

GARAMBA NATIONAL PARK



ECOSYSTEM RESOURCE INVENTORY

by

Kes Hillman Smith

1989

np

GARAMBA NATIONAL PARK

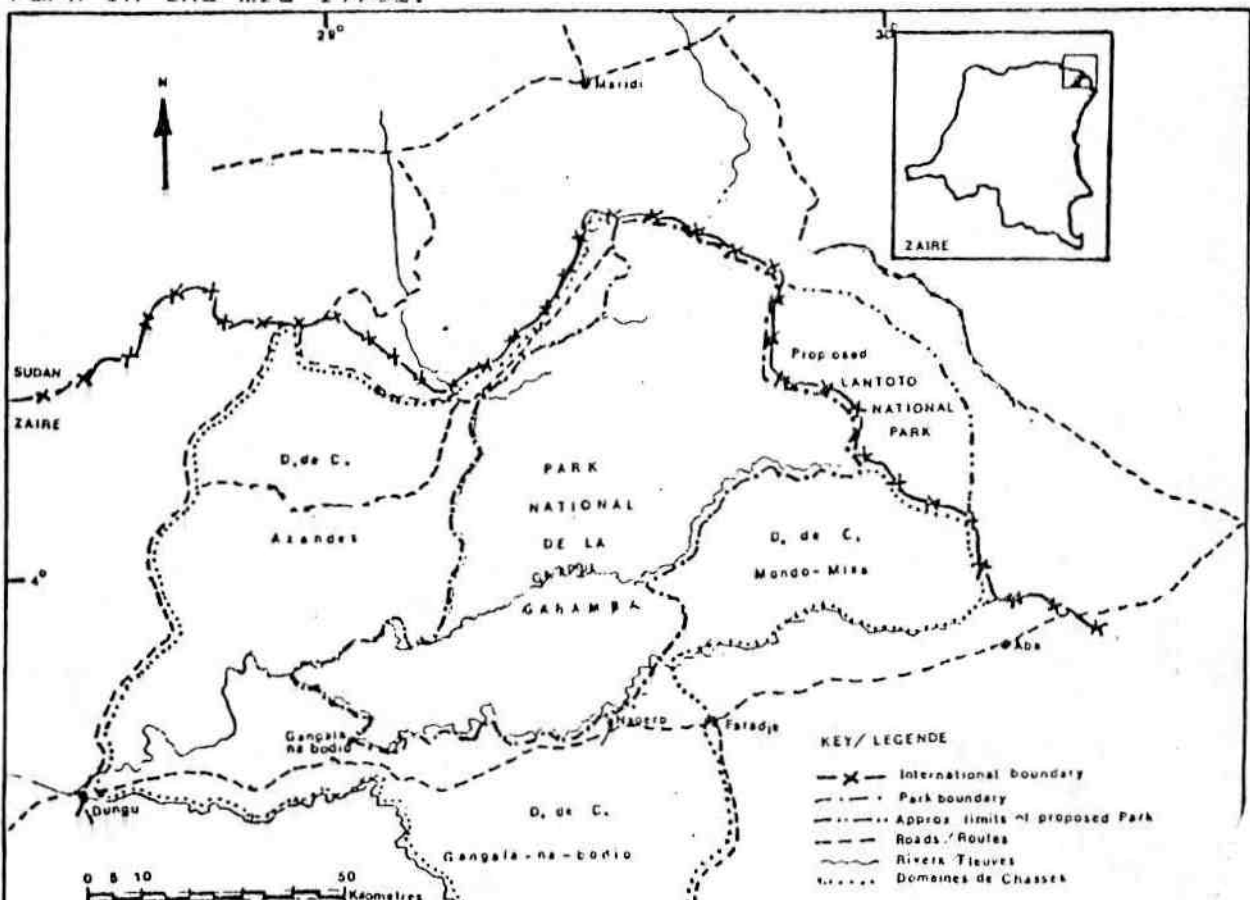
Garamba National Park is one of the oldest in Africa. It was established in March 1938 to protect the northern sub-species of white rhinoceros (*Ceratotherium simum cottoni*), the congo giraffe (*Giraffa camelopardalis congoensis*), and the variety and density of other species that occupy this ecosystem. Since 1980 it has also been a World Heritage Site.

Covering 4,900km² the Park is situated in the north-east corner of Zaire between latitudes 3° 8' and 4° 4' north and longitudes 29° and 30° west. It abuts Sudan and the northern boundary is the watershed between the Nile and Zaire rivers. It is surrounded by hunting reserves, theoretically as a buffer zone.

The climate is tropical semi-humid. The Park is in the guinea savanna vegetation zone, but much of it is secondarily modified to fire-climax grassland.

The Park is administered and protected by the Zairois Institute for Nature Conservation (IZCN). Since March 1984 this work has been aided by the staff and funds of the Garamba Rehabilitation Project, which is supported by the Frankfurt Zoological Society (FZS), the World Wide Fund for Nature (WWF) and UNESCO, under the auspices of the International Union for the Conservation of Nature (IUCN).

The main research previously carried out at the Park has been that of the exploratory mission of H. de Saeger, which was at the Park from 1950-52, and studies made during the FAO project at the Park in the mid 1970s.



Parc National de la Garamba

GENERAL COUNT, December 1984

INTRODUCTION

A systematic sample count of all large mammal species was carried out over the Park and a small section of the surrounding Domaines de Chasse in December 1984.

The two main objectives were:

- 1) an examination of animal distributions at the beginning of the dry season, in relation to habitat condition and particularly in relation to areas that had recently burned;
- 2) a census of animal numbers.

It is not the ideal time of year for getting the most accurate count, as many areas of long grass remain which hide animals, and visibility is reduced by smoke haze in the air. However a count had not been possible at the ideal time of April due to a lack of fuel.

METHOD

The method was the standard systematic transect aerial count used throughout East Africa, as described by Norton-Griffiths (1978), and was the same as that used on previous counts at Garamba (Savidge et al 1976, Hillman-Smith et al 1983)

Aircraft: Cessna 185, N5401R Pilot: Charles Mackie

Front seat observer: Kes Smith

Rear seat observers: Fraser Smith,
 Conservateur Batechi

Height: 343 ft a.g.l. (average)

Speed: 192 k.p.h. (average)

Area: The whole park, (4,900km²) and 450 km² of Domaine de Chasse d'Azande to the west.

Transects: Straight line, north-south transects were flown at 5km intervals. Each transect was sub-divided into 5km sub-units.

Strip width: Rods on the wing struts demarcated strip widths, which were calibrated for different flying heights by flying over markers laid out on the runway. Strip widths were calculated per transect based on average height above ground. Overall combined strip width in transects averaged 425m.

Sample intensity: 8.6%

Analysis: Data were analysed on a Kaypro 2 computer using 'Supercalc 2'

Species: All large mammal species were counted within the strip widths. Rhinos were also noted and identified outside transects, but for the purpose of the census were only counted within strip widths. Human settlements and domestic livestock and poaching camps were also counted where present. Any skeletons seen were counted within strip widths, identified to species if possible and classified according to Douglas-Hamilton & Hillman (1981), as follows:

Category 1 - Fresh, muscle tissue still present giving rounded appearance.

Category 2 - Bare rot patch caused by release of body fluids and trampling by scavengers still present.

Category 3 - Rot patch absent, bones white.

Category 4 - Bones grey and flaking

In this climate the first 2 categories pass more quickly than in dryer areas, and the frequency of termitaria confuses the definition of rot patches.

Habitat factors: Every sub-unit the front seat observer recorded the height as measured by the radar altimeter and estimated percentages of the following habitat parameters:

Tree cover - In units of 10% as % of sub-unit

Tree greenness - as a percent of trees present

Bush cover - % of sub-unit

Bush greenness - % of bushes present

Grass cover - % of sub-unit

Grass greenness - % of grass present

Long old grass - % of grass present

Burn - % in sub-unit of fresh burn

Flush - % in sub-unit of new flush

Water availability - 0:none available

1:available only to humans and livestock

2:limited availability

3:unlimited availability

4:running water

5:floods

Agriculture - as % in sub-unit

Vegetation zones, as defined in vegetation classification of Park

Other notes to aid analysis.

RESULTS

Results are given in the accompanying table and distributions are plotted on accompanying maps.

Parc National de la Saramba

GENERAL COUNT/RECENSEMENT GENERAL, December/Decembre 1984

POPULATION ESTIMATES/DES ESTIMATIONS DE POPULATIONS

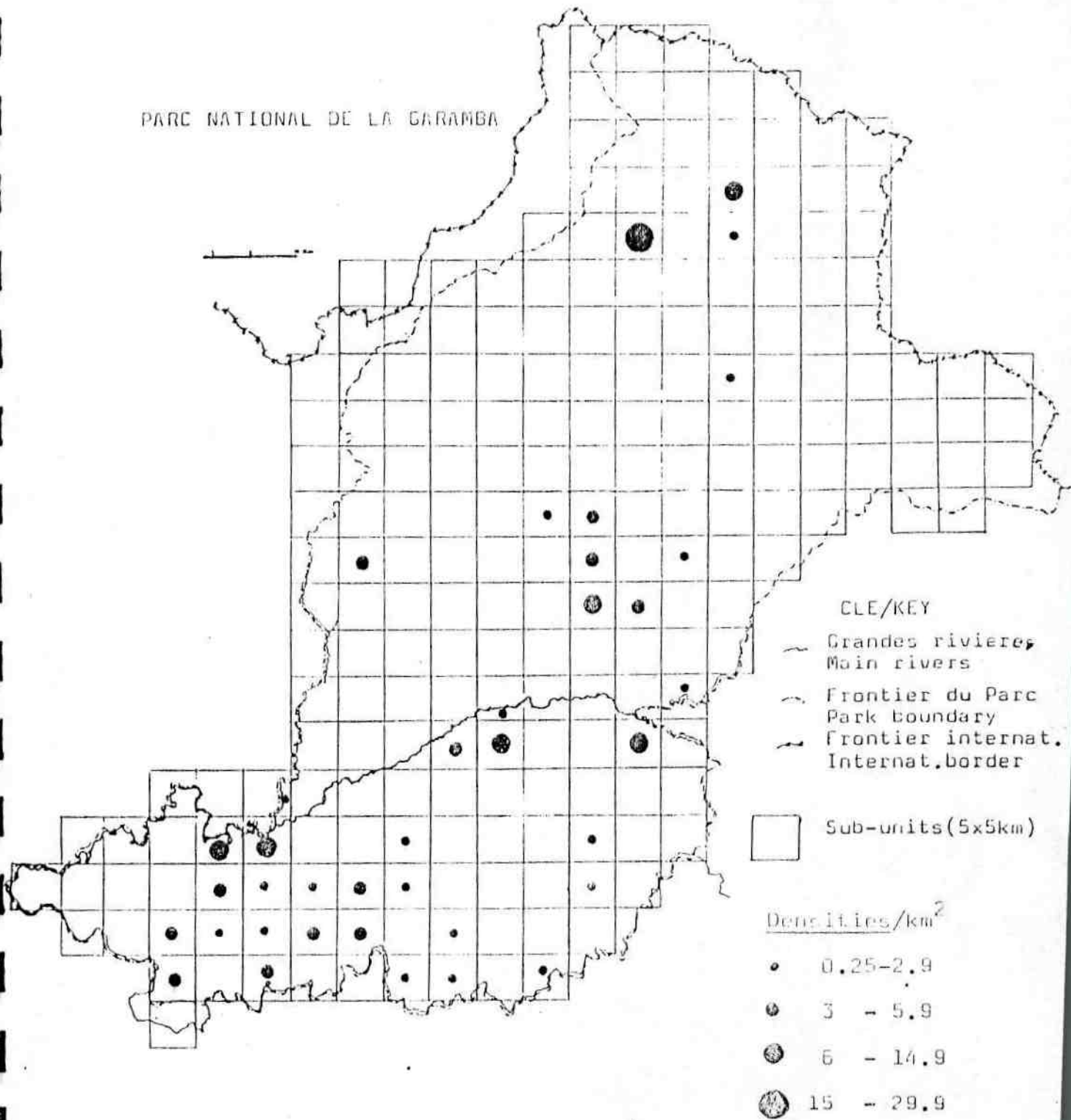
Area: Park/Parc: 4900km²
 Out/en dehors: 450km²

SPECIES/ESPECES	POP. EST. IN PARK/ DANS LE PARC	+ - S. E.	OUT OF PARK/EN DEHORS DU PARC	% ON BURN % SUR AIRES BRULEES
Elephant	3300	509		2%
Buffalo/Bufle	48284	5892	76	38%
Rhinoceros	11	12		
Giraffe/Girafe	273	144		84%
Hippo/Hippopotame	448*	442		
Hartebeeste/Bubale	1224	442		71%
Kob/Cobe	3792	214		14%
Waterbuck/Cobe defassa	568	293	218	69%
Reedbuck/Redunca	175	101		6%
Bushbuck/Guib harnache	131**	57	11	38%
Duiker, grey/Cephalophe	109**	126	11	36%
Oribi/Durebi	153**	103		64%
Warthog/Phacochere	404**	182		32%
Lion	33**	69		
Hyena/Hyene	44**	38		
Elephant skeleton(old)/ Squelette d'elephant(ancien)	142	88		
Unidentified skeleton (old)/Squelette pas identifie(ancien)	109	126		
Poachers camp/ Campement de braconniers	98	56		

* Clumped distribution, therefore estimate inaccurate/ Distribution limite, donc l'estimation ne peut pas etre precise.

** Cryptic species, therefore probable undercount/ Especes pas facilement vus, donc le nombre est probablement moins que ceux qui existent.

PARC NATIONAL DE LA GARANBA



ELEPHANTS

Decembre/December 1984

Parc National de la Garamba

GENERAL COUNT, March 1986

INTRODUCTION

A systematic sample count of all large mammal species was carried out over the Park and some of the surrounding Domaines de Chasse in March 1986 as part of the monitoring programme at Garamba. The method was the standard systematic transect aerial count used throughout East Africa, as described by Norton-Griffiths (1978), and was the same as that used on previous counts at Garamba (Savidge et al 1976, Hillman-Smith et al 1983, 1984).

The count is programmed for March or April each year as this is the time of maximum visibility, at the beginning of the wet season when most of the grass is short and the haze in the air has been cleared by the first rains.

METHODS

Aircraft: Cessna 185, N5401R Pilot: Charles Mackie
Front seat observer: Kes Smith
Rear seat observers: Fraser Smith, Manya
Height: 350 ft a.g.l. (as measured by radar altimeter)
Speed: 204 k.p.h. (average)

Area: The whole park, (4,900km²) and 1325 km² of Domaine de Chasse d'Azande to the west and 1350 km² of D.de C. Gangala na Bodio to the south, as far south as the Kibali river.

Transects: Straight line, north-south transects were flown over most of the area at 5km intervals and over the southern section of the park, south of the Garamba river at 2.5km intervals. The area out of the Park to the south was flown at 10 km intervals. Each transect was sub-divided into 5km sub-units. Combined strip width in transects averaged 430m. but varied for each transect depending on average height maintained, and as such led to minor variations in sample intensity for different areas flown at the same transect spacings.

Stratification: The area was stratified for analysis on the basis of elephant and buffalo distribution as indicated on the map, Fig.2. Strata were as follows:

High density - South of Garamba river, 1587.5km², 17.04% sample intensity.

Medium density - Central and western part of park north of Garamba river, 2575 km², 8.6% sample intensity.

Low density - Eastern projection of Park, 550 km², 8.9% sample intensity.

Out of Park, west - 1325 km², 8% sample intensity.

Out of Park south - 1350km², 4.3% sample intensity.

Analysis: Data were analysed on a Kaypro 2 computer using the "Quick calc" part of the programme "Aerocount" (Burrill, Kaliski and Douglas-Hamilton.)

Body weight figures for the calculation of biomass were taken from Savidge et al (1976), quoted in Hillman et al (1983).

Correction factors: Only one observer, Smith, photographed large groups of buffalos, and not all photos were useable. He also estimated group sizes at the same time, and on the buffalo count made shortly after this count he also estimated and photographed

buffalo herds. The ratio between his estimates and photo counts (71%) was therefore used as a correction factor on the 23% of his buffalo figures that were not either photo counts or groups of 5 or less. To test the estimates made by the other observer, he was given a series of 20 slides of large groups of buffalo to observe for 8 seconds each and to give an estimate of the numbers. His estimates were compared with counts of the photos, and were found to be on average, 26% of the totals present. This figure was therefore used to correct his estimates of large groups.

Species: All large mammal species were counted within the strip widths. Rhinos were also noted and identified outside transects, but for the purpose of the census were only counted within strip widths. Human settlements and domestic livestock were also counted where present. Any skeletons seen were counted within strip widths, identified to species if possible and classified according to Douglas-Hamilton & Hillman (1981), as follows:

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Agriculture - as % in sub-unit

Vegetation zones, as defined in vegetation classification of Park

Other notes to aid analysis.

RESULTS

Numbers are given in the following tables and distributions are plotted on the accompanying maps.

Ratio of elephants to elephant skeletons

AREA	ELEPHANTS:ELESKELS.	CATEGORIES
Total Park	118:1	3 & 4
High density	223:1	3 & 4
Low density	13:1	3 & 4

RESULTS

GENERAL COUNT, March 1936

TOTAL POPULATION ESTIMATES

In ParkArea 4712km²

SPECIES	POP. EST.	+SE	DENSITY ani/km ²	BIOMASS 100000kg
Elephant	4339	1648	0.92	108.48
Buffalo (corrected)	29419	3485	6.00	151.50
Rhino	17	13	0.004	0.26
Giraffe	153	140	0.03	1.22
Hippo	2874	1668	0.62	31.61
Hartebeeste	1705	589	0.36	2.64
Kob	7222	2601	1.53	6.50
Waterbuck	1322	456	0.28	2.64
Reedbuck	328	136	0.07	0.20
Roan	34	25	0.01	0.05
Bushbuck	149	57	0.03	0.10
Duiker, Grey	12	12	0.003	0.002
Oribi	230	90	0.05	0.04
Warthog	943	344	0.20	0.66
Lion	63	46	0.01	0.09
Hyaena	157	121	0.03	0.08

Out of ParkArea 2675 km²

SPECIES	POP. EST.	+SE	DENSITY ani/km ²	BIOMASS 100000kg
Elephant	13	13	0.01	0.33
Buffalo	341	288	0.13	1.76
Giraffe	13	13	0.01	0.10
Hartebeeste	75	68	0.03	0.12
Kob	490	280	0.18	0.44
Waterbuck	669	339	0.25	1.34
Bushbuck	93	66	0.03	0.02
Duiker, Grey	23	27	0.01	0.01
Red flanked	25	26	0.01	0.01
Oribi	13	13	0.01	0.002
Warthog	86	56	0.03	0.06

STRATA

High Density Area

Area 1587.5 km²; Sample intensity 17.04%; Baseline 72.5km
Transect spacing 2.5km

SPECIES	POP.EST.	+SE	95%C.L.	DENSITY (ani/km ²)	BIOMASS 100000kg
Elephant	3899	1624	3328	2.46	97.48
Buffalo	8133	3472	7117	5.12	41.88
Rhino	17	13	26	0.01	0.26
Giraffe	41	39	80	0.03	0.33
Hippo	2782	1667	3417	0.02	0.25
Hartebeeste	434	146	299	0.27	0.67
Kob	3310	1588	2055	2.09	2.98
Waterbuck	528	185	379	0.33	1.06
Reedbuck	40	20	42	0.03	0.02
Roan	23	21	44	0.01	0.03
Bushbuck	34	16	33	0.02	0.02
Oribi	80	32	66	0.05	0.01
Warthog	276	92	188	0.17	0.19
Lion	6	5	11	0.004	0.01
Hyaena	6	5	11	0.004	0.003

Medium density area

Area 2575 km²; Sample intensity 8.6%; Baseline 50; Transect
spacing 5km.

SPECIES	POP.EST.	+SE	95%C.L.	DENSITY ani/km ²	BIOMASS 100000kg
Elephant	440	284	641	0.17	11.0
Buffalo	8655	4504	10179	3.36	44.57
Hippo	92	77	175	0.03	0.95
Hartebeeste	1159	561	1268	0.45	1.80
Kob	3418	2349	5309	1.33	3.08
Waterbuck	625	391	838	0.24	1.25
Reedbuck	243	127	286	0.09	0.15
Bushbuck	93	51	115	0.036	0.07
Duiker, Grey	12	12	28	0.004	0.002
Oribi	139	82	186	0.05	0.02
Warthog	498	293	662	0.19	0.35
Lion	35	37	83	0.01	0.05
Hyaena	151	121	273	0.06	0.08

Low density area

Area 550 km²; Sample intensity 8.9%; Baseline 25km ; Transect spacing 5km.

SPECIES	POP.EST.	+SE	95%C.L.	DENSITY ani/km ²	BIOMASS 100000kg
Buffalo	135	122	338	0.25	0.70
Giraffe	112	134	374	0.20	0.90
Hartebeeste	112	106	294	0.20	0.17
Kob	494	492	1367	0.90	0.44
Waterbuck	169	145	404	0.31	0.34
Reedbuck	45	45	126	0.08	0.03
Roan	11	13	37	0.02	0.02
Oribi	11	13	37	0.02	0.002
Warthog	169	156	433	0.31	0.12
Bushbuck	22	21	58	0.41	0.12
Lion	22	27	75	0.41	0.03

Out of Park, West

Area 1325 km²; Sample intensity 0%; Baseline 60km, Transect spacing 5km.

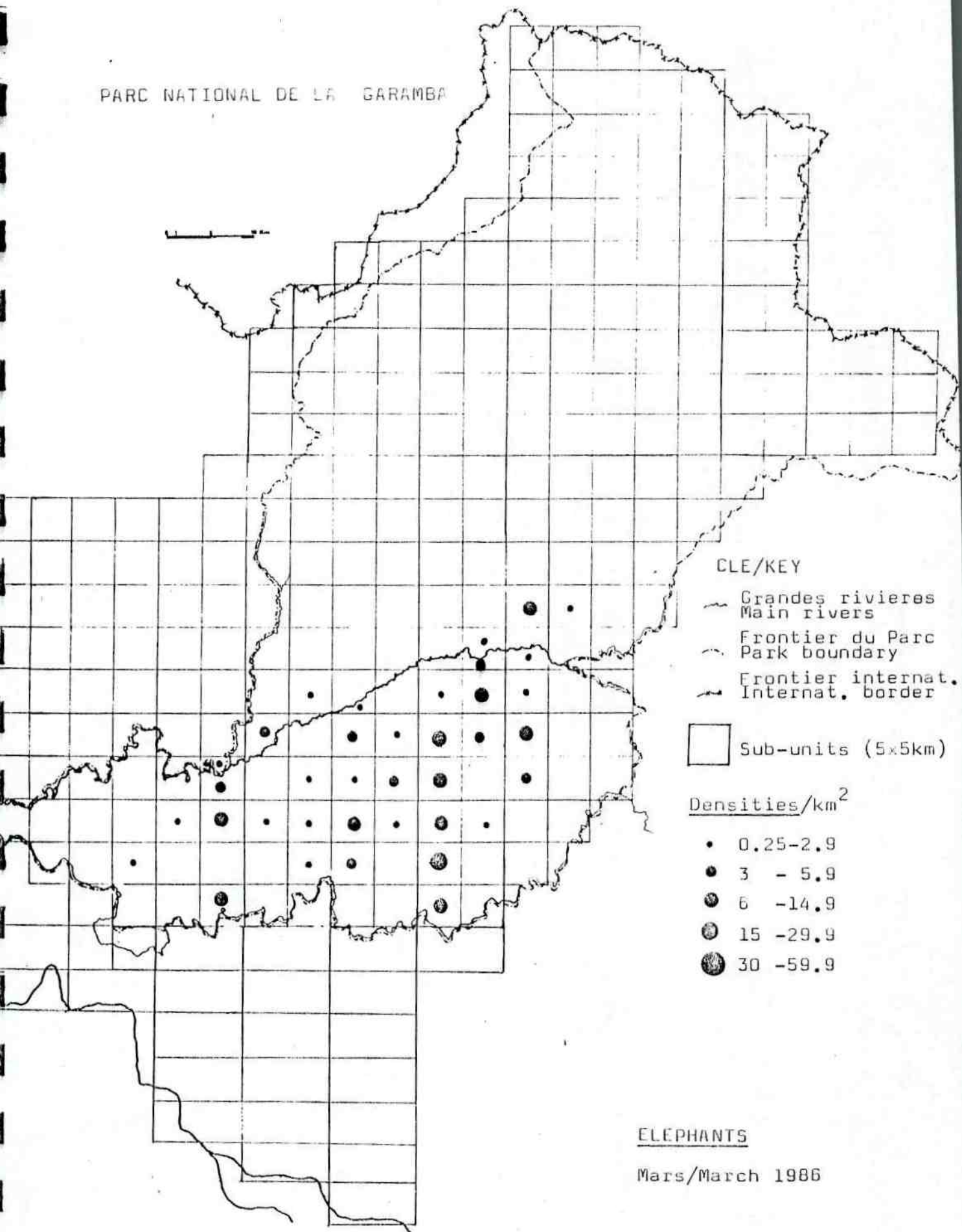
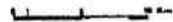
SPECIES	POP.EST.	+SE	95%C.L.	DENSITY ani/km ²	BIOMASS 100000kg
Elephant	13	13	29	0.01	0.33
Buffalo	225	183	403	0.17	1.16
Giraffe	13	13	29	0.01	0.10
Hartebeeste	75	68	151	0.06	0.12
Kob	188	175	384	0.14	0.17
Waterbuck	250	200	441	0.19	0.50
Duiker, Red flanked	25	26	58	0.02	0.01
Oribi	13	13	29	0.01	0.002
Warthog	63	49	109	0.05	0.04

Out of Park, South

Area 1350 km²; Sample intensity 4.3%; Baseline 60; Transect spacing 10 km.

SPECIES	POP.EST.	+SE	95%C.L.	DENSITY ani/km ²	BIOMASS 100000kg
Buffalo	116	136	351	0.09	0.60
Kob	302	219	563	0.22	0.27
Waterbuck	419	345	887	0.31	0.84
Bushbuck	93	66	171	0.07	0.07
Duiker, Grey	23	27	70	0.02	0.01
Warthog	23	27	70	0.02	0.01

PARC NATIONAL DE LA GARAMBA



CLE/KEY

- Grandes rivieres
Main rivers
- Frontier du Parc
Park boundary
- Frontier internat.
Internat. border

Sub-units (5x5km)

Densities/km²

- 0.25-2.9
- 3 - 5.9
- 6 -14.9
- 15 -29.9
- 30 -59.9

ELEPHANTS

Mars/March 1986

Park National de la Garamba

ELEPHANT COUNT, March 1989

INTRODUCTION

From 27th to 29th March 1989 an aerial census of the elephants was carried out in the Park. The objective was to obtain an estimate of the elephant population using a different method from the sample strip counts carried out in 1984 and 6, in order to compare this with the previous estimates. It was not possible to carry out a comparable sample strip count at the time due to the lack of a radar altimeter.

The count was timed for when visibility was at a maximum because the rains had started, clearing the air of haze, and over 80% of the Park had been burned and flushed. Many of the elephants were forming large aggregations of several hundred animals.

METHOD

Aircraft: Cessna 206 90-CBR
Pilot: Charles Mackie
Observer: Kes Smith

Initially a reconnaissance was flown to work out a stratification of the Park. Figure 1 plots the flight path and the elephant distribution.

On the basis of this the Park south of the Garamba river was divided into high and low density strata which were sampled by means of quadrats. The strata are indicated on Figure 2 and were sampled as follows:

Table 1

STRATUM	AREA	SAMPLE INTENSITY	NO. QUADRATS
High density	835km ²	25%	17
Low density	605km ²	15%	7
Total area	1440km ²		

The quadrats were flown in squares whose sides went north, west, south and east, each of one minute flying time at 213km.p.h.. Each side measured 3.5km to give quadrats of 12.25km² each. Height was maintained at 800' a.g.l. The quadrats were positioned by using a table of random numbers to select grid references on the standard 1x1km grid which is used to locate rhino and other observations within the southern sector of the Park. These starting points were then located on the ground by reference to watercourses and tracks. It was generally found to be sufficient to fly three sides of each quadrat and to sight down the fourth side to the starting point in order to decide how many elephants were in the quadrat. The observer sat behind the pilot and both observed from the same side into the quadrat. Each elephant group was counted and their location in either long or short grass recorded. The observer also estimated the percentage of long grass within each quadrat.

The distribution of elephants north of the Garamba river was very clumped and generally related to areas of long grass, with the elephants either being in or near such areas. It was therefore

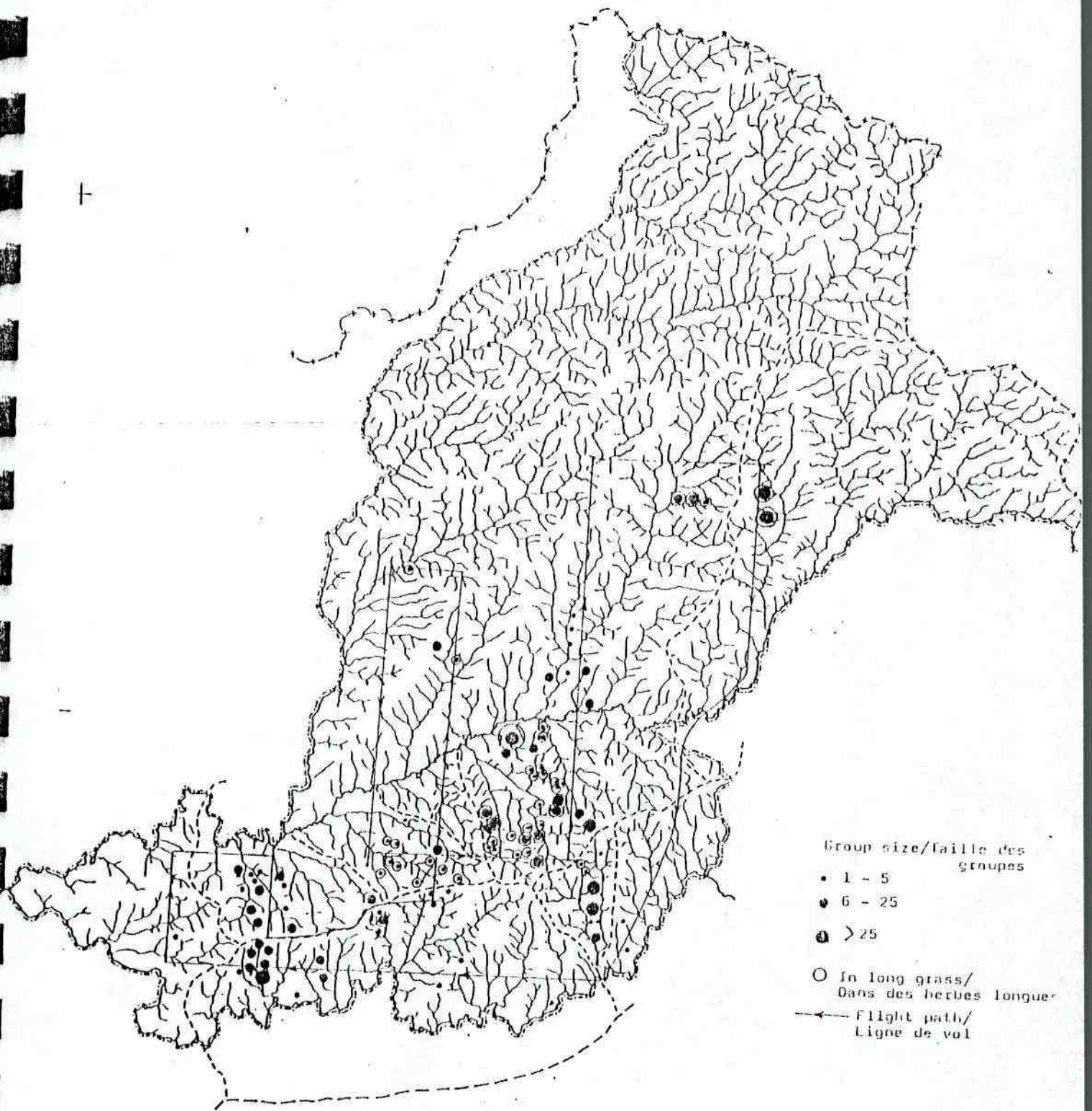
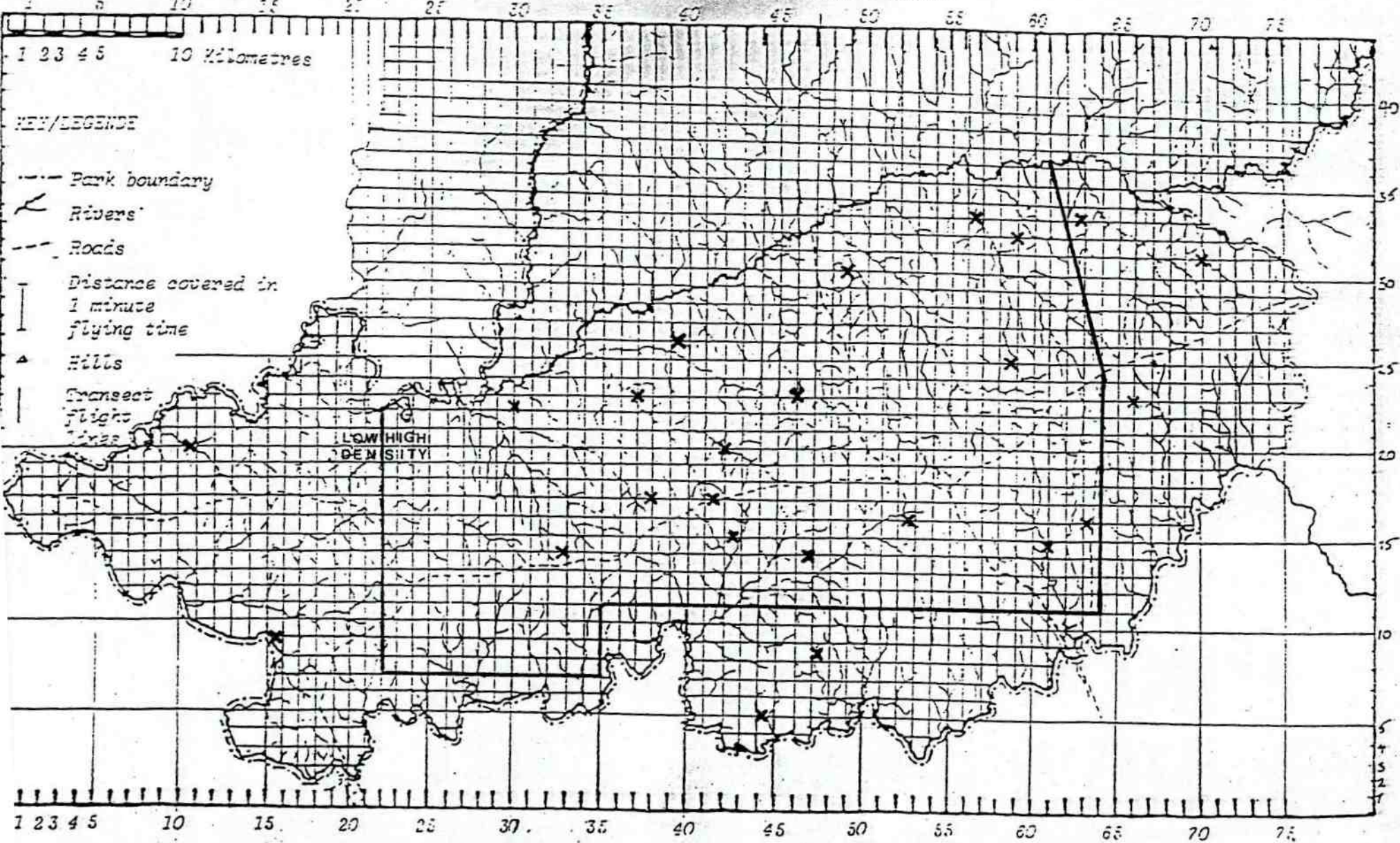


FIG. 1 GARAMBA NATIONAL PARK / PARC NATIONAL DE LA GARAMBA
ELEPHANT DISTRIBUTION 27.3.89 / DISTRIBUTION DES ELEPHANTS 27.3.89

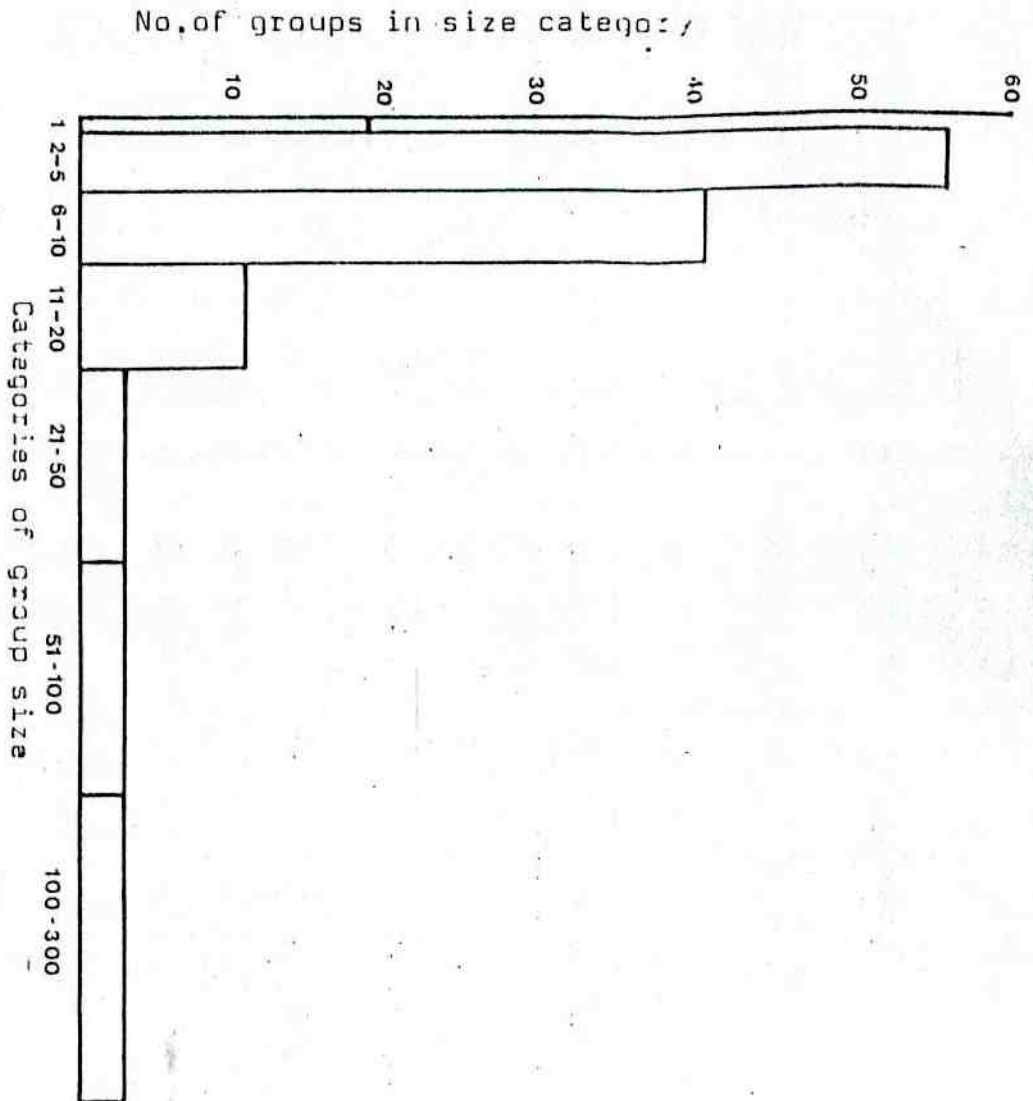
Fig.2 - STRATIFICATION AND LOCATION OF QUADRATS - ELEPHANT SAMPLE COUNT



PARC NATIONAL DE LA GARAMBA (Southern sector)

x Starting point of quadrats

Fig. 3 - FREQUENCY OF ELEPHANT GROUP SIZE, March 1989



considered more practical to search the north of the Park and do a total count of the elephants seen than to attempt a representative sample count. The final estimate therefore is a minimum figure.

RESULTS

The results of the sample and total counts are given in Table 2:

Table 2

Sample count south of the Garamba River

STRATUM	ELE. SEEN	POP. EST.	+S.E.	DENSITY (E/km ²)
High density	749	2992	1465	3.6
Low density	9	64	38	0.1
Total	758	3056	1466	2.1

Total count north of the Garamba River

Elephants seen	1009	1009		0.3
TOTAL POPULATION		4065		0.8

Figure 3 plots the group sizes. Aggregations have been counted as groups in this case. The aggregations can often be sub-divided into smaller group components, but as these divisions are not always clear enough to define effective groups, the whole aggregations have been used to represent the situation pertaining at the time.

The modal number of groups was in the category 2-5 animals per group. 56 groups, which was 41.2% of all the groups seen, were in this category. However 50.8% of the elephants seen were in groups of more than 50 animals.

DISCUSSION

The results indicate a minimum population of elephants in the Park at this time of year of over 4065. The actual number present was almost certainly larger since part of the result was from a total count. This agrees reasonably well with the results of the general sample count at the same time of year in 1986 (4339 ± 1648). The standard errors of both estimates were high, but were greater on this count than on the strip sample count. The high standard errors result particularly from the clumped distribution of the elephants at this time of year with aggregations into large groups. The density of elephants in the south of the Park is high compared with densities of elephants in other parts of Africa these days.

The most common group sizes were of 2-5 animals.

of 2-5 elephants. However the tendency to aggregate into large groups at this time of year is demonstrated by the fact that over 50% of the elephants were in such aggregations. This phenomenon has been observed each year in March or April and is probably associated with the availability of palatable grass during the early wet season.

An average of 24% of the quadrat areas was of long grass. 29% of the elephants were in long savanna or riverine grass, an occupancy which is not significantly different from availability. However, all except those to the west of the southern sector were near long grass. The two very large groups in the north of the Park near Mt Kpaza were in an isolated patch of long grass during the recce flight. During the count they were out of the grass but very close to it. It has been observed during elephant capture operations that the elephants know the locations of the remaining patches of long grass and head for them when disturbed. It has also been observed as a result of the General count in December 1984, and as a result of surveys made as part of the burning programme, that elephants prefer the long grass, particularly when there is still enough green growth within it to eat. Only 2% of the elephants seen in December 1984 were in short grass. In the early wet season they are attracted out of the long grass to feed on the luxuriant new growth, but favour the long grass for protection when disturbed.