



IUCN ELEPHANT SURVEY AND  
CONSERVATION PROGRAMME

REPORT ON  
MERU NATIONAL PARK  
AND CONSERVATION AREA

August 1976

I. Douglas-Hamilton & A.K.K. Hillman

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Report on Meru National Park and Conservation Area - August 1976.

By I. Douglas-Hamilton and A.K.K. Hillman

Meru National Park, an area of 844 km<sup>2</sup>, contains varied habitat, including Acacia woodlands, grasslands and commiphora scrub, intersected by permanent rivers which are fringed with riverine trees.

The Park was set aside by the Wameru people in 1957, to conserve their wildlife and to bring in tourist revenue. It is distinguished by abundant wildlife, among which elephant and rhino are major attractions, and by the unusually tolerant attitude of the Park's Wameru neighbours.

Unfortunately, in recent years, three factors have caused increasing concern :-

1. The expanding Wameru in the West have come into conflict with the elephants, who visiting their former wet season dispersal area, invade newly established shambas along the borders of the Park. The damage caused to the crops has led to worsening human relations. A ditch dug to contain the elephants has failed to act as an effective barrier due to lack of funds for maintenance (P. Jenkins, pers. comm.), despite the success of this method as employed in the Aberdare National Park.
2. To the East of the Park, in the adjoining Conservation area and beyond, throughout the NFD, there has been an increase in poaching of elephants and rhinos, that is reported to be as heavy as anywhere in Kenya. The poaching is organised by Somali gangs armed with rifles, and elephants are reported to have been virtually eradicated through much of their former range, which used to extend as far as the Lorian Swamp.  
In recent years the attention of the poachers has focussed on the Park itself, and poaching has increased tenfold (Jenkins, pers. comm.). Along the Southern boundary, elephants are also hunted by the Tharaka and Kamba.
3. There has also been a build up of elephant numbers within the Park, probably as a consequence of external harrassment, competition with invading Somali livestock, and a run of four exceptionally dry years.

As a consequence, elephant damage to the woody vegetation has suddenly increased, where before, little damage was observed (P. Jenkins, pers. comm.). Elephant dispersal has also been curtailed in the South West, where a migration route through the Imenti Forest has been cut by a rapid increase in human settlement.

For these reasons the Park was selected for study as part of the IUCN Elephant Survey and Conservation Programme. The main research objectives were :

1. To record numbers and distribution of all large animals especially elephants, in order to establish their status and trends.
2. To record the distribution and relative intensity of elephant damage to the trees.
3. To record the elephant age structure by aerial photographs.

It is intended that these results should provide :

- Comparative data for the IUCN elephant survey.
- Preliminary information for management.
- A baseline for future studies planned by the Division of Wildlife and Conservation.
- Input for the current Wildlife Research review.
- Comparative input for the KREMU who intend to survey the same area although less intensively.

## METHODS

### Total Count

Aircraft : Cessna 185 with radar altimeter, and a Super-cub.

Pilots : I. Douglas-Hamilton and P. Jenkins.

Observers : J.C. and A.K.K. Hillman and P.H. Hamilton.

Height and Speed varied according to terrain, vegetation and animal density.

Area : Park area, 844.34 km<sup>2</sup>.

The area was sub-divided into 13 blocks, as used in a previous count (Jenkins pers.comm.) (fig. 1). Within each block transects were flown and large herds were circled to enable them to be counted. Flight paths and animal observations were plotted on sketch maps of the blocks.

### Sample Count

Aircraft : Cessna 185 with radar altimeter.

Pilot : I. Douglas-Hamilton.

Observers : P. Jenkins (Vegetation recording), P.H. Hamilton and J.C. Hillman (Counting).

Height : 300 ft a.g.l. maintained by reference to a radar altimeter.

Av. Speed : 96 m.p.h.

Strip width : Hillman (R) 240.5 m; Hamilton (L) 270.0 m; combined 510.5 m.

Sample intensity : 10.21 per cent.

Area : 2575 km<sup>2</sup>.

North/South transects were flown at 5 km intervals (total length 515 km) along the National UTM Grid lines, and numbers and distribution of all species were recorded including elephant skeletons. Large groups were photographed so that these could be counted later, and we estimated the proportion of recumbent trees within each 5 km sub-unit, as a percentage.

Data was analysed for all species in an IBM computer using the analytical programme ANPR (Dearing 1976). Population estimates for the Park and outside area were made separately for elephants and elephant skeletons using Jolly (1969) method 2. All carcasses seen of elephant and rhino were recorded under the following categories :

1. Fresh, flesh present.
2. Skin present, bare ground around carcass.
3. Articulated bones, bare ground.
4. Scattered bones.

Categories 1 - 3 were considered to indicate relatively recent death (within previous year).

### Vertical Elephant Photography

Vertical photographs were taken of elephant groups, using a hand held Hasselblad (80 mm lens) and a Nikon (105 and 50 mm lenses) from the Cessna 185. Back length measurements were later taken from prints and analysed for age structure using the method of Croze (1972), without the 'anal flap' photogrammetric correction which was tested and found to make no significant difference to this data.

## RESULTS

### Total Count

A table of results of the total count is given below (table 1). Distribution and sizes of elephant groups within the Park are plotted (fig. 3) and for comparison a similar map of the count of 1974 is given (fig. 4). Buffalo, rhino and hippo are also plotted by group (fig. 2).

TABLE 1  
TOTAL COUNT - 5 & 6 August 1976

<u>Block</u>	<u>Elephant</u>	<u>Elephant Skeleton</u>	<u>Buffalo</u>	<u>Rhino</u>	<u>Hippo</u>
1	25	0	317	0	0
2	160	2	2420	0	0
3	27	8	584	9	0
4A	522	6	104	6	0
4B	92	4	0	0	0
5A	52	4	360	3	0
5B	68	4	65	2	0
6A	58	1	201	3	0
7	26	11	75	1	0
8	0	8	51	2	0
9A	40	4	0	1	0
9B	55	5	59	0	0
10	115	6	41	0	0
Tana River					115
TOTAL	1328	63	4810	29	115
		(1974)			
Mean Group Size	7.69	8.56	45.95	1.17	
S.E.	±0.67	±0.55	±9.77	±0.08	
n	173	181	104	23	

### Sample Count

Population estimates for all species with standard errors and confidence limits as obtained by ANPR analysis are given in table 2. Density distribution by sub-unit is plotted for major species, (figs 5 - 12) in which an open symbol = 1 animal/km<sup>2</sup> and each closed symbol = 1-10 animals/km<sup>2</sup>.

The population estimate for the Park and Conservation Area for elephants was 2948 ± 72%. The estimate of elephant numbers within the Park was 2122 ± 103% as compared with the total count figure of 1328.

TABLE 2  
POPULATION ESTIMATES FOR ALL SPECIES COUNTED IN SAMPLE COUNT

(As analysed by ANPR)

<u>Species</u>	<u>Population Estimates</u>	<u>S.E.</u>	<u>95% Confidence limits</u>
Baboon	812	± 205.0	± 66%
Buffalo	5964	± 462.0	±167%
Camel	1194	± 614.0	±110%
Cattle	2203	± 791.0	± 77%
Donkey	9	± 8.4	±186%
Eland	127	± 108.0	±184%
Elephant	2948	± 987.0	± 72%
Elephant Skeleton	558	± 89.0	± 34%
Grant's	146	± 74.3	±109%
Gerenuk	19	± 11.4	±125%
Giraffe	313	± 85.1	± 58%
Hippo	9	± 8.4	±186%
Impala	19	± 16.7	±184%
Kongoni	146	± 103.0	±151%
Lesser Kudu	97	± 47.4	±104%
Ostrich	107	± 49.8	± 99%
Rhino	127	± 49.3	± 83%
Rhino Skeleton	19	± 11.5	±126%
Shoats	13731	±4570.0	± 71%
Warthogs	225	± 89.3	± 85%
Waterbuck	479	± 135.0	± 60%
Zebra - Burchell	274	± 136.0	±106%
Zebra - Grevy	58	± 51.1	±187%
Mabati Huts	215	± 91.3	± 91%
Thatch Huts	1508	± 463.0	± 66%

Table 3 gives numbers and densities of live and dead elephants inside and outside the Park.

TABLE 3  
SAMPLE COUNT : ESTIMATES OF ELEPHANT NUMBERS AND DENSITY

(As analysed by Jolly method 2 (1969))

	<u>Inside Park</u> <u>844.34 km<sup>2</sup></u>	<u>Outside Park</u> <u>1730.66 km<sup>2</sup></u>	<u>Total Area</u> <u>2575 km<sup>2</sup></u>
Live Elephants	2122	620	2742 ±79%
Density (E/km <sup>2</sup> )	2.52	0.35	1.06
Dead Elephants	138	381	519 ±38%
Density (ES/km <sup>2</sup> )	0.16	0.22	0.20
Freshly dead Elephants Cat.1-3	10	98	108
Density	0.01	0.06	0.04
Dead : Live ratio (from sample figures)	6:100	78:100	19:100
Freshly dead : Live ratio	0.4:100	20:100	4:100

Table 4 compares the present numbers with previous counts. Of the freshly dead elephants seen, only category 3 was found inside the Park and categories 2 and 3 outside.

TABLE 4  
MERU NATIONAL PARK : SUMMARY OF COUNTS

	<u>Type of count</u>	<u>Elephant</u>	<u>Buffalo</u>	<u>Source</u>
September 1965	Total	544	1126	Goss
1969	Estimate	600		Jenkins
October 1974	Total	1520	2721	Jenkins
August 1976	Total	1328	4810	IUCN Survey
	Sample	2122 $\pm 10\%$	5964 $\pm 16\%$	IUCN Survey

#### Vertical elephant photography

Figure 13 shows the age structure of elephants obtained using body length measurements from photographs. The dotted lines summarise 5 year groups of age classes to be comparable with data from other areas. The measurements were taken from breeding herds only, solitary or bull herds being excluded. The proportion of large bulls was 4.81 per cent of the total.

#### DISCUSSION

The estimates are consistent with the hypothesis that elephant numbers have built up since 1965, when E.C. Goss counted 554 within the Park boundaries. The apparent 12% decrease between the total count of 1974 and 1976 can probably be accounted for by differences between observers, and may not represent a true decrease. The 1976 sample estimate of 2122 elephants within the Park is higher than the total count made at the same time, probably as a result of more intensive scanning by the observers of a small strip, than is possible in the total count.

At any rate, the density estimates of  $1.57/\text{km}^2$  from the total count or  $2.52/\text{km}^2$  from the sample count, are relatively high for an area with an annual average rainfall of 15 - 20" a year. We also found that the elephants were concentrated within the Park, especially in the West, and that the percentage of recumbent trees was closely correlated with elephant density. (Figs 1, 5 and 6.)

It is likely that to some extent the elephants may have been concentrated by the drought. The area had been exceptionally dry in the preceding four years, and the elephant distribution recorded is typical of the dry season. Mr. P. Jenkins told us that in the rains they tend to disperse outside the Park.

However, the distribution of dead elephants suggests that mortality, especially within the last year, is higher outside the Park where the ratio of dead to live elephants was 78:100, compared to only 6:100 within. The distribution of dead and freshly dead elephants also supports the Warden's observations that poaching continues unabated outside the Park and threatens even those elephants within. In 1976, up until September, he had recorded 60 carcasses of elephant which had been poached, and this is thought to be a fraction of the whole.

The age structure of the elephant populations in fig. 13 shows a low proportion of animals below the age of 5 years, when compared with populations from Voi-Aruba in 1962 and Koito in 1966 (Laws, 1969), Lake Manyara in 1970 (Douglas-Hamilton, 1972) and Kidepo in 1970 (Croze 1972). It is similar to populations in Tsavo East in 1974 (Leuthold, 1976) but without quite such a drastic reduction in the numbers of young animals. It is possible that the number of animals less than a year old is slightly lower than the true value due to calves hiding beneath their mothers, but this would be expected to be a minor distortion (Croze, 1972).

A low rate of conception or high calf mortality rate is therefore indicated, which could be related to the years of drought prior to the count. Carcasses of young animals disappear very quickly, which might explain why few fresh carcasses were seen within the Park. The peak of animals within the 5 year class could possibly be related to good rainfall during 1968 leading to high conception rates.

As a result of a combination of these factors, and a period of reduced rainfall, the population appears to be declining. If the poachers succeed in eradicating the elephants throughout the NFD and in the Conservation Area, then even those within Meru National Park may become endangered when there is no other source in this part of Kenya to satisfy the demand for ivory.

Meru National Park presents a classical example of the familiar elephant problem seen elsewhere in Africa. To the West elephants are being supplanted by agriculture, in the East they compete with livestock and are being eradicated by poachers. Within the Park they have concentrated where they are protected by a highly efficient and well trained ranger force, but they are probably now causing excessive damage to the vegetation.

The elephant population and woodland damage should be closely monitored so that unacceptable levels of change are not reached. Poaching pressure needs to be relieved by extending the anti-poaching operations into the Conservation area and beyond. This should in turn relieve the elephant pressure on the Park by allowing them to disperse. The Conservation Area would also have a great tourist potential if there were more wildlife and less domestic stocks. If, however, all attempts at spreading out the elephants fail, and if the vegetation changes continue in an undesirable direction, then culling the elephants should be considered as a management option, but we would recommend this only when all alternatives have failed and it can be shown, on the basis of further research, to be urgently and unavoidably necessary.

Relations with the Wameru in the West would probably be greatly improved if the elephant ditch were properly maintained.

#### ACKNOWLEDGEMENTS

We are grateful to the Permanent Secretary for the Ministry of Tourism and Wildlife, Mr. Komora, for permission to carry out this count and we are especially indebted to Mr and Mrs P. Jenkins for their warm welcome and for organising all the logistics. Peter Jenkins flew the Super-Cub, which was paid for by the East African Wild Life Society. The rest of the flying was funded by the World Wildlife Fund and the New York Zoological Society.

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## APPENDIX

P. Jenkins, Warden Meru National Park.

A game moat of 6' wide by 6' deep was constructed along the Park boundary adjacent to the Kanjoo settlement scheme at a cost of K.Shs 94,500/00. These funds were raised in the U.S.A. The total length covered was 5,739 yards. Initially this proved successful and has only failed to act as a deterrent barrier owing to the fact that the former Kenya National Parks did not allocate funds for annual recurrent maintenance elements, in spite of estimates being submitted at the beginning of each financial year. No maintenance, therefore, has been carried out to this ditch since its construction and it has now become totally ineffective.

FIG. 1 MERU NATIONAL PARK AND CONSERVATION AREA

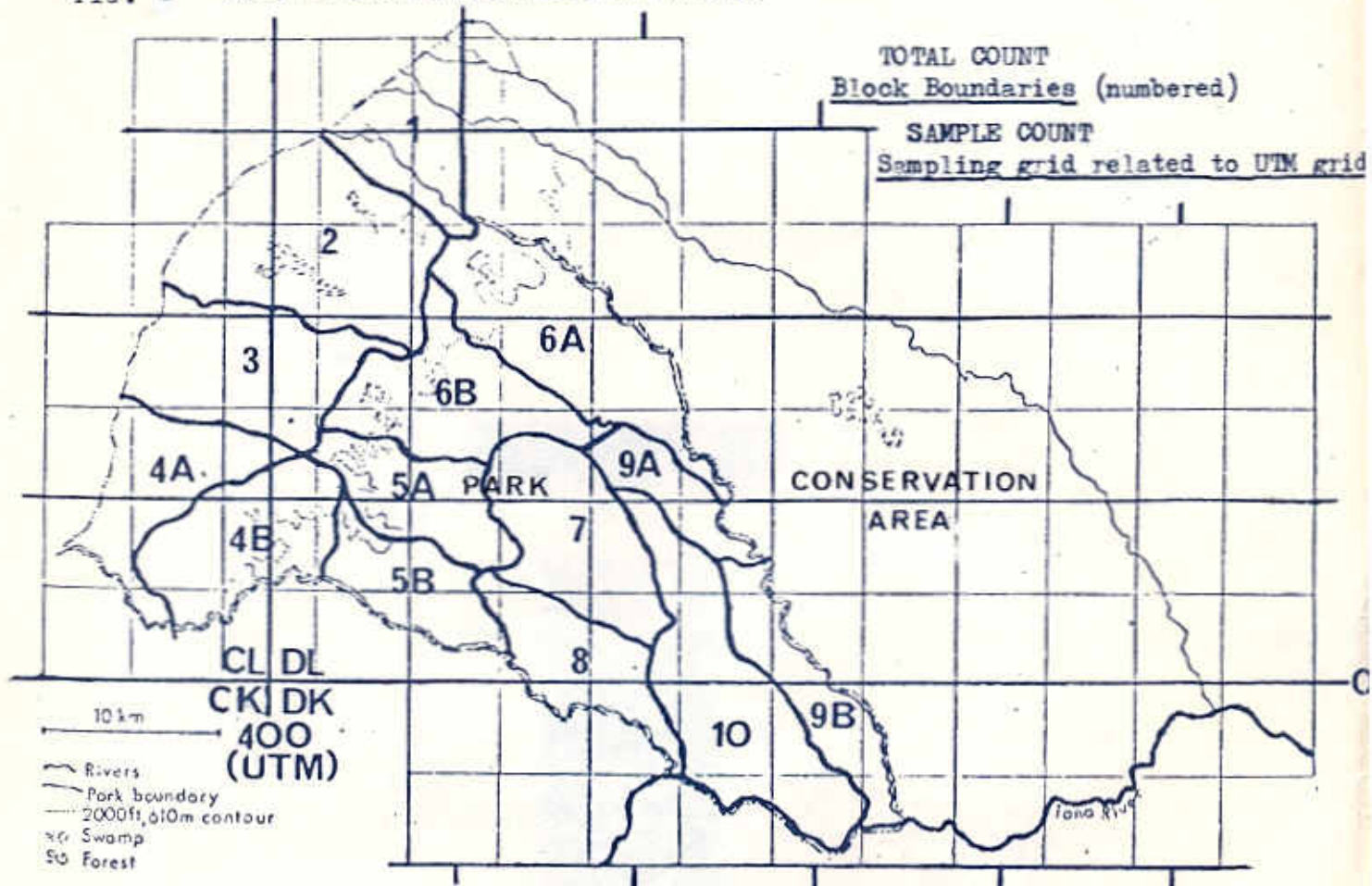


FIG. 2 MERU NATIONAL PARK AND CONSERVATION AREA

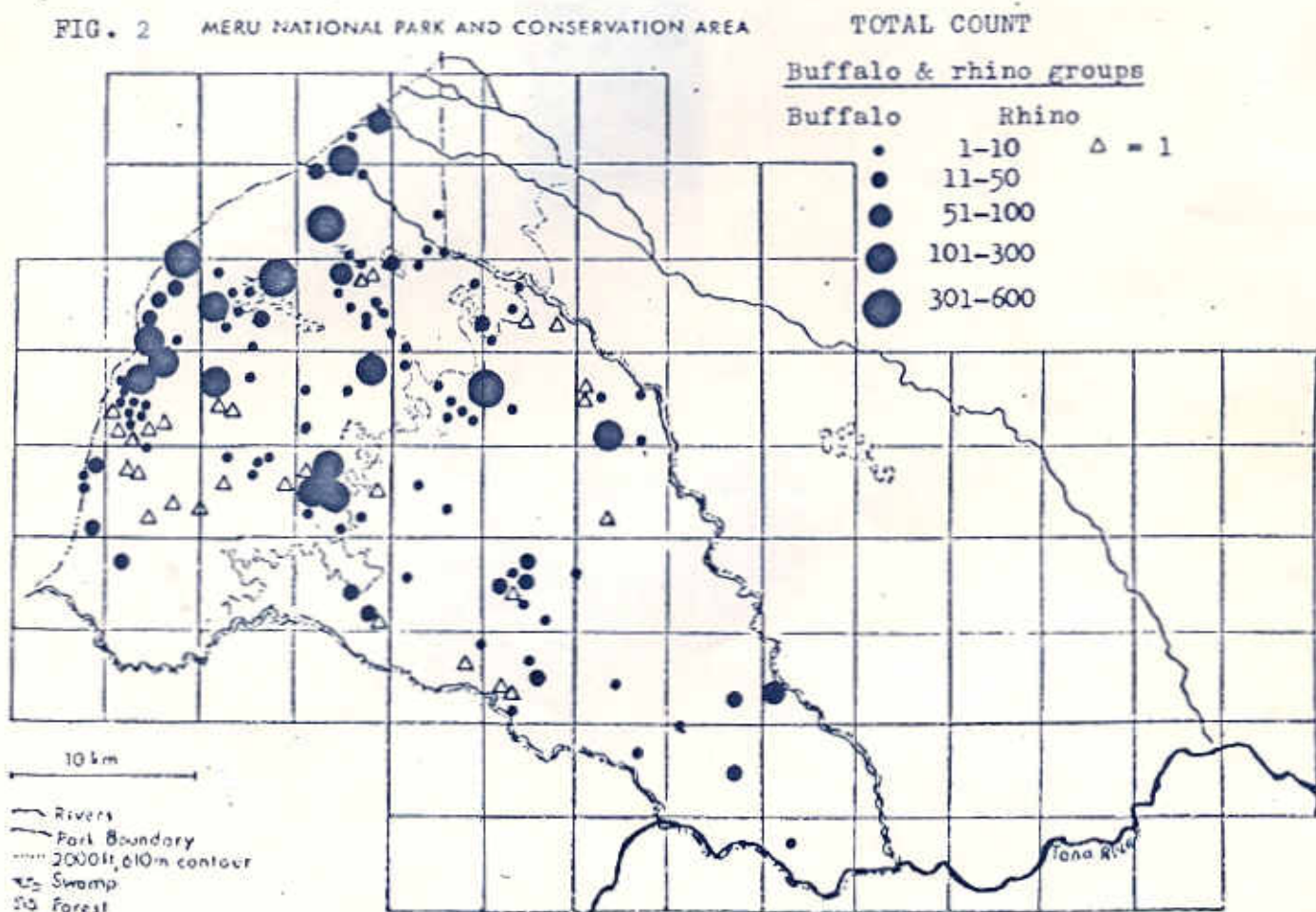


FIG. 3

MERU NATIONAL PARK

5th & 6th August, 1976.

TOTAL COUNT - ELEPHANTS - Group size & distribution

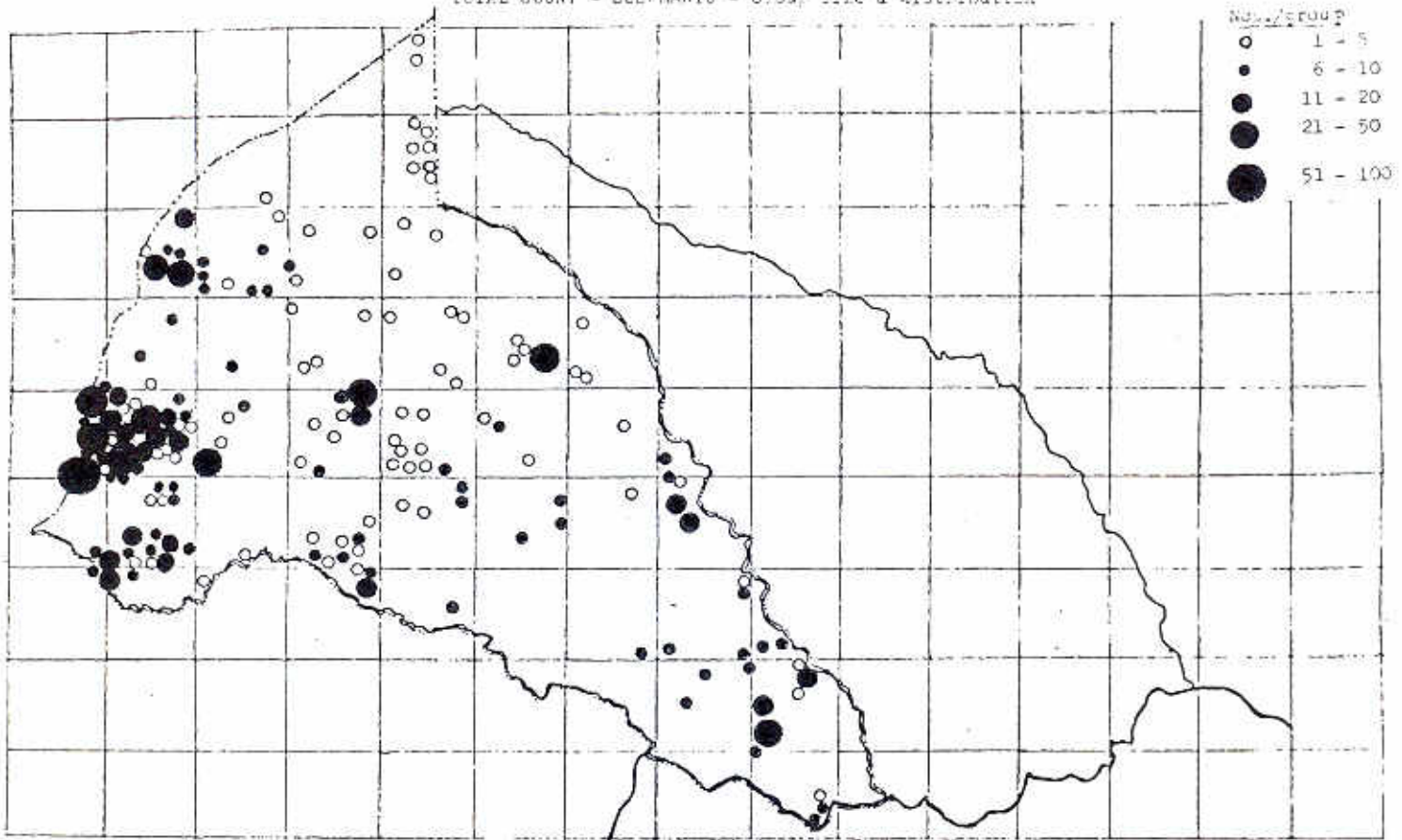


FIG. 4

MERU NATIONAL PARK

8th October, 1974.

TOTAL COUNT - ELEPHANTS - Group size & distribution

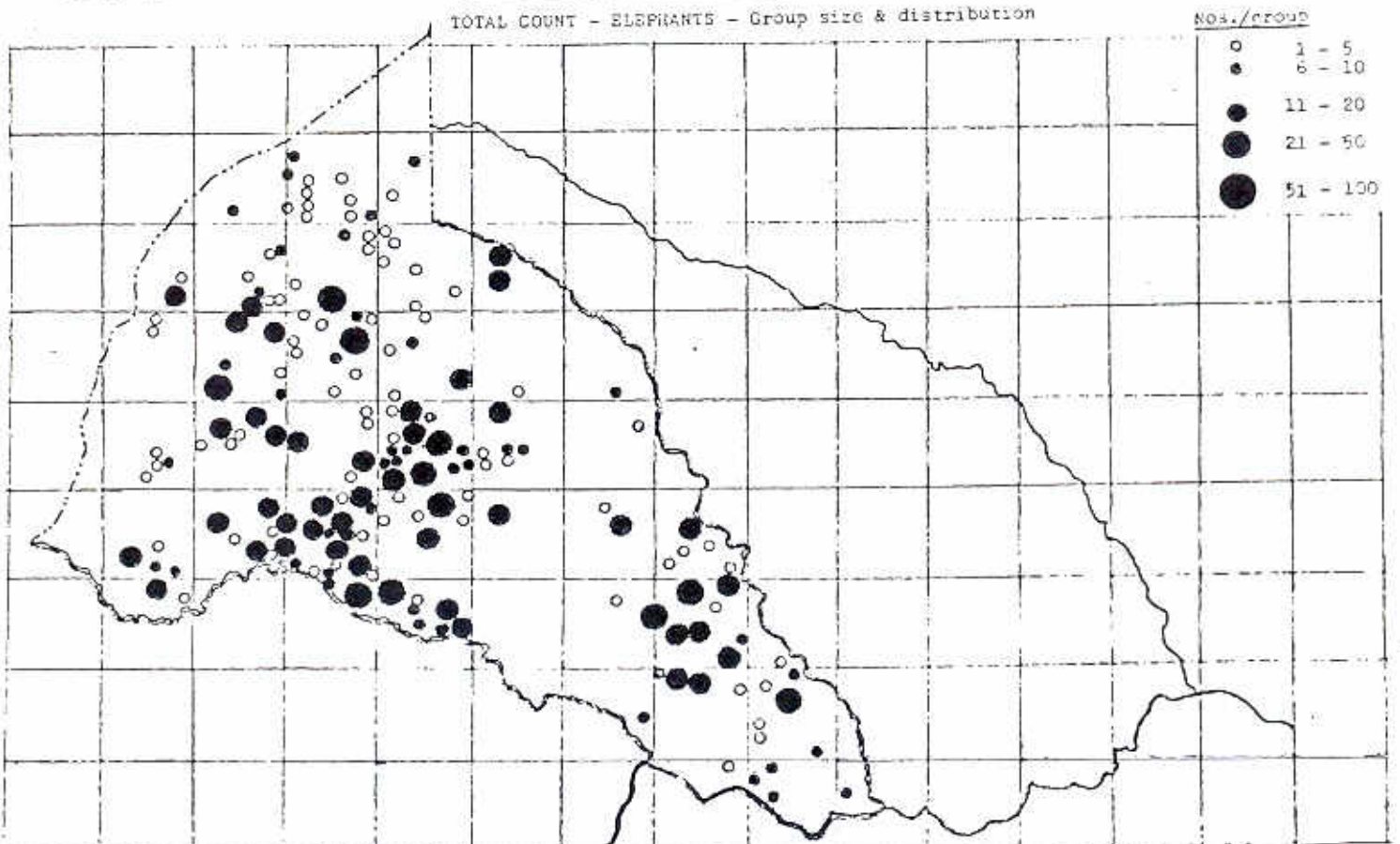


FIG. 5

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

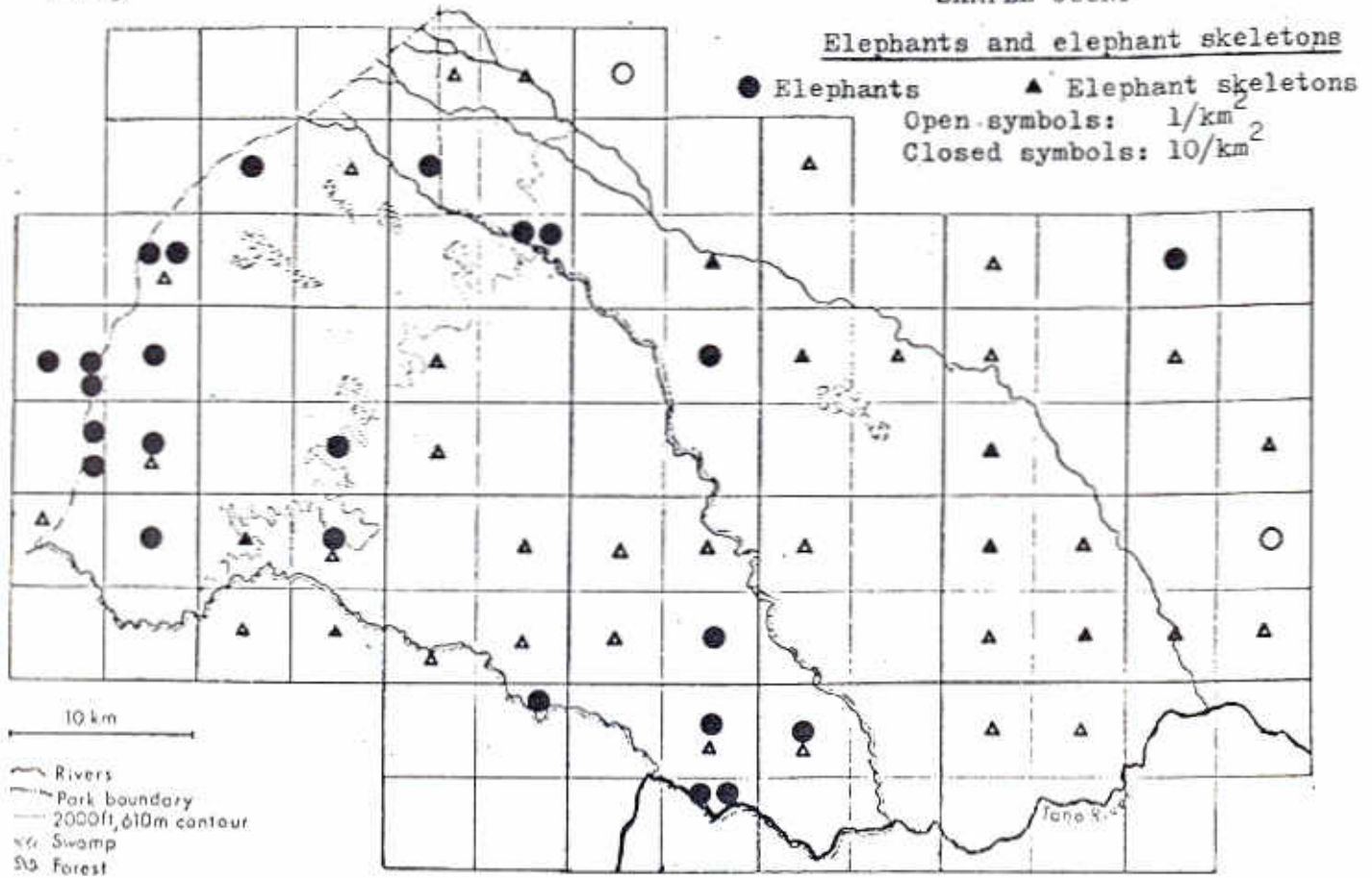


FIG. 6

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

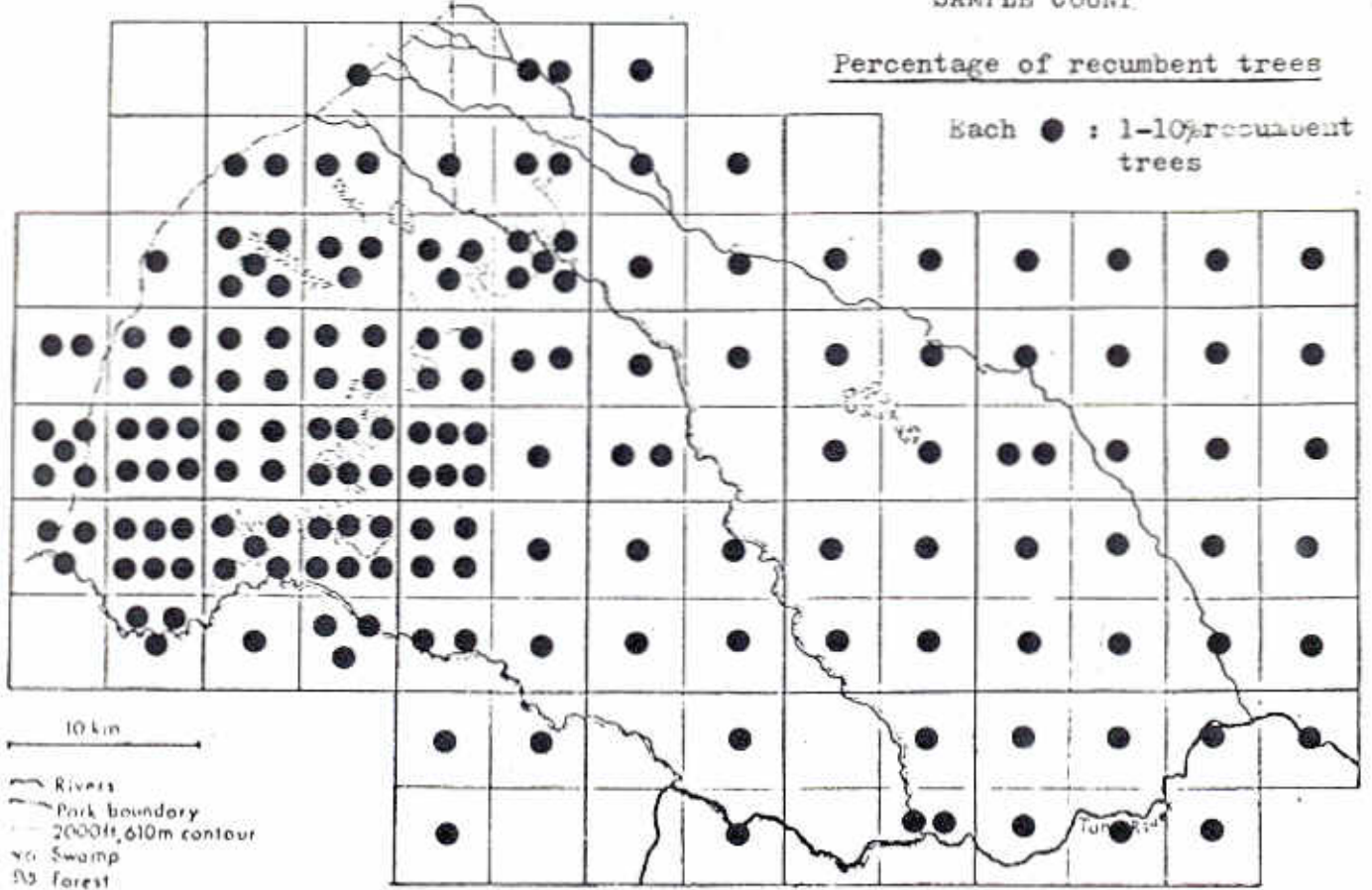


FIG. 7

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

Buffalo

KEY FOR FIGS. 7 to 12 :-

Open symbols:  $1/\text{km}^2$   
 Closed symbols:  $10/\text{km}^2$

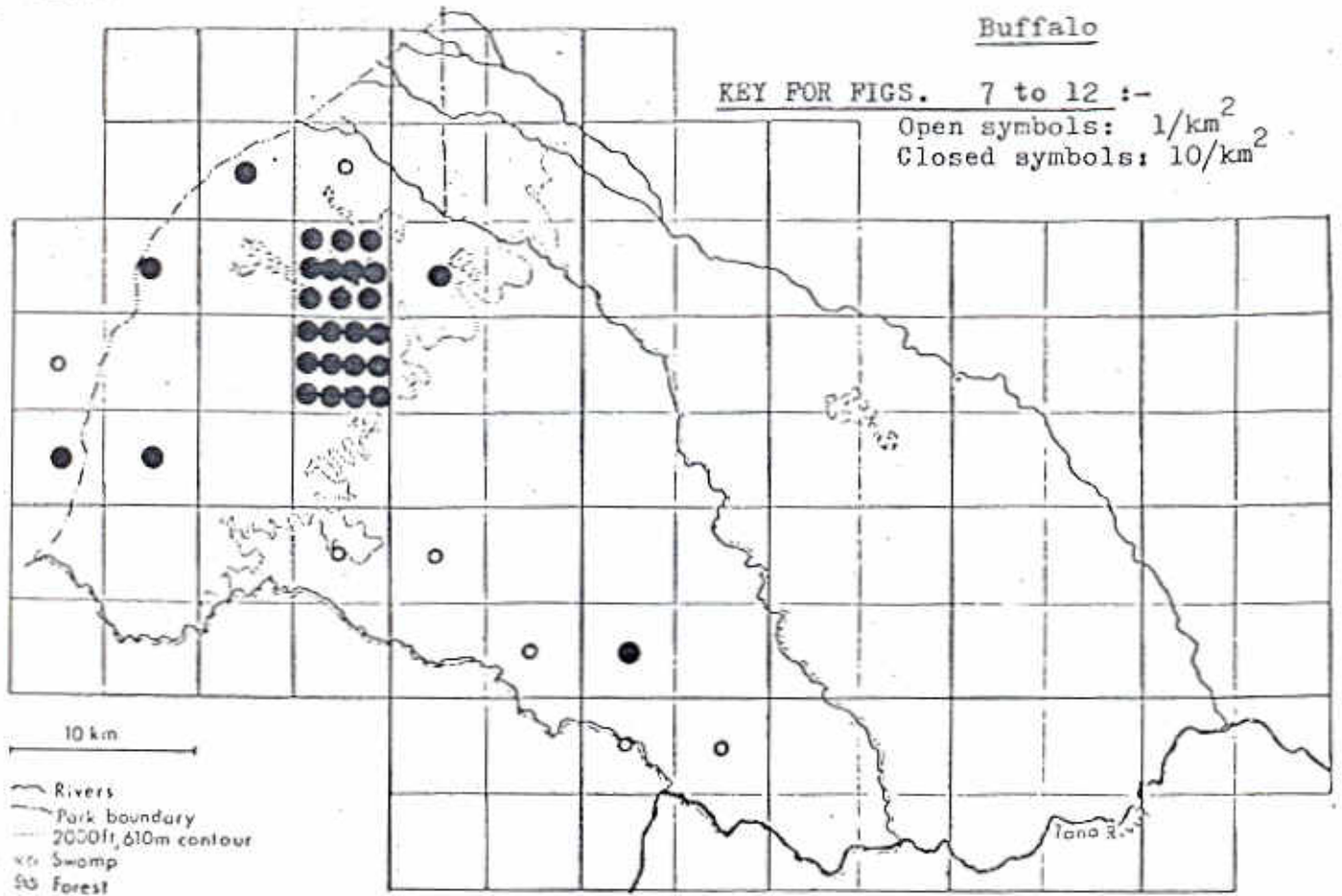


FIG. 8

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

Rhino and rhino skeletons

● Rhino  
 ▲ Rhino skeletons

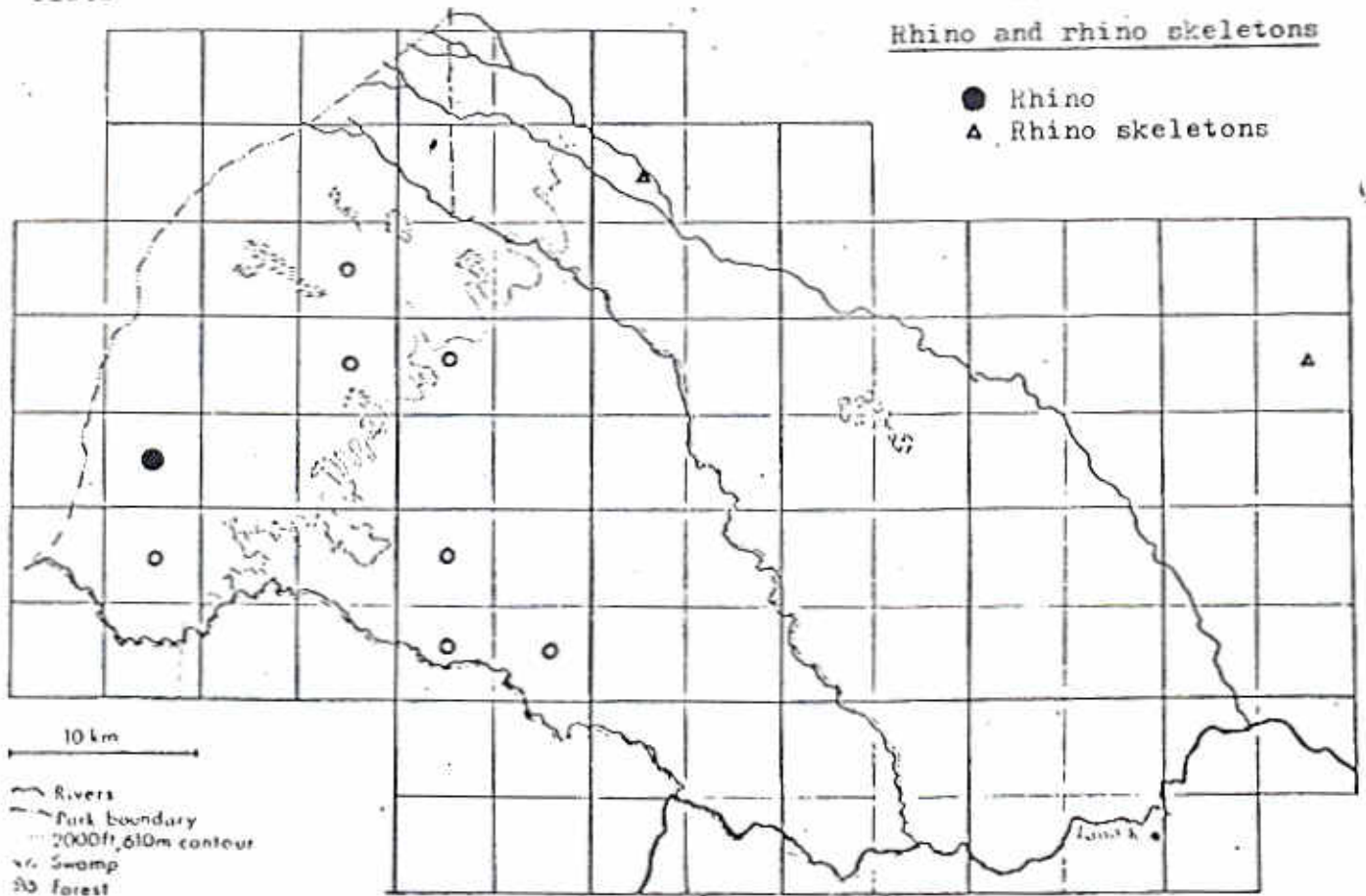


FIG. 9

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

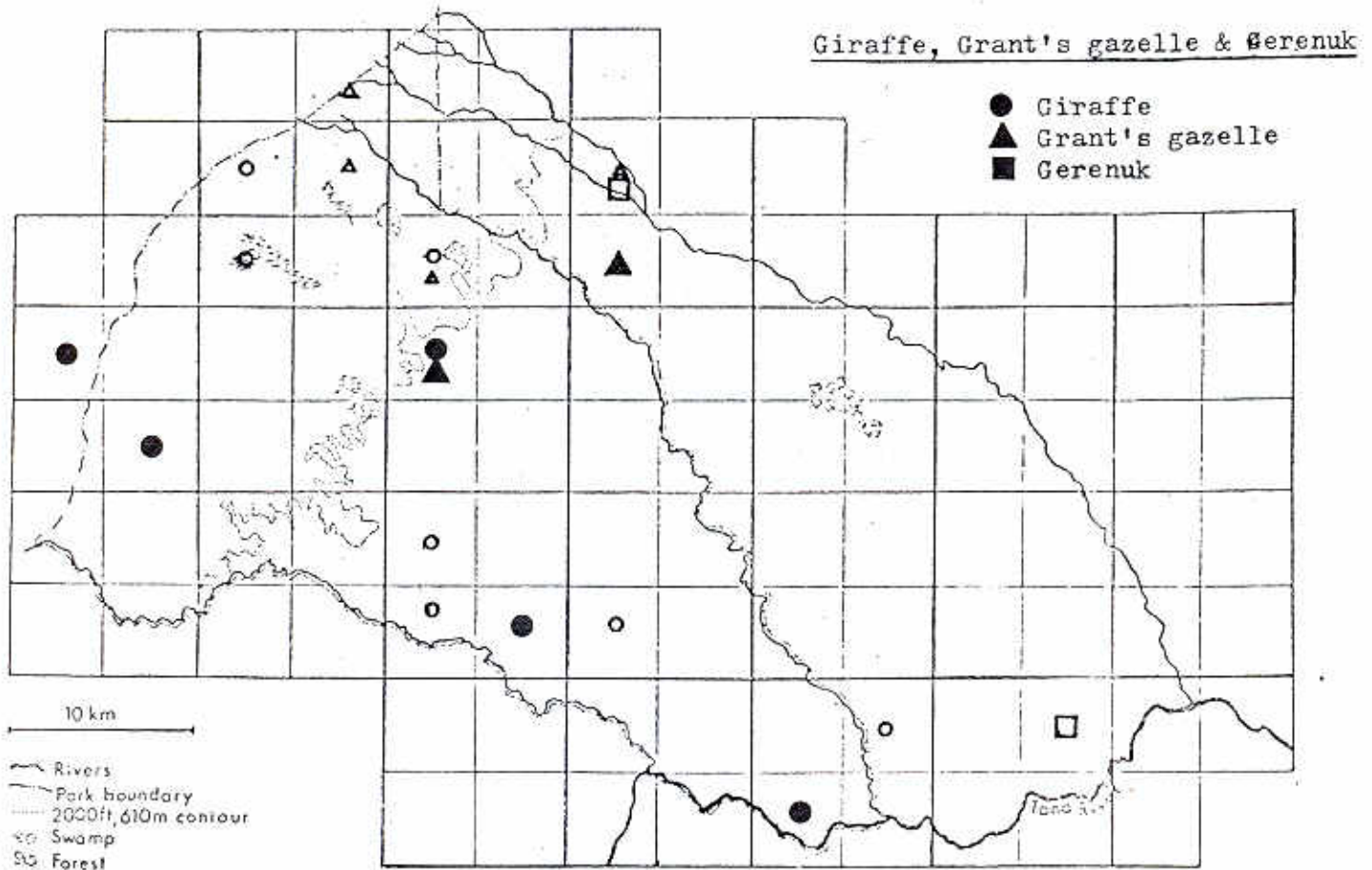


FIG. 10 MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

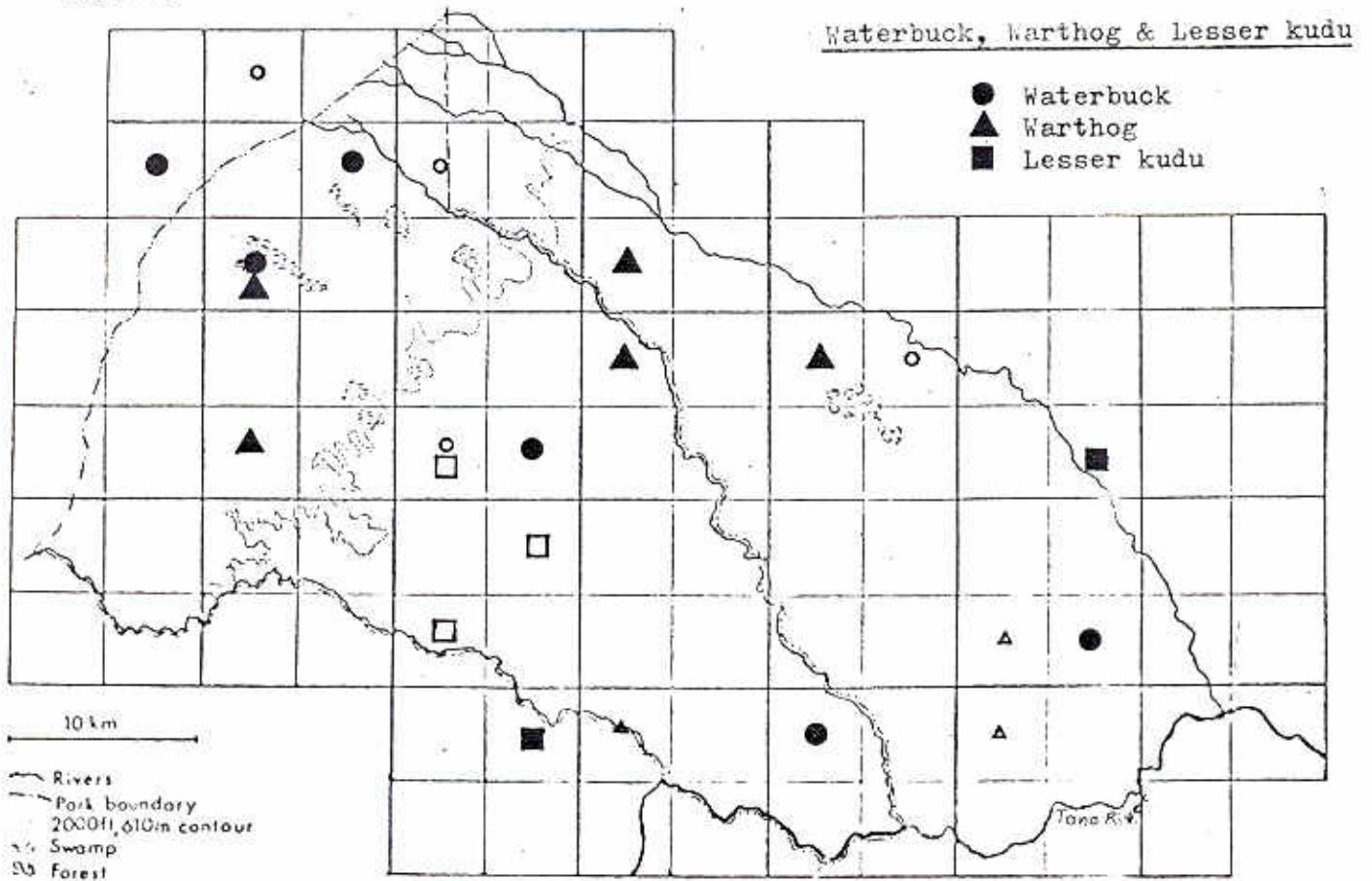


FIG.11

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

Domestic livestock

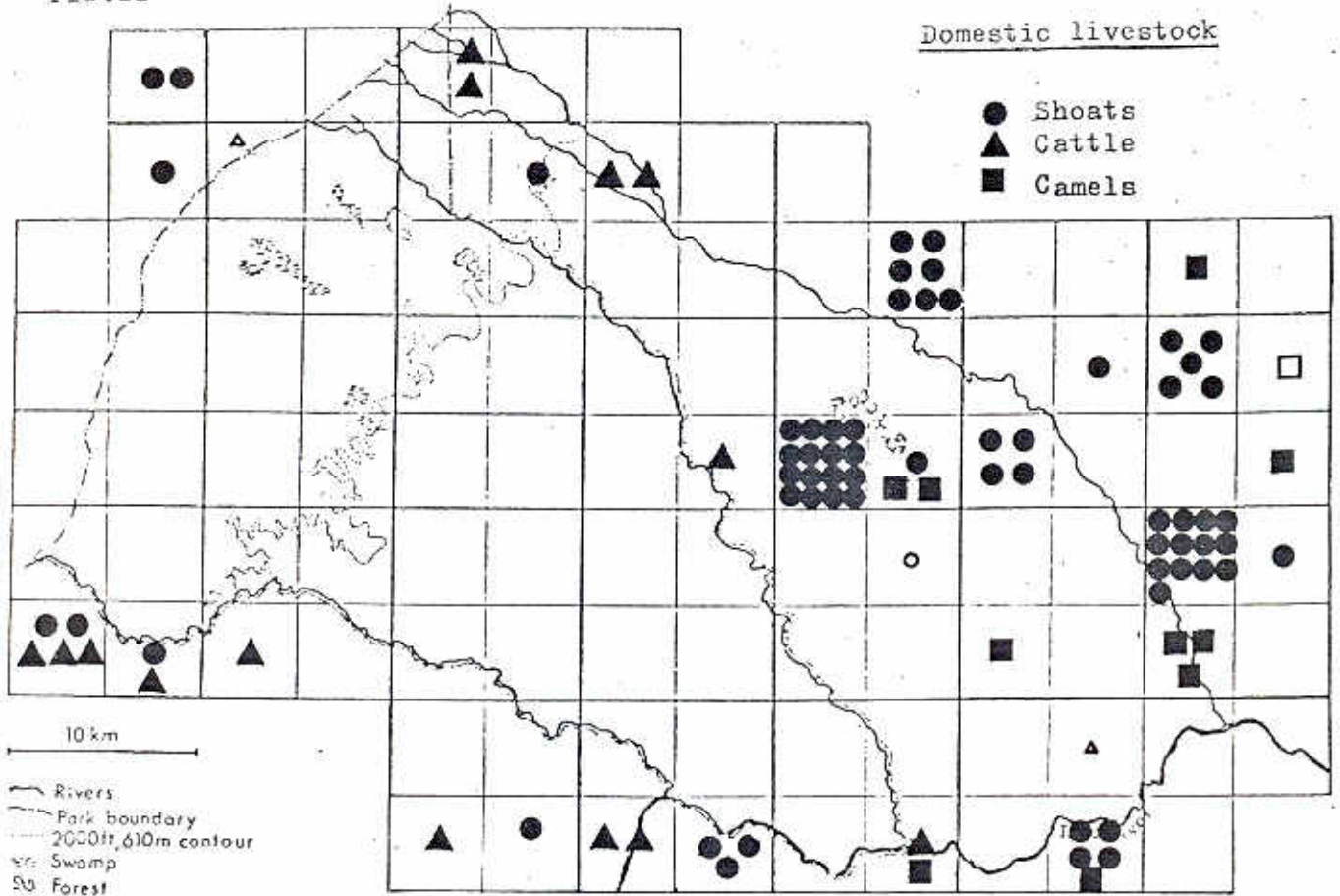


FIG.12

MERU NATIONAL PARK AND CONSERVATION AREA

SAMPLE COUNT

Buildings

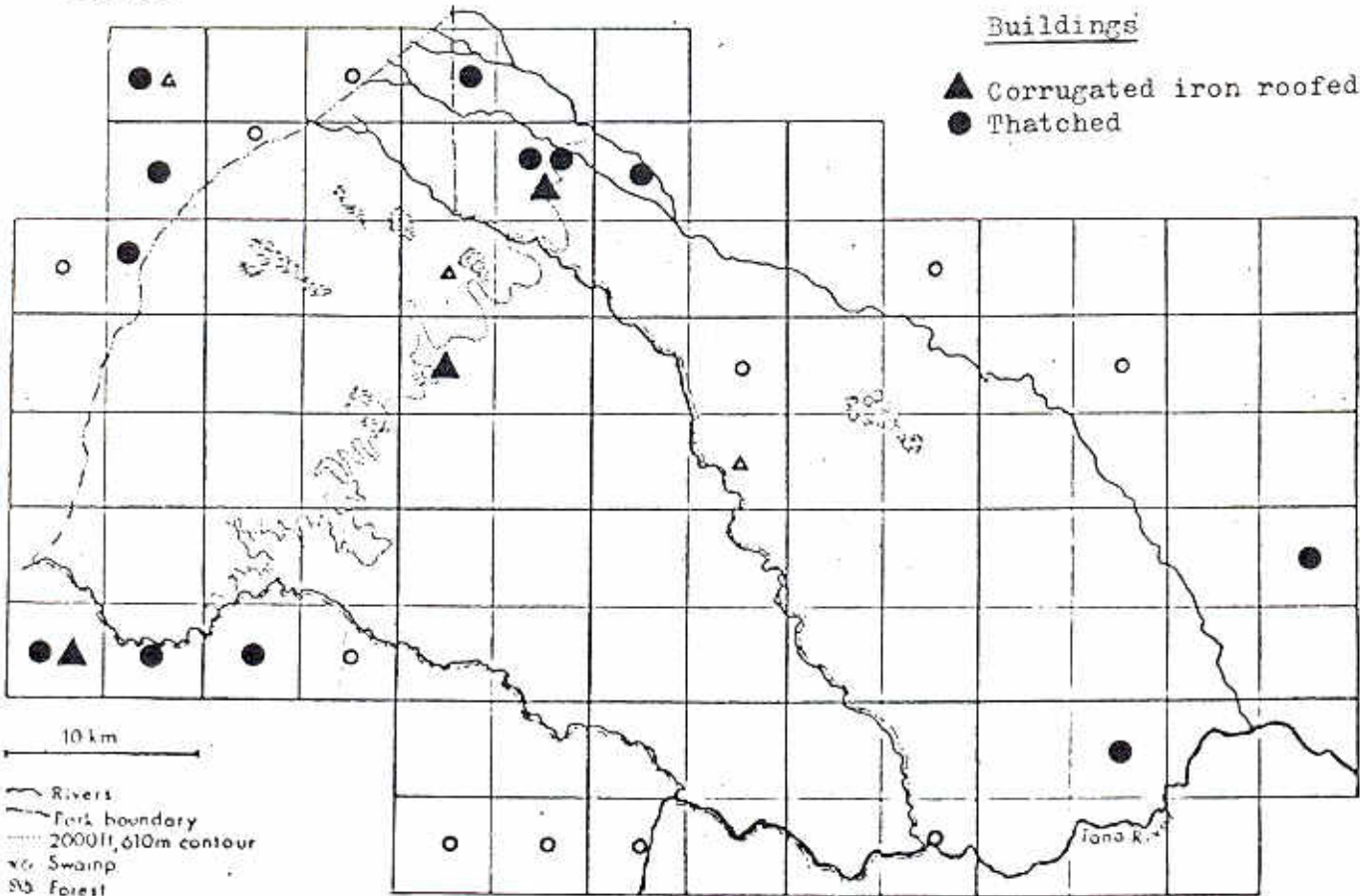


FIG. 13

MERU NATIONAL PARK

Age structure of elephants - 1976

(n=257)

