CONSERVING RHINOS IN GARAMBA NATIONAL PARK

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BACKGROUND

Historical
When the northern sub-species of white rhinoceros (*Ceratotherium simum cottoni*) was discovered in 1900 in the Sudan, the southern race (*C.s.simum*) was nearly extinct in South Africa. At that time the northern white rhinos occurred in the guinea savannas of five countries: Zaire, Sudan, Uganda, Central African Republic and Chad. (Fig 1). Now the situation is reversed and almost certainly, their only representation in the wild is in Garamba National Park in Zaire.

Within the park they have been subject to two major population fluctuations. Figure 2 gives an indication of these fluctations, though the figures cannot strictly be compared since methods of estimation varied. The rates of increase for example are almost certainly exagerated, though they may have been supplemented by immigration. After the creation of the park, which protected the rhinos from hunting for meat by the local people, numbers appear to have increased until by 1960 there were 1000-1300 (Park Reports). They were decimated by poaching during the Simba rebellion of 1964 and then increased again to 490 ±270 (Savidge, *et al.*, 1970) in 1976. After 1978 they were reduced by heavy poaching for commerce in the horn, much of it carried out or condoned by the park staff themselves. One official in the region claimed to have exported 4 tons of horn during the 1970s (equivalent to about 1000 rhinos).

In 1983, when there were 13-20 (Hillman, *et al.*, 1983), a recommendation was considered to take the remaining rhinos in the park into captivity, with the idea of possible later re-introduction. This would have implied not only the problems and dangers inherent in capture, translocation and re-introduction, but also made it unlikely that a project to redevelop the park and protect the ecosystem would have materialised. Fortunately this was unnacceptable to Zaire and it was decided that a project should be funded to redevelop the ability of the park to protect the ecosystem, of which the rhinos were an important part. The Garamba National Park Project is a co-operative venture between the World Wide Fund for Nature (WWF), the Frankfurt Zoological Society (FZS), The International Union for the Conservation of Nature (IUCN), the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the Institut Zairois pour la Conservation de la Nature (IZCN) with additional small contributions from elsewhere.

Current situation
At the start of the project in 1984 there were 15 rhinos, now there are 28. During that period one has been born in captivity and the number of pure *C.s. cottoni* in captivity has gone from 11 to 10. The decision to try to conserve them *in situ* has been proved correct. But what has been involved and what are the prognostications for the future?

We propose to consider three main aspects that affect their existence and which can, at least to some extent, be managed to try to acheive a "self-sustaining population":

1. The genetics of a small population and the demographic events we have observed as an indicator of population fitness;
2. Ecological and density dependent effects; and
3. The most important and over-riding effect of poaching and what is involved in combatting it and maintaining a project such as this.

1. POPULATION DYNAMICS

The problem

The founder population of this phase of the northern white rhinos in Garamba was only 15 animals, with an N_e of 11. Potential inbreeding depression is therefore a possibility in the future (Foose, 1986). However so far the demographic events we have recorded are very favourable.

Results of monitoring

The observed rate of increase is 9.68% per annum (r=0.09). This compares favourably with the rate of 9.5% found by Owen-Smith (1973) in Umfolozi Game Reserve for what is effectively the founder population of all *C.s.simum*, a sub-species that has increased from 100-200 in 1920 (Owen-Smith, 1973) to nearly 5000 individuals now. The doubling time of the Garamba population is estimated at eight years and a population of over 60 would be possible by the year 2000, if they can continue to be protected.

The mean inter-calf interval of observed recruitments is 32.9 months (2.7 years) (Table 1), but as we suspect that one female, F1, had a calf which was lost during one interval, the true interval is probably 29.9 months (2.5 years). One female, F4, has averaged only 23.8 months (1.98 years) between her four calves. Owen-Smith (1973) estimated a mean interval of 2.4 years, though that dropped to 2.2 years if he assumed an undetected infant mortality of 8%.

We have had the first third generation calf born since the start of the project, to a female aged 7 years, who was herself a calf in 1984. Mean age at first parturition in the Umfolozi population was also 7 years (Owen-Smith, 1973). We have observed oestrus in females of 5 years and suspected oestrus in a female of 4 years.

At the start of the Garamba project in 1984, after the heavy poaching of the preceeding five years, the adult:subadult and juvenile ratio was 10:5 (1:0.5) and only three females were accompanied by juveniles. The current ratio is 13:15 (1:1.2), indicative of an increasing population and all six females are accompanied by one or more juveniles.

The current overall sex ratio is 15 males:13 females. The adult ratio is 7 males : 6 females. All adult females are parous. Of the seven adult males, we have seen six either mating, courting or in consort with females. The seventh is a young male, who is probably socially restricted from mating. The suspected effective reproductive population, N_e, is therefore equally representative of males and females. Although the current N_e is only 12, the sex ratio of equality gives maximum chance for maintenance of genetic diversity. The N_e/N ratio is 0.43, within the range of 0.25-0.5 proposed by Foose (1986) as a guideline in conservation strategies for black rhinos.

Management action

Compared with figures for southern white rhinos, population dynamics appear to be good so far. Given adequate protection the population has proved that it can increase at a satisfactory rate. No genetic management is currently necessary. However, with so small a founder population there could still be a potential for future inbreeding depression. To be able to make more accurate predictions and to consider the need for possible future genetic management of this population we have proposed taking skin samples by biopsy darting (Karesh, *et al.*, 1987) in order to examine the genetic diversity and in order to carry out genetic finger-printing of the whole population.

2. DENSITY DEPENDENT AND ECOLOGICAL EFFECTS

Low density problem

One question that has arisen in the past when rhinos have been reduced to very low densities by poaching is: "Can such sedentary animals find each other at appropriate times to maintain an adequate rate of reproduction?".

Results of monitoring
Despite the rhinos having been at overall densities of 0.003 to 0.006/km^2 and at local densities of 0.02 to 0.03/km^2 during the period of the project the answer we have found here is "Yes". This is manifest in the results reported above and appears to be acheived primarily by means of very large home ranges. The average home range size is 251 km^2, and the ranges are over 10 times larger than those reported for southern white rhinos (Owen-Smith, 1973) This means that most of the female ranges overlap with most of the male ranges, and that most of the male ranges are too large too be defended as strictly exclusive territories. Figure 4 demonstrates an example of the ranges of two females (F3 and F6) compared with that of a male, M2, who in fact changed his range in September 1988. He had previously held the prime territory, most visited by most of the females. He was ousted by a young male who had previously shared it as a subordinate sub-adult. M2 then established another territory to the east which brings him into more frequent contact with the F6 familly who had not often visited his previous territory.

Our observations also indicate that each male is associating sexually with a number of different females. For example, M2 has been seen in consort with four of the original five adult females and could easilly have been, unobserved, with the fifth, since their ranges overlap. On the basis of observed associations relative to subsequent births we suspect that M2 sired 4c Noel, that M4 sired 5b Grizmek and that M6 sired 1b Mpiko and 3aa Bonne Annee. (Fig. 5).

Figure 7 depicts the location of individuals in March, 1991 as an example of temporary aggregations of female families. At least three young females in oestrus and a number of different males occurred within the same small area. In this example it was a habitat of 34 km^2 which included four adult females and their respective accompanying juveniles and sub-adults and at least three males. Two of the males hold territories which overlap, but the third, who was actually observed mating, normally resides over 20 km away.

The end result of all this mobility is maximum genetic mixing, which is ideal for maintaining as much genetic diversity as possible.

Management action
None is required.

An interesting peripheral question that has emerged from the repeated occurance of loose aggregations in this population of low density is that of communication among individuals. We should like to investigate this at greater depth.

Habitat problem
The ecology of the rhinos can also affect their survival. Garamba Park is an area of fire-climax open savanna grassland. Tree cover is less than 5% compared with 50-90% just outside the park. This is partly due to elephants but also to fires. The grassland is dominated by perennial *Loudetia arudinacea* and *Hypparhenia* species that grow to 2 to 3m tall. In the latter half of the wet season they are very unpalatable and under the old regime they were all burnt off in the dry season leaving vast areas devoid of grazing and of cover. This tended to cause large movements by the rhinos, even outside the park where they were more vulnerable to poaching. There were similar effects on the elephants (*Loxodonta africana*).

Experimental results
To combat this we have established an experiment, dividing the rhino area up into management blocks which are subjected to different fire regimes. These include, early wet season, early dry season and late dry season burns, and no burn blocks. This creates a mosaic of different states of the habitat at all times of the year. From direct observations of the rhinos, observations of spoor and aerial counts of the experimental blocks we have found that the rhinos favour short grass, 2-4 months post burn for feeding at night and

during the early morning. After 10.a.m. more than 50% of them are resting and they invariably choose termite area clearings within areas of long grass as resting sites. If they are disturbed out in the short grass the reaction the majority of the time is to retreat into long grass. The same is also true of the elephants, another species vulnerable to poaching. Elephants select long grass in contrast to buffalo (*Synceros caffer brachyceros*) ($P<0.001$) (Figure 6).

Thus, the favoured habitat for the rhinos is an interface between long and short grass. Short grass is used for feeding and the long grass for cover. Figure 7 is an example of choice of this type of habitat. As a result of the burning regime, in February and March each year a 3-4 km wide block is short grass bordered on either side by long grass. Each year it attracts a high density of rhinos, as demonstrated by the observations for March, 1991.

Management Action

The mosaic effect has been successful in creating a mixture of habitats that keeps the rhinos within a reasonably protectable core area. Fire management needs to be continued, as well as more detailed studies of feeding behaviour.

3. POACHING AND PROJECT MANAGEMENT

The problem

Poaching is the most important and over-riding negative effect for survival of the rhinos. Genetic and ecological management are the icing on the cake. If poaching cannot be controlled there is no cake.

One could consider three types of poaching that can and have affected these rhinos, though all are inter-linked:

1. Poaching due to war. This was what decimated the rhino population in 1964. Curry Lindahl, (1972) estimated that the rhinos were reduced from 1300 to about 100. The secondary effects of war threaten the park even now from Sudan and political instability in Zaire could be a potential problem.
2. Internal poaching. This is commercially motivated poaching carried out mainly by the park staff themselves. This was the main type of poaching during the late 1970s and because of this it has been possible to significantly reduce this form of poaching by modification of park and personnel management.
3. External poaching. Large scale poaching, well organised and armed from outside the park could be more difficult to control.

Scope and results of management action

The current increase of the rhinos could be attributed to two main factors: the existence of the Garamba National Park Project and changes within the Institut Zairois pour la Conservation de la Nature (IZCN). The changes within IZCN centre on the appointment of Dr. Mankoto ma Mbaelele as President Delegue General. He has been able to improve the conditions for the guards and hence their motivation and he has changed attitudes through increased control and a better example. The presence of an excellent Conservateur Principal at Garamba has also been important.

What has been involved in the project itself? The project is aimed at the whole park. The rhinos cannot be considered in isolation. Hence the sphere of activity is broad. Immediately prior to the project there were no equipment, vehicles or fuel at the park and barely any roads. There were no guards' rations for patrolling, salaries were minimal (approximately US$4 per month) and six months in arrears. Poaching was therefore rife among the park staff.

In order to improve the ability of the park to protect the ecosystem the project has provided vehicles, fuel, uniforms and equipment, rations, bonuses and technical training. In order to re-organise the anti-poaching it has constructed patrol posts and provided radios and aerial support and has opened and maintained roads and constructed river crossings. Research and monitoring is focused on data needed to guide conservation and management.

One of the main factors affecting the Garamba National Park Project is the remoteness and hence the difficulty in obtaining supplies. For the initial 5 years all the fuel was trucked in from Kenya, some 2,000 km away. Roads and bridges within Zaire are so bad that often large shipments of equipment have to be left 200 km away, and then ferried by lighter vehicle. Most large shipments such as equipment for guards, vehicle spare parts, workshop equipment and vehicles are ordered from Europe and take the best part of a year to reach Garamba.

In an area so remote, every activity is linked to the next. By providing vehicles, one had to invest in setting up a workshop unit capable of performing major repairs and modifications, as well as regular maintenance. Mechanics were trained, general equipment stores and supply lines established. Conditions being what they are in the Park, the first two landrovers had chasses broken through in eight places after only 40,000 km.

New tracks have been opened in order to improve access to the different sectors of Garamba. For more than half the year the grass is over 3m long, and makes driving in the Park nearly impossible, unless the tracks have been kept open by tractor and mower. Over 400 km of internal tracks need 3 cuts per season. Thus, an enormous effort is made each year to keep the tracks open.

Originally, access into the park was by pontoon over the Dungu river. One of the first major project activites was to construct a concrete causeway, 3m wide and 90m long, so as to allow quick access into the park for 10 months of the year. This type of river crossing has been used on a number of rivers throughout the park. In the northern section, observation outposts have been developed on isolated hills, providing a panoramic view for spotting smoke from poachers fires. These outposts are equipped with solar powered radio systems in contact with park headquarters, vehicles or aircraft.

The present low level of poaching in the north of the park is largely for meat and is done by the local people around the park, and occasionally by guards based at remote outposts. Fortunately there is little or no commercial poaching for rhino horn or ivory. However, rhino conservation activities in the Park are affected by the political instability in Sudan. All that has been achieved over the past 7 years could be lost if the political situation in Zaire gets out of control.

The SPLA rebel forces in Sudan have bases along the northern boundary of the park. They are well equipped and, supplied with rations, do not need to poach in order to feed themselves. They strongly rely on good relations with Zaire and, in fact, are assisting with combating poaching activites carried out by the Sudanese. The abundance of arms and ammunition left in the area once the fighting stops are a source of concern.

In late March, 1991, when rebel forces took the town of Maridi, Government forces fled with their families and local population. Some 50,000 refugees passed through the park on their way to a refugee camp in the nearby town of Dungu. Our guards confiscated over 300 weapons and 10,000 rounds of ammunition. Unfortunately, this is only an indication of how the area surrounding the park is now saturated with ammunition. An operation is underway to recover it.

The financial level of input of the international project has been on average a little over $200,000 per annum over the past seven years. Together with the IZCN input, which amounts to about 10% of that and funds for research and monitoring, the annual expenditure is $\$55/km^2$. Probably as a result of greater poaching pressure from the north the rhinos and elephants are concentrated in the south of the park (3.1 elephants/km^2 in the south and 0.3/km overall). This makes it possible to concentrate more effort in the south. Nevertheless the financial support is considerably less than that of $\$230/km^2$

extrapolated by Leader-Williams and Albon (1988) as needed to ensure adequate rhino conservation. Yet the success of the project is amply indicated by the rhino increase and by evidence of reduced poaching. The live:dead ratio of elephants in 1983 was 8:1. In 1986, it was down to 118:1 with no fresh carcasses.

We believe that the success of the project has been largely due to the fact that most of the recent poaching was internal and that the presence of the project with improved conditions and control coupled with improvements within IZCN have been able to achieve a good level of control from within.

However, we cannot by any means afford to be complacent. Such a small population in a less than politically stable area is vulnerable. It is invaluable that two back-up populations exist in captivity. Co-operative research is between the wild and captive populations is valuable and we hope can be increased, and co-operative management may be necessary in the future.

However, the current cost of maintaining the park is the equivalent of $10,000 per rhino per year, which is similar to figures for captive conservation (M. Stanley-Price, pers. comm.). For this we not only conserve the rhinos but the whole ecosystem of which they are a figurehead, including 4,500 elephants, 32,000 buffalos, the only giraffes (*Giraffa camelopardalis congoensis*) in Zaire and a unique example of this type of habitat in Zaire, within a World Heritage Site. It is vital that at least the same level of support continues, ideally a higher level, to improve the surveillance, increase the research and to put the conservation of the park on a more stable long term basis. As much as possible, a higher proportion of the cost needs to be borne from within Zaire. Ways need to be developed to make the park more self-supporting. For the long term, development in the buffer zones around the park needs to be integrated with that of the park. Garamba has a unique advantage in the effort to become more self-financing through tourism. It has the only Africa Elephant Domestication Centre and elephants can be ridden through the park.

These are the objectives for the current third phase of the project. To achieve them will initially require more funding, but it would seem to be a worthwhile investment compared with merely taking all the rhinos into captivity.

REFERENCES

Curry-Lindhal, K. (1972). War and the White Rhinos. Oryx 11(4): 263-267

Hillman, K., M. Borner, Mankoto ma O., P. Rogers, F. Smith, (1983). Aerialcensus of the Garamba National Park, Zaire, March 1983. Report to IUCN/WWF/FZS and UNEP.

Karesh, W., F. Smith and H. Frazier Taylor. (1987). A remote method for obtaining skin biopsies. Conservation Biology 1, 257-258.

Foose, T. (1987). Long term management of small rhino populations. Pachyderm 9, 13-15.

Owen-Smith, R.N. (1974). The behavioural ecology of the white rhinoceros. Doctoral thesis University of Wisconsin.

Savidge, J.M., M. Woodford and H.Croze. (1976). Report on a mission to Zaire. FAO W/K1593 KEN/71/526 - ZAI/70/001

Leader-Williams, N. and Albon, S.D. (1988). Allocation of resources for conservation. Nature 336, 533-535.

Table 1

RHINO INTER-CALF INTERVALS
GARAMBA N.P. 1983-1991

FEMALE	JUVENILE	BIRTH DATE	INTERVAL (months)	MEAN (months)
F1	1aM	7-8/83		
			69 (poss. 1 calf lost)	
	1bM	3-4/89		45.5 or 30.3
			22	
	1cF	2/91		
F3	3aF	9-10/83		
			21-22	
	3bF	7/85		37
			53	
	3cM	12/89		
F4	4aM	8-9/83		
			20-21	
	4bF	5/85		
			29	23.8
	4cF	10-11/87		
			22	
	4dF	8-9/89		
F5	5aM	2/85		
			32	
	5bF	10/87		27
			22	
	5cM	8/89		
F6	6aF	3/86		
			39	39
	6bF	6/88		
		OVERALL MEAN:		33 (2.75yrs)
		ASSUMING LOST CALF:		30 (2.5yrs)

Table 2

POPULATION DYNAMICS

A comparison between observed demographic parameters in populations of Ceratotherium simum cottoni and C.s.simum.

	GARAMBA N.P. 1984-1991	UMFOLOZI G.R. 1969-1973
Annual rate of increase	9.68%	9.5%
Inter-calf interval	2.5 years	2.4 years
Age at first parturition	7 years	7 years
Adult : Sub-adult & juvenile ratio	1 : 1.2	1 : 1.4

Table 3

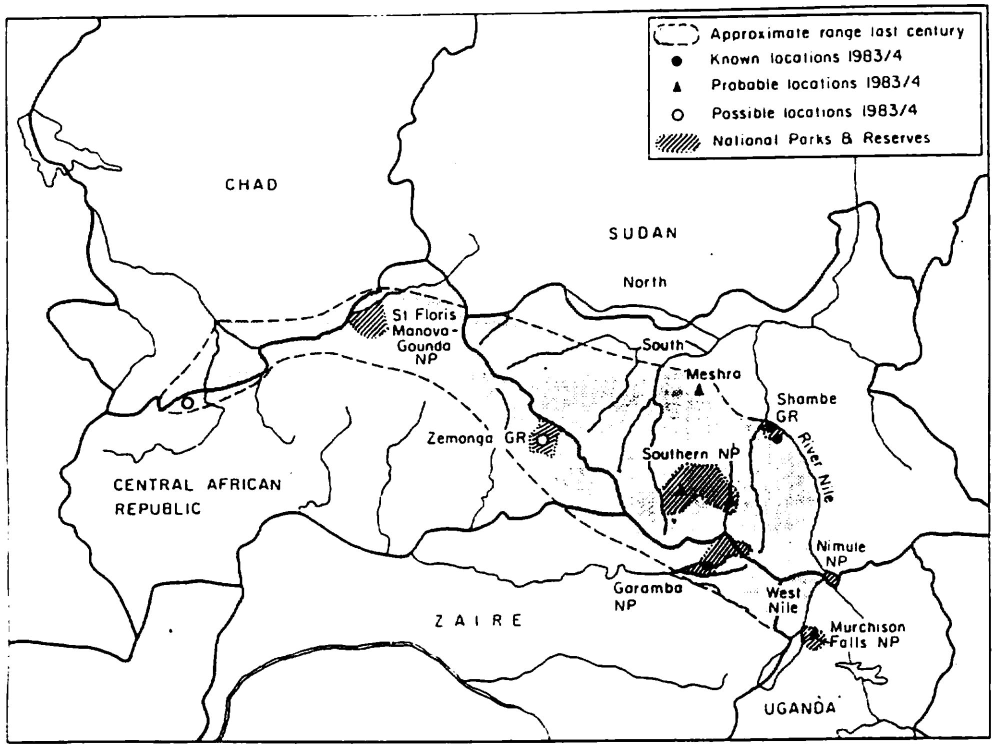
Parc National de la Garamba

NORTHERN WHITE RHINOCEROS (*Ceratotherium simum cottoni*)

POPULATION STRUCTURE AND DYNAMICS, MARCH 1991

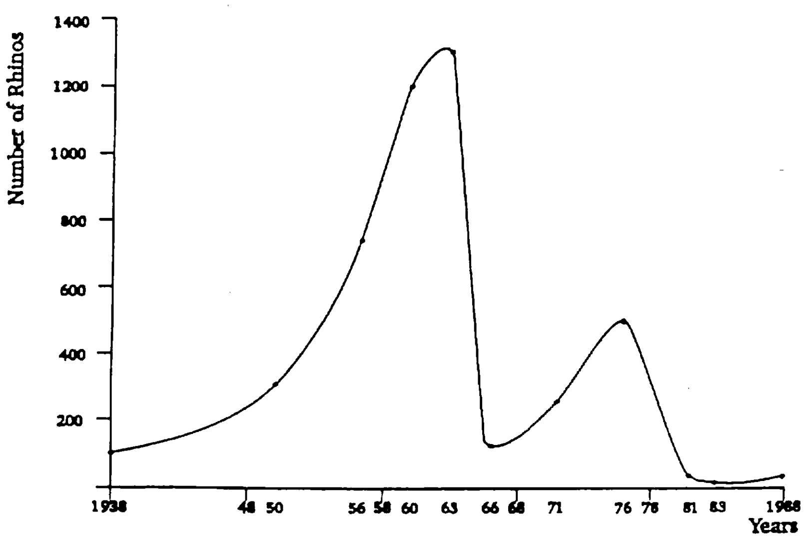
ADULT MALES		STATUS
M2	'Eleti'	dominant, territory changed in 09.88.
M3	'Kondo akatani'	prior to 09.88 classed as old sub-adult, took over territory of M2
M4	'Bac'	probably dominant.
M5	'Bawesi'	dominant
M6	'Longuecorne'	dominant
M7	'Moitier'	young male
M9	'Notch'	dominant
ADULT FEMALES		
F1	'Mama Moke'	with IF
F3	'Kunalina'	with JM
F4	'Boletina'	with JF and SF
F5	'Mama Giningamba'	with JM
F6	'Pacque'	with JM and SF
3aF	'Kuni'	born c.9-10/83, with IM
SUB-ADULTS		
1aM	'Moke'	S2, male, born mid 1983
4aM	'Bolete moke'	S2, male, born c. 08-09.1983
5aM	'Giningamba'	S1, male, born 02.85
4bF	'Mai'	S1, female, born 05.85
3bF	'Juillet'	S1, female, born 07.85,
6aF	'Oeuf de Pacque'	S1, female, born 03.86
4cF	'Noel'	S1, female, born 10-11.87
5bF	'Grizmek'	S1, female, born 10.87
JUVENILES		
6bM	'Elikya'	J3, male, born 06.88
1bM	'Mpiko'	J3, male, born 03-04.89
4dF	'Minzoto'	J2, female, born 08-09.89
5cM	'Molende'	J2, male, born 08.89
3cM	'Solo'	J1, male, born 12.89,
3aaM	'Bonne Annee'	I2, male, born 12.90
1cF	'Nawango'	I1, female, born 02.91

TOTAL KNOWN INDIVIDUALS	
Male adults (MA)	7
Female adults (FA)	6
Males sub-adults (SM)	3
Female sub-adults(SF)	5
Male juveniles (JM)	4
Female juveniles (JF)	1
Male infant (IM)	1
Female infant (IF)	1
TOTAL	28
SEX RATIO	15M : 13F
ADULT:SUBAD.& JUV.RATIO	1 : 1.2



Past and present ranges of northern white rhinos.

Figure 1



Estimates of the northern white rhino population of Garamba National Park since its inception in 1938.

Figure 2

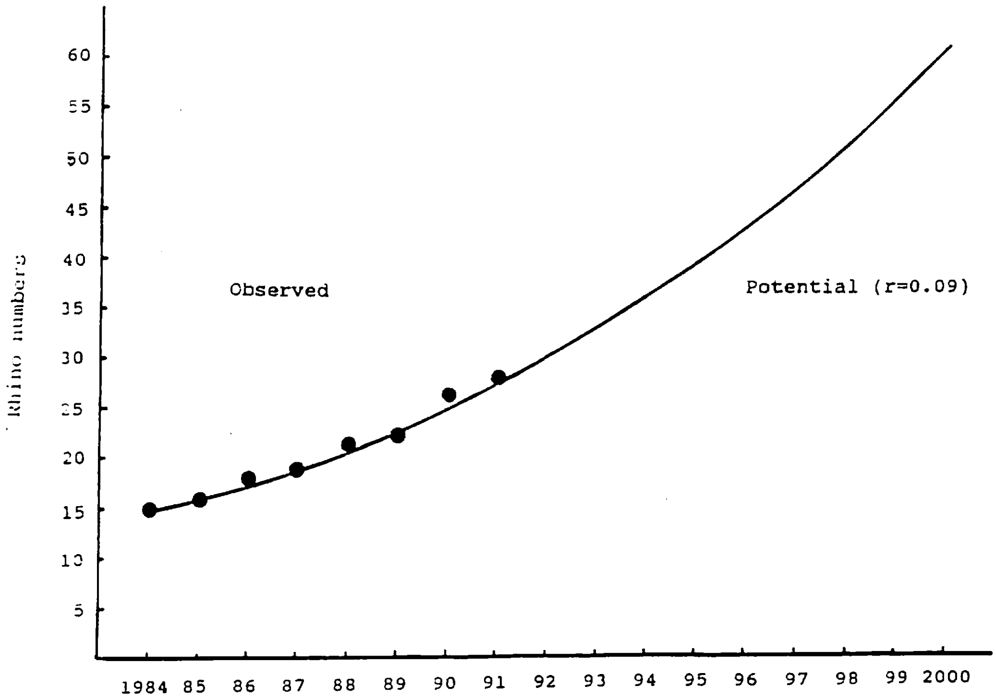


Figure 3

OBSERVED AND PREDICTED NORTHERN WHITE RHINO POPULATION GROWTH
GARAMBA NATIONAL PARK

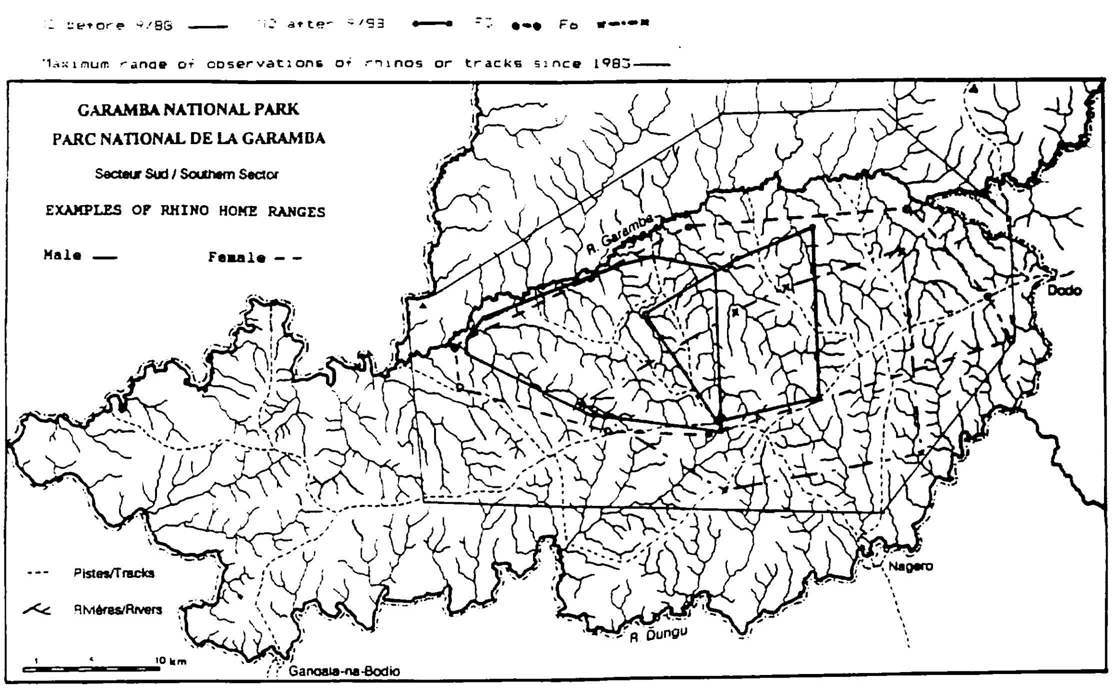


Figure 4

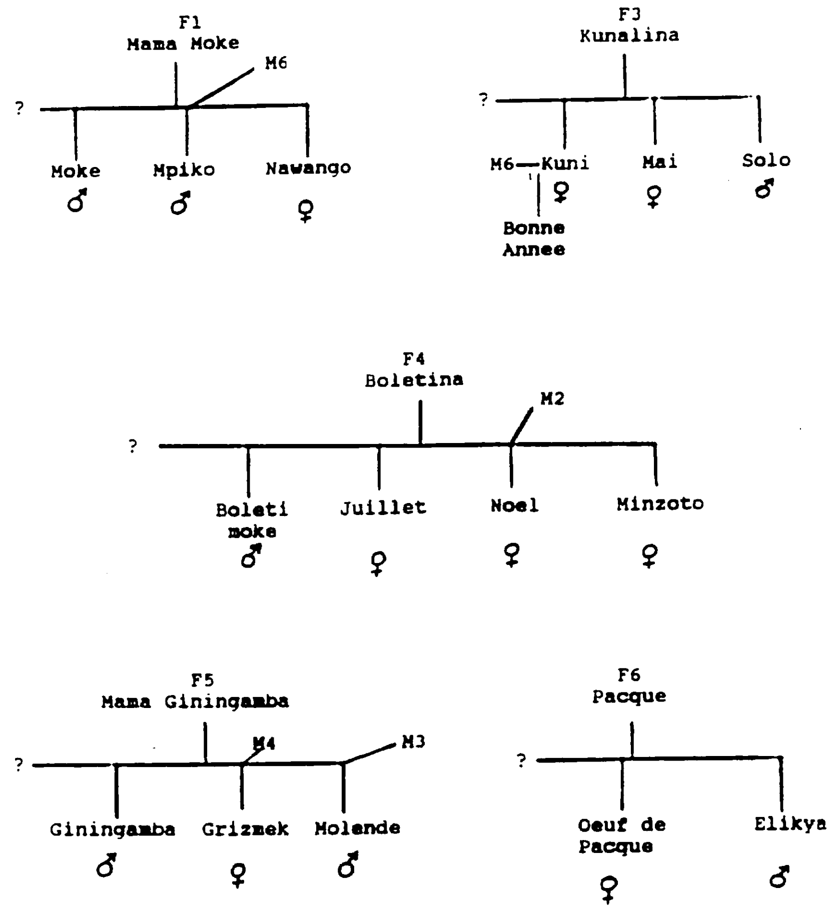


Figure 5

NORTHERN WHITE RHINOS, GARAMBA NATIONAL PARK

FAMILLY TREES

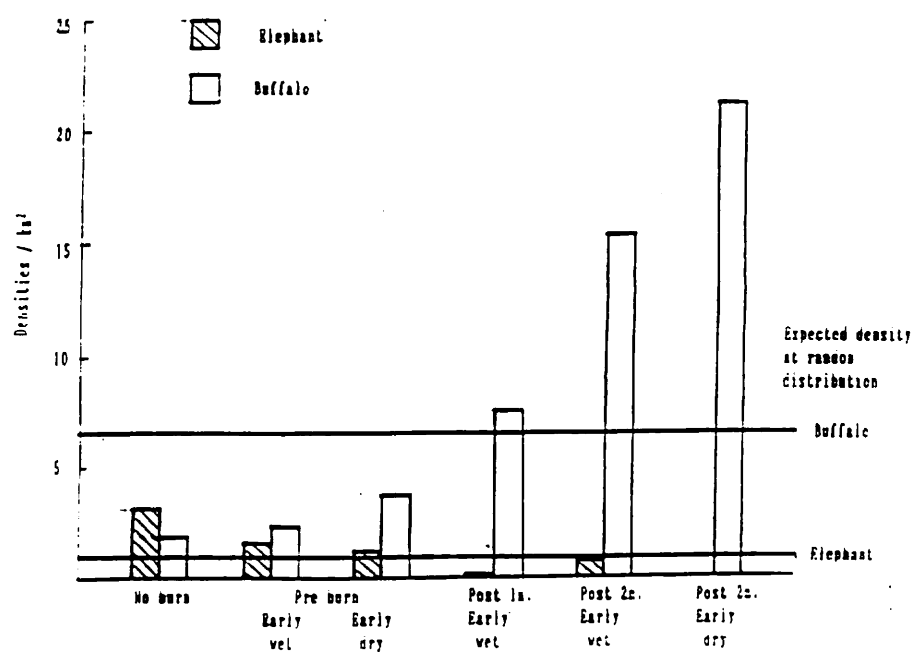


Figure 6

Densities of Elephant (Loxodonta africana) and Buffalo (Syncerus caffer brachyceros) in experimental burn blocks 1988-1990.

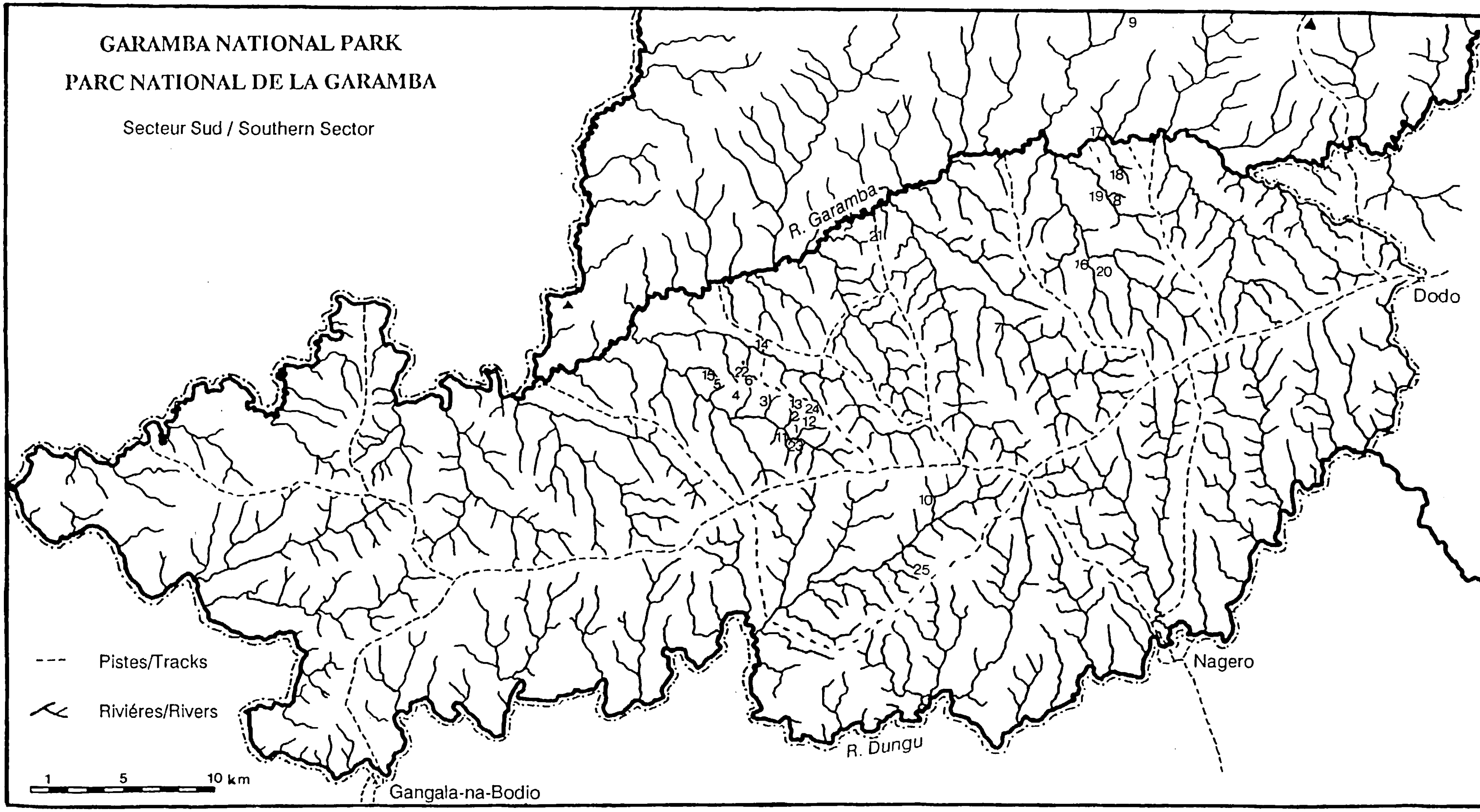

GARAMBA NATIONAL PARK
PARC NATIONAL DE LA GARAMBA
Secteur Sud / Southern Sector
R. Garamba
Dodo
Nagero
R. Dungu
Gangala-na-Bodio
Pistes/Tracks
Riviéres/Rivers
1
5
10 km

Figure 7