of both ogives is the extinction of some populations which had under 10 individuals in 1980. Generally the survey reveals that the alarming decline of rhinos continues over most of the species range although at a lower rate. The exceptions are southern Africa and Kenya where rhino populations are stable or increasing, which is a reflection of the commitment and efficiency of wildlife authorities and, especially, the development and implementation of rhino management plans.

In countries which have experienced major civil unrest in the last decade rhino numbers are negligible; to all intents and purposes the rhino is extinct. The ready availability of automatic weapons, allocation of nearly all resources to war and the fact that poaching becomes a means of survival for people in remote areas during civil disturbance, are the main reasons for the demise of rhinos in these countries.

The cause of continuing pressure on rhinos is the intolerable trade in their horn which is used mainly for making traditional medicines in the Far East.[8],[9],[10],[11] The limited supply has caused prices to rise to a level which encourages poachers to take great risks. What needs to be done has been repeated time and again: reinforce anti-poaching measures; improve regional co≠operation of management and law enforcement authorities; find acceptable substitutes for rhino horn as medicine; enforce CITES regulations.

Half of all the world's black rhinos are in Zimbabwe and three other countries have more than 80% of the rest. South Africa holds nine of every ten white rhinos. Even to a layman the "all eggs in one basket" risk is obvious. For the conservationist questions of genetic depression, biased sex ratios and age structures and active management are the obvious challenges. Conservationists most often operate in areas of peace but the risk of future civil unrest in the countries with nearly all rhinos cannot be ruled out. Personally, I see a future challenge: endeavour to influence socio-political and economic systems so as to prevent those civil wars whose impact on rhinos and other wildlife is only too evident.

Nearly all rhinos are in parks or on private lands. Those outside protected areas and some in the larger parks are either scattered individuals or live in very small populations. Such conditions expose the animals to biological and environmental problems that accelerate their extinction and, because of limited resources, their protection is beyond the capability of wildlife authorities. Sanctuaries are often the rhinos' only chance of survival but require much forethought and careful planning.

Table. Present and Past Estimates of Black and White Rhino Populations in Africa

	Black Rhino				% of 1990 Total	White Rhino			% of 1990 Total
Country	1980	1984	1987	1990	Pop.	1980	1984	1990	Pop.
Angola	300	90			0.0				0.0
Botswana	30	10	10	2	0.1	70	200	15	0.3
Cameroon	110	110	25	15	0.4				0.0
CAR	3,000	170	10		0.0	20	1	0	0.0
Chad	25	5	5	2	0.1				0.0
Ethiopia	20		10		6	0.2			0.0
Kenya	1,500	550	520	400	11.8	25	30	65	1.4
Malawi	40	20	25	5	0.1				0.0
Mozambique	250	130			0.0	30	20		0.0
Namibia	300	400	470	400	11.8	150	70	200	4.2
Rwanda	30	15	15	9	0.3				0.0
Somalia	300	90			0.0				0.0
South Africa	630	640	580	626	18.5	2,500	3,330	4,225	89.0
Sudan	300	100	3		0.0	400	10		0.0
Swaziland				2	0.1	60	60	8	0.2
Tanzania	3,795	3,130	270	185	5.5				0.0
Uganda	5			0	0.0	400	15	26	0.5
Zaire				0	0.0	400	15	26	0.5
Zambia	2,750	1,650	110	40	1.2	5	10	6	0.1
Zimbabwe	1,400	1,680	1,760	1,700	50.1	180	200	200	4.2
Totals	14,785	8,800	3,803	3,392		3,841	3,947	4,745	

The capture and translocation of solitary rhinos to small safe sanctuaries has proved the best strategy.[12,13] The success of the Kenyan experiment is evidence that normal population growth can be realized together with improved security from poaching. However, sanctuaries do pose management challenges in the establishment, development and operational stages.

Adopting sanctuaries without overall long-term management plans should be avoided. Plans and their development assist in evaluating costs, prospects and available alternatives, and are likely to gain the attention of international donor agencies. A preliminary survey for the establishment of a sanctuary should cover: the geographic location and history of the area in terms of past rhino numbers; the available food vegetation; security; the communication infrastructure, which is essential during translocation and future protection; and natural factors like predators and disease. Evaluation of other forms of land use and investigation of the lifestyles of surrounding human communities to establish potential support or hostility toward the sanctuary are also essential. Finally, there is need to assess the indirect benefits towards other wildlife species and habitats within the proposed sanctuary and neighbouring conservation areas.

Currently, information, knowledge and skills on rhino sanctuaries and other aspects of rhino conservation and management are almost totally confined to Kenya, South Africa and Zimbabwe. There is a need for more continental cooperation and exchange of knowledge and skills. AERSG has encouraged such interchange and will continue to do so in the future.

The survey reported here also requested information on problems and needs of rhino conservation. It would appear most difficulties are linked to poaching, inadequate communications, and un-coordinated management plans and strategies. The needs for repeated surveys, continuous monitoring and improved anti-poaching surveillance featured prominently. Lack of technical personnel and equipment including aircraft, vehicles and field gear are common to all rhino areas.

In summary, and as urged in the past, range states with rhinos should develop specific management plans both nationally and for conservation areas. Intensive anti-poaching surveillance together with active management and protection are essential. And, most importantly, if the African rhinos are to recover, there must be total elimination of trade in rhino horn products.

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Monitor

Police Intercept $178,000 Ivory

Ivory worth $178,947 was intercepted by Tanzanian police here on Sunday before being smuggled to Dubai, the authorities said.

A police commander at Dar es Salaam Port said that 68 elephant tusks were stuffed in a container and were to be transferred to a cargo ship leaving for Dubai. A South Korean national, Mr Sung Man Chuo had been arrested for questioning while police are still looking for another South Korean and a Tanzanian freight clerk in connection with the same incident.

According to the police commander, the container belonging to Mr Sung was to have been shipped to Dubai by a German cargo liner *Deuitsche Africa.*

Mr Sung entered Tanzania as a tourist and told Port Authorities that the container was stuffed with charcoal. The interception resulted from a tip-off by a person who trailed the container from Morogoro 182 kilometres (120 miles) west of Dar es Salaam, where it was loaded with the ivory.

This is the first incident since the newly-appointed Home Affairs Minister Augastine Mrema, promised to give 50 per cent of the value of the impounded contraband to the person who informs the police.

(AFP) *Daily Nation,* Nairobi, 17th December 1990

Botswana' s Problem Elephants

In my article "Botswana's Problem Elephants I stated that it was not known where a figure of an estimated 20,000'elephants in northern Botswana in 1979 came from. The relevant document (undated) has subsequently been unearthed. In 1977 Sommerlatte[2] estimated a total of 33,000 elephants in northern Botswana for the Africa-wide elephant survey. Subsequently two other persons considered that Som-merlatte's estimate was too high, claiming that he had extrapolated from high density areas to those of low density. These persons therefore suggested that Sommerlatte's estimate should have been about 20,000 or even, to err on the side of safety, 15,000 to 20,000. A figure of 20,000 was then transposed to the estimate for 1979 although Sommerlatte's original estimate had been for 1977. In fact the original estimate of 33,000 is a remarkably close fit to the 33,272 for that year predicted from the logistic equation given in my article.

That is not to say that the logistic curve that I presented should be taken literally. The object was to provide an illustration of what might happen at the absolute maximum possible rate of increase of an elephant population; and the observed events appeared to follow this picture.

If one detects a lack of consistency between the suggestion that the numbers might stabilize at some higher level than presently exists, say about 135,000, and the statement that the effects on the environment could be catastrophic, then that is to say that with a total of 135,000 elephants one would expect to have a very different environment within reach of the permanent water than one would have with half that number of elephants, and that this environment on loose Kalahari sands would have very few trees or shrubs, or even perennial grasses.

I had overlooked the map in Smithers[3] in which he shows the distribution of elephants about 1969 to extend westwards to the border with Namibia, whereas recent surveys have detected no elephants west of the Okavango River. The increase therefore may be due to an eastwards compression of the population caused by drought, because the area west of the river is waterless, or by interruption to movement due to the settlement that has taken place along the river in recent years. A north-south buffalo fence is to be erected east of the river to control foot and mouth disease which will restrict movement westwards anyway. The logistic curve is of course simply an exercise of the mind and the reflections on possible causes of increase lively speculation.

C.A. Spinage

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Riddle's Elephant Breeding Farm and Wildlife Sanctuary, Greenbrier, Arkansas

On a peaceful 330 acre farm dotted with ponds, streams, and surrounded by woods, an unusual new Sanctuary has been established in central Arkansas. The only one of its kind, Riddle's Elephant Breeding Farm and Wildlife Sanctuary,'Inc., a non-profit corporation, has been conceived by Scott and Heidi Riddle who between them have been working with'elephants for 35 years.

The Riddle's Elephant Breeding Farm is dedicated to'preserving both African and Asian elephants and keeping these already endangered animals from disappearing altogether from the face of the earth.

In their native environment, both of these species of magnificent animals have seen their numbers dwindle drastically due to poaching for their ivory but mainly because of local farmers

taking over the elephant's grazing areas which results in a permanent loss of the elephant's habitat.

Riddle's Elephant Breeding Farm and Wildlife Sanctuary, Inc. has many goals. The foremost being the establishment of breeding herds of both African and Asian elephants; building more facilities at our sanctuary for these animals; giving refuge to any needy elephants; and educating the general public about the importance of safeguarding these majestic creatures for future generations.

You can be very important in helping to protect these rare and unusual animals. We need your donations. For further information or to answer any of your questions, please contact: Scott or Heidi Riddle, Riddle's Elephant Breeding and Wildlife Sanctuary, Inc., Post Office Box 715, Greenbrier, Arkansas 72058. Tel: *(501)* 589 3291.

Press release

Reserve for Rare Rhino

In 1989 George Schaller, Wildlife Conservation International director for science, and three Vietnamese researchers found solid proof that the Javan rhino still existed in Vietnam. They estimated that perhaps 10-15 of the animals survived near the Dong Nai river, in the Budang district of Song Be Province. Last year Le Dien Duc, of the University of Hanoi, and other biologists surveyed Budang and two other districts with WCI support to identify the rhino's range and recommend areas for protection. On the basis of reports from local people that five or six rhinos live along the Dong Nai in Budang, the Song Be government has set aside about 66 square miles for a rhino reserve. In the Cat Tien district there are six or seven animals, and Duc and his colleagues are proposing that a reserve be created there too.

The only other place where this most endangered of species is known to exist is Udjong Kulon National Park, in Java, where there are about 50.

Wildlife Conservation International

For White Rhinos, Guarded Condition is Good News

Under the watchful eyes of 180 well-motivated guards, the world population of northern white rhinos jumped nearly 20% last year (1989) with the births of four babies to the rhinos in Zaire's Garamba National Park. Now numbering 26 up from a mere 15 in 1983 this subspecies of the white rhinoceros survives only in the 3,000-square-mile park. It once ranged through five countries in Central Africa.

The heavy poaching that nearly wiped out the sub-species and which together with habitat destruction, disease, and drought, has reduced all rhino populations by 85 percent in the past 25 years, came to a halt in Garamba six years ago when a vigourous rhino protection programme was launched. The Zairean government, with the help of conservation groups, increased the number of guards, raised their monthly salaries from US$ 4 to US$ 16, and provided uniforms, better equipment, and other benefits and pay incentives.

Muhindo Mesi, the park warden, plans to pursue yet another approach to save the rhinos in Garamba: actively courting the support of the 100,000 or so people living around the perimeter of the park, through a conservation education programme and, possibly, by improving goat and sheep herds to reduce the temptations for villagers to come to the park for meat.

The New York Times

Vitamin E Levels Measured in Rhino Browse Plants

Previous work in our laboratory and others has shown differences in plasma alpha-tocopherol levels between zoo (0.2 micrograms/ml) and free-ranging (0.8 micrograms/ml) black rhinos. Because this is a measure of vitamin E activity, the result suggested that many captive animals may be suffering from vitamin E deficiency. The original comparison was made with 31 blood samples taken during a 1988 translocation exercise in Zimbabwe. Later we measured plasma alphatocopherol in samples from 44 free-ranging black rhinos in South Africa, 7 in Kenya, 4 in Namibia, and an additional 24 animals in Zimbabwe. These results averaged 0.6,0.2,0.8 and 0.5 micrograms/ml respectively.

Because plasma and dietary levels of alpha-tocopherol are closely correlated, the differences seen among these various rhino populations suggested widely varying diets and/or habitat quality. To investigate this possibility, a collaborative field study with Fred K. Wawereu, Wildlife Conservation International, Kenya, R. DuToit, Zambezi Rhino Project, and R. Brett, World Wildlife Fund, Kenya, was organized to quantify alpha-tocopherol levels in major browse species consumed by black rhinos. Two national parks and two private reserves in Kenya, and the Zambezi Valley, Zimbabwe, were chosen as study sites.

Tocopherols must be extracted from fresh plant tissues, and, to our knowledge, have not before been measured in a field study. In order to do so, a portable laboratory containing necessary chemicals and a hand-held homogenizer, as well as a full-sized tank of nitrogen gas, was loaded into vehicles and taken to makeshift labs. Converted storerooms or kitchens generally met our relative minor requirements of bench space, electricity and water, although we were treated to a proper laboratory at the Rukomechi Tsetse Fly Research Station in the Zambezi Valley! Samples were weighed, homogenized, extracted, evaporated, reconstituted, sealed, and freezer-stored until shipment back to the United States for high-performance liquid chromatography analysis.

The experienced African field researchers identified a minimum of ten species of major food plants for each site. Results indicated wide variation in vitamin E levels in fresh rhino browse plants. Leaves contained two to fifty times more alpha-tocopherol than stem fractions of the same plant; mature tissues had higher concentrations than young, growing tissues. Environmental

variables appeared to influence vitamin E levels in browse significantly, but were not taken into account in this preliminary study. Rainfall, temperature and sunlight effects on alpha-tocopherol metabolism in plants are currently being examined in controlled greenhouse studies.

Whole plants ranged from 4.1 *(Acacia drepanolobium)* to 420.9 *(Scutia myrtinus)* mg alpha-tocopherol per kg dry matter which is equivalent to 6-630 International Units of Vitamin E activity/ kg (1 mg = 1.49 IU). Dietary levels of alpha-tocopherol from various locations (unweighted means) did not correlate well with the plasma levels previously measured in animals from the various sites. For example, the twenty-seven Zambezi Valley plants averaged 45.5 mg/kg alpha-tocopherol (range 6.4 to 191.8) whereas the Kenyan location, which had the animals with lowest plasma alpha-tocopherol, averaged 154.2 (range 21.2 to 420.9). Reasons for this apparent discrepancy are being investigated.

Nonetheless, about 60% of the plants sampled contained vitamin E levels greater than 50 lU/kg, the current National Research Council recommendation for dietary vitamin E in horses. These data, though limited, should provide excellent guidelines for use in formulating appropriate levels of vitamin E supplementation for zoo rhinoceros. Based on field observations, diets fed to black rhino should contain a minimum of 150 IU, and more likely 250 IU vitamin E per kg of dry matter. Future projects will be designed to investigate seasonal and other environmental as well as physical (i.e. fire, grazing pressure) influences on vitamin E in plants, in an effort to refine not only herbivore feeding recommendations, but also plant conservation in relevant locations.

Ellen S. Dierenfeld, *The Rhino Conservation Newsletter*, I, No 3 (Autumn 1990).

Black Rhinos Sold to Private Owner in Southern Africa

History was made on June 18, 1990, when the Natal Parks Board auctioned a founder population of five black rhino to a privately owned nature reserve. Lapalala Wilderness successfully bid 2.2 million rand for the two bulls and three cows.

Because the black rhino is so highly endangered, South Africa, like Kenya and Zimbabwe, is turning to controlled breeding in small discrete reserves to ensure the species' survival. Assessments by the Natal Parks Board and Peter Hitchens, a black rhino specialist, found the 24,400 hectare Lapalala Wilderness to be one of eight private reserves in southern Africa considered suitable for black rhino introduction. It is located in the Waterberg Mountains in the northwestern part of the Transvaal province, a region from which black rhinos have been absent for over 100 years.

The rhinos 900 kilometre trip to Lapalala Wilderness was supervised by Dr Martin Brooks of the Natal Parks Board. On August 8, 1990, the animals were immobilized by Parks Board veterinarian Peter Rogers, at which time body measurements were taken and ears were notched for future field identification. Also at this time, the tip of each rhino's horn was cut off as a precaution against injury to one another. The horn tips will be used in a DNA fingerprinting study being undertaken by Dr Anthony Hall-Martin of the National Parks Board of South Africa.

Upon their arrival on August 9, they were released into specially constructed enclosures within a 10,000 hectare game-fenced section of Lapalala Wilderness to undergo a settling in period before their release. As of October 12, 1990, the rhinos were still being held in the enclosures and doing very well. The release process was to begin in late October, 1990, after the rainy season had commenced and the quality of the habitat had improved.

Clive Walker of Lapalala Wilderness admits that there is some controversy about turning black rhinos over to private owners, but he believes most would agree that it is wise and that it will continue to occur. The significance of the event to the private sector can be gauged by the price that was paid for the privilege of acquiring the five rhinos. As stated by Clive Walker: "This is a great responsibility for us at Lapalala Wilderness. This opportunity arises from the confidence the Natal Parks Board has placed on the private sector in allowing these animals to go onto private land. We are only too aware of what has happened to the black rhino across Africa; southern Africa is their last stronghold and we are happy to be part of their conservation. A great deal will be expected of us and we will have to measure up to those expectations."

The Lapalala transaction was of great economic benefit to the Natal Parks Board because sale proceeds were used to provide funding for its various conservation programmes. Of even greater significance, however, was the fact that for the first time ever in South Africa, black rhinos were assigned an economic value. This could potentially prove helpful in the courtroom, as judges can now take into consideration a replacement cost in assessing penalties against rhino poachers. Increased fines and stiffer sentences are being called for in South Africa where the current penalty for rhino poaching is only 1,500 rand or one year in jail.

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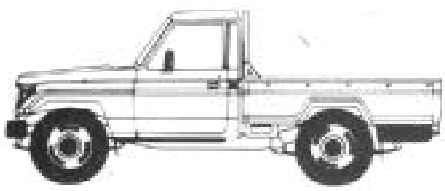

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