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1976

SELOUS ELEPHANT AND WILDLIFE SURVEY

I. DOUGLAS - HAMILTON

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ACKNOWLEDGEMENT

I am very grateful to the Tanzanian Game Division for honouring me with this consultancy. In particular, the former Director of Game, Mr. Raphael Jingu lent his support. To Mr. Alan Rodgers and Bakari Mbano, I offer my sincere thanks for so much of the planning and logistics.

I am also indebted to Alan Rodgers for generous hospitality in Dar es Salaam. Bakari Mbano, George Mgongo, William Summay and Paul Klingenstein thoroughly performed their duty as observers.

The survey was funded by the Danish Government, and was made possible through the good offices of the African Wildlife Leadership Foundation to whose Field Director, the late Robert Poole, I owe a great debt of gratitude.

Carol Ann Zito operated the computer in Nairobi and drew the maps, for which I am thankful.

DANIDA/IUCN SELOUS ELEPHANT AND WILDLIFE SURVEY (1976)

I. Douglas - Hamilton

INTRODUCTION

The Selous Game Reserve, is an area of approximately 55,000 km² (the exact boundaries being unsurveyed at the time of the survey). It has no human population. History and nature have conspired periodically to decimate the residents of the region through wars, famine and disease. (Matzke, 1976). Part of the Reserve was gazetted for the purpose of denying people access to sleeping sickness areas, and in recent years the policy of Ujamaa, has concentrated human settlement even more. The wilderness established is probably the largest unbroken elephant range in Africa, devoid of people, and containing the miombo habitat in a great variety of forms.

The intentions of the 1976 survey was to establish the size and distribution of the Selous wildlife resource, with particular reference to elephants. Mr. Alan Rodgers and Mr. Bakari Mbanjo of the Tanzania Game Division organized the logistics and I was employed as a consultant to train observers, to supply a suitably equipped aeroplane, and to organise and execute the count and the analysis. The cost was met by the Danish government under their DANIDA aid programme.

The survey was of especial relevance in laying a baseline before development began on the Stiegler's Gorge dam.

An important objective was the training of Game Department staff in techniques of aerial observation and recording, and later in analysis of completed data. The aim was to build up a team of observers for future counts in the Selous or other reserves.

METHODS

The census zone chosen measured 73,959 km² in the wet season and 74,131 km² in the dry season and covered the whole of the reserve and adjoining areas. It was sampled by flying parallel transects, five nautical miles (9.2 km) apart, which collected data on numbers, distribution and habitat condition simultaneously. The methods selected were compatible with other counts of the IUCN Elephant Survey and Conservation Programme, and followed those developed at the Serengeti Research Institute, (Norton-Griffiths, 1975).

Transects were flown at 250 feet above the ground and two rear-seat observers scanned a strip of ground demarcated by markers attached to the struts on either side of the aircraft. The two strips amounted to approximately 300 metres giving a sampling intensity of slightly ~~less~~ ^{more} than 3%. Height was regulated by the pilot using a radar altimeter which was independently monitored by the front-seat observer.

All animals seen within the strips were counted and the results were dictated into tape-recorders so that the observers did not have to take their eyes off the ground. The narrowness of the strips was chosen to make it easier to see animals in thick vegetation and to compensate for the observers' initial inexperience.

Elephant carcasses and skeletons were recorded as an indication or recent mortality.

Ecological data on habitats were also recorded by the front-seat observer, who took photographs periodically so that a complete photographic library was built up of every major habitat type. All data were recorded so that observations could be related to the grid squares in which they occurred.

Aerial observations were transcribed from the tape recorders on to data sheets, and from these entered on computer cards. Large mammal population estimates, with confidence limits, were calculated by the University of Nairobi computer using the programme "ANPR", (Western, 1976) which incorporates a formula of Jolly (1976), known as method 2. This programme also converts the numbers of animals seen to densities, which may be plotted on the map. The whole grid, was too large for the computer's capacity, and, for the purpose of analysis, the census zone was separated into three subdivisions (marked SOUTH, NORTH A and NORTH B), which were later recombined.

RESULTS

Estimates

Populations estimates for each species are given on page 8. It is evident that the elephants, at 109,419 in the dry season, dominate the large mammal biomass. The overall density of 1.48/km² is however moderate in comparison with other East African National Parks.

Bias

The estimates are given without any attempt at correcting for bias. Due to many factors, well discussed in the literature, it is virtually certain that for each species the estimates given are low. However, the uncorrected figures will be of more use to future workers. While every scientist has his own formula for correction, the unvarnished raw data can be better used for comparative purposes, or for the measurement of trends.

If correction factors are required the reader is referred to those used by Norton-Griffiths (1975) in the Ruaha National Park, much of which has a similar visibility to Selous.

The undercount for elephants will probably be less than for other species. Elephants are more obvious, we were concentrating on them and their groups were seldom larger than eight and were therefore easy to count. Buffalo, on the other hand, which were found in large herds will suffer a greater underestimate. We did not use cameras as an aid to counting large herds since this would have imposed an additional training burden, with an increased risk of mistakes in the time available.

The dry season estimates were higher for most species than in the wet season, probably due to better visibility. The long grass was burnt and the *Brachystegia* tree species had dropped their leaves, leaving a mesh of branches through which elephants and other species were usually clearly visible.

Habitat Maps

Since no vegetation map has been made of the whole Selous, we have allocated a habitat type to each grid square on the basis of Mr. Alan Rodgers front seat observations, and have thus compiled a crude vegetation map. Tree cover and the proportion of trees recumbent were also plotted. While the estimates for these values were subjective, they indicate the relative distribution of elephant damage to trees which was light throughout the Selous, especially when compared with areas such as the Msembe area of the Ruaha National Park.

Shrub cover was also recorded which, together with tree cover, gives a good idea of relative visibility. The estimates will be lower in areas of thick cover, than in open habitats, and this is reflected in the species distribution maps.

Certain species such as wildebeeste and impala appear especially to favour the annual short grasses, and to avoid thickets and steeply dissected hillsides.

Human settlements and activities were plotted in and around the Reserve. These results show that the Reserve is effective in excluding human settlement and also that a proportion of cultivation has been abandoned in the adjoining areas, due to the policy of concentrated settlement adopted by the Government.

In the dry season much of the Eastern boundary was burnt, and was followed by a green flush.

Species Distribution

The distribution of each species is plotted, with a density estimate calculated for each grid square.

Elephants were widely distributed. In both wet and dry seasons the greatest densities were found along the confluence of the Luwegu, Mbarangandu and Njenje Rivers, and in Mikumi National Park, Beho-Beho, and Ulanga areas. The lowest densities were found near Liwale and along the Reserve boundaries, especially in the East.

Elephant carcasses and skeletons were most numerous around Liwale, scene of heavy elephant control operations every year, and in Northern Selous within striking distance of roads and railways.

Of the other species, rhinoceros were found scattered throughout the centre of the reserve, zebra showed less restriction to short grass than wildebeest, giraffe were entirely restricted to the north bank of the Rufiji river, and the distribution of hippos followed the major rivers.

DISCUSSION

These two counts provide a base-line for the future against which changes induced by developments can be assessed. With the species data entered on computer cards, the material is open to many forms of analysis of species and habitat associations.

The Selous ecosystem is remarkable in that the elephants do not seem to have suffered population concentration at the hands of man. If anything they have invaded areas formerly occupied by man. At present the elephants do not seem to be causing significant damage to the woody vegetation, although their effects are localized

The mean elephant group size of 3 is remarkably low, and suggests that the elephants are subject to a low degree of harassment. The ratio of dead to live elephants was also low at 4:100 in the reserve, 9:100 outside the reserve and 6:100 overall. Elephant mortality is evidently higher outside the reserve while the density of elephants is the converse.

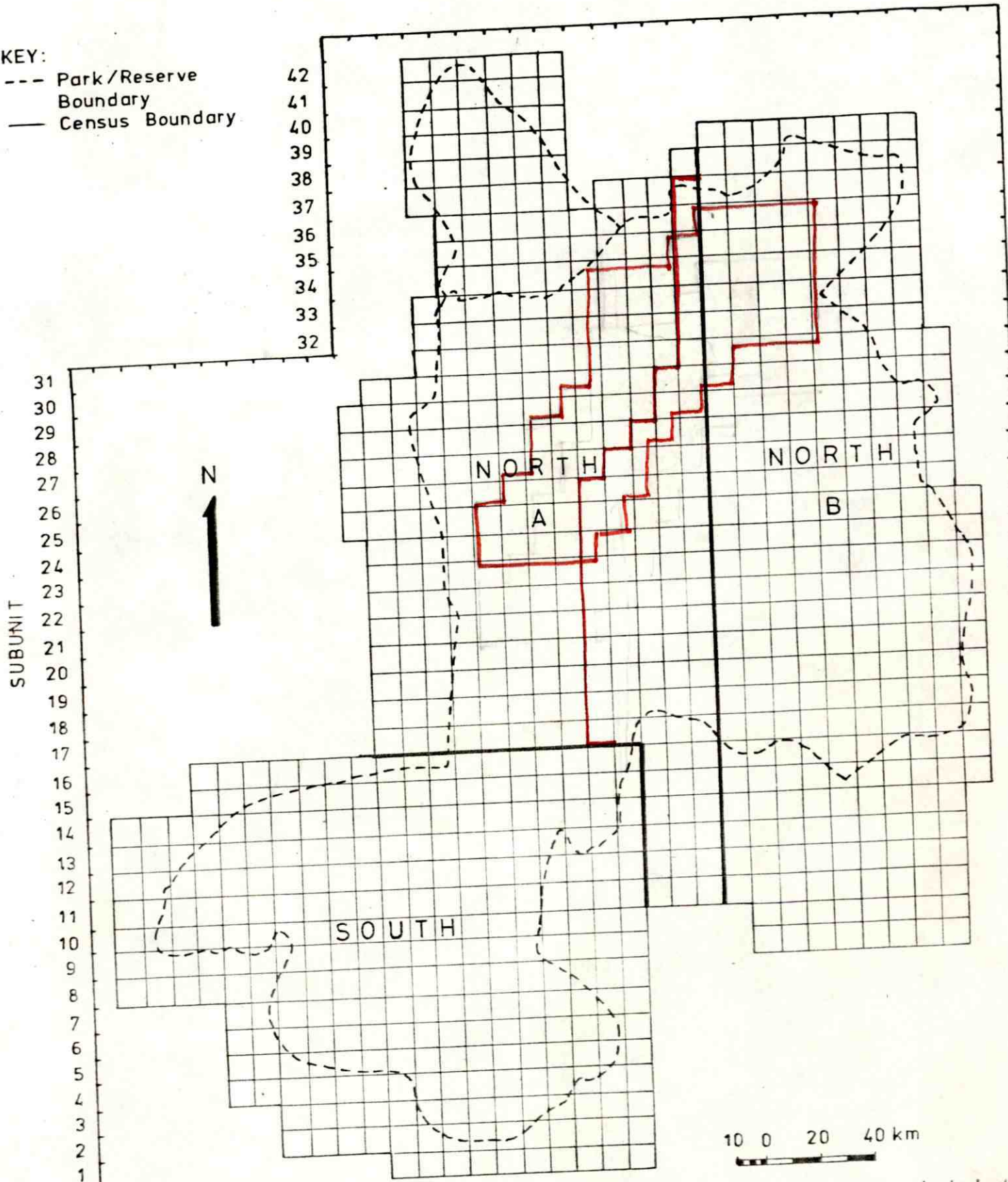
It would appear that by 1976 the intensity of poaching, which had decimated elephants in parts of Northern Tanzania, Kenya and Uganda, had not yet affected the Selous Reserve to any marked degree. However, as the former Director of Game, Mr. Raphael Jingu remarked on hearing our elephant population estimate for Selous, "Let's hope the survey does not invite problems".

SELOUS CENSUS ZONE

ANALYSIS SUBDIVISIONS

KEY:

- - - Park/Reserve Boundary
- Boundary
- Census Boundary



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NORTH A NORTH B

SOUTH

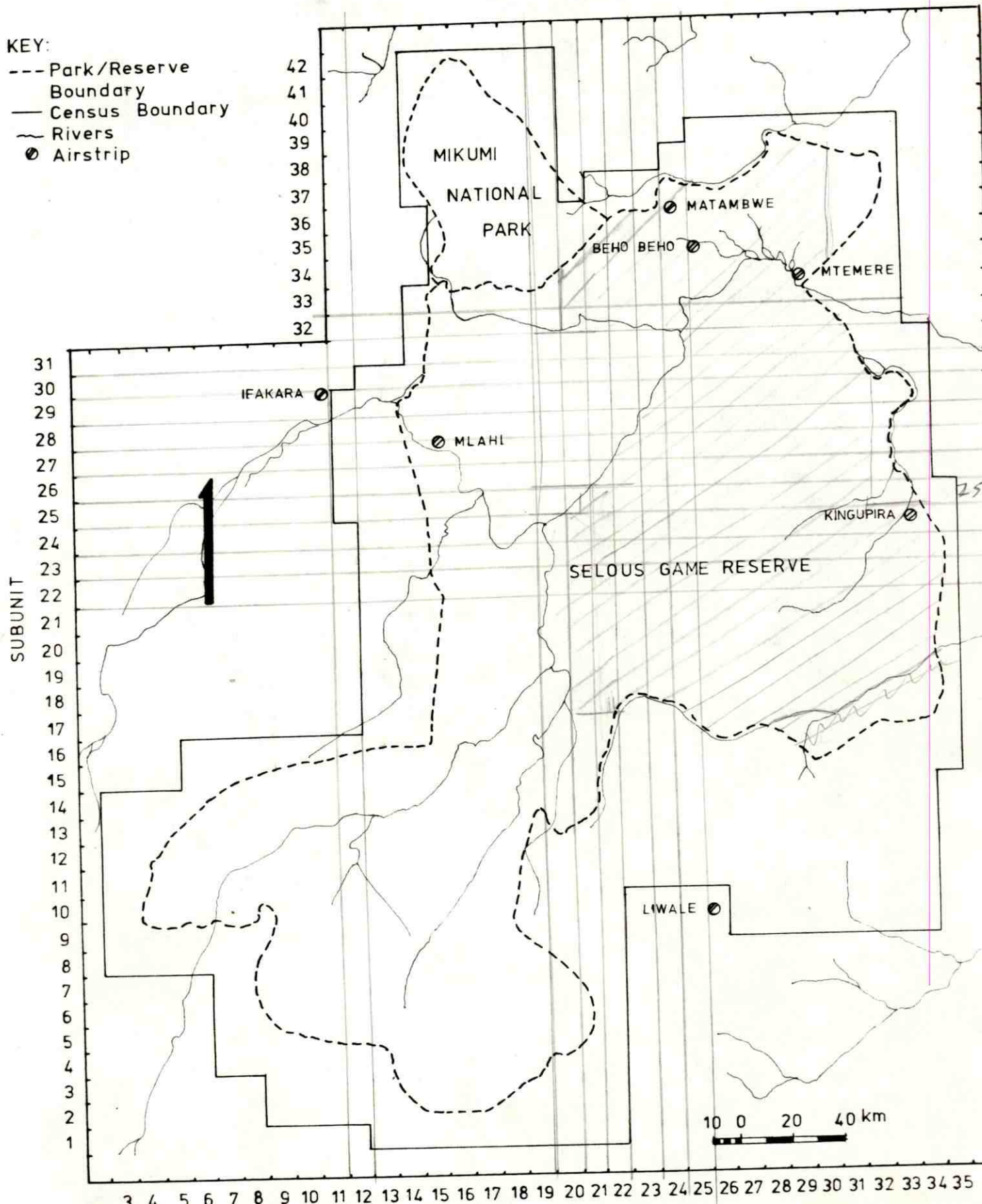
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SELOUS CENSUS ZONE

KEY:

- Park/Reserve Boundary
- Census Boundary
- ~ Rivers
- ⊙ Airstrip



SELOUS CENSUS ZONE
WET SEASON - MARCH TO APRIL 1976

POPULATION ESTIMATES

Species	Population Estimate	<i>d</i>	Standard Error	95% Confidence Limit (%)
Baboon	3268		1080	66
Buffalo	164269	2.22	30204	37
Bushbuck	546		372	137
Cattle/Shoats	4646		4340	201
Duiker	2925		433	30
Eland	10274		3555	70
Elephant	82628	1.12	7036	17
Elephant Skeleton	2973	.04	398	27
Giraffe	1182		464	79
Greater Kudu	344		132	77
Hartebeest	47981		4377	18
Hippo	16818		2072	25
Impala	106265	1.44	11866	22
Reedbuck	1312		325	50
Rhino	2033	.03	467	46
Sable	5896		1092	37
Warthog	27726		2694	20
Waterbuck	12713		2683	42
Wildebeest	67301		12379	37
Zebra	52245		6596	25

97%
3%

SELOUS CENSUS ZONE
DRY SEASON - AUGUST TO SEPTEMBER 1976
POPULATION ESTIMATES

Species	Population Estimate	<i>d</i>	Standard Error	95% Confidence Limit (%)
Baboon	5932		2052	70
Buffalo	78893	1.07	16616	42
Bushbuck	1058		202	38
Cattle/Shoats	4851		4486	186
Duiker	4973		629	25
Eland	11009		3057	56
Elephant	109419	1.48	8222	15
Elephant Skeleton	6493	.09	505	16
Giraffe	1332		652	98
Greater Kudu	1635		509	63
Hartebeest	34507		3992	23
Hippo	18505		3522	38
Impala	43891	.59	6290	29
Puku	121		94	166
Reedbuck	2146		859	80
Rhino	2541		423	33 (low good!)
Sable	9728		1751	36
Warthog	20232		2900	29
Waterbuck	12060		2309	38
Wildebeest	69044		9543	28
Zebra	44421		5445	25

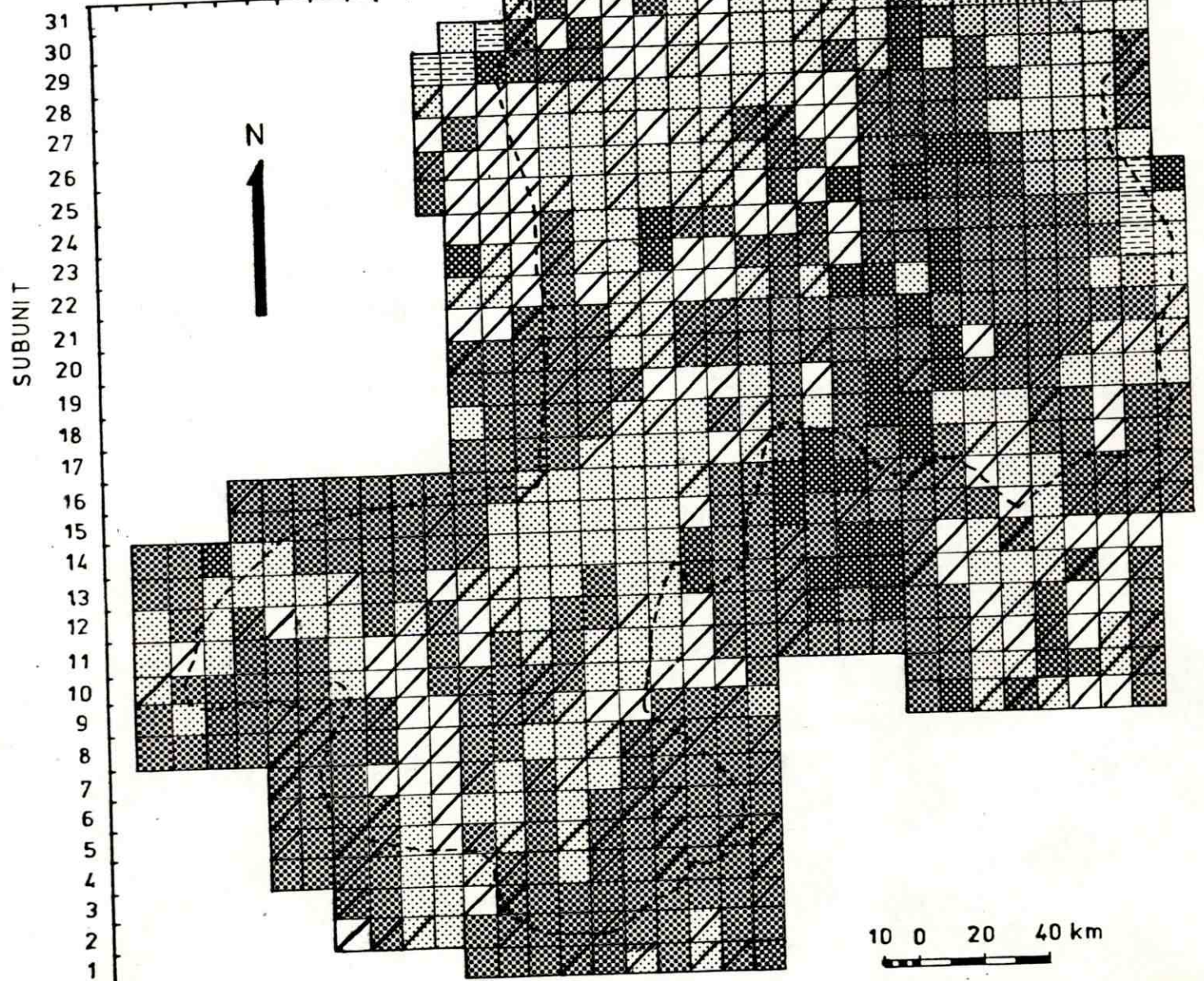
SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

VEGETATION TYPE

KEY:

- Park/Reserve Boundary 42
- Boundary 41
- Census Boundary 40
- Vegetation Type:
- Swamp/Treeless Floodplain 39
- Combretum 38
- Open Woodland 37
- Miombo 36
- Thicket/Forest 35
- M/C Catena 34



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

TREE COVER

KEY:

--- Park/Reserve Boundary
— Census Boundary

Percent Cover (%):

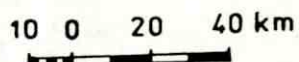
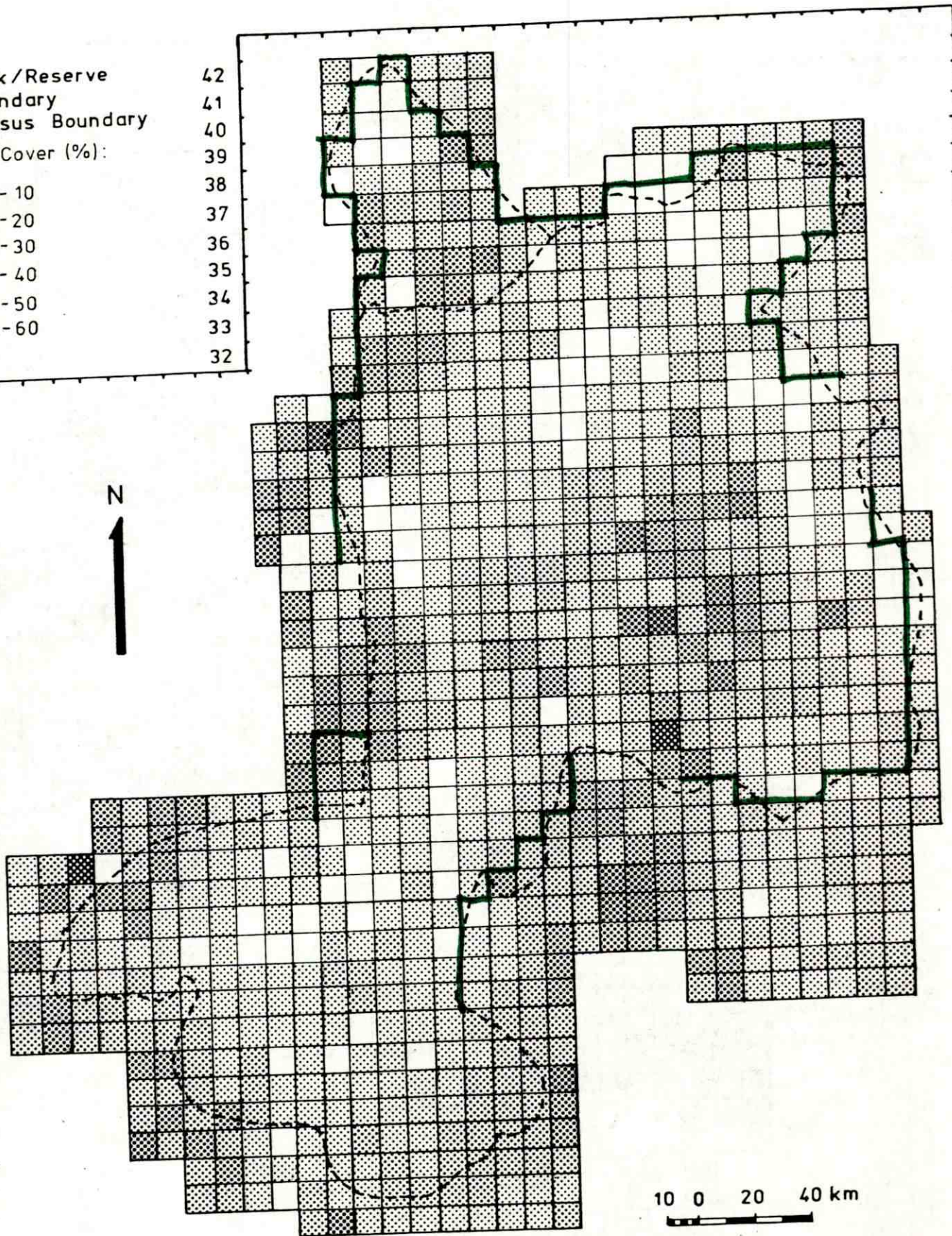


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SUBUNIT

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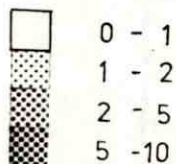
SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

RECUMBENT TREES

KEY:

- Park/Reserve Boundary
- Census Boundary
- Percent Recumbent (%):



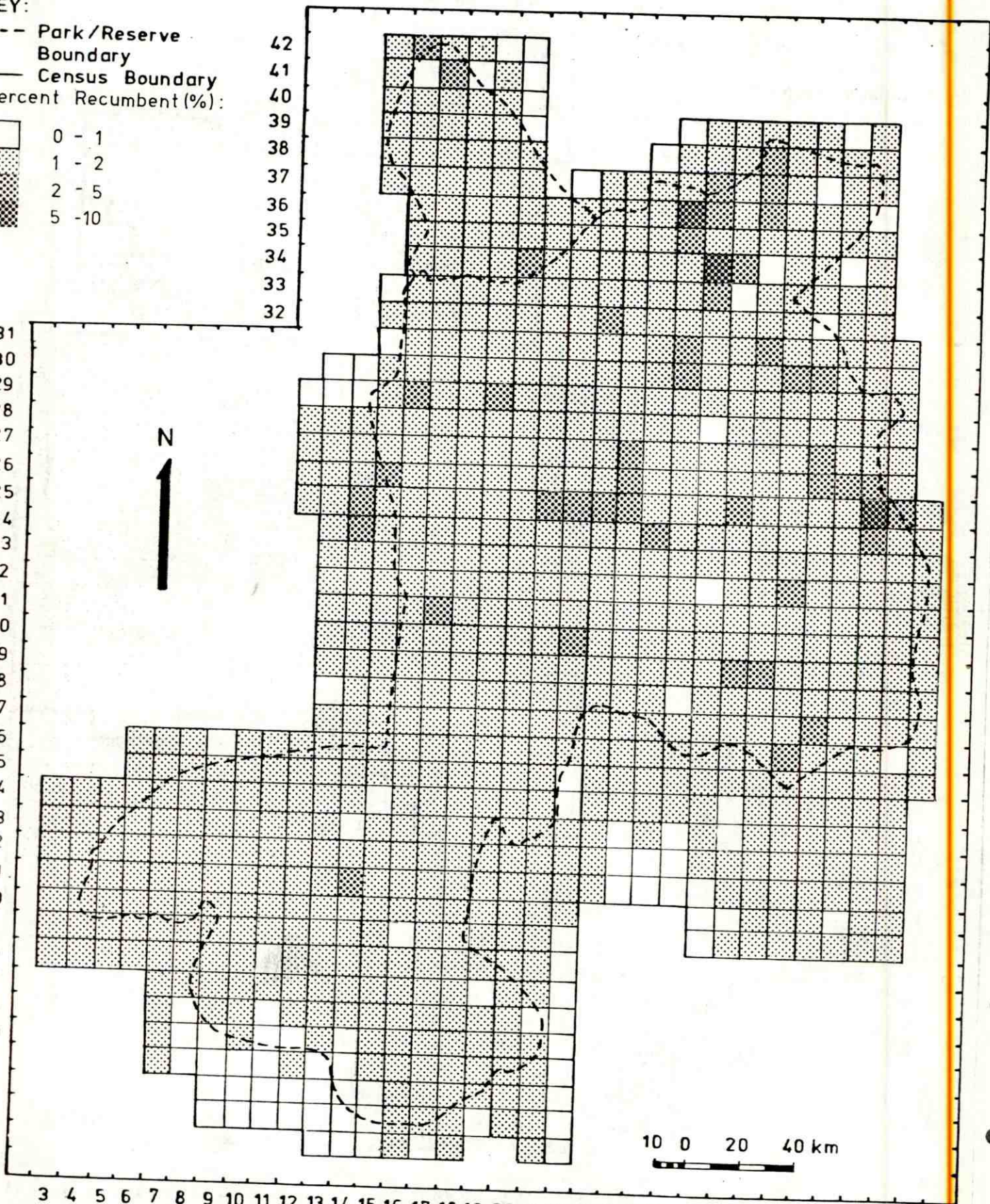
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SUBUNIT



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

RECUMBENT TREES

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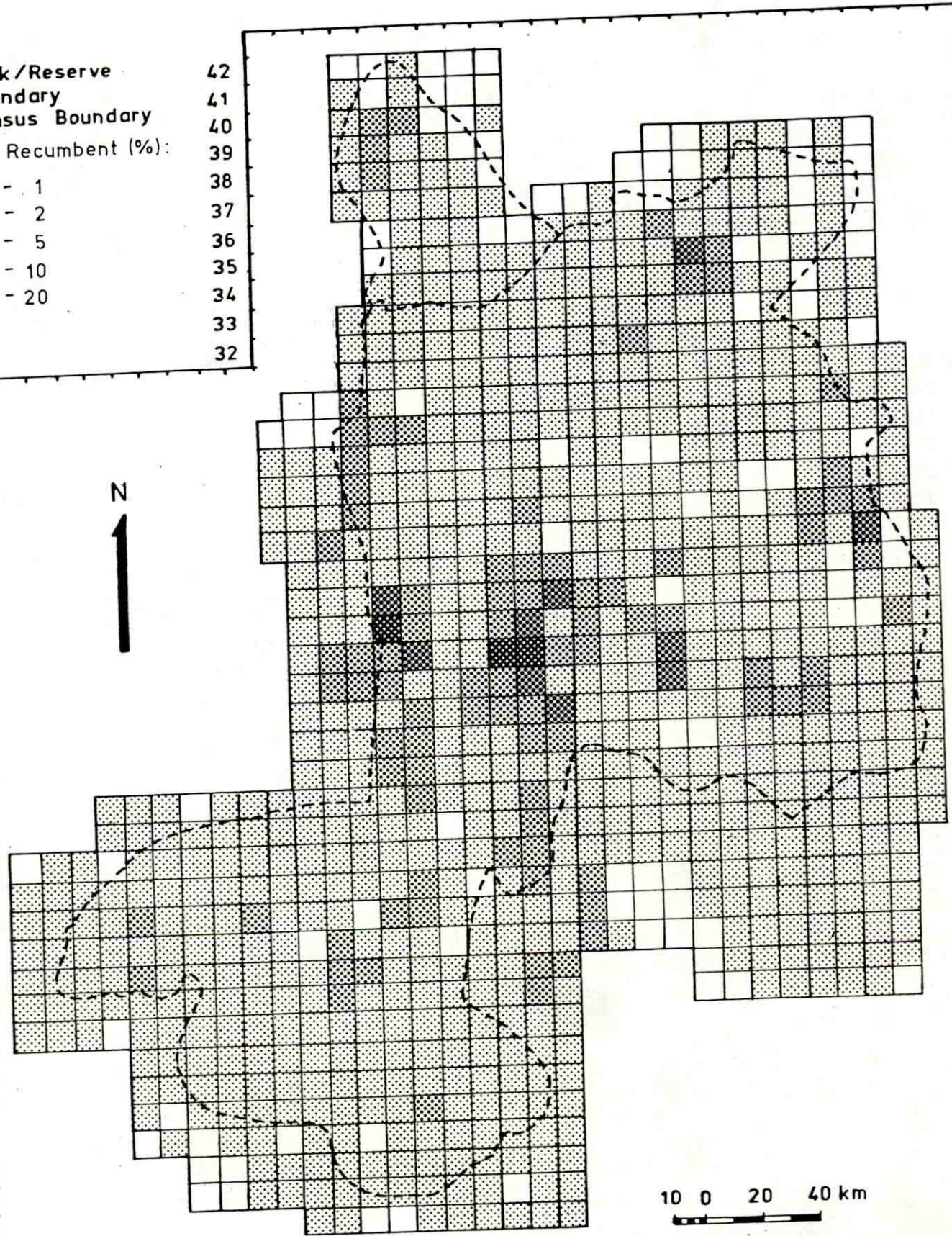
- Park/Reserve Boundary
- Census Boundary

Percent Recumbent (%):

[White]	0 - 1	42
[Dotted]	1 - 2	41
[Cross-hatched]	2 - 5	40
[Diagonal lines /]	5 - 10	39
[Diagonal lines \]	10 - 20	38
[Dark cross-hatched]		37
[Dark diagonal /]		36
[Dark diagonal \]		35
[Dark solid]		34
[Dark solid]		33
[Dark solid]		32

SUBUNIT

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10 0 20 40 km

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SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

SHRUB COVER

KEY:

- Park/Reserve Boundary
- Boundary
- Census Boundary

Percent Cover (%):

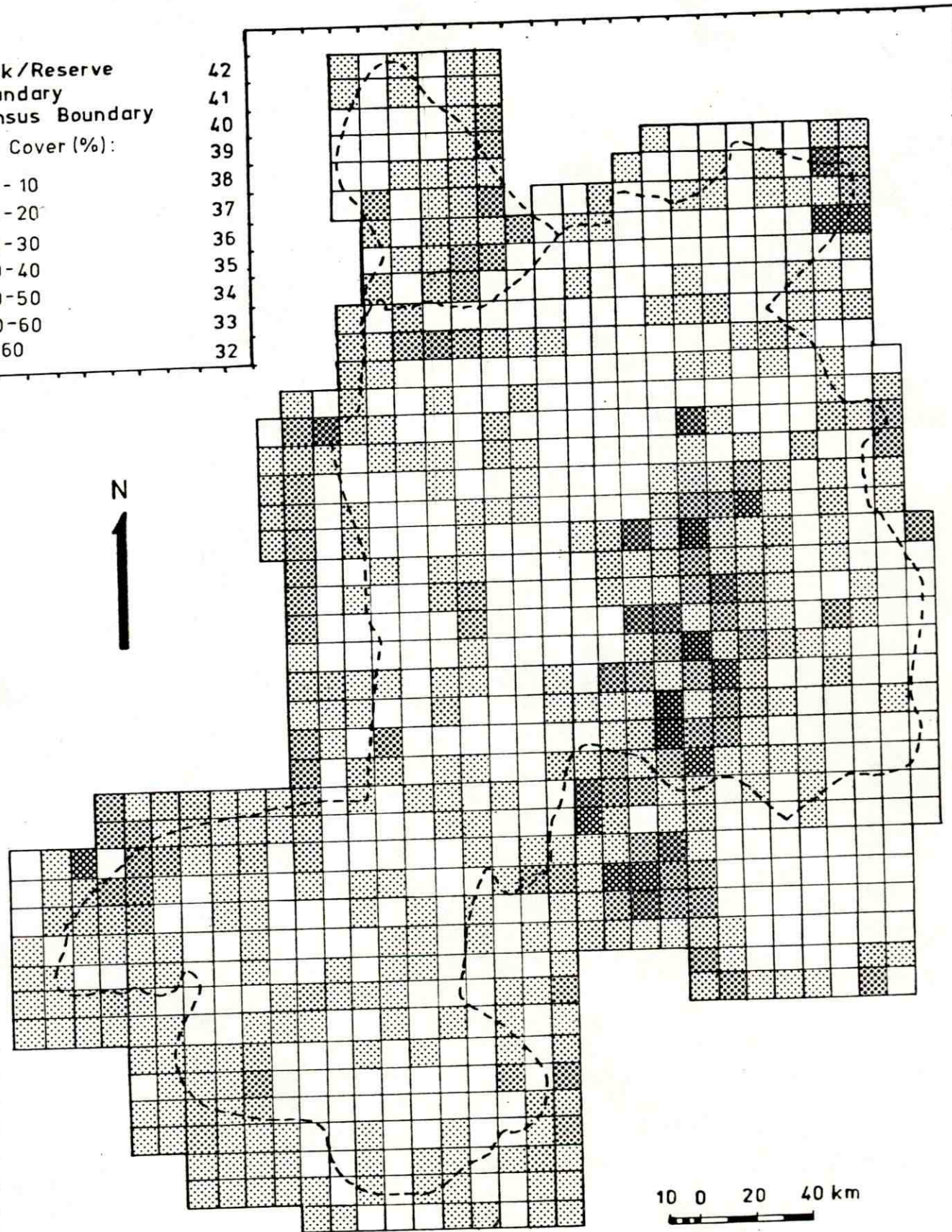


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SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

GRASS TYPE AND HEIGHT

KEY:

--- Park/Reserve Boundary

— Census Boundary

Grass Type:

▧ Annual

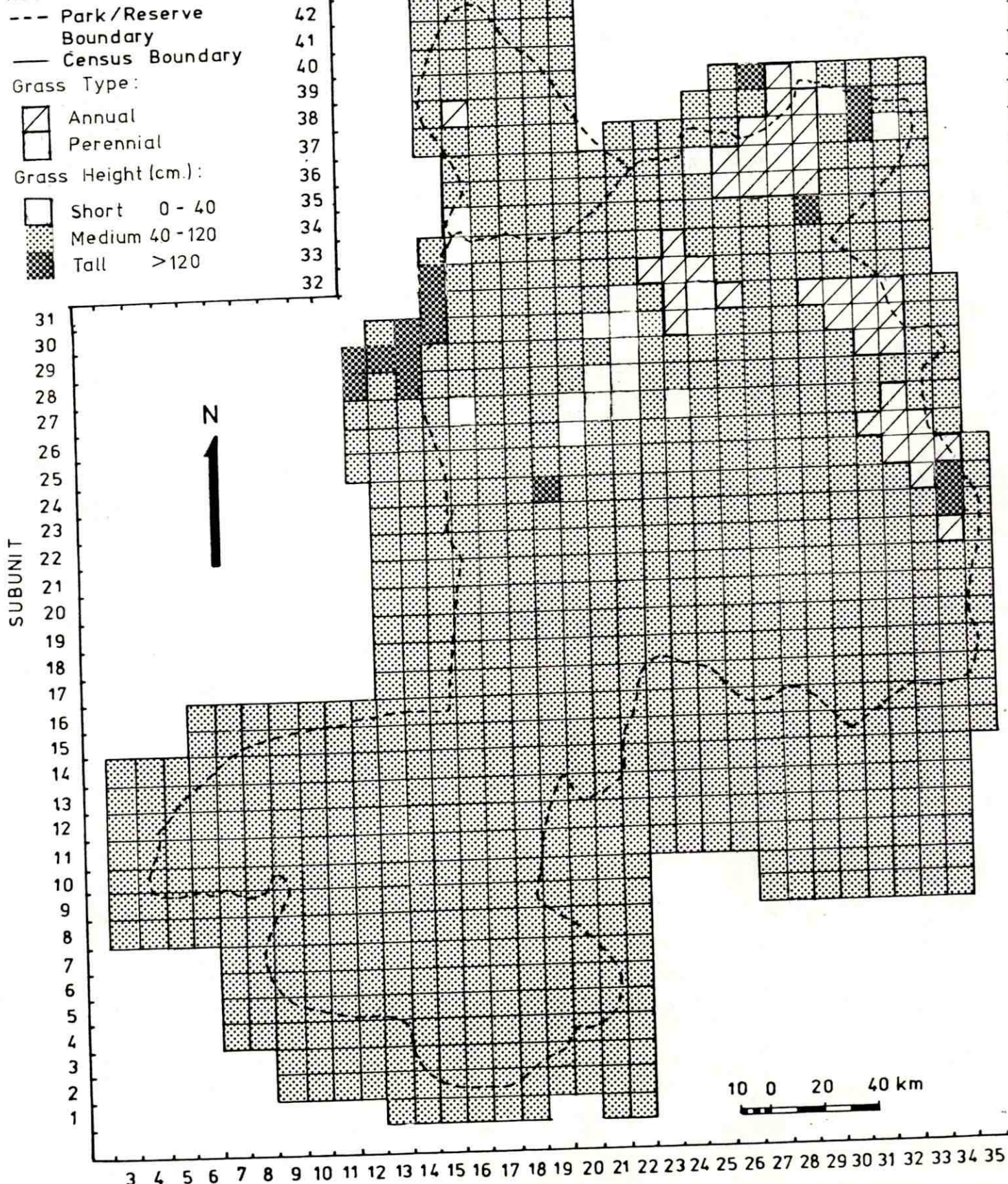
□ Perennial

Grass Height (cm.):

□ Short 0 - 40

▤ Medium 40 - 120

▨ Tall >120



SELOUS CENSUS ZONE

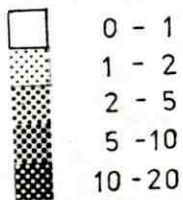
DRY SEASON - AUGUST TO SEPTEMBER 1976

BARE GROUND

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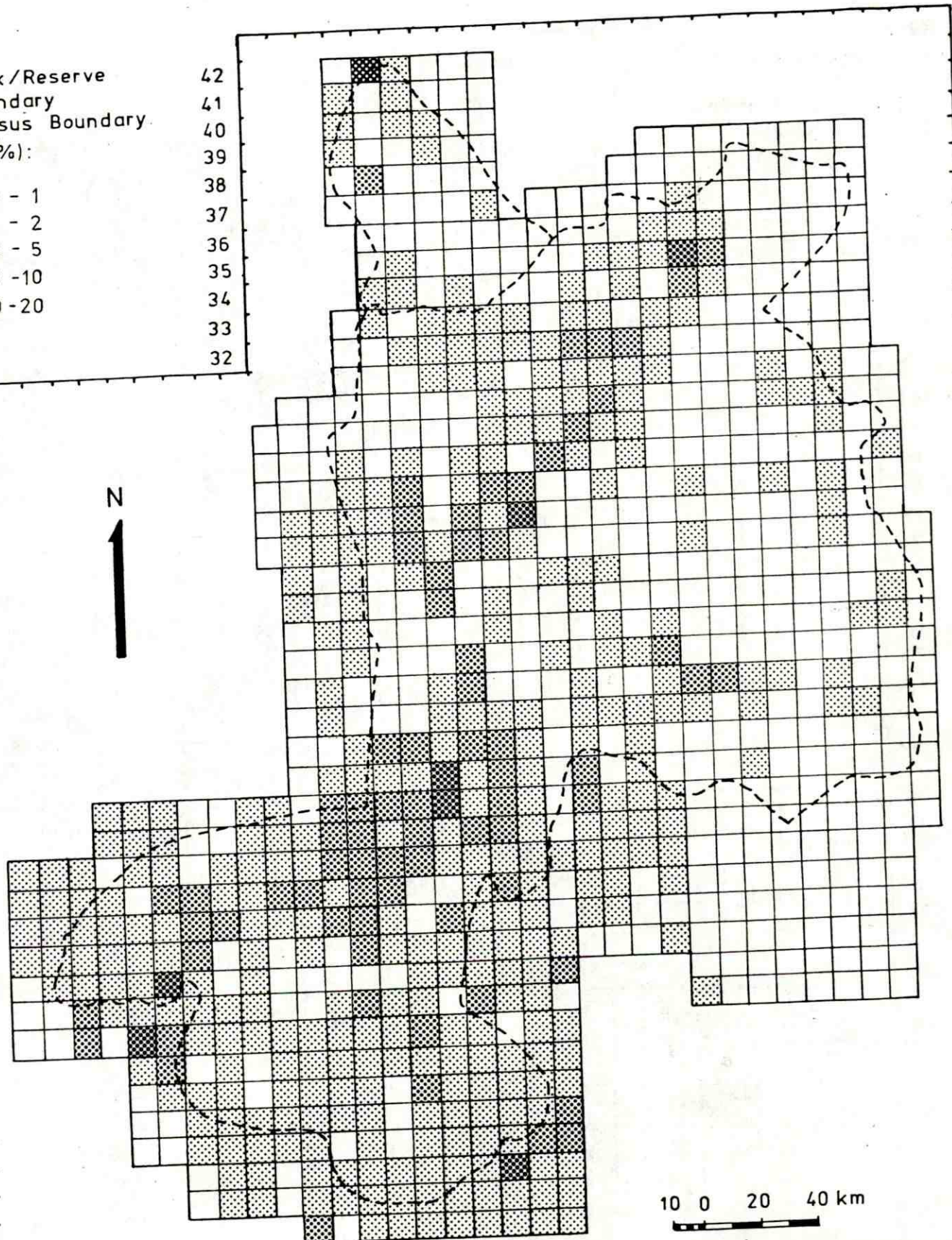
- Park/Reserve Boundary
- Census Boundary

Percent (%):



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10 0 20 40 km

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SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

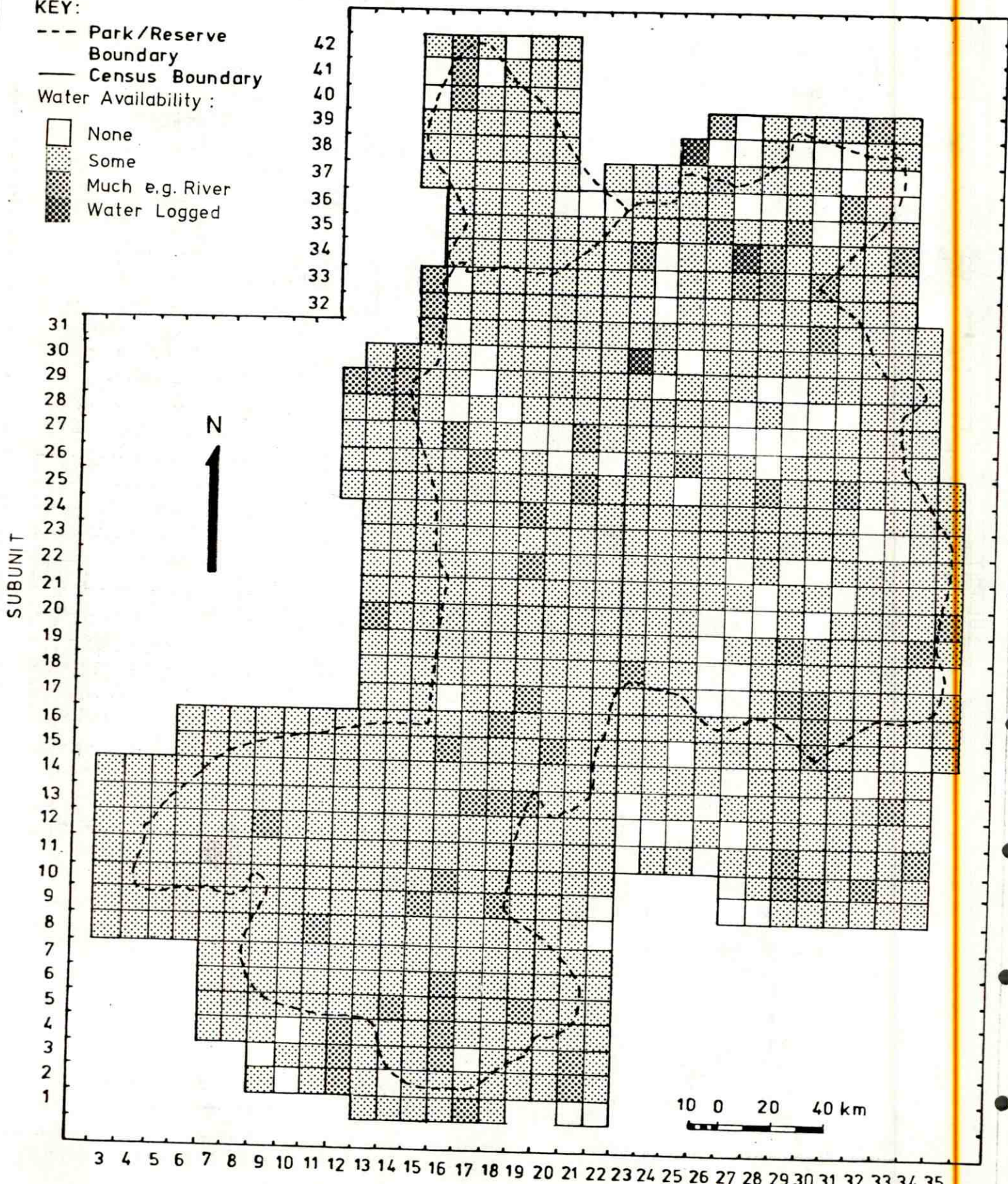
WATER AVAILABILITY

KEY:

- Park/Reserve Boundary
- Census Boundary

Water Availability :

- None
- ▒ Some
- Much e.g. River
- Water Logged



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

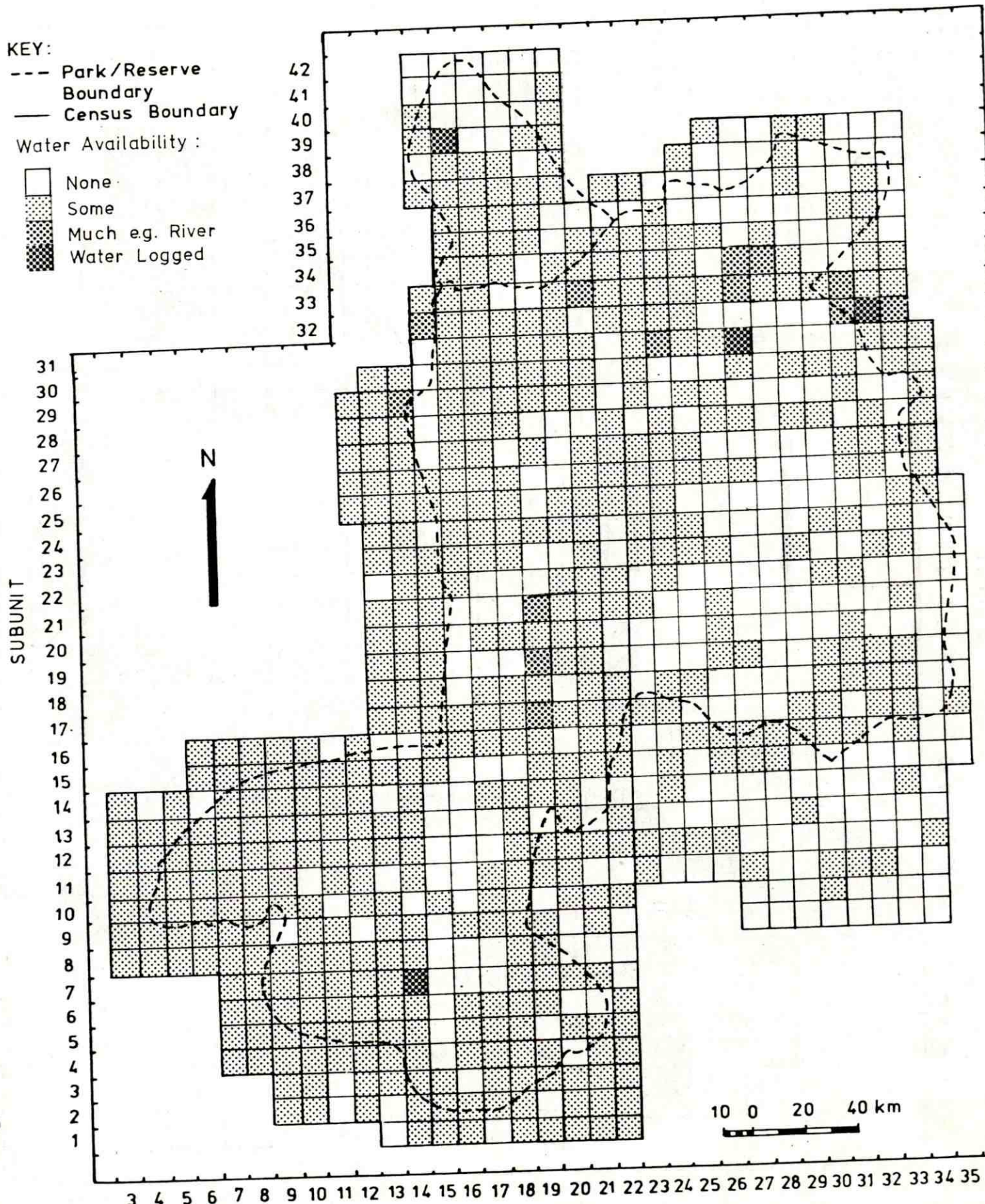
WATER AVAILABILITY

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- Park/Reserve Boundary
- Census Boundary

Water Availability :

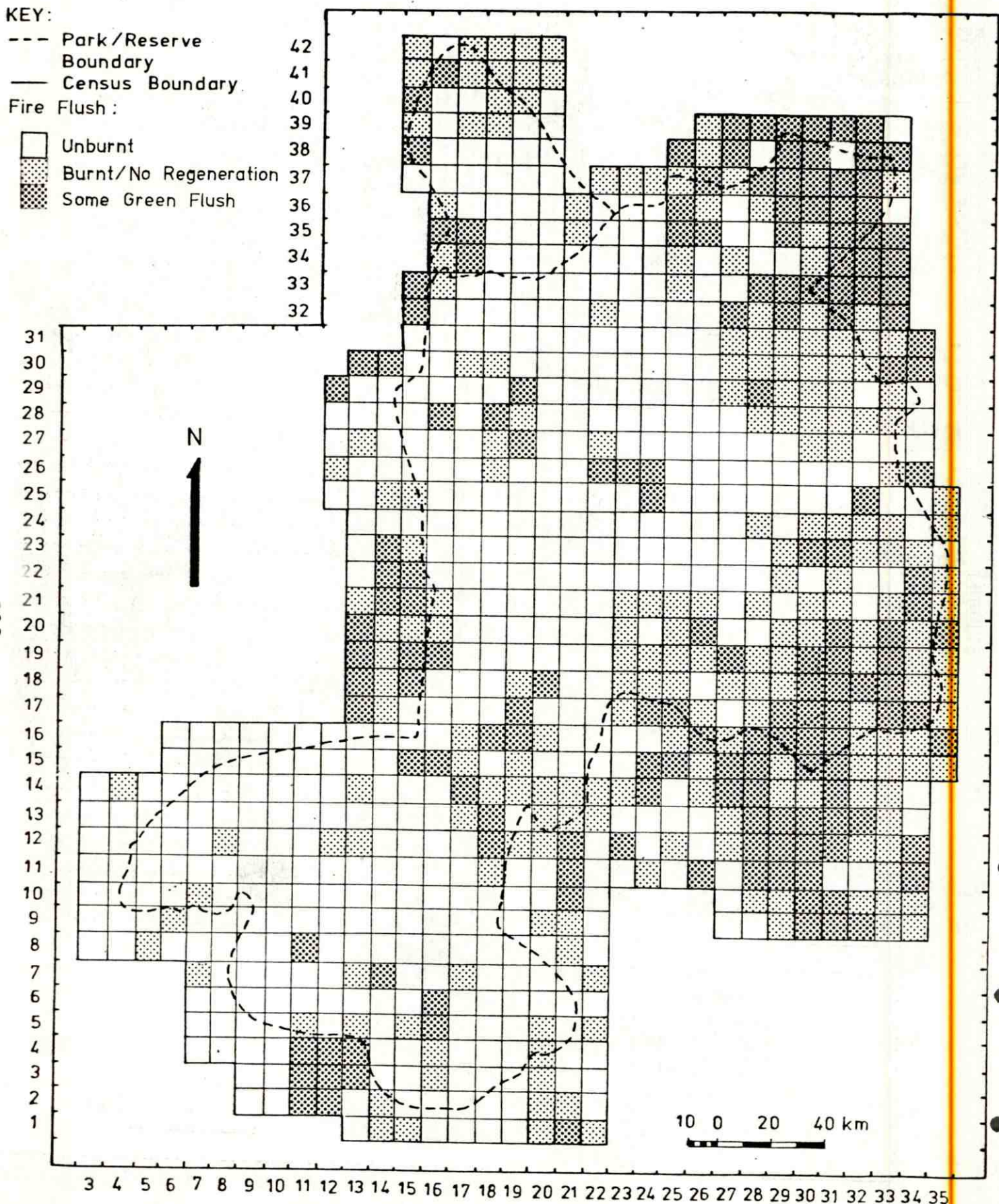
- None
- ▒ Some
- ▓ Much e.g. River
- Water Logged



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

GREEN FLUSH AFTER FIRE



SELOUS CENSUS ZONE

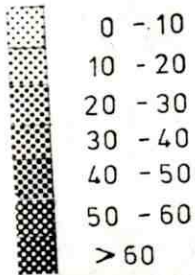
DRY SEASON - AUGUST TO SEPTEMBER 1976

FIRE

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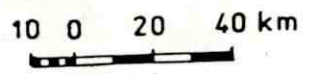
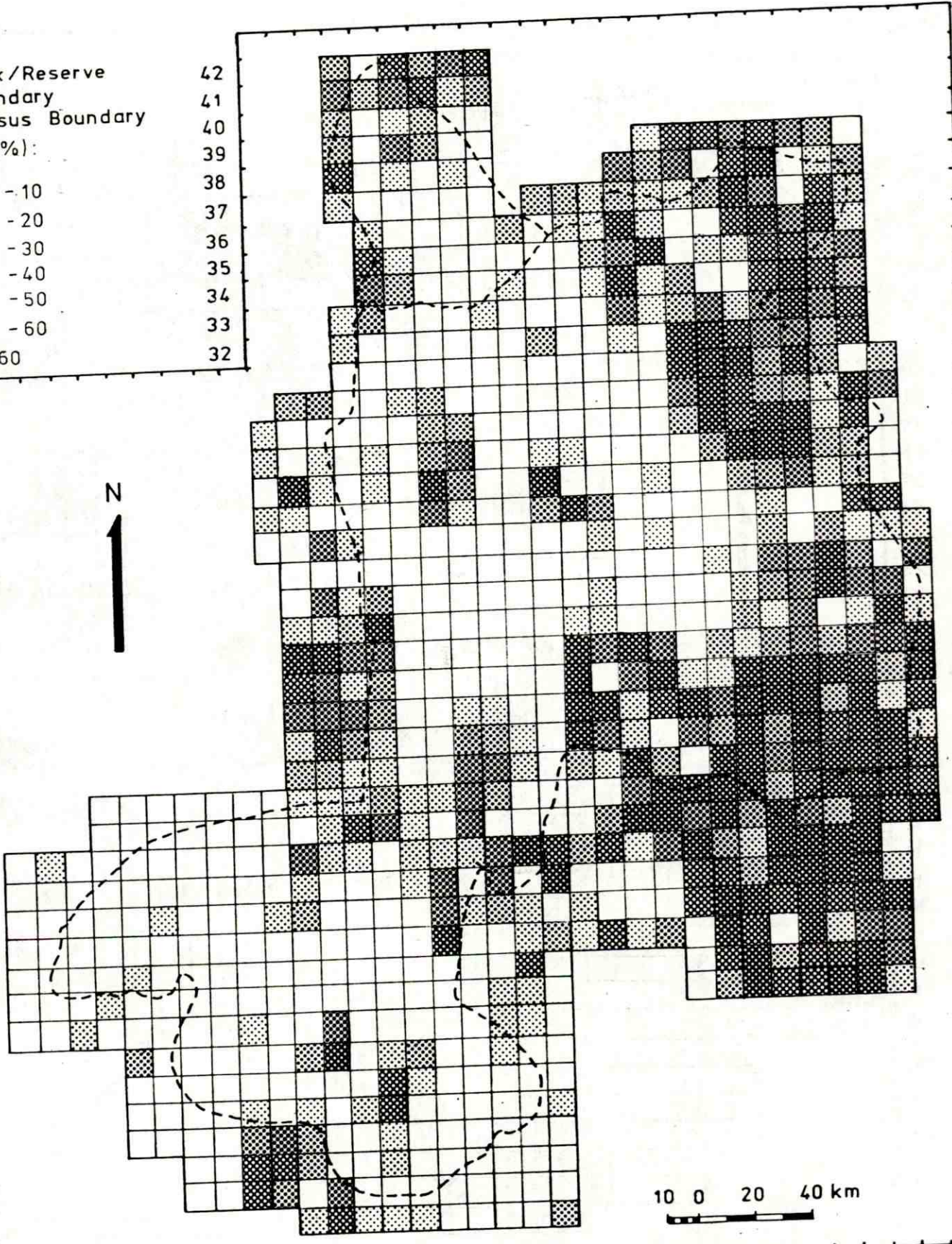
- Park / Reserve Boundary
- Census Boundary

Percent (%):



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SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

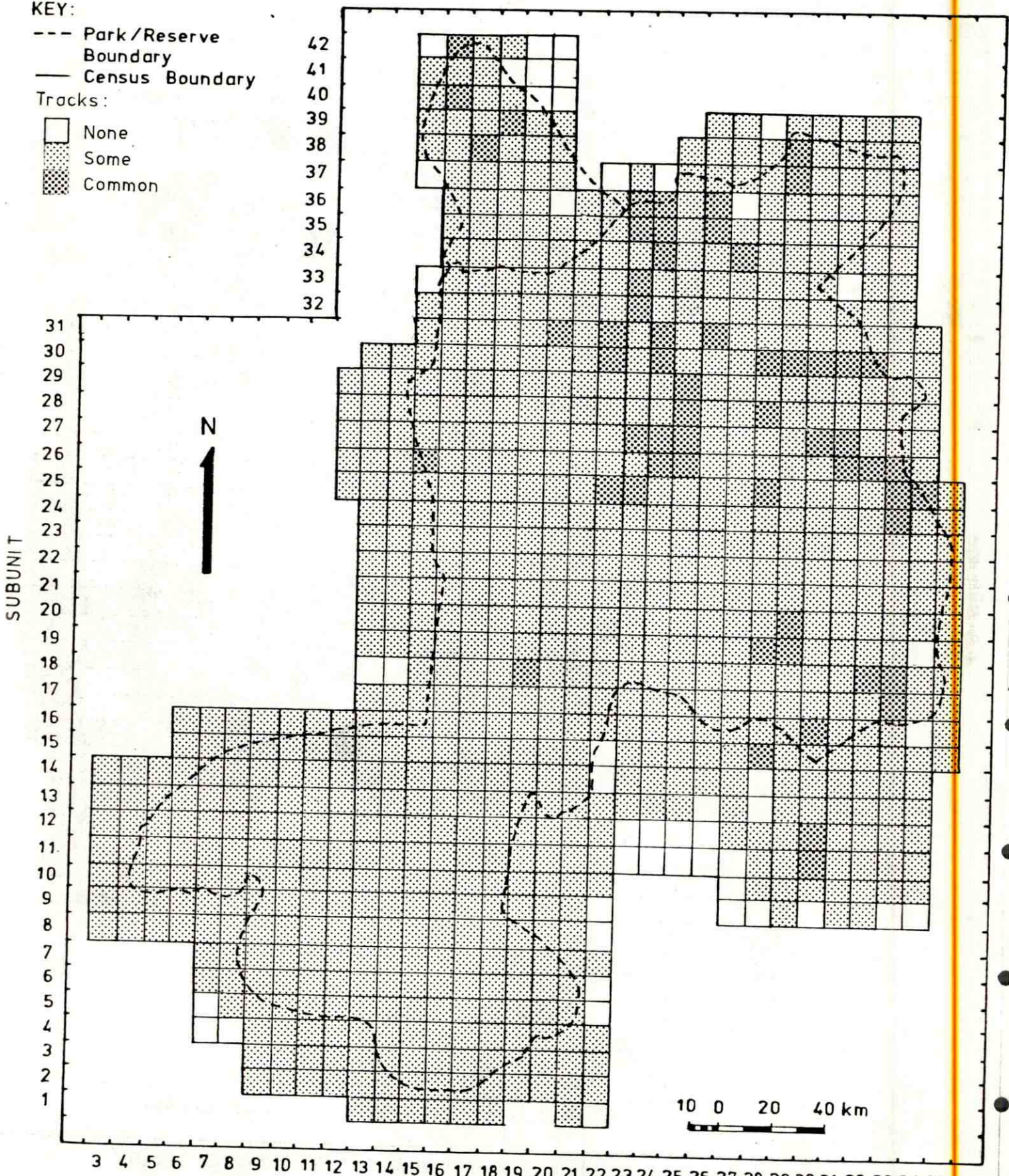
TRACKS

KEY:

--- Park/Reserve Boundary
— Census Boundary

Tracks:

□ None
▒ Some
■ Common



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

TRACKS

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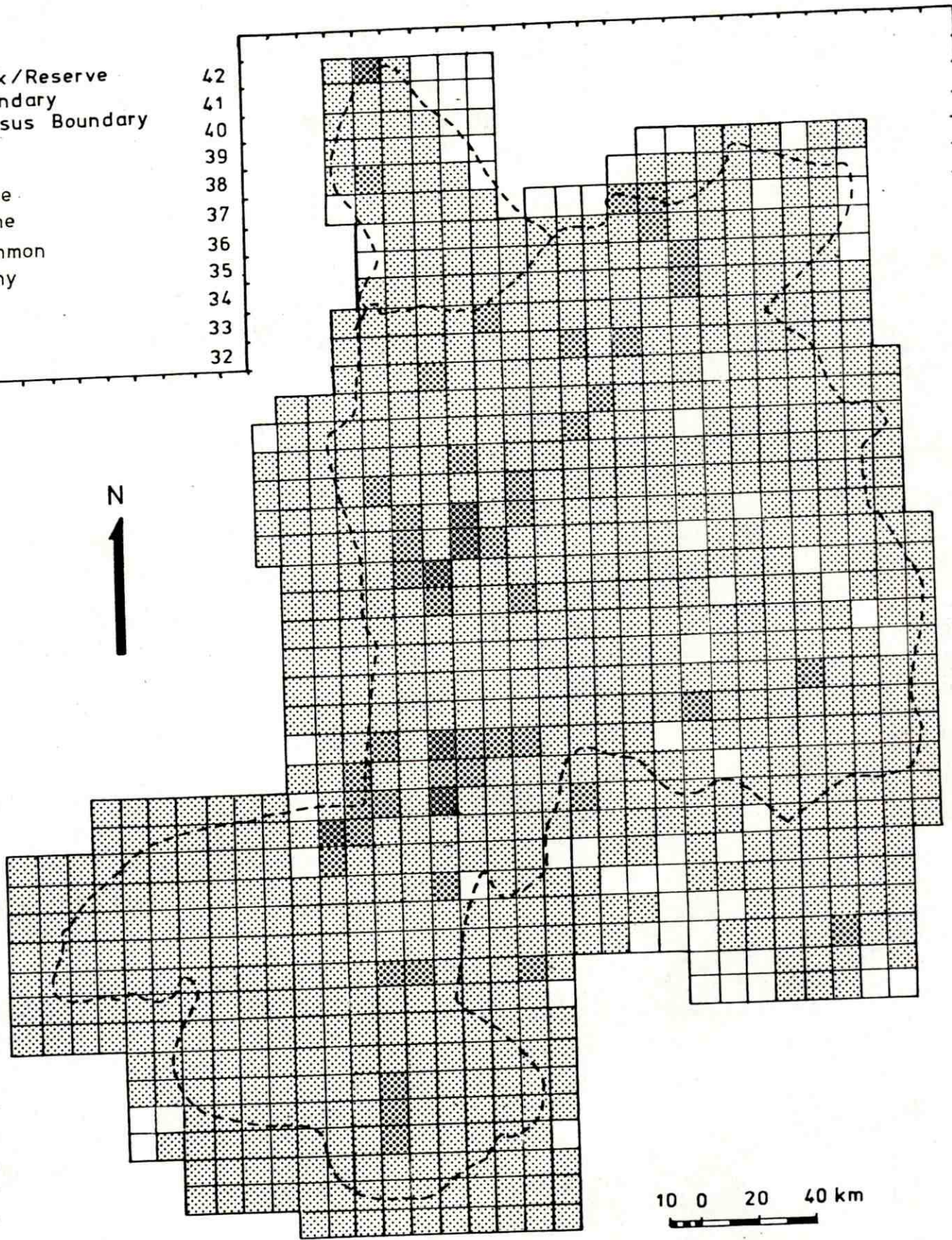
- Park/Reserve Boundary
- Census Boundary

Tracks :

- None
- Some
- Common
- Many

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SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

SOIL COLOUR

KEY:

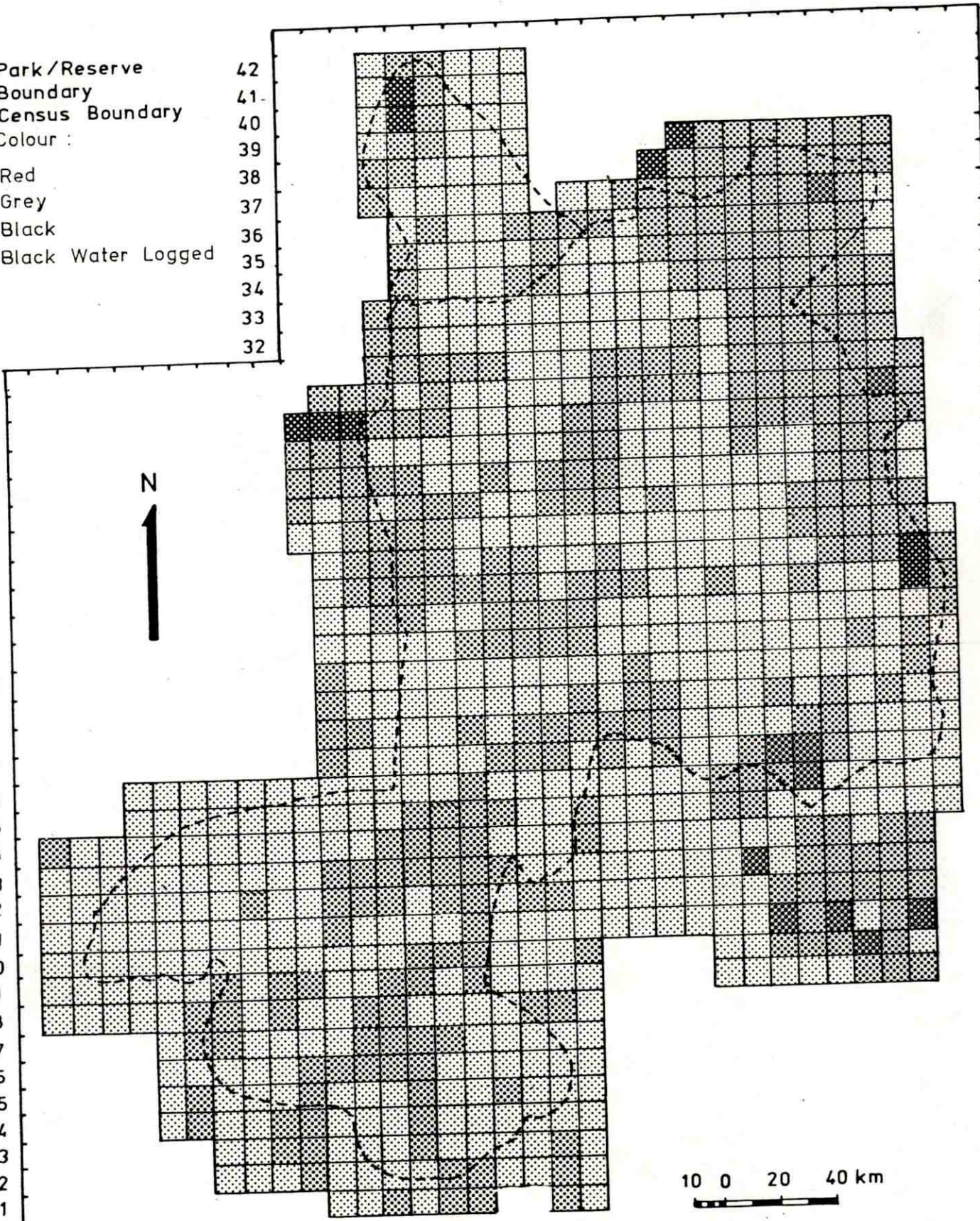
- Park/Reserve Boundary
- Census Boundary

Soil Colour :

-  Red
-  Grey
-  Black
-  Black Water Logged

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SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

DISSECTION

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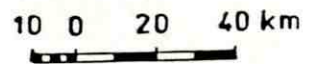
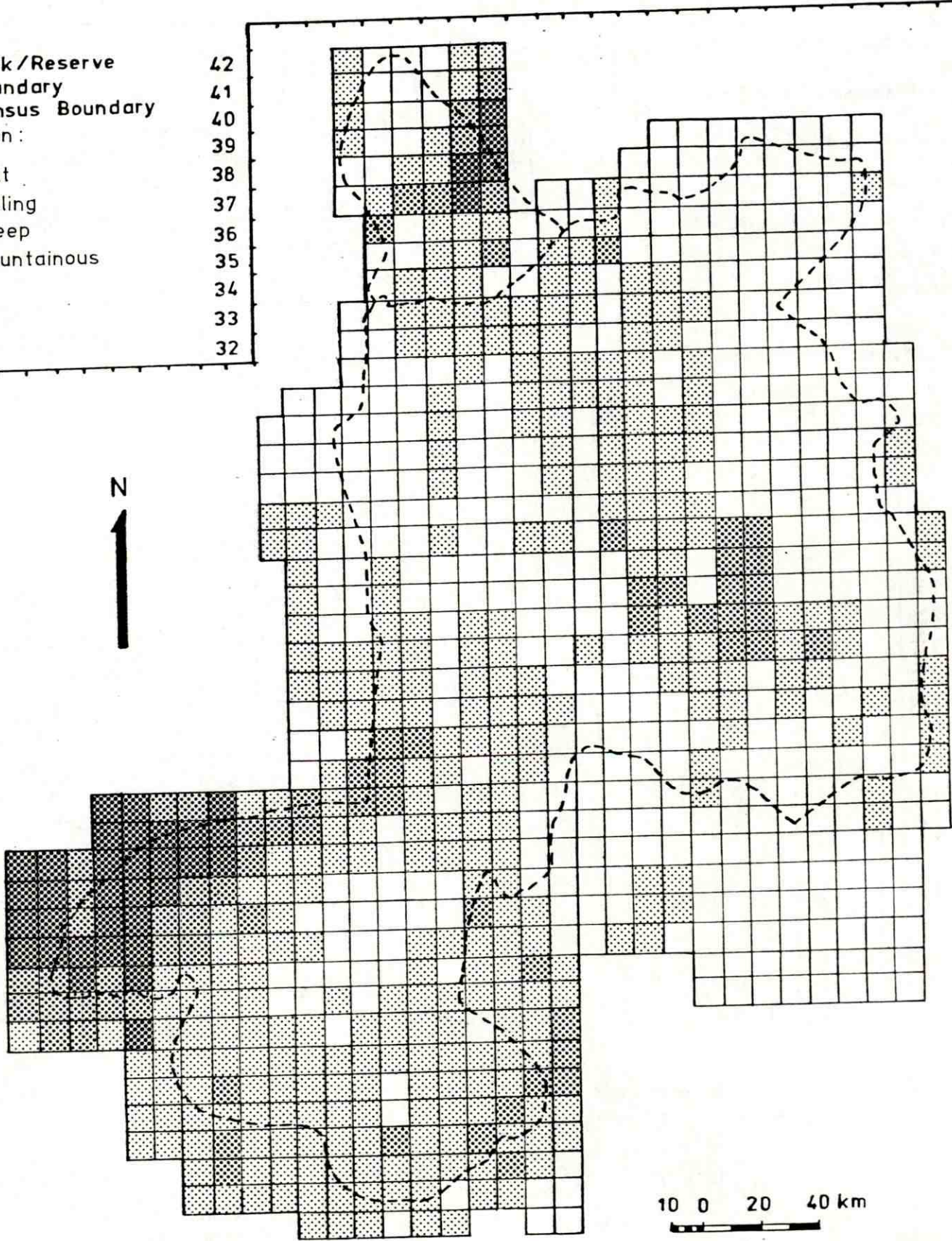
- Park/Reserve Boundary
- Census Boundary

Dissection:

- Flat
- ▒ Rolling
- ▓ Steep
- Mountainous

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SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

HUMAN SETTLEMENT

KEY:

- Park/Reserve Boundary
- Boundary
- Census Boundary
-  Present Agriculture
-  Abandoned
-  Agriculture
- | |
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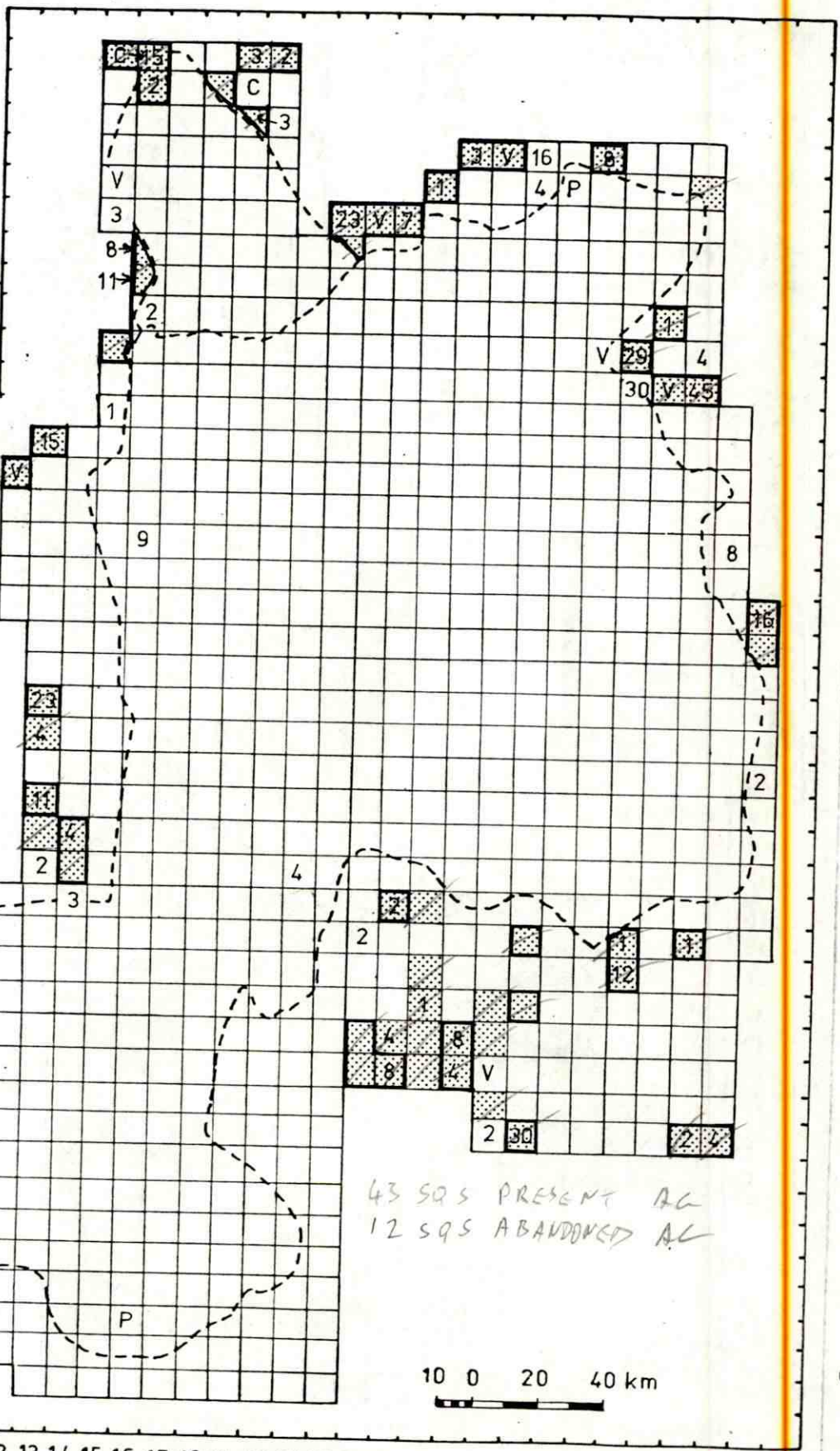
 Number of Huts
- | |
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| C |
|---|

 Cattle/Shoats
- | |
|---|
| P |
|---|

 Poaching
- | |
|---|
| V |
|---|

 Village

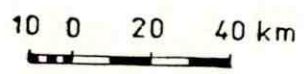
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SUBUNIT

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43 SQS PRESENT AG
12 SQS ABANDONED AG



3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

HUMAN SETTLEMENT

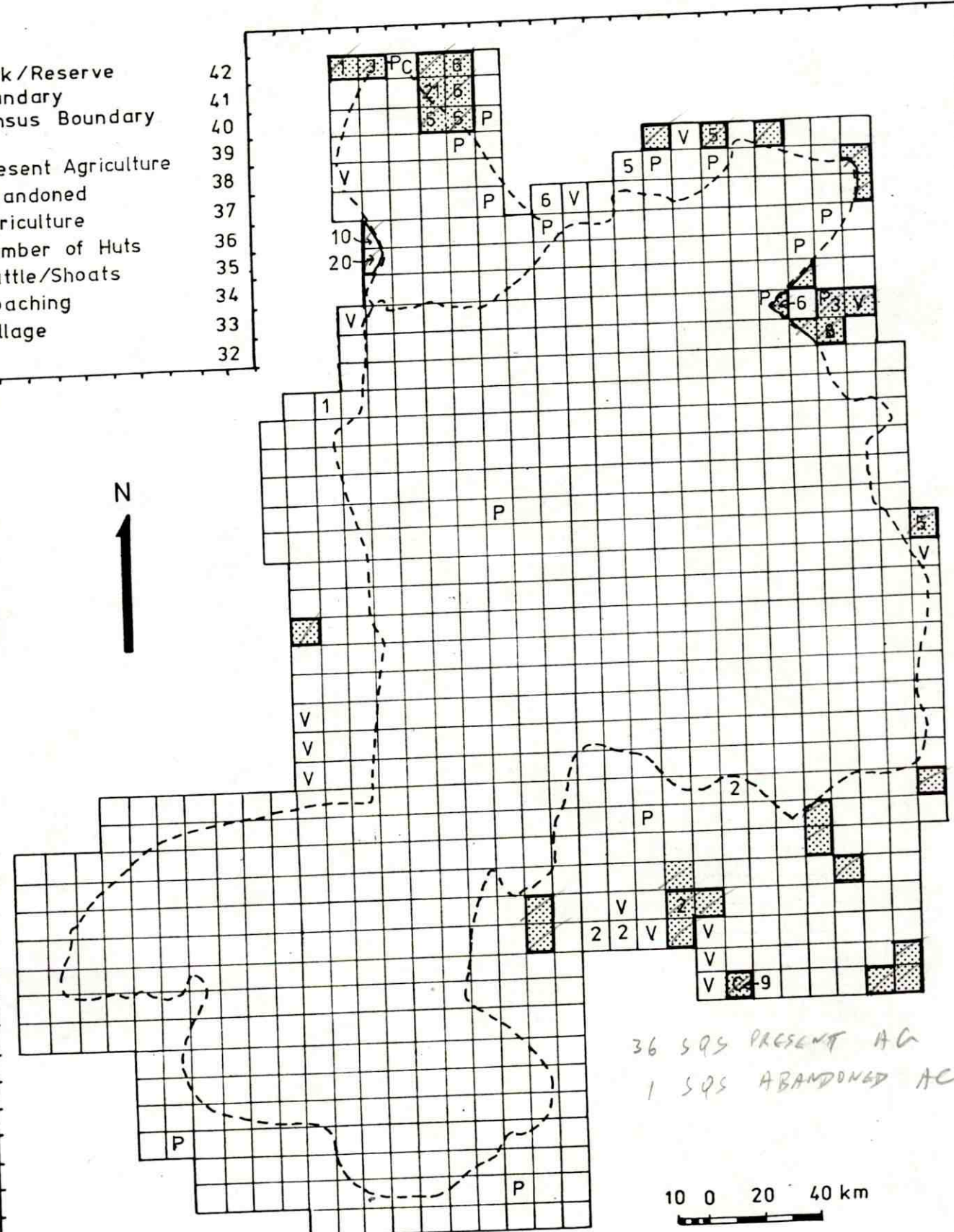
KEY:

- Park/Reserve Boundary
- Census Boundary

- Present Agriculture
- Abandoned Agriculture
- Number of Huts
- Cattle/Shoats
- Poaching
- Village

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36 SQS PRESENT AG
1 SQS ABANDONED AC

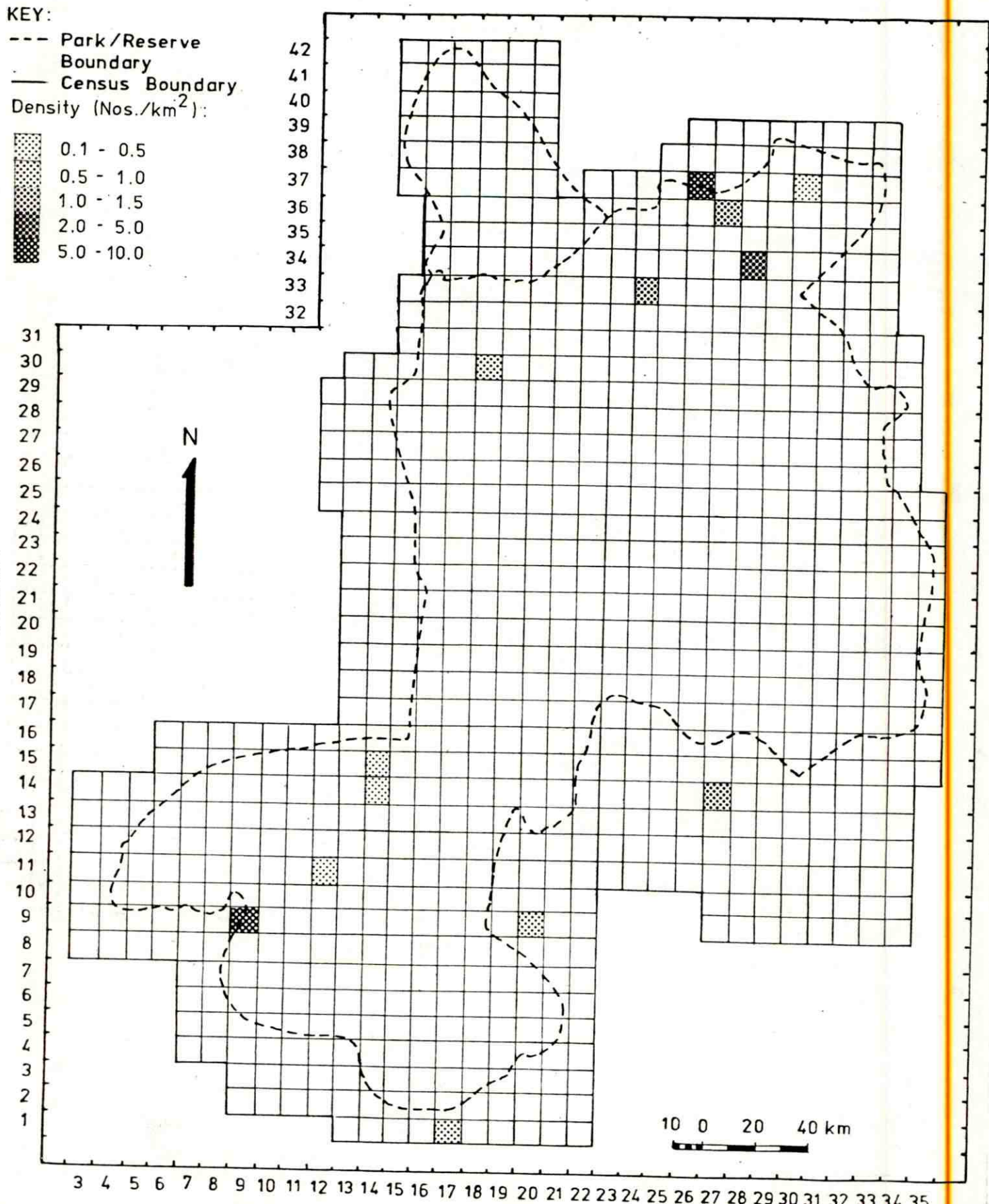
10 0 20 40 km

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

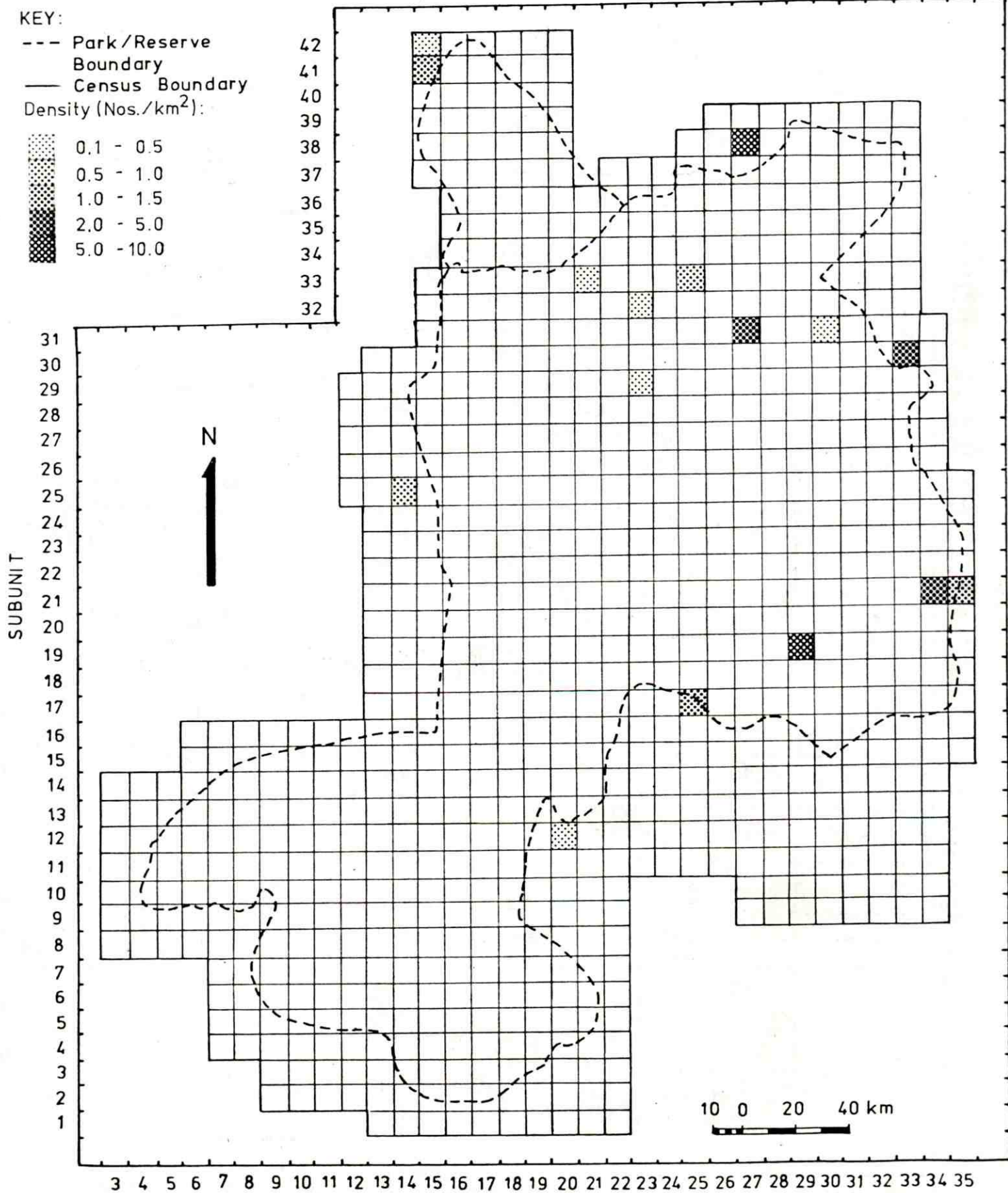
BABOON DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

BABOON DENSITY



SELOUS CENSUS ZONE

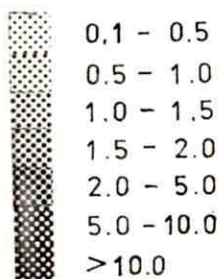
WET SEASON - MARCH TO APRIL 1976

BUFFALO DENSITY

KEY:

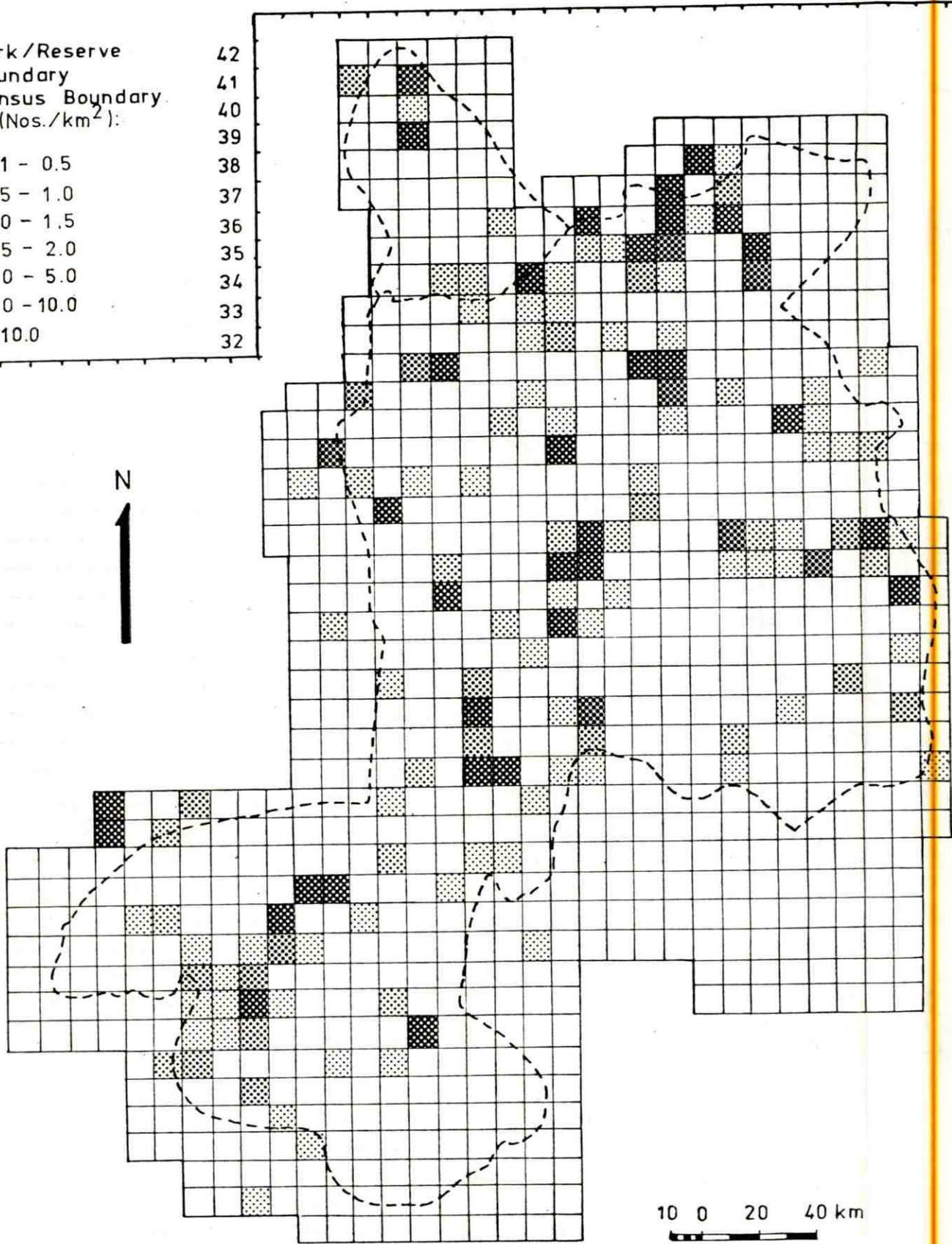
- Park/Reserve Boundary
- Census Boundary

Density (Nos./km²):



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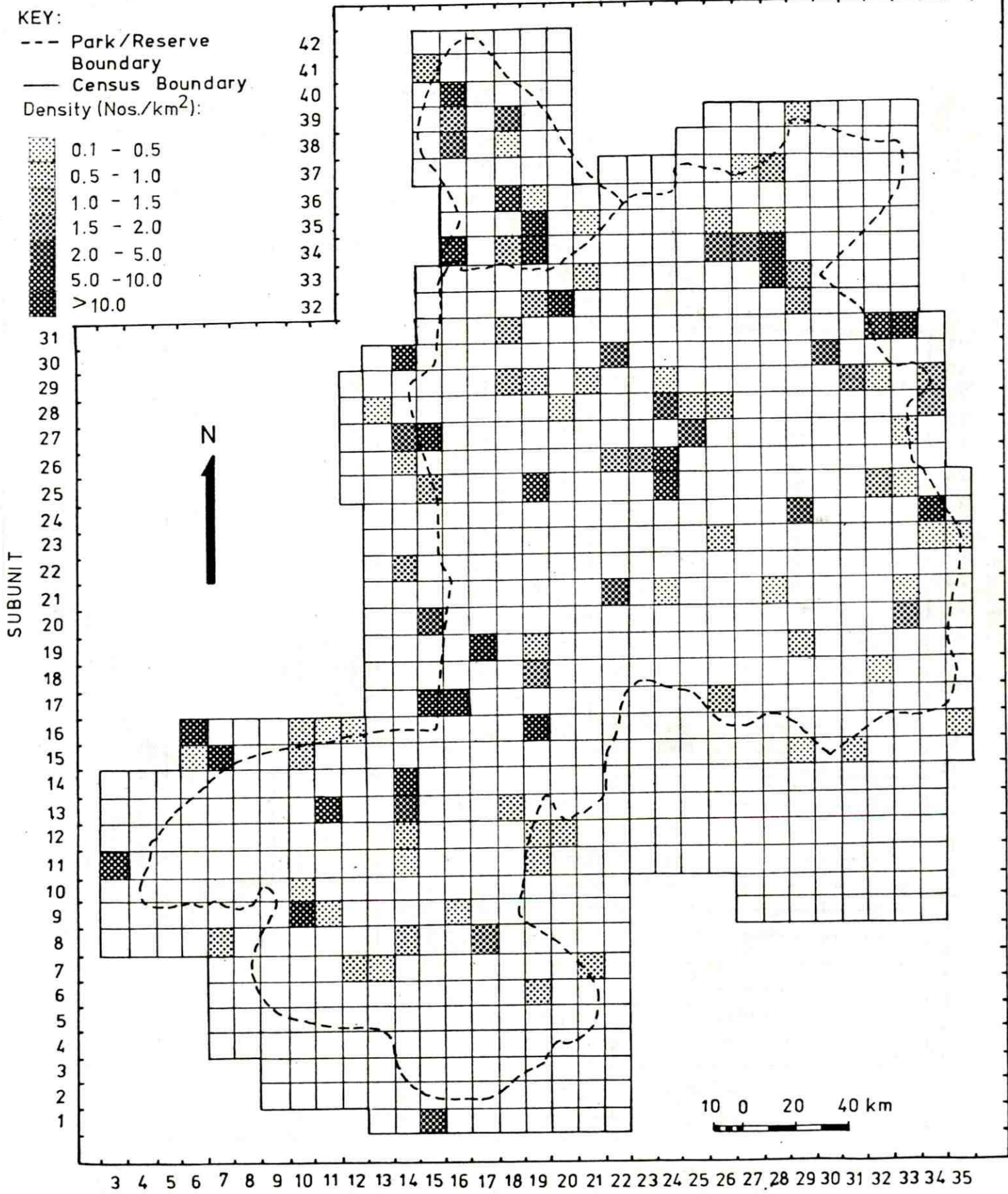
10 0 20 40 km

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

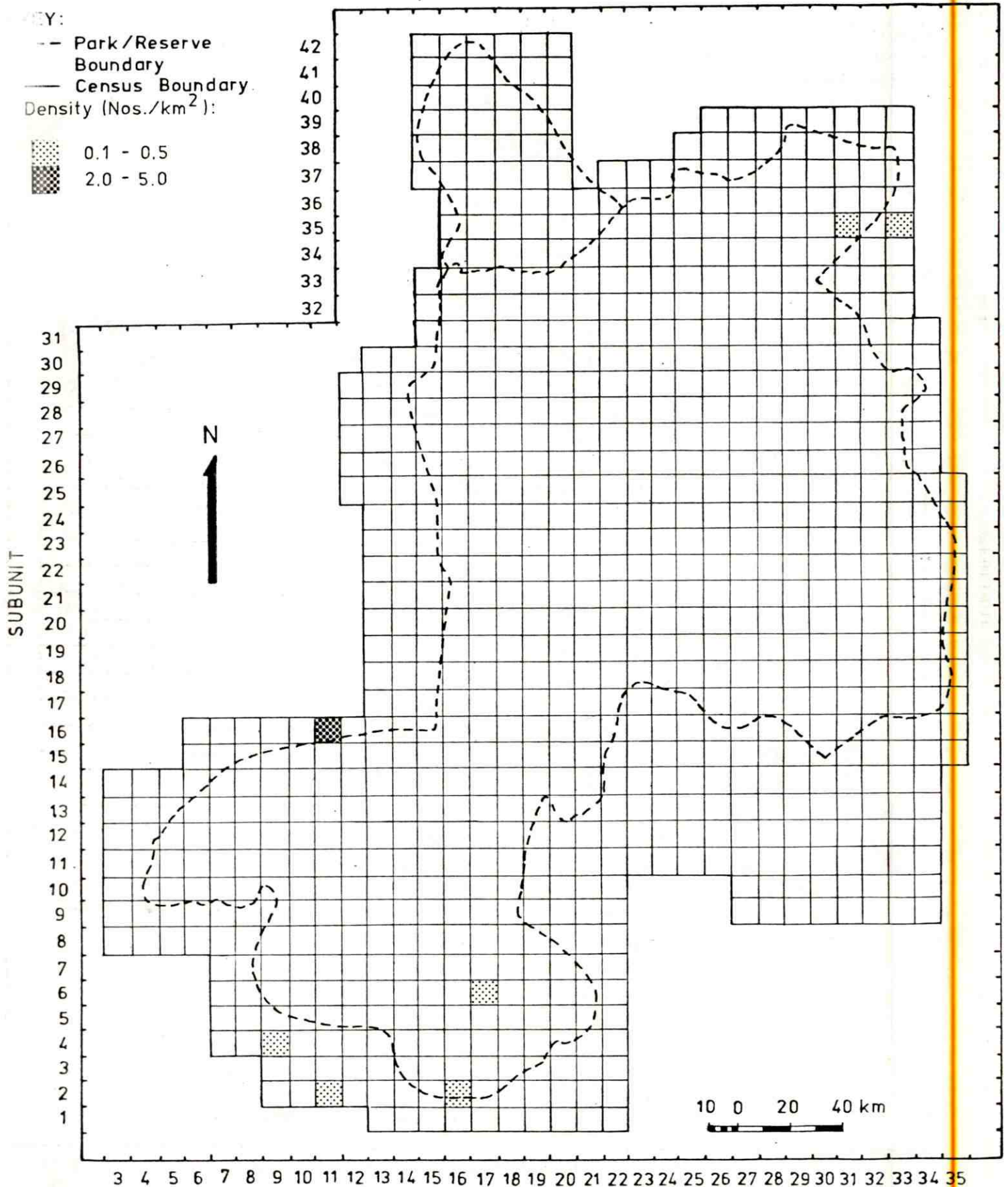
BUFFALO DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

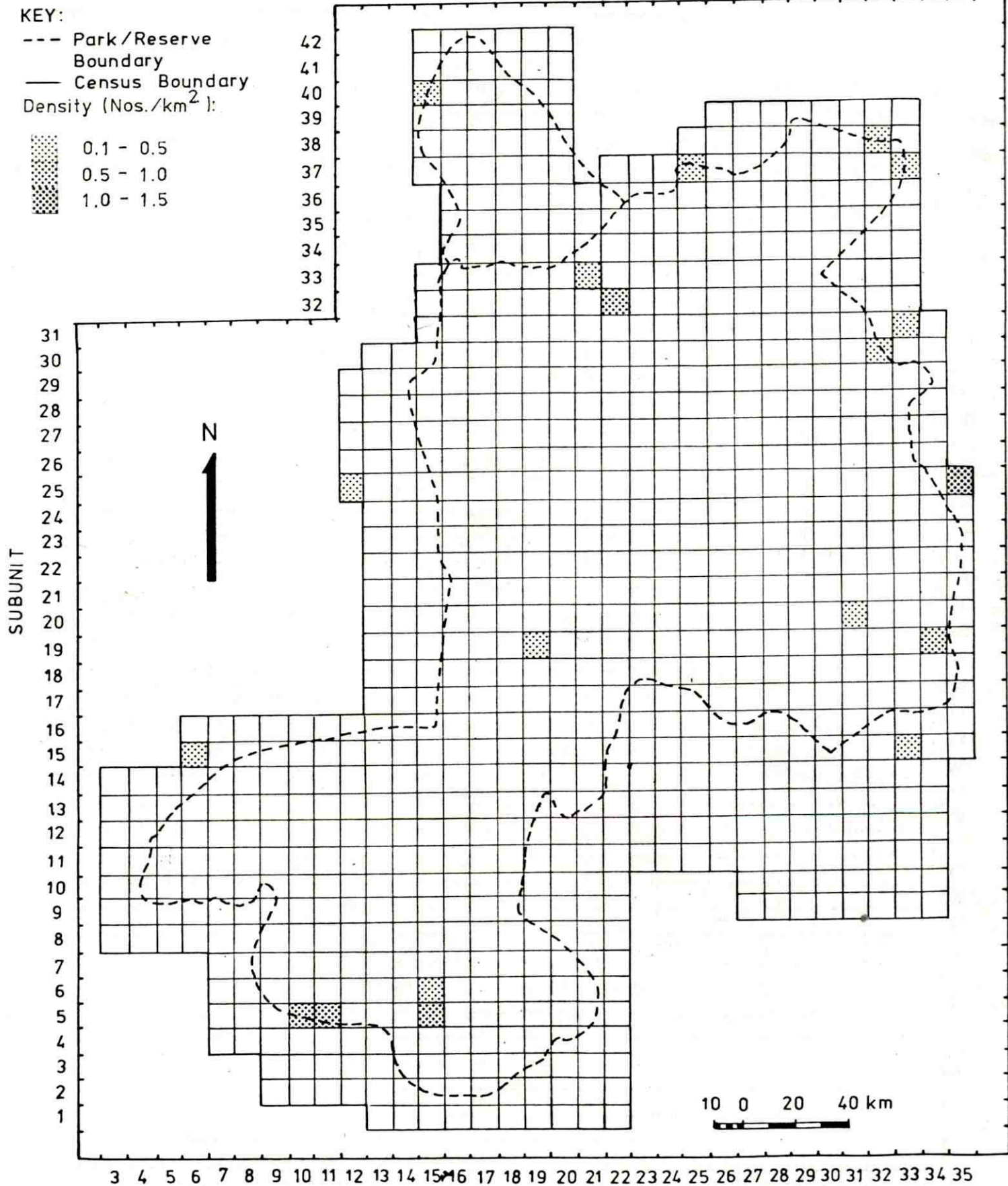
BUSHBUCK DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

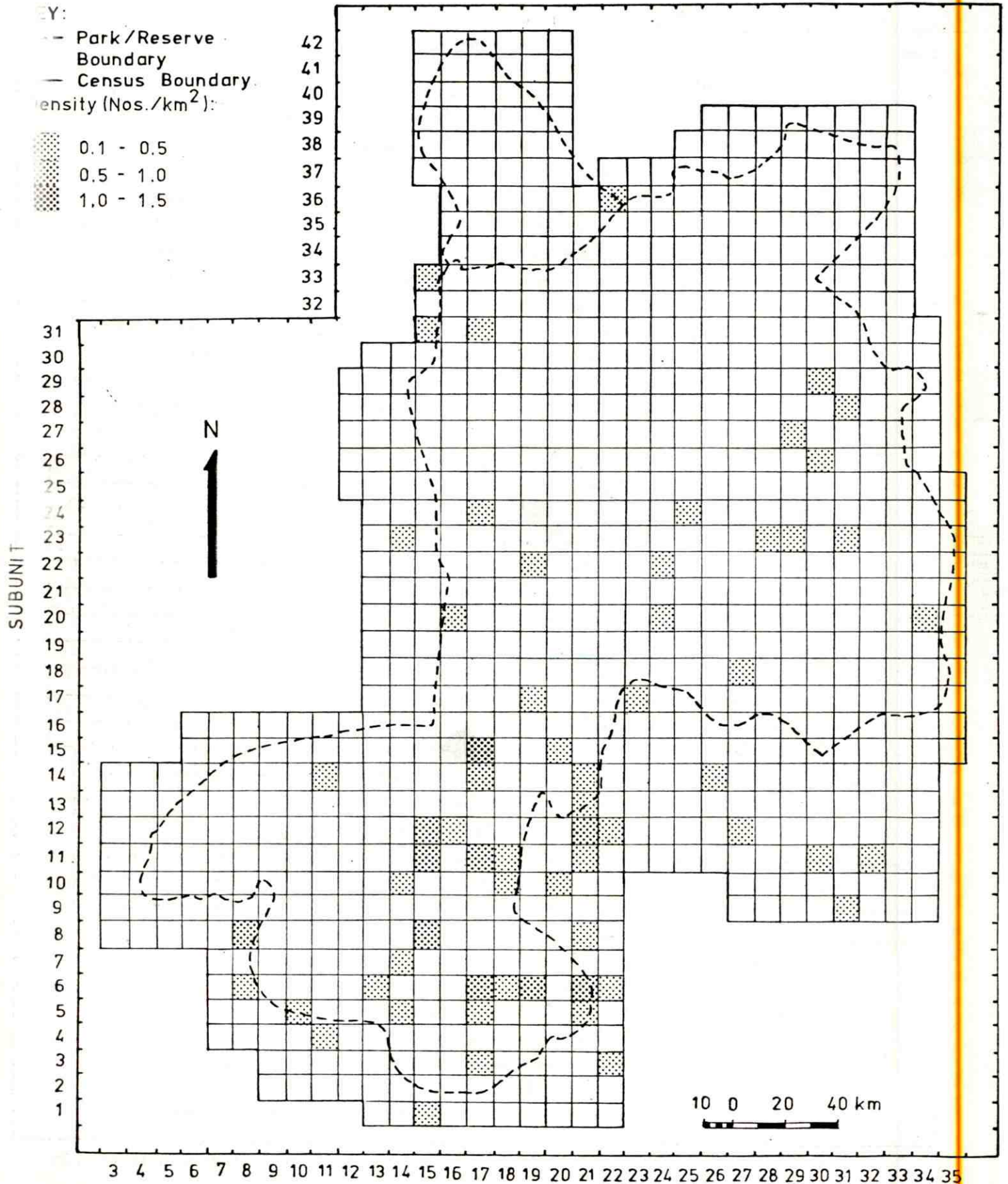
BUSHBUCK DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

DUIKER DENSITY



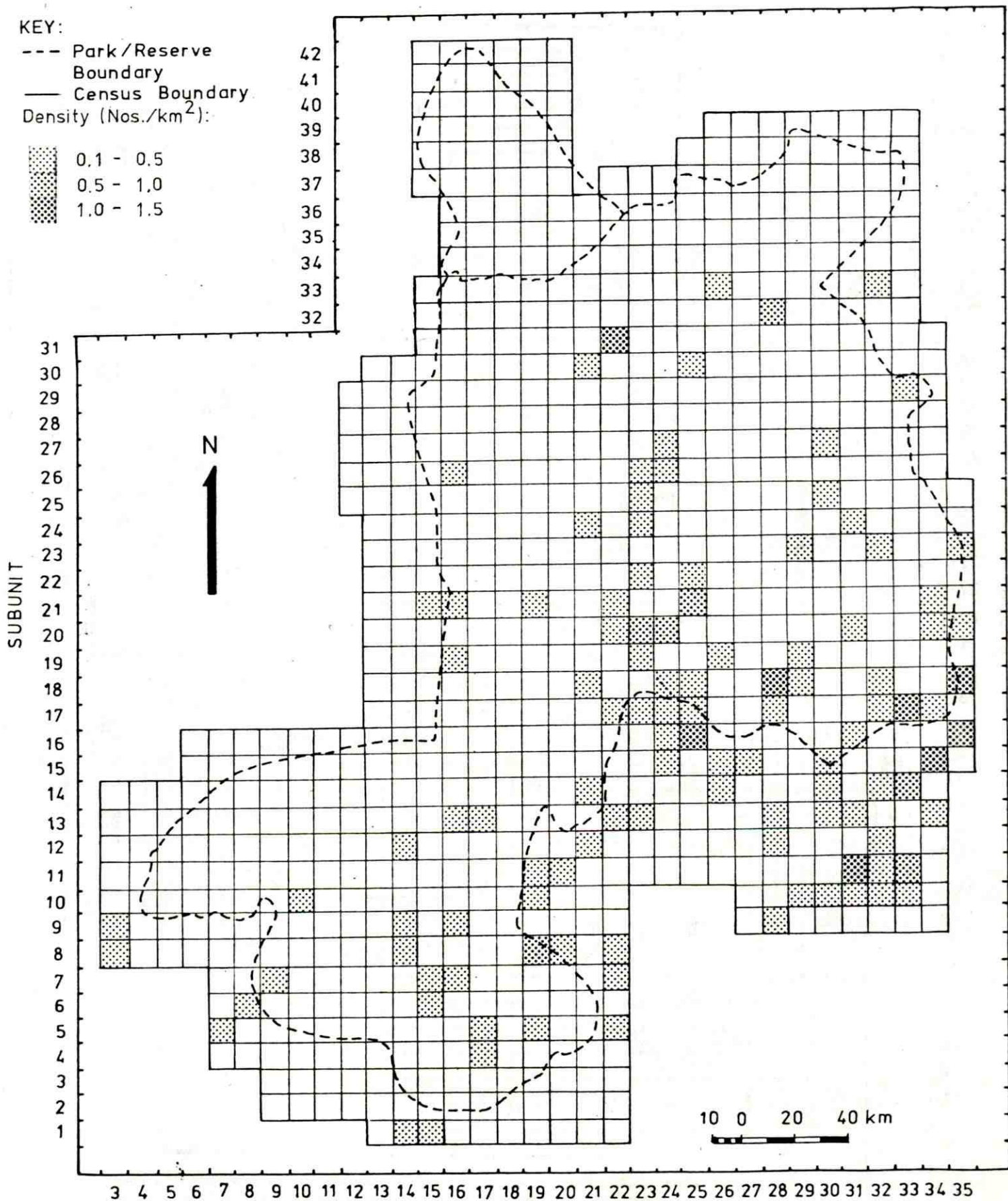
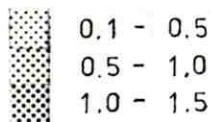
SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

DUIKER DENSITY

KEY:

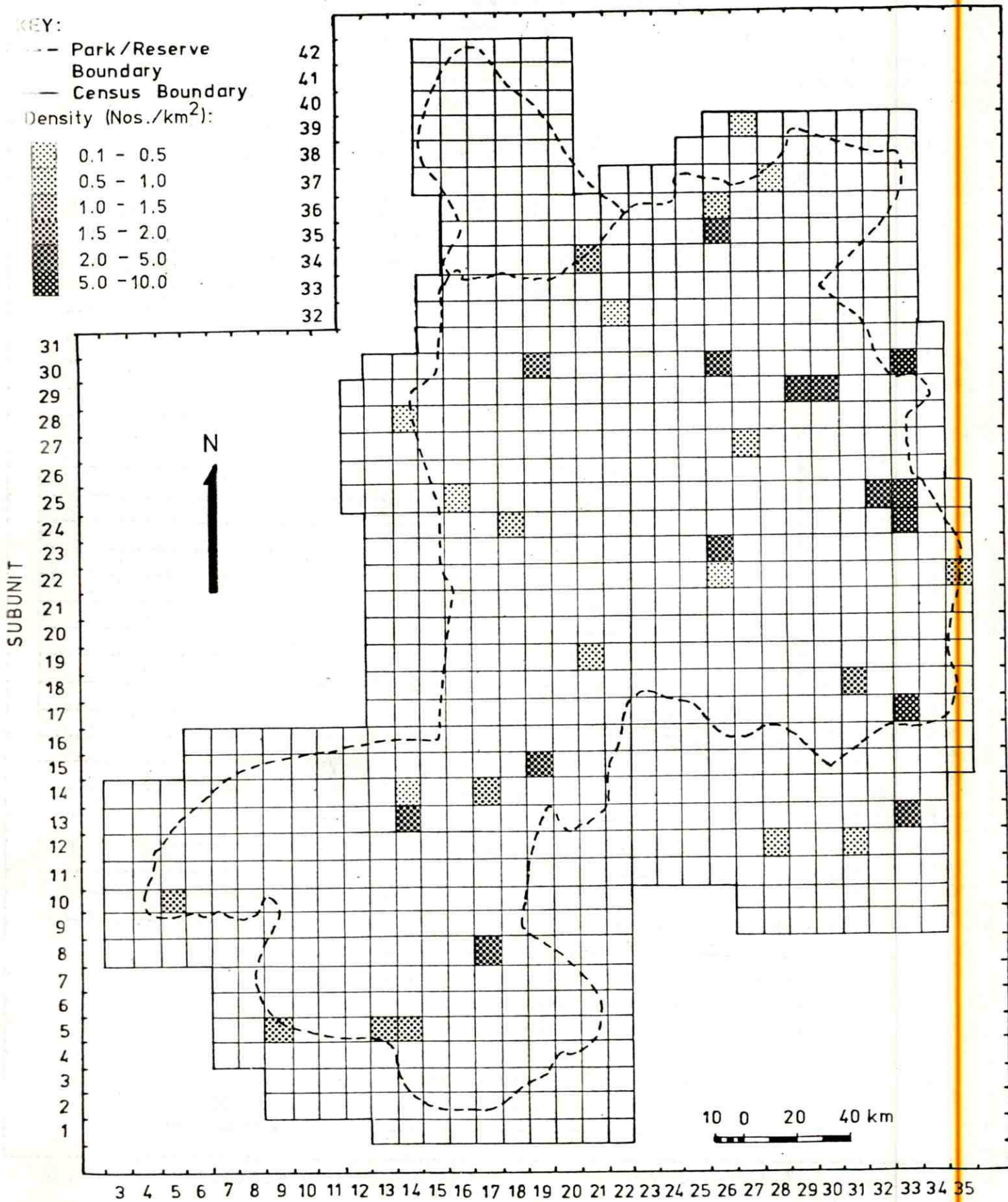
- Park/Reserve Boundary
 - Census Boundary
- Density (Nos./km²):



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

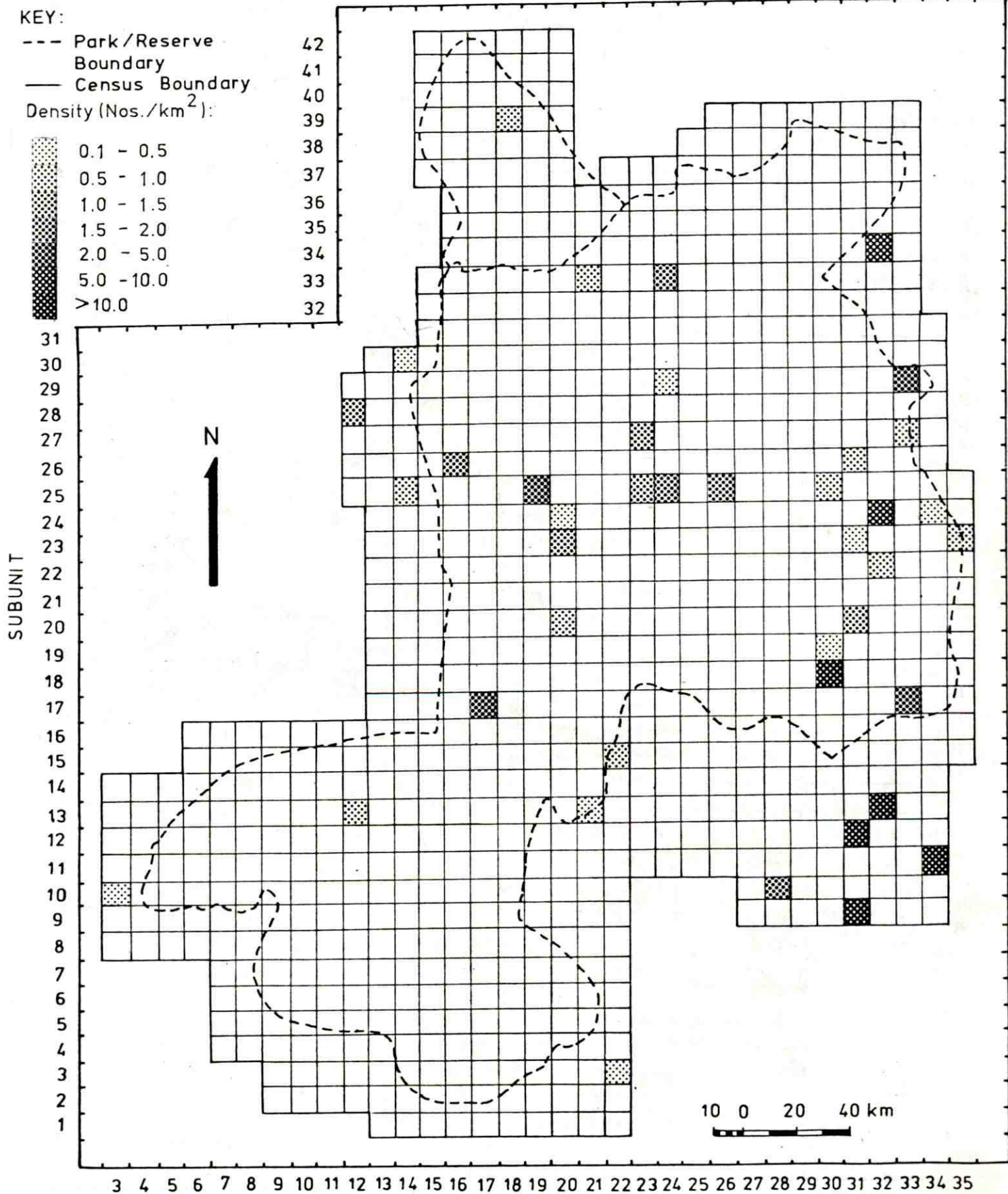
ELAND DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

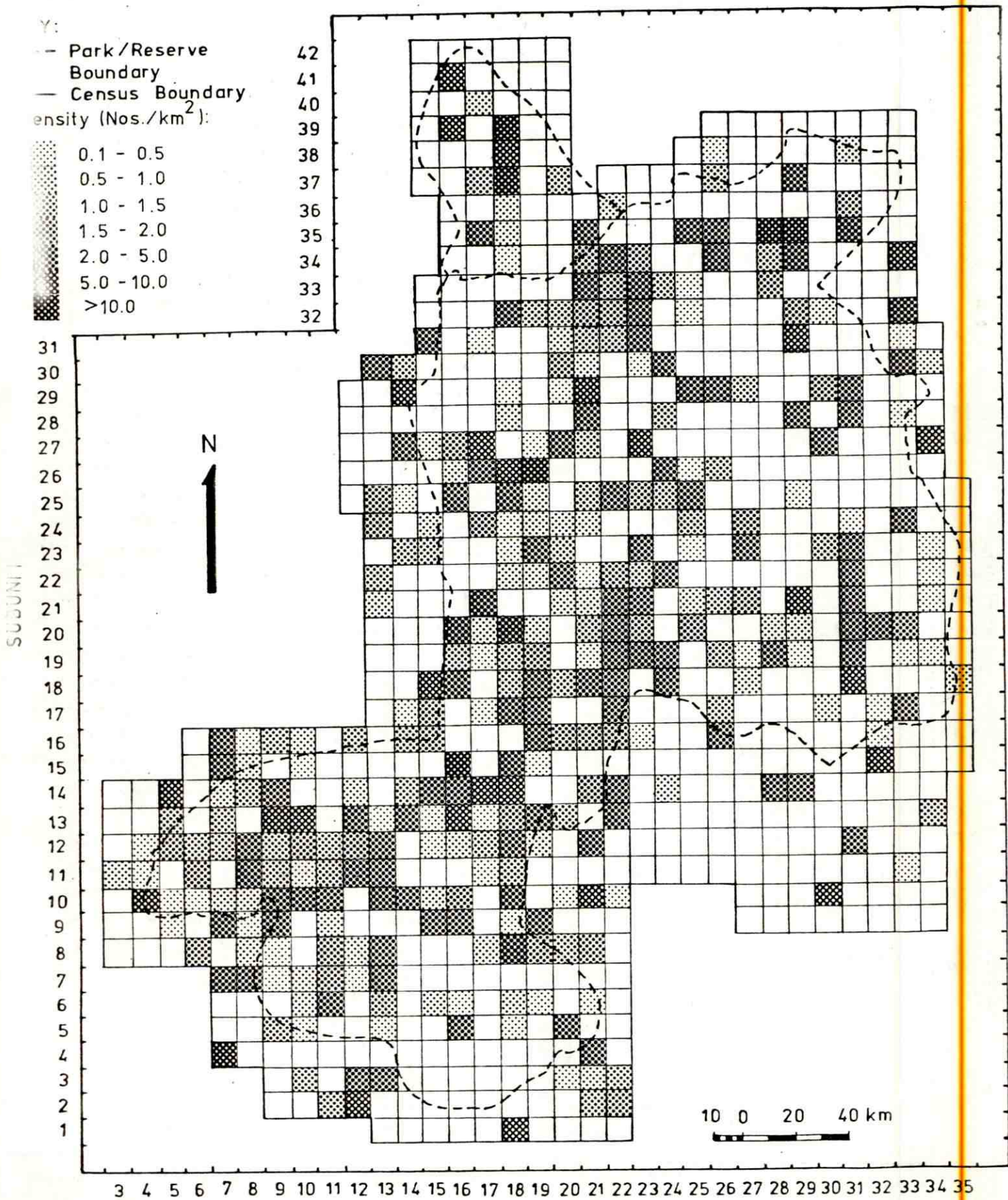
ELAND DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

ELEPHANT DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

ELEPHANT DENSITY

269 595 ELES - 1N

281 595 ELES + 1N

550

KEY:

- Park/Reserve Boundary
- Census Boundary

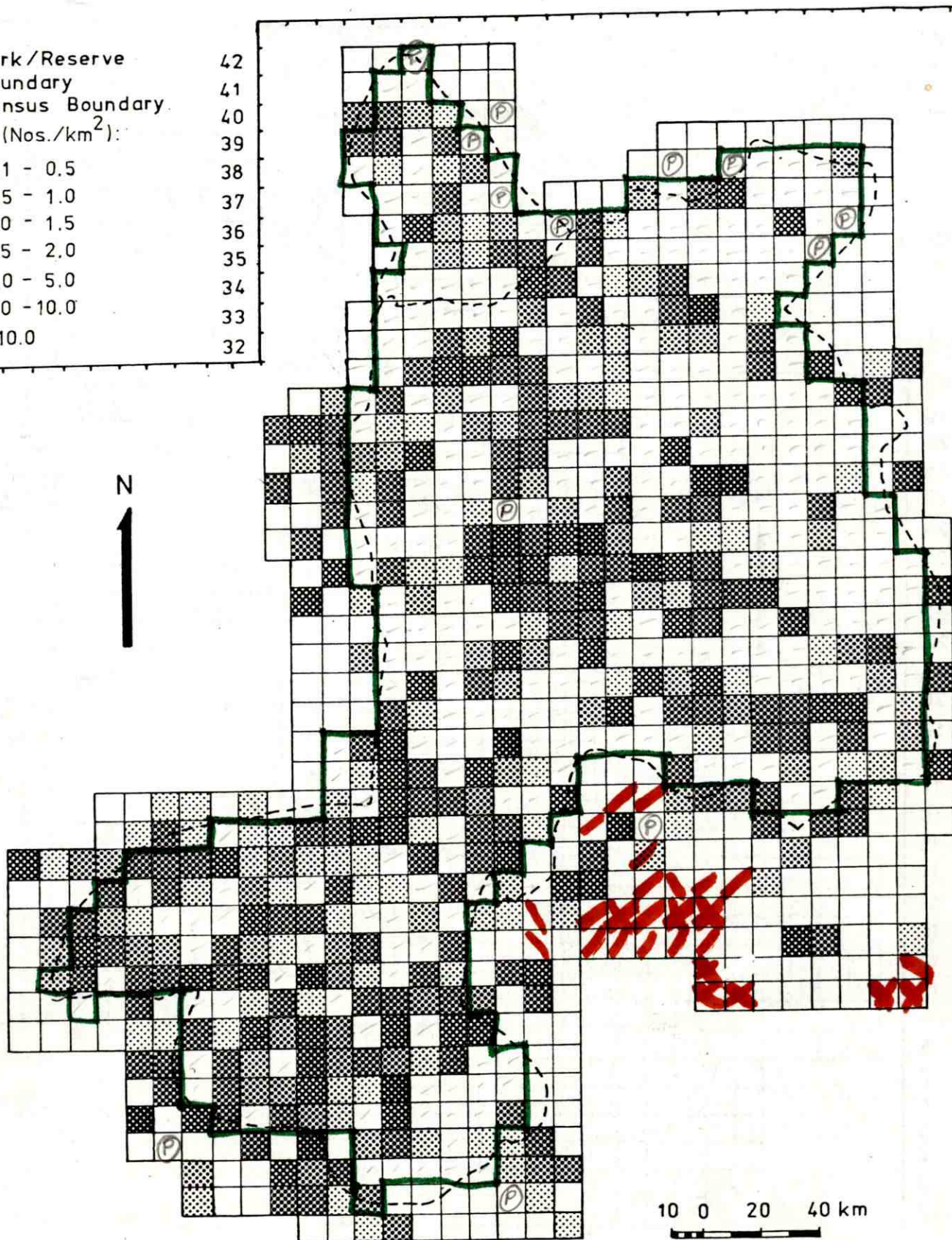
Density (Nos./km²):



- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 5.0
- 5.0 - 10.0
- >10.0

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10 0 20 40 km

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

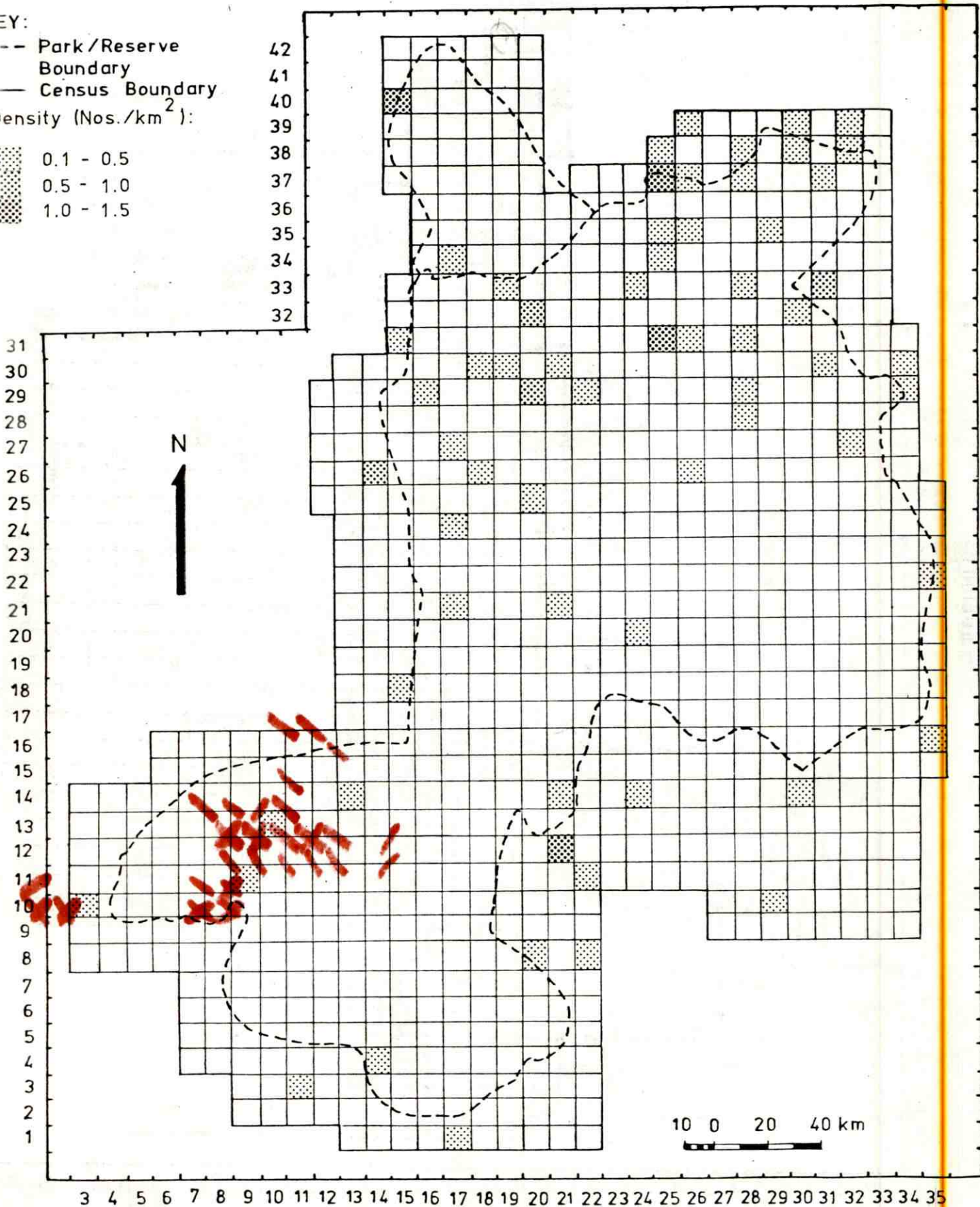
SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

ELEPHANT SKELETON DENSITY

KEY:
--- Park/Reserve Boundary
— Census Boundary
Density (Nos./km²):

0.1 - 0.5
0.5 - 1.0
1.0 - 1.5



SELOUS CENSUS ZONE




DRY SEASON - AUGUST TO SEPTEMBER 1976

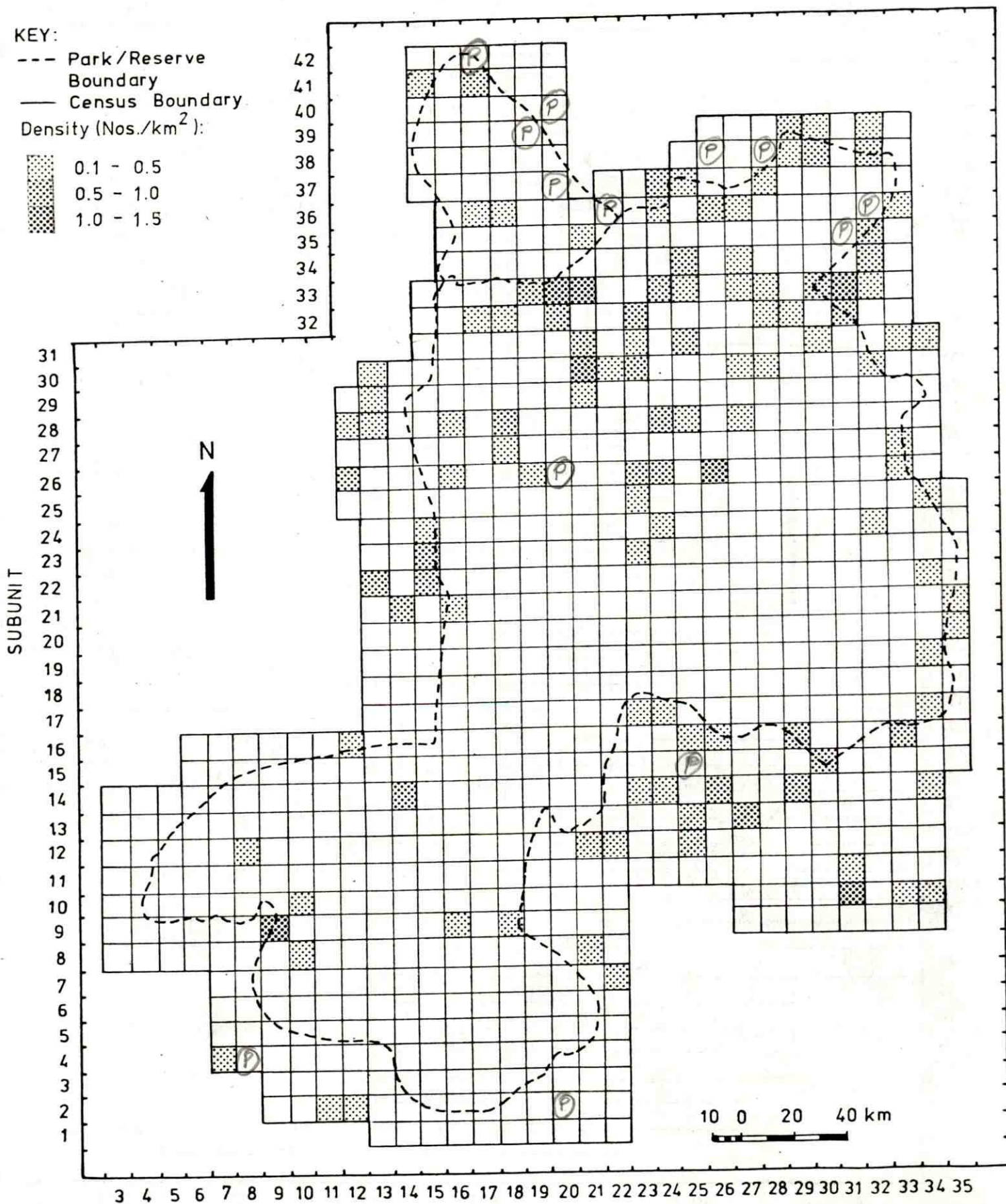
ELEPHANT SKELETON DENSITY

KEY:

- Park/Reserve Boundary
- Census Boundary

Density (Nos./km²):

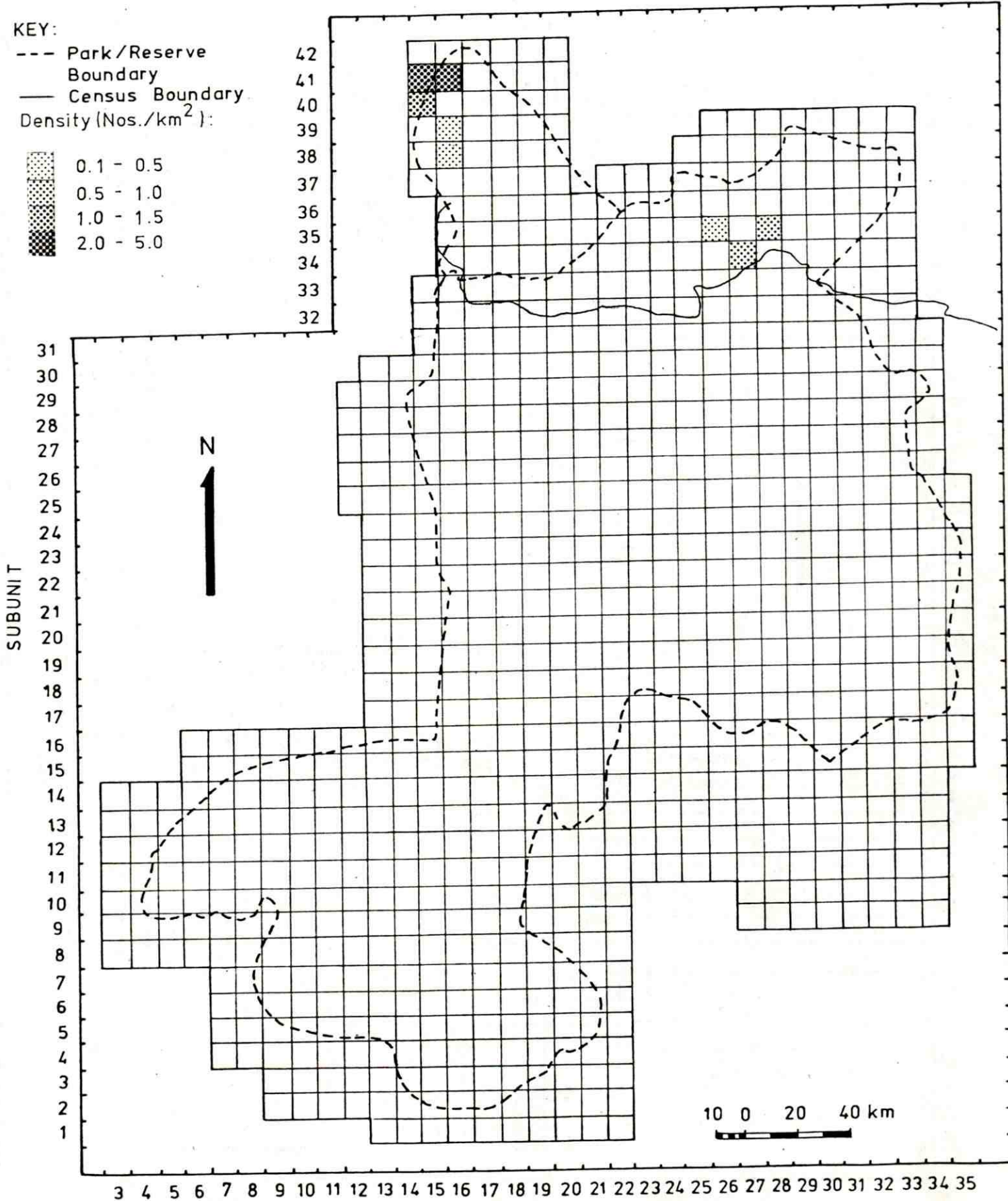
-  0.1 - 0.5
-  0.5 - 1.0
-  1.0 - 1.5



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

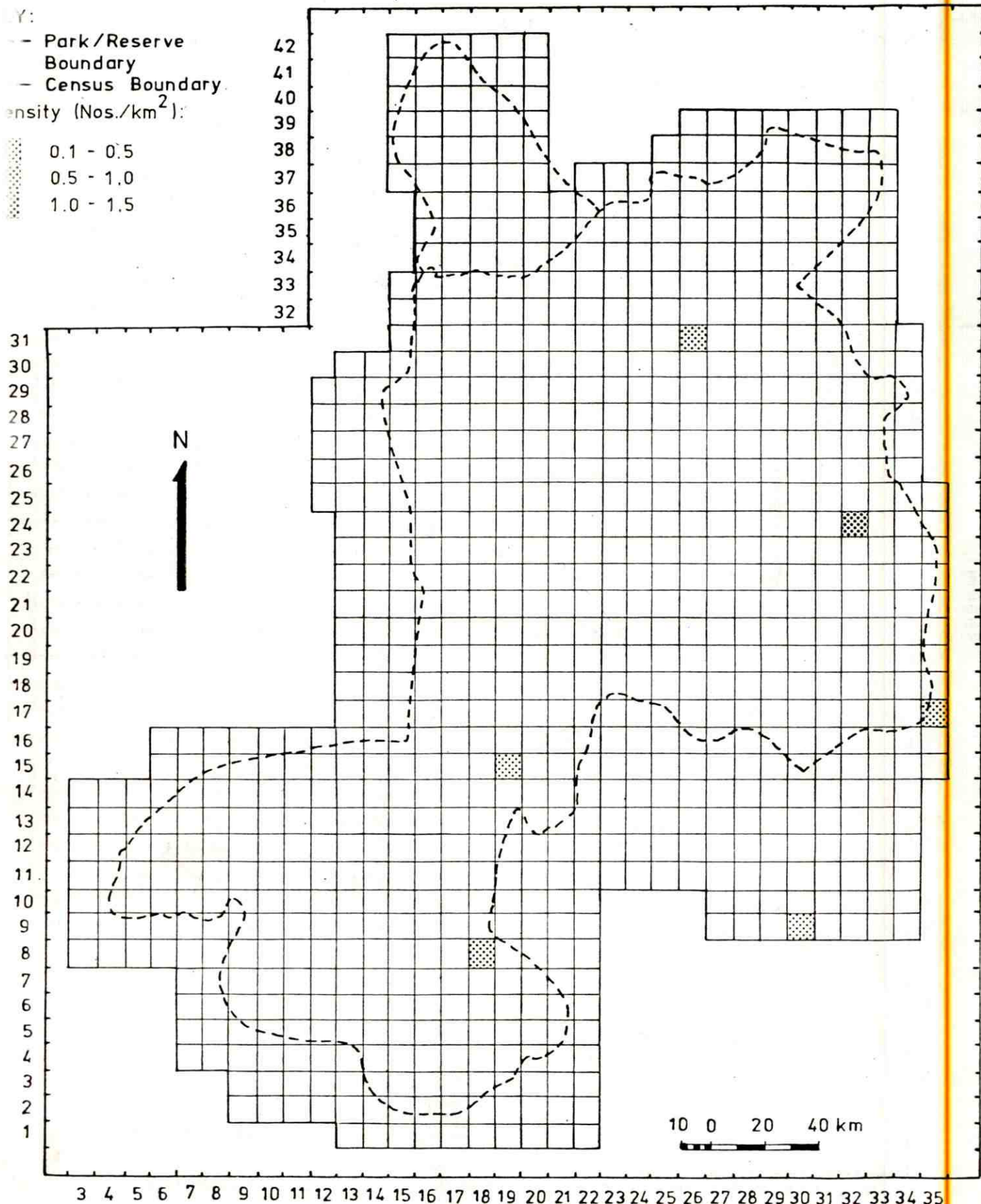
GIRAFFE DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

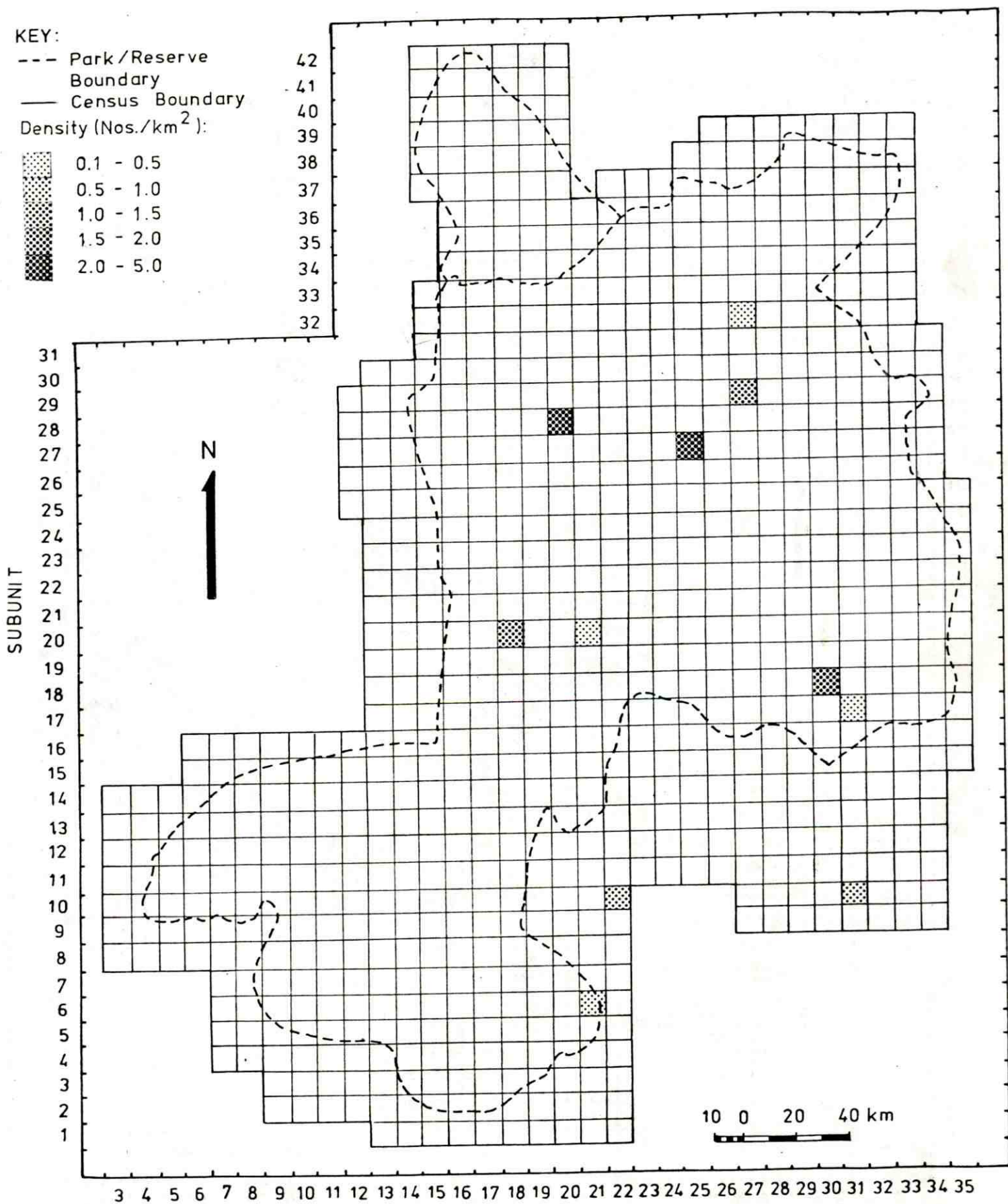
GREATER KUDU DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

GREATER KUDU DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

HARTEBEEST DENSITY

KEY:

- Park/Reserve Boundary
- Census Boundary

Density (Nos./km²):

- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 5.0
- 5.0 - 10.0
- >10.0

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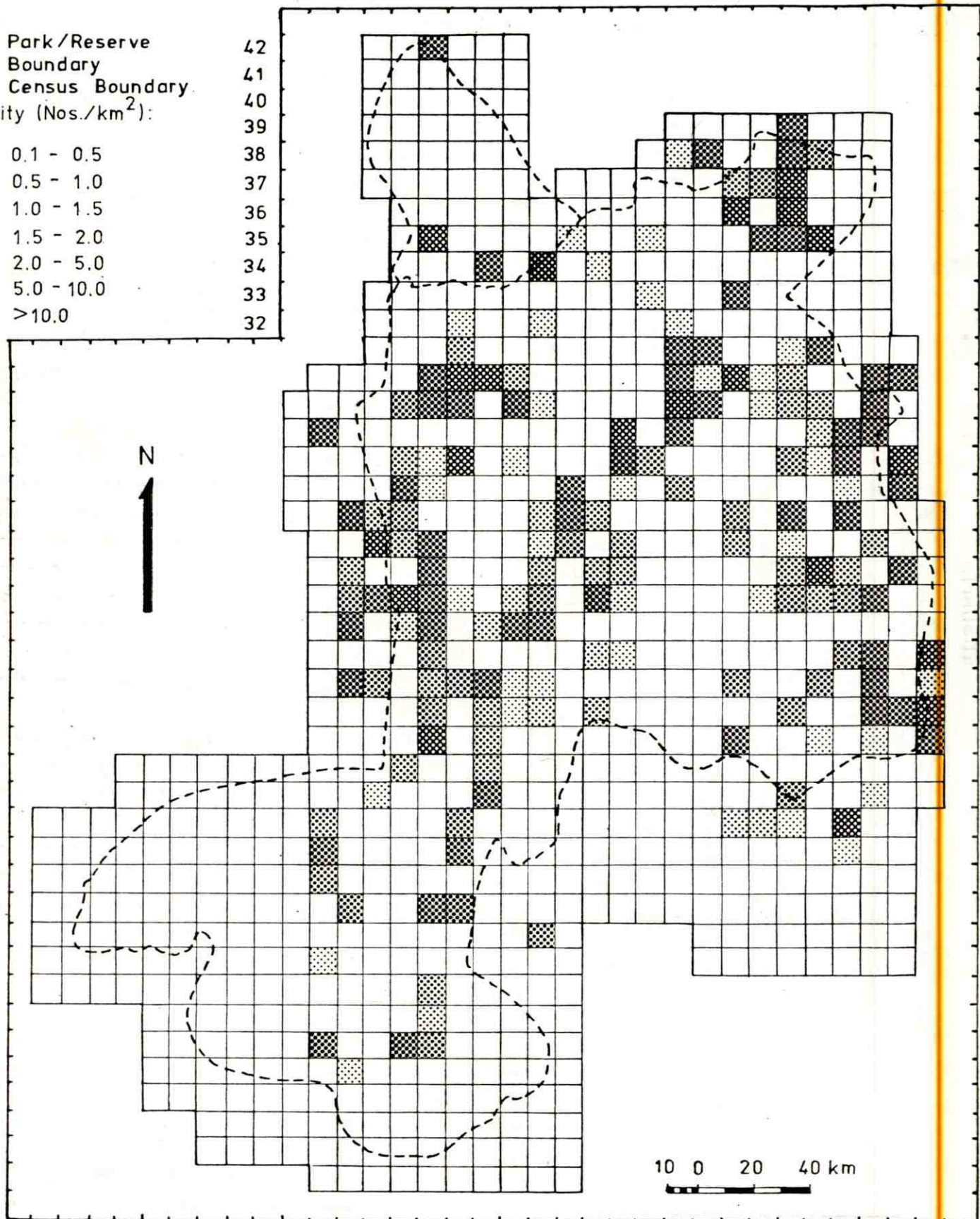
SUBUNIT

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10 0 20 40 km

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35



SELOUS CENSUS ZONE

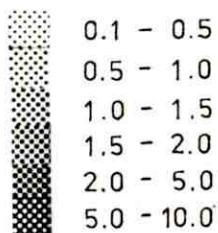
DRY SEASON - AUGUST TO SEPTEMBER 1976

HARTEBEEST DENSITY

KEY:

- Park/Reserve Boundary
- Census Boundary

Density (Nos./km²):

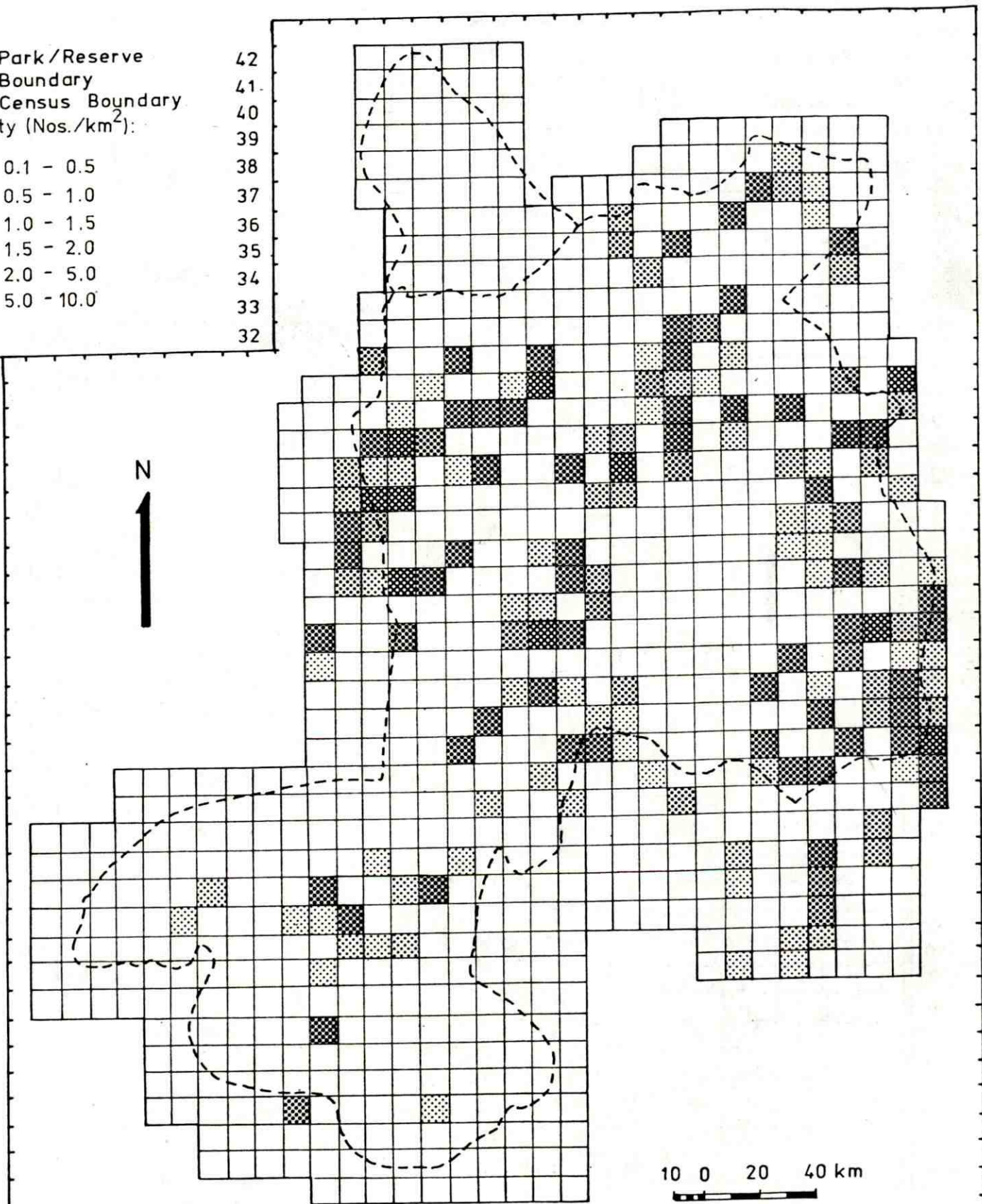


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3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35



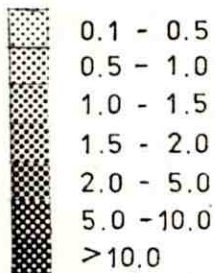
SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

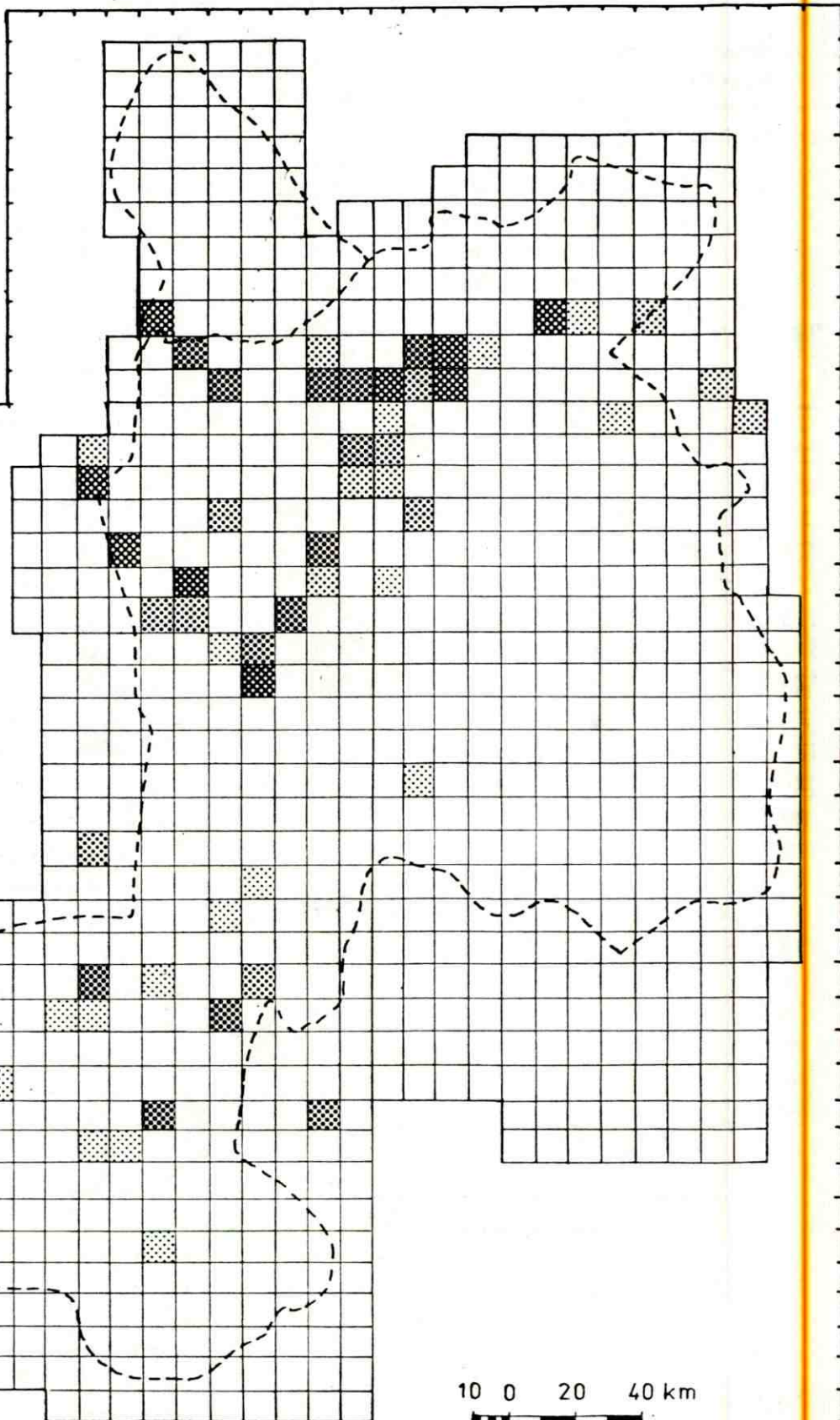
HIPPO DENSITY

KEY:

- Park/Reserve Boundary
 - Census Boundary
- Density (Nos./km²):



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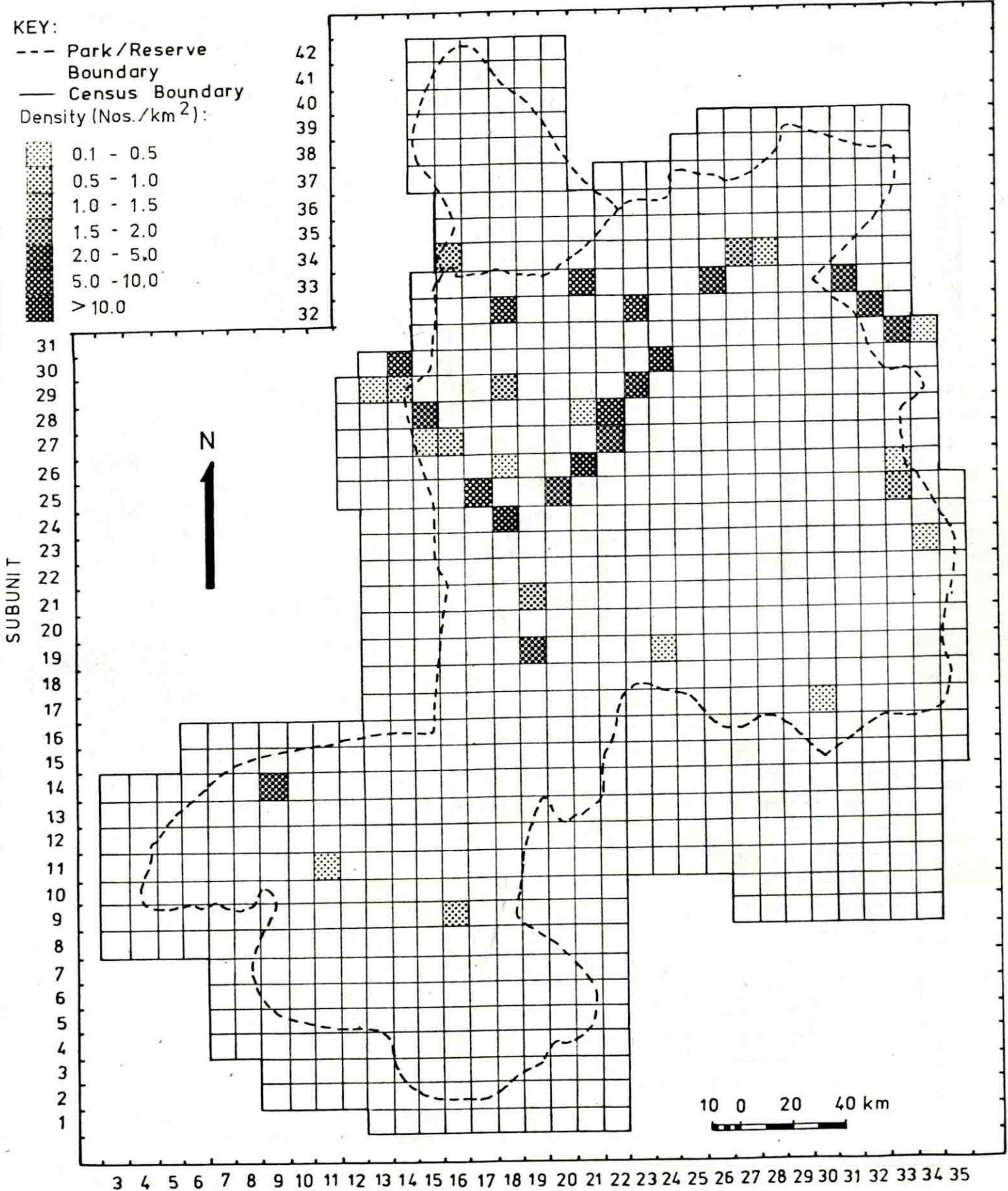
SUBC

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

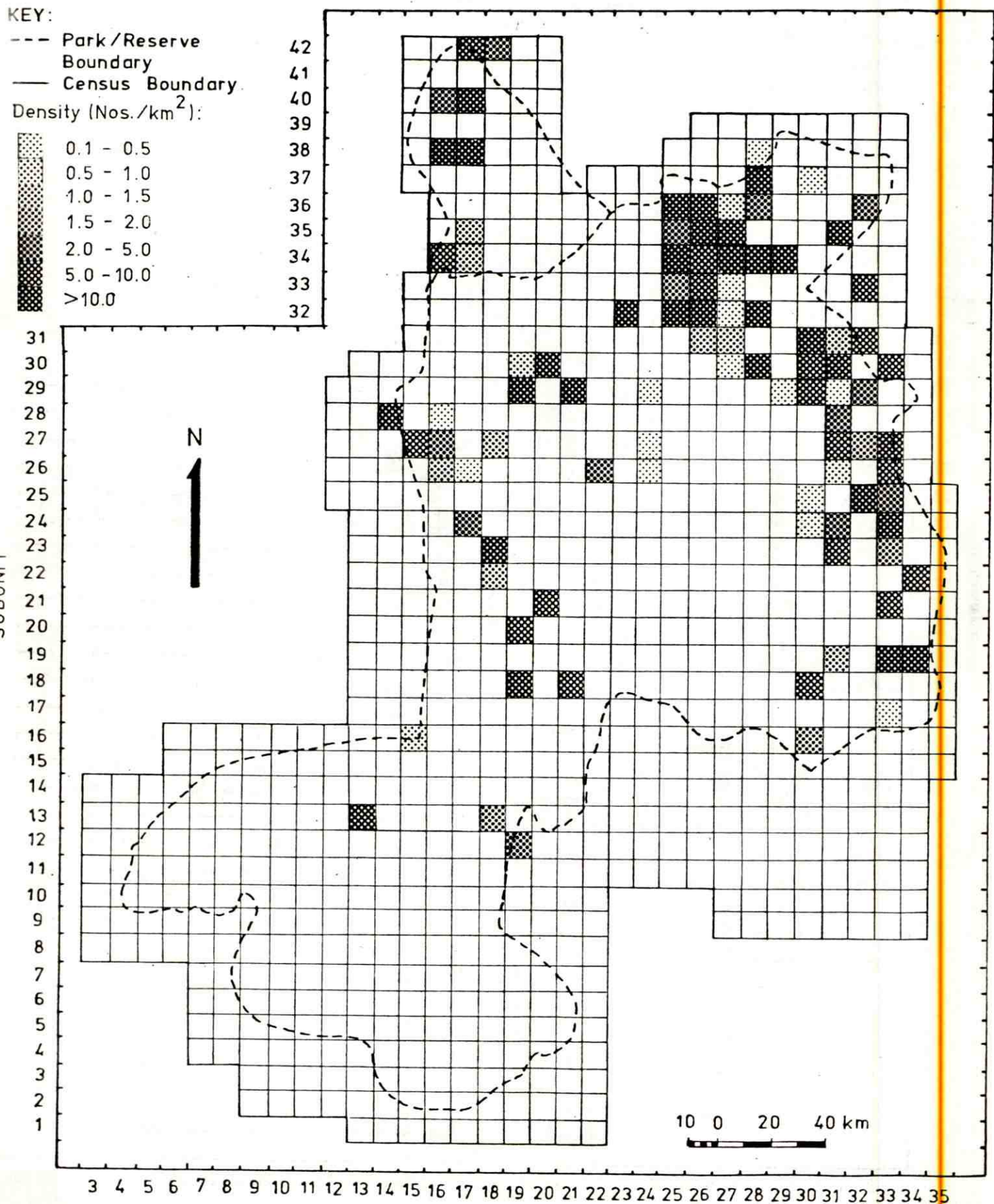
HIPPO DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

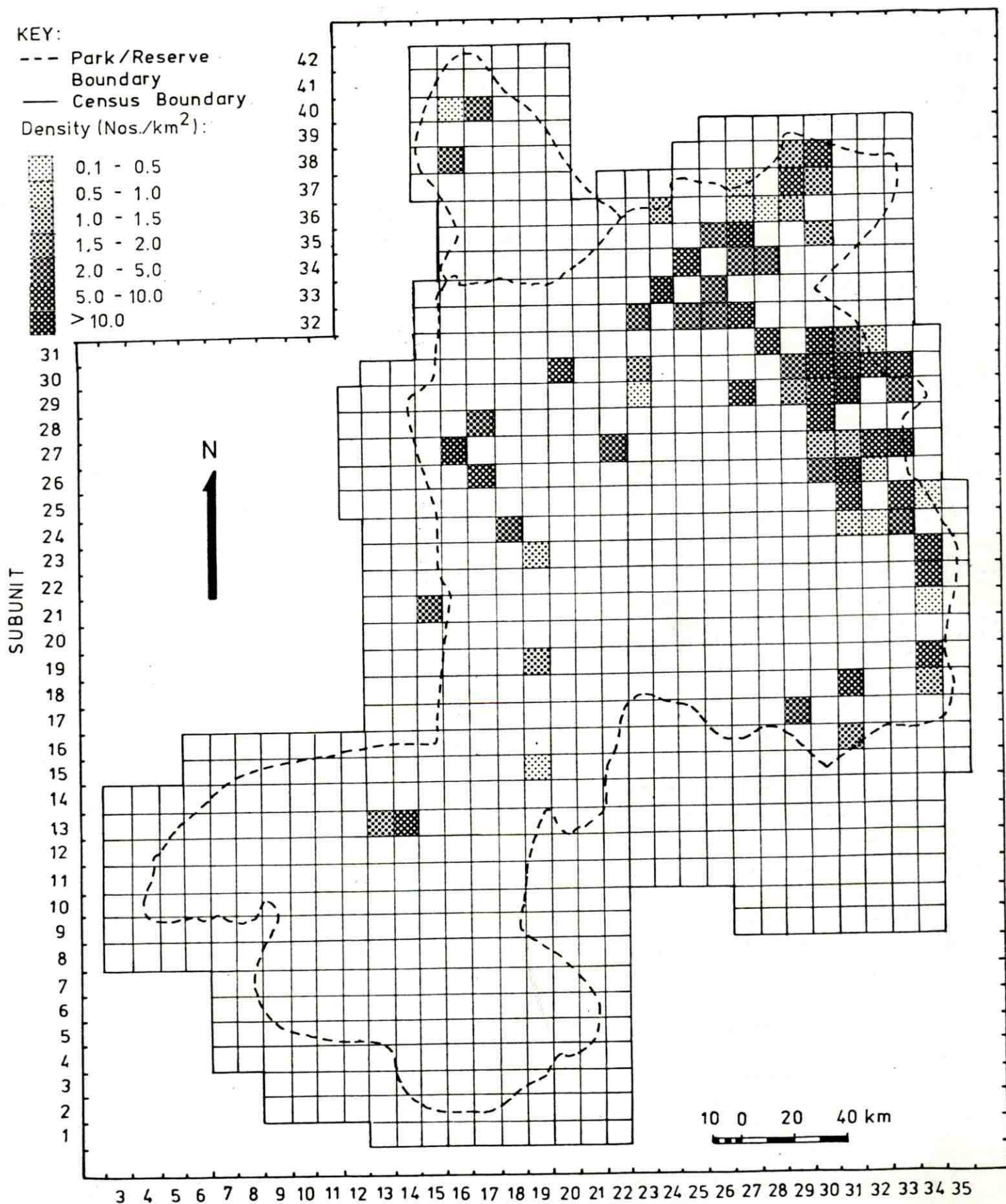
IMPALA DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

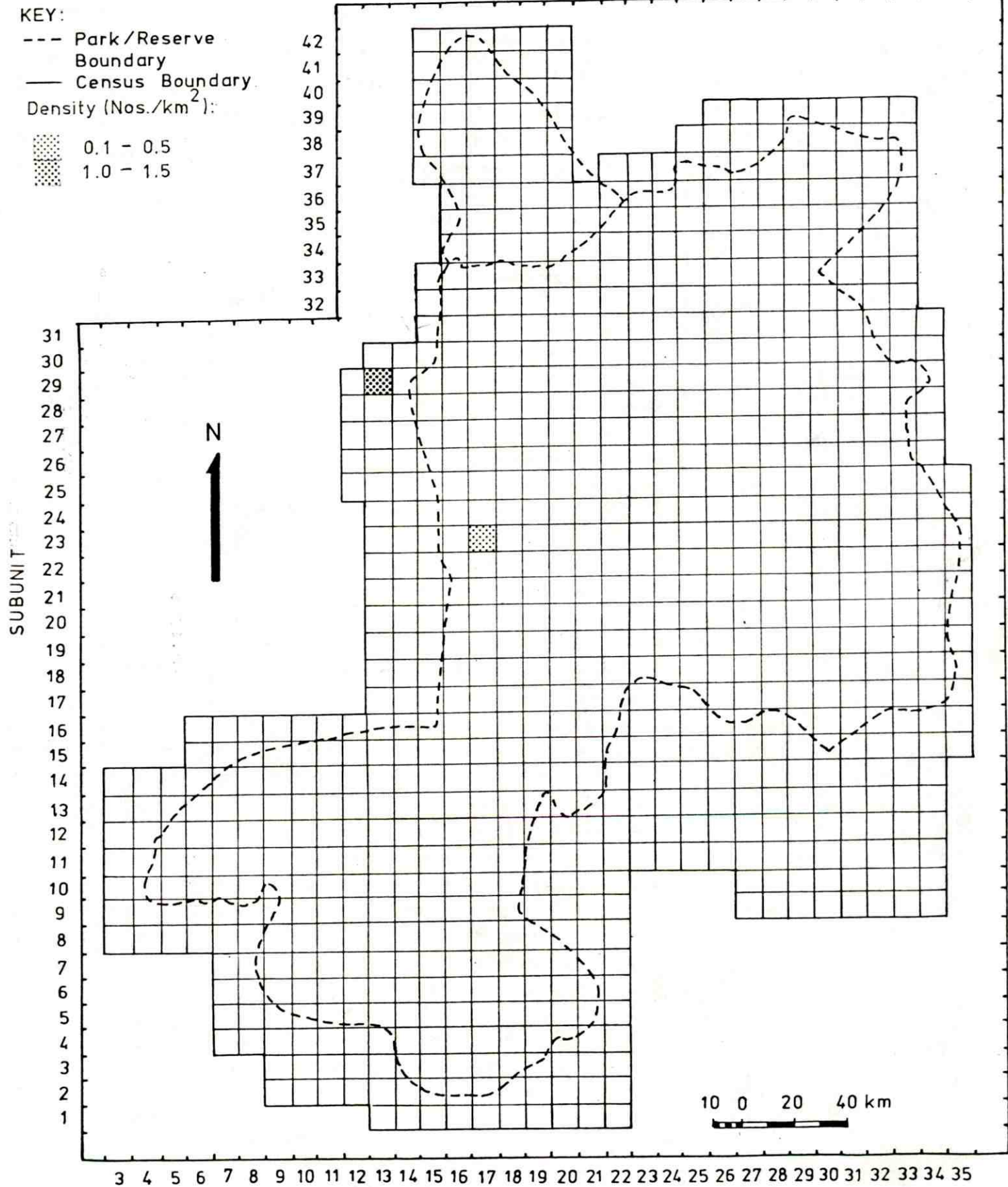
IMPALA DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

PUKU DENSITY







SELOUS CENSUS ZONE

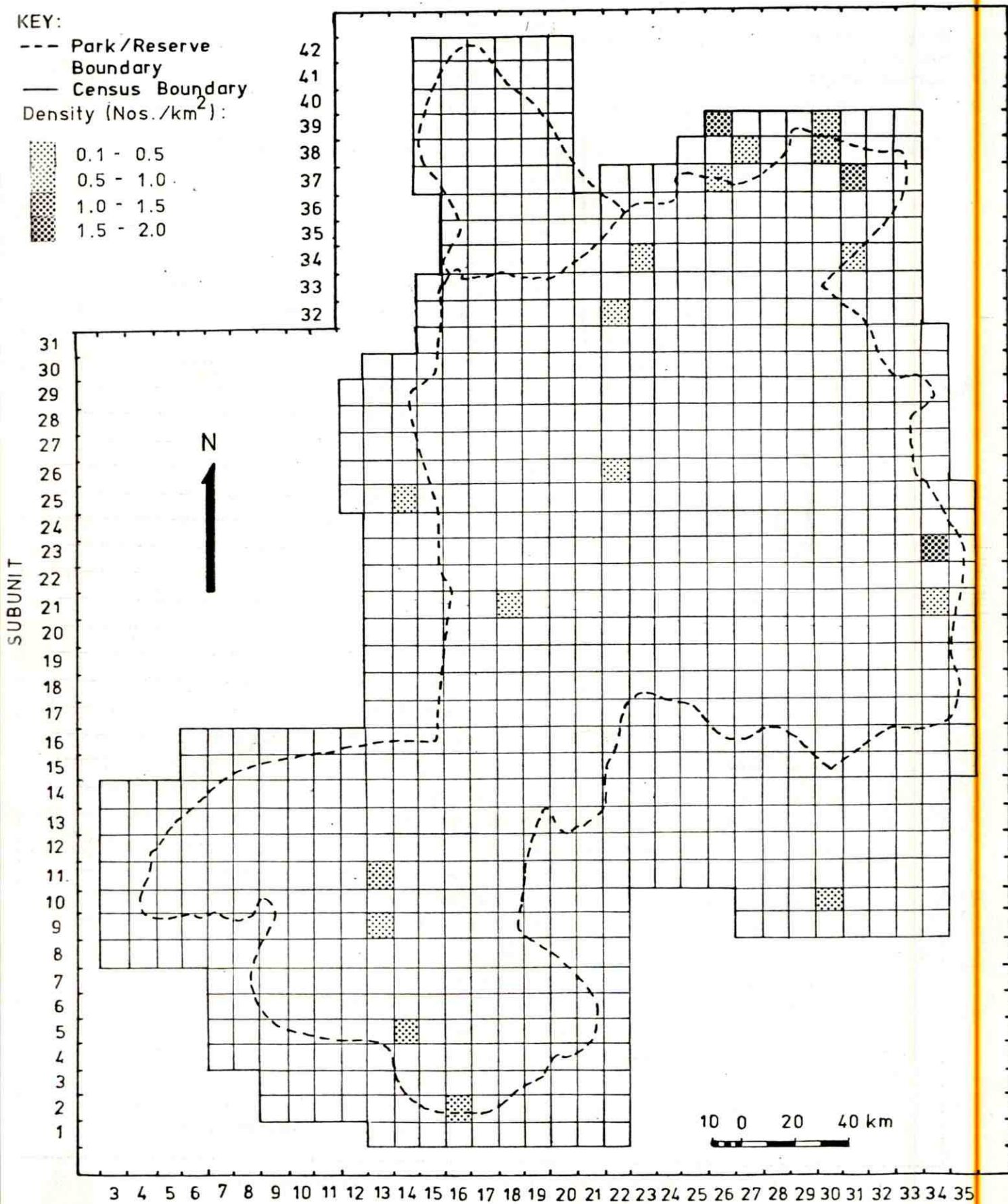
WET SEASON - MARCH TO APRIL 1976

REEDBUCK DENSITY

KEY:

- Park/Reserve Boundary
 - Census Boundary
- Density (Nos./km²):

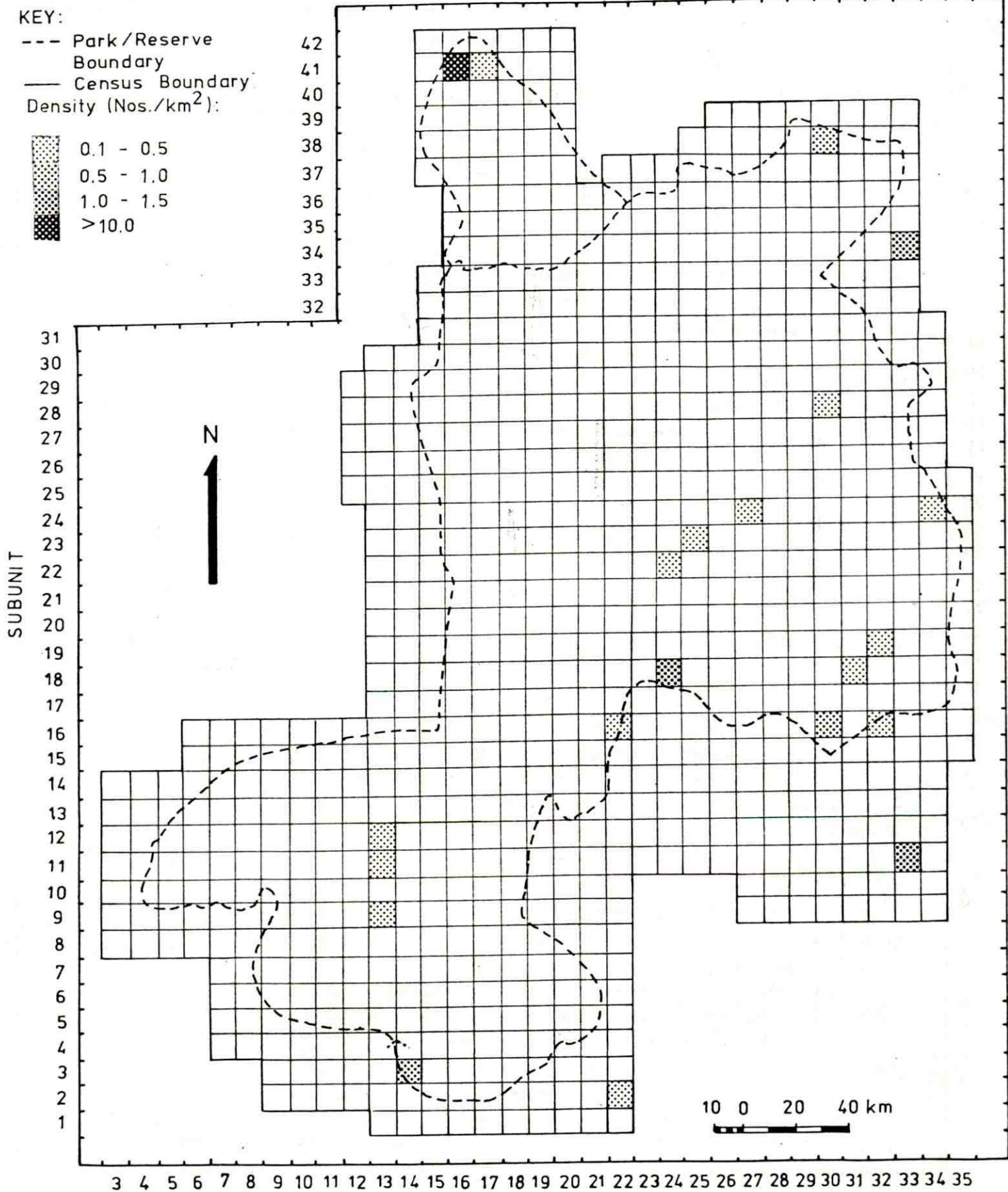
-  0.1 - 0.5
-  0.5 - 1.0
-  1.0 - 1.5
-  1.5 - 2.0



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

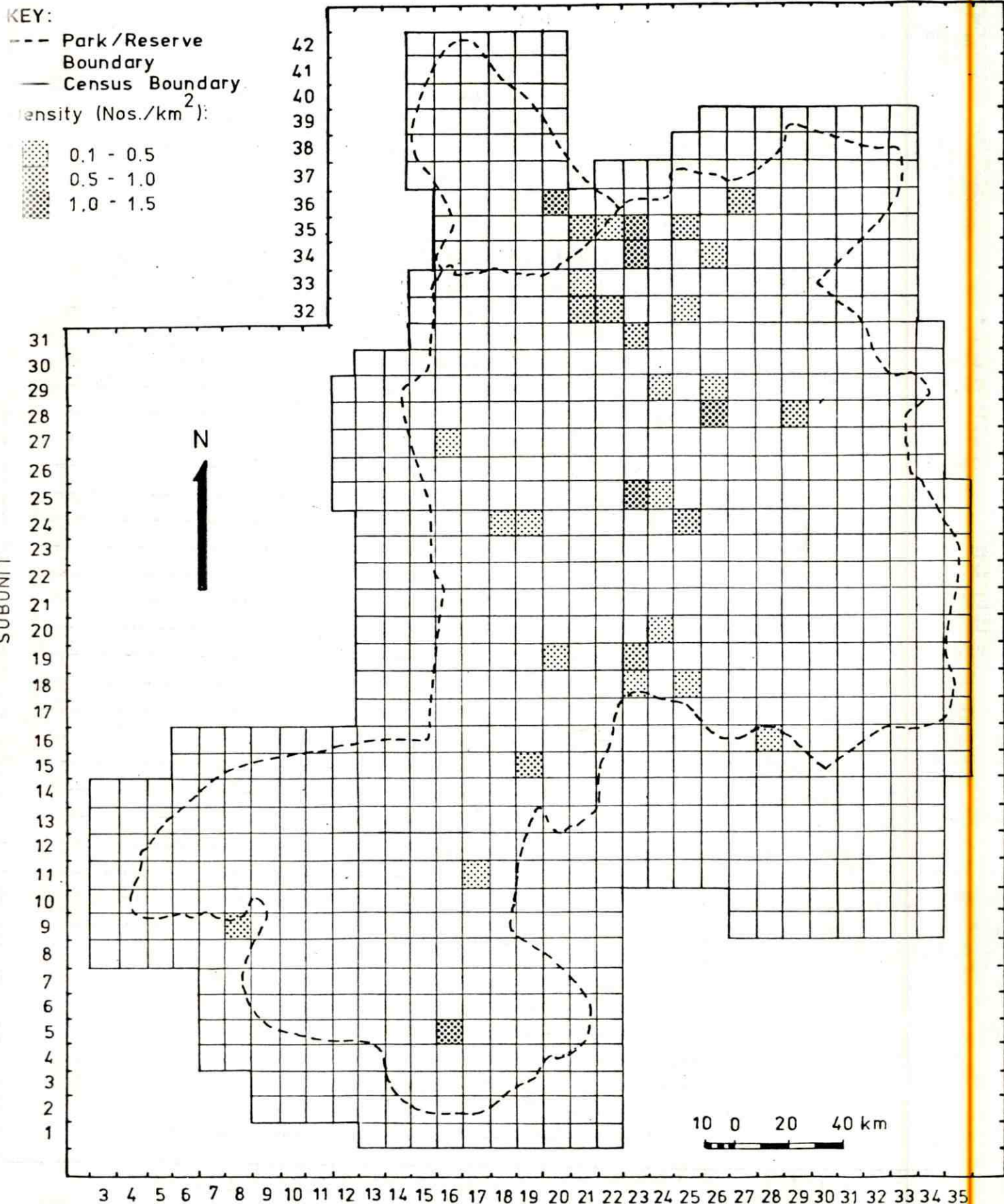
REEDBUCK DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

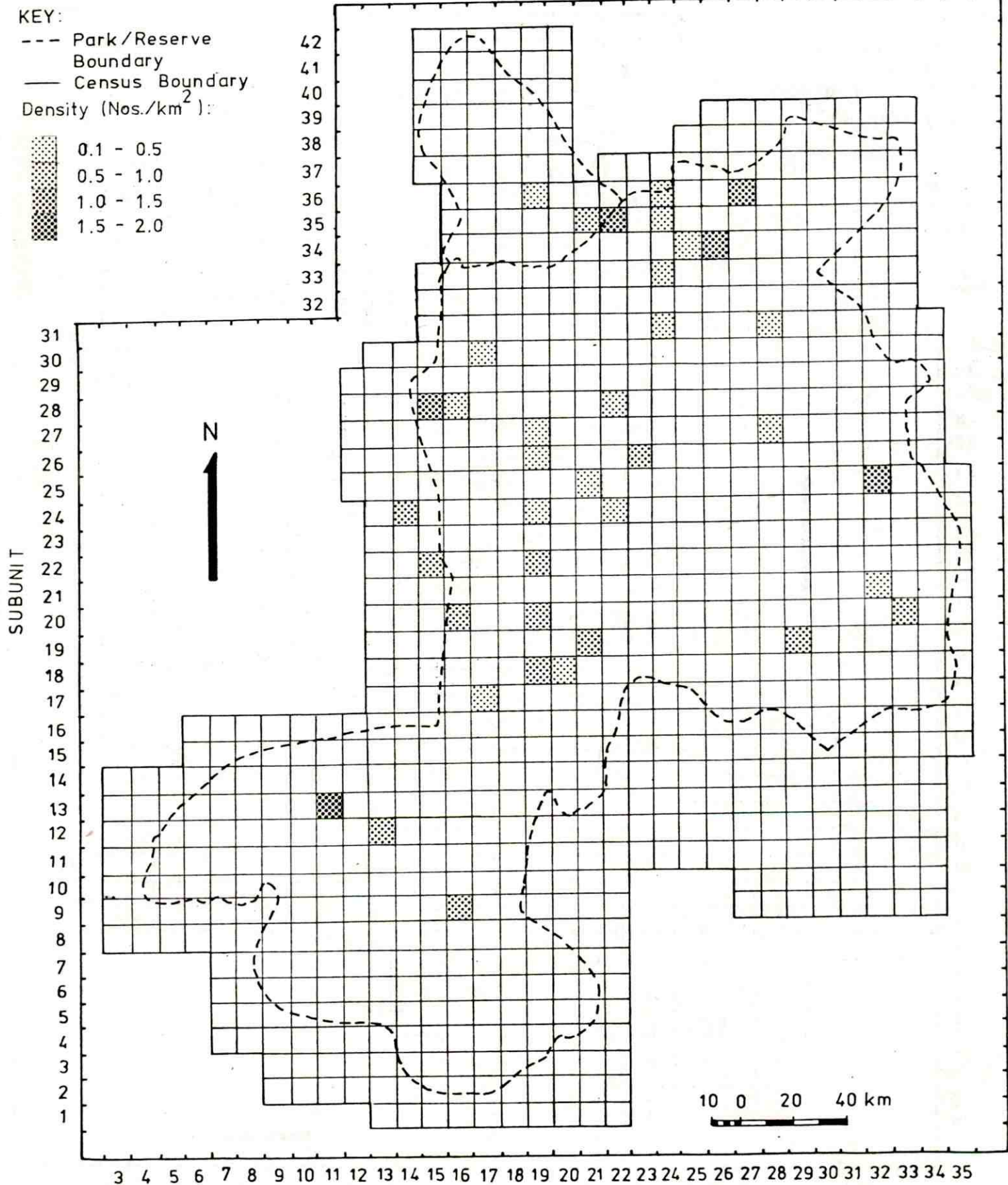
RHINO DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

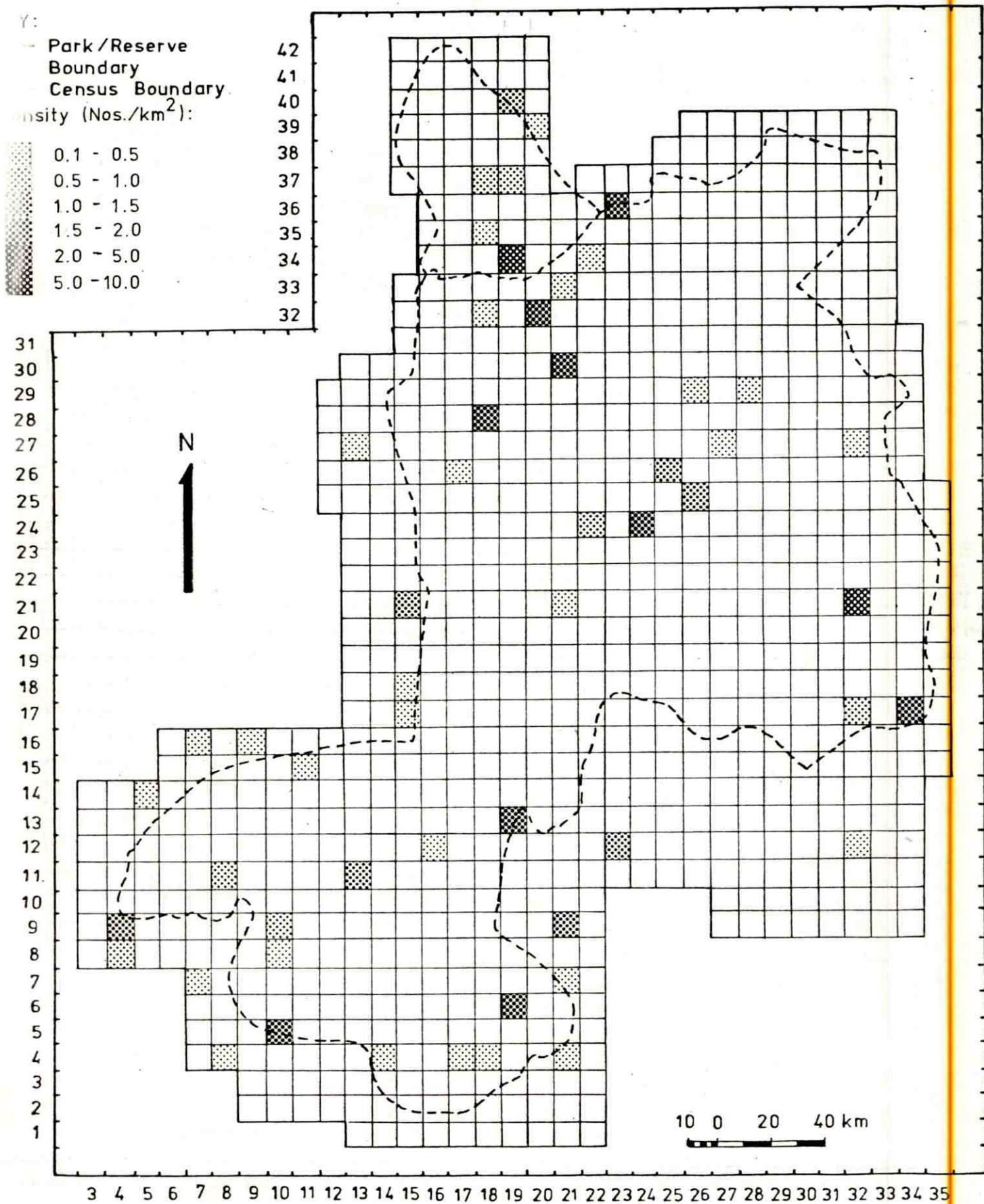
RHINO DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

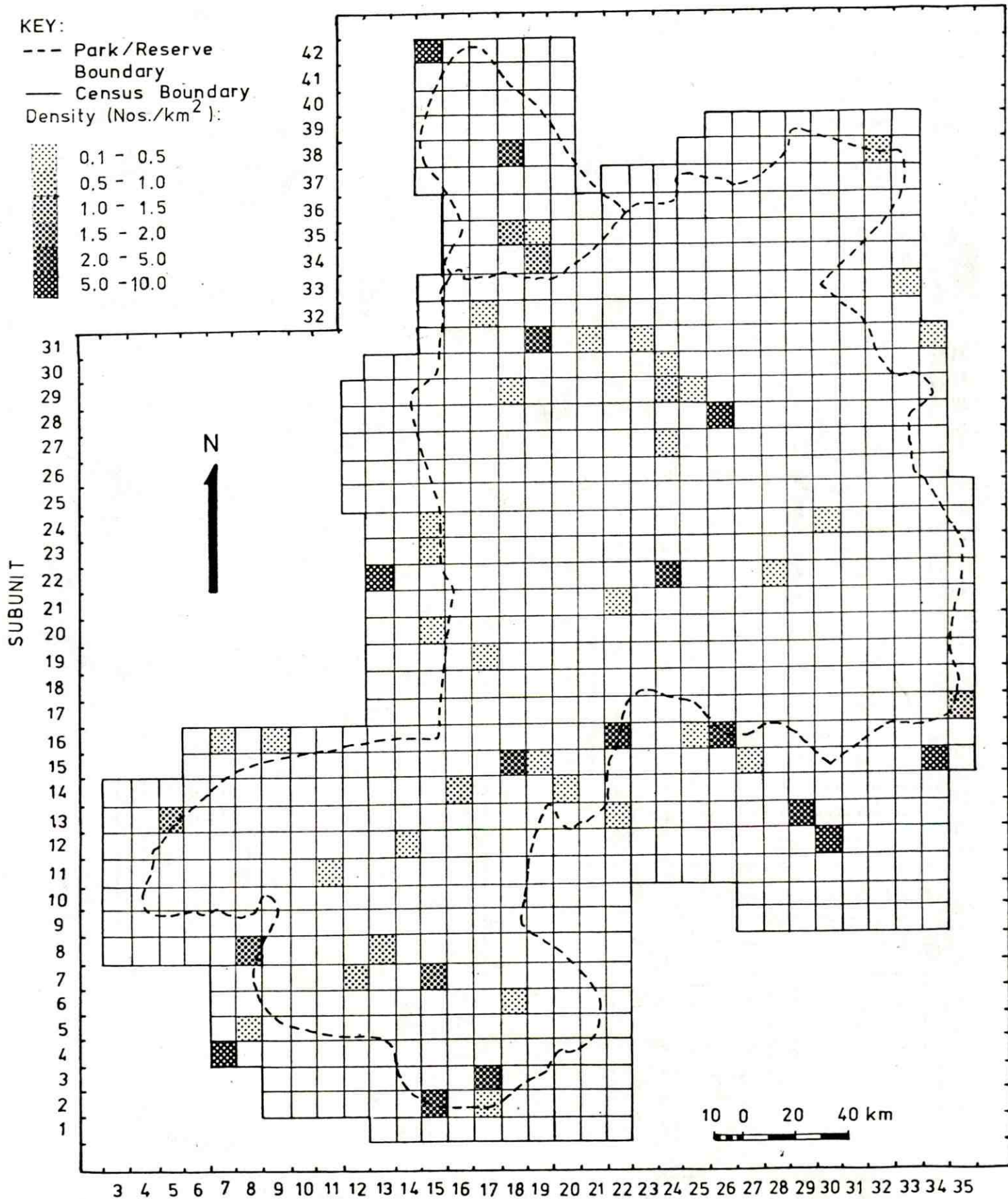
SABLE DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

SABLE DENSITY



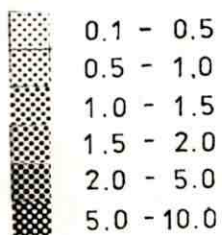
SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

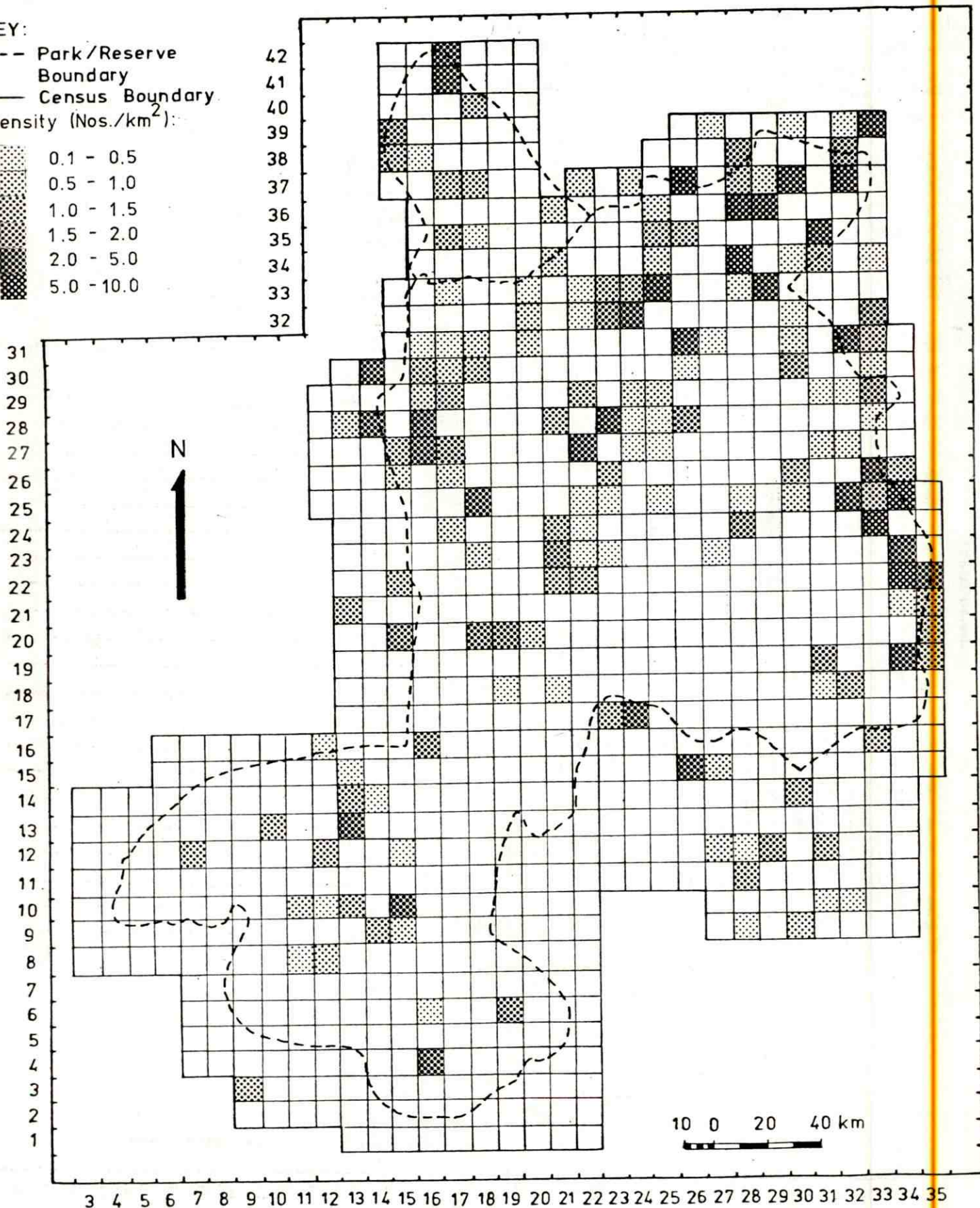
WARTHOG DENSITY

KEY:

- Park/Reserve Boundary
- Census Boundary
- Density (Nos./km²):



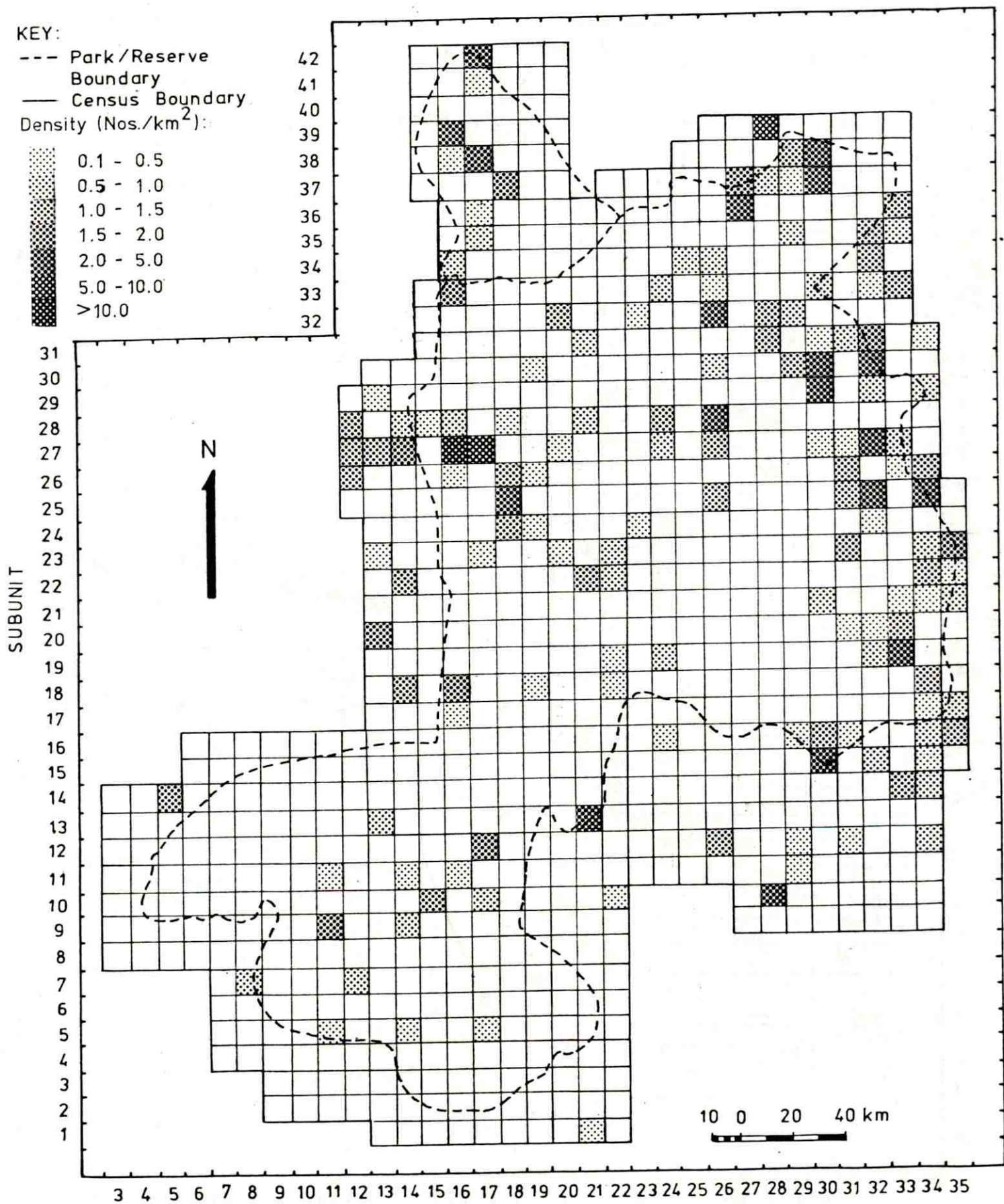
SUBUNIT



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

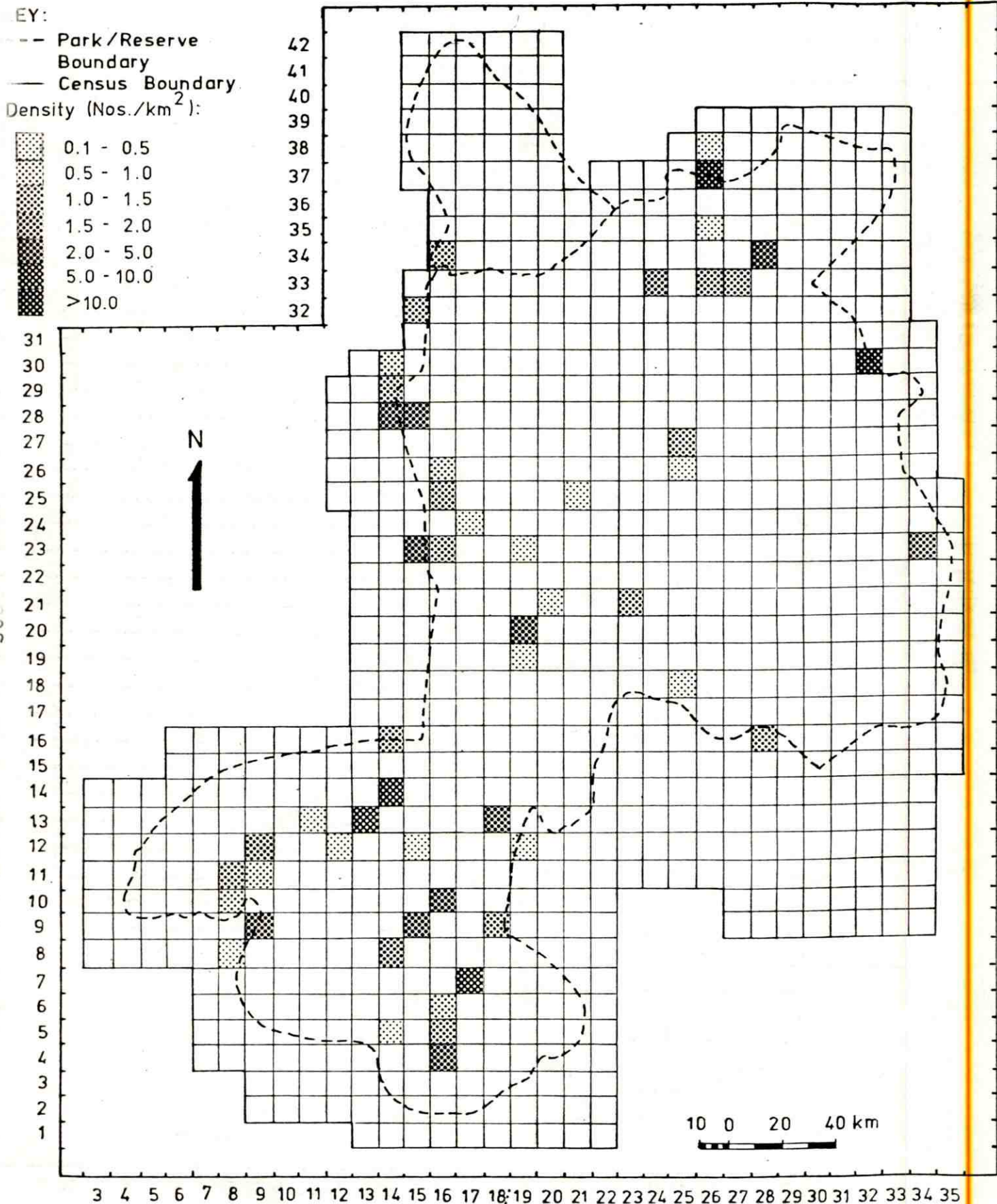
WARTHOG DENSITY



SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

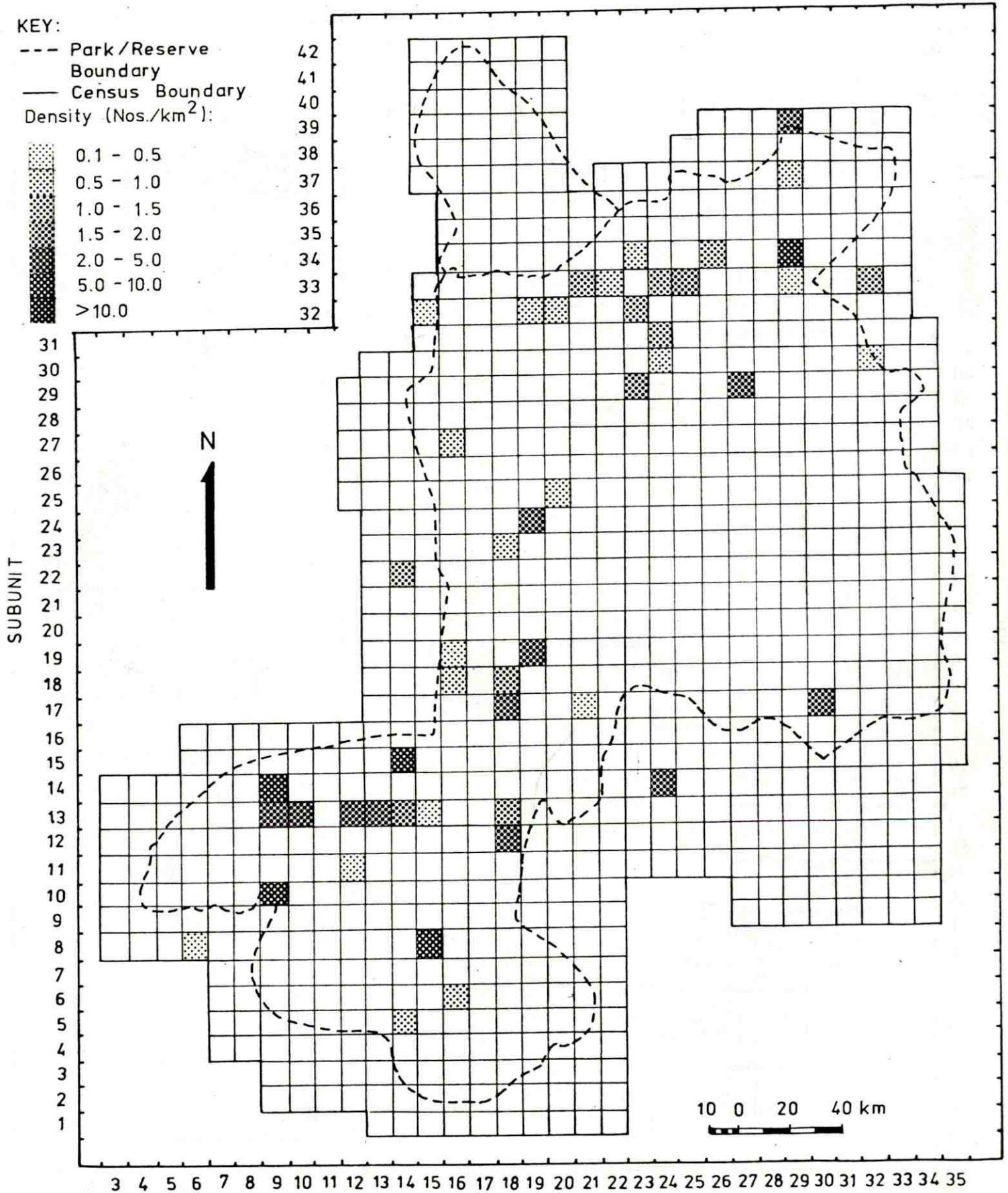
WATERBUCK DENSITY



SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

WATERBUCK DENSITY



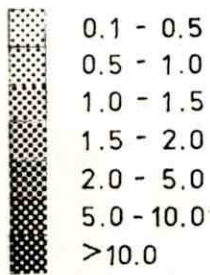
SELOUS CENSUS ZONE

WET SEASON - MARCH TO APRIL 1976

WILDEBEEST DENSITY

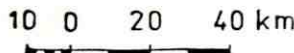
KEY:

- Park/Reserve Boundary
- Census Boundary
- Density (Nos./km²):



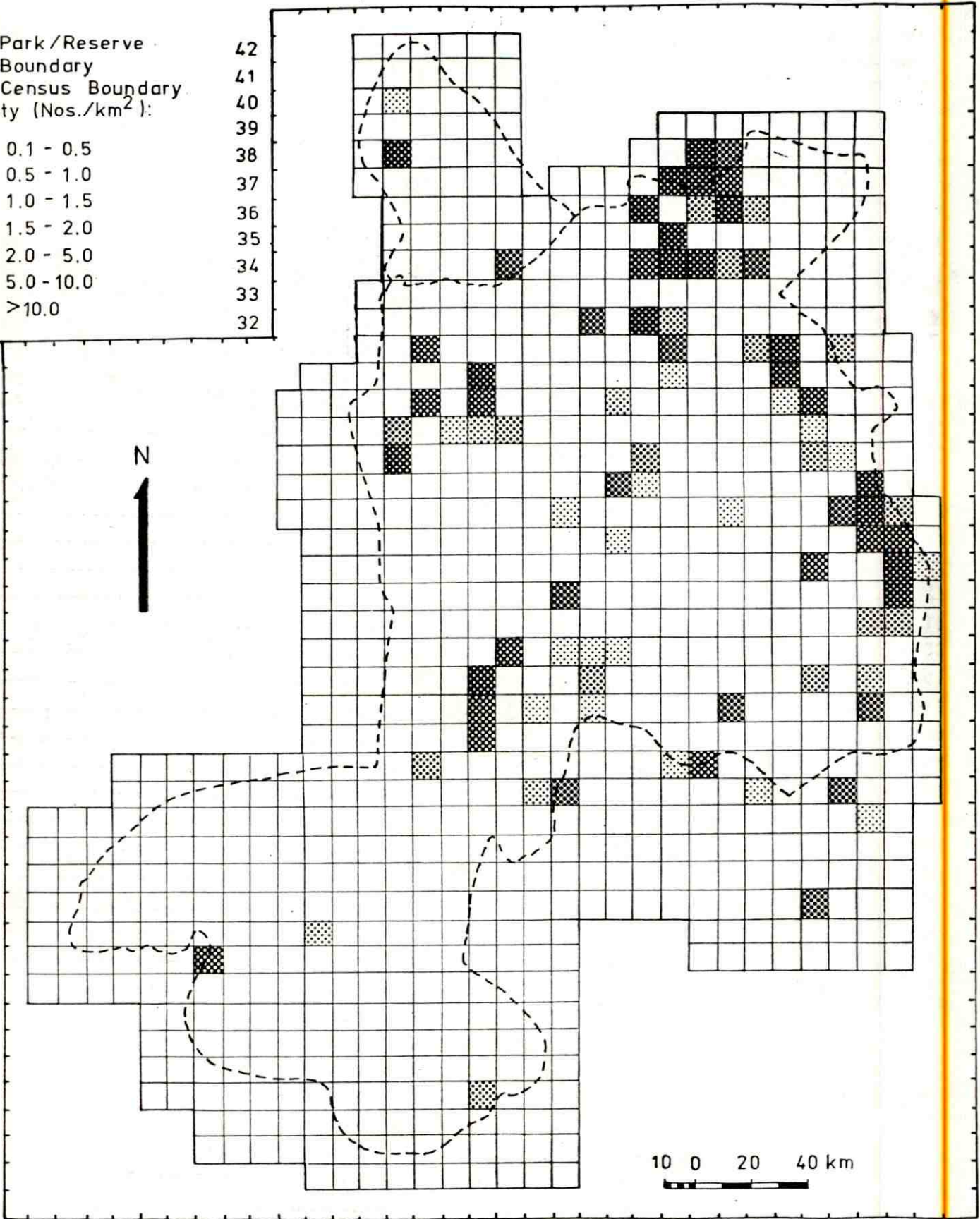
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SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

WILDEBEEST DENSITY

KEY:

- Park/Reserve Boundary
- Census Boundary

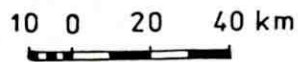
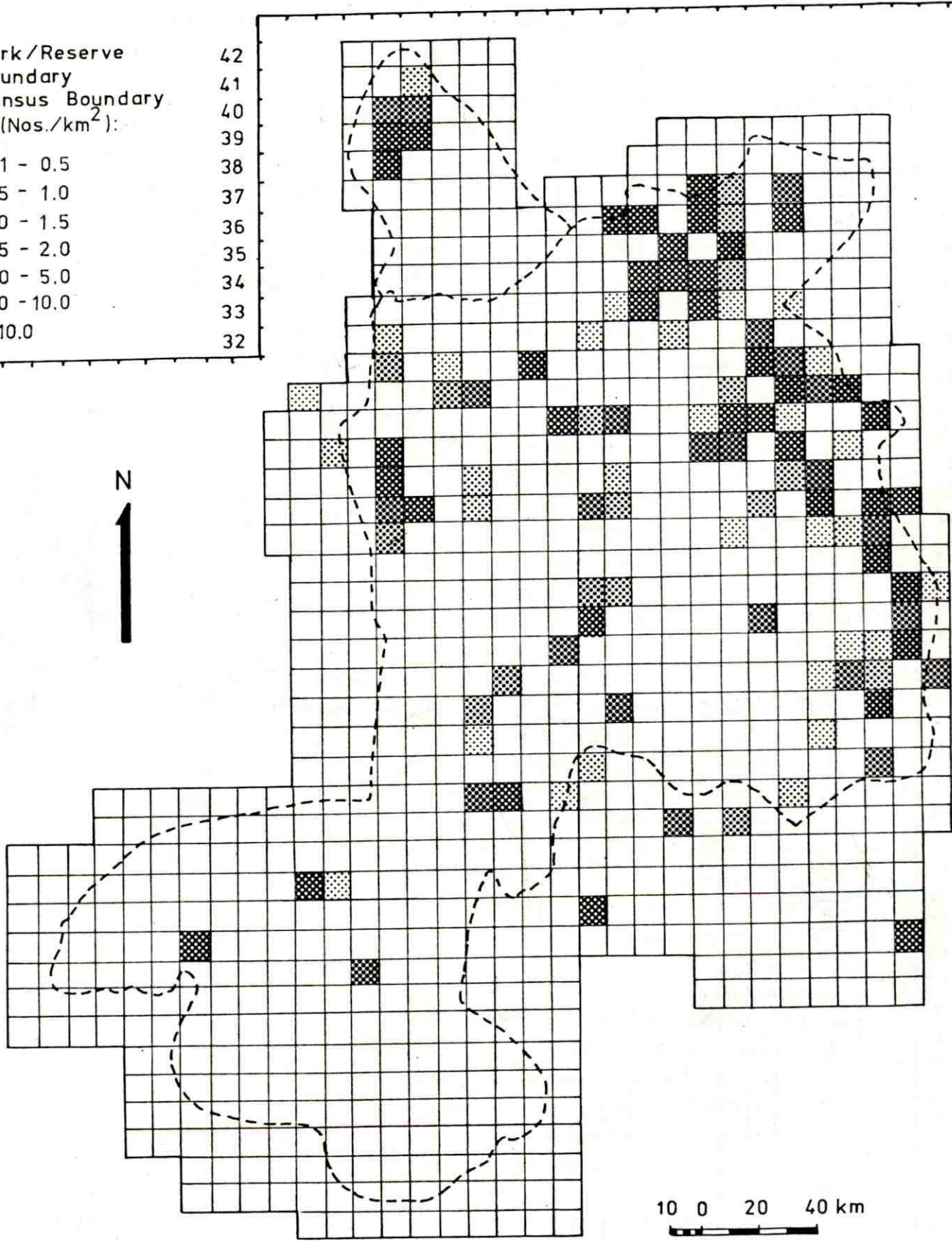
Density (Nos./km²):



- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 5.0
- 5.0 - 10.0
- >10.0

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- SUBUNIT
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SELOUS CENSUS ZONE

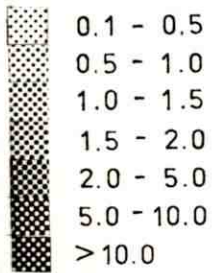
WET SEASON - MARCH TO APRIL 1976

ZEBRA DENSITY

KEY:

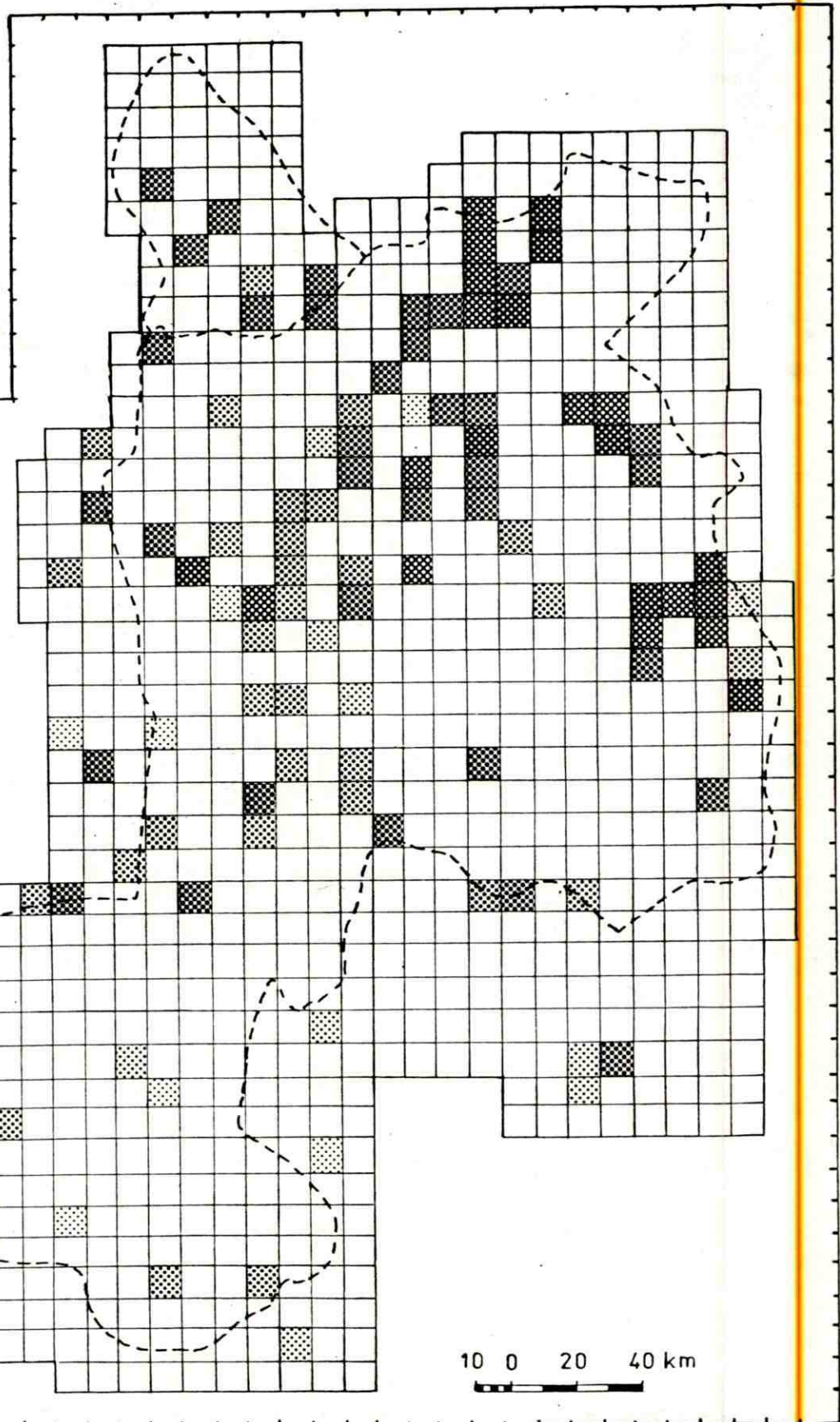
- Park/Reserve Boundary
- Census Boundary

Density (Nos./km²):



42
41
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2
1



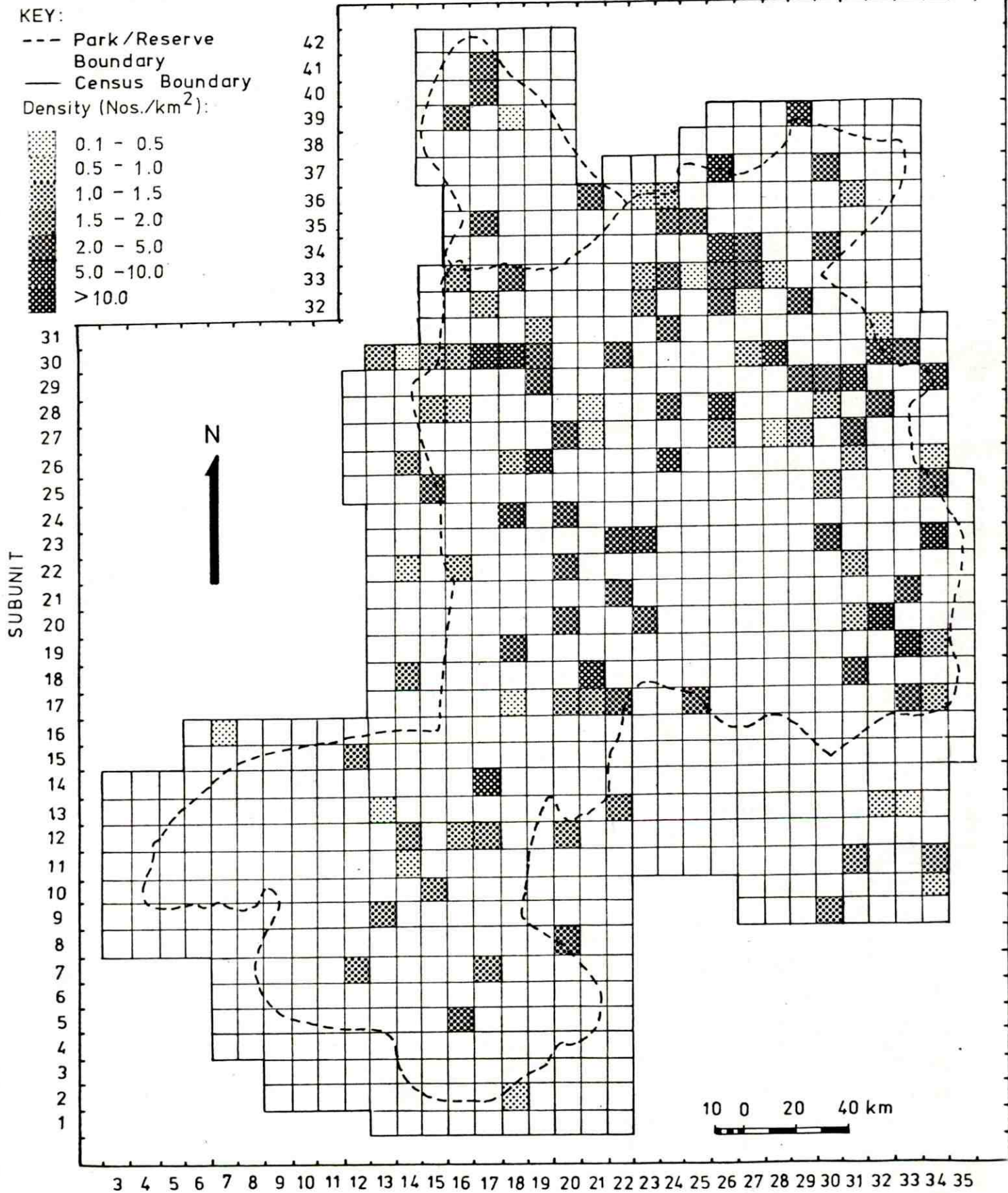
10 0 20 40 km

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

SELOUS CENSUS ZONE

DRY SEASON - AUGUST TO SEPTEMBER 1976

ZEBRA DENSITY



SELOUS CENSUS ZONE
WET SEASON - MARCH TO APRIL 1976

TRANSECT DATA

Transect	Length - km	Mean Strip Width - m	Transect Area - km ²
3	64.86	294	19.08
4	64.86	294	19.08
5	64.86	294	19.08
6	83.39	294	24.52
7	120.46	294	35.43
8	120.46	294	35.43
9	138.99	290	40.29
10	138.99	290	40.29
11	138.99	290	40.29
12	185.32	291	53.93
13	277.98	292	81.06
14	277.98	292	81.06
15	277.98	294	106.35
16	389.17	294	113.52
17	389.17	292	113.56
18	389.17	291	113.37
19	379.90	285	108.12
20	379.90	285	108.12
21	333.57	290	96.84
22	342.84	291	99.73
23	240.91	293	70.68
24	240.91	293	70.68
25	250.18	294	73.55
26	259.45	295	76.43
27	277.98	299	83.20
28	277.98	299	83.20
29	277.98	299	83.20
30	277.98	299	83.20
31	277.98	299	83.20
32	277.98	299	83.20
33	277.98	299	83.20
34	213.12	299	63.79
35	101.92	299	30.50
Total:	7894.58		2317.00

Grid square width = 9.26590 km (i.e. $5 \text{ km} \times 1.85318$)

Sampling Intensity = 3.13282%

SELOUS CENSUS ZONE
DRY SEASON - AUGUST TO SEPTEMBER 1976

TRANSECT DATA

Transect	Length - km	Mean Strip Width - m	Transect Area - km ²
3	64.86	316	20.50
4	64.86	316	20.50
5	64.86	316	20.50
6	83.39	316	26.36
7	120.46	316	38.08
8	120.46	316	38.08
9	138.99	316	43.93
10	138.99	348	48.37
11	138.99	348	48.37
12	185.32	336	71.53
13	277.98	329	91.62
14	277.98	314	89.35
15	361.37	312	112.75
16	389.17	311	121.11
17	389.17	313	121.69
18	389.17	313	121.69
19	389.17	313	121.69
20	389.17	313	121.69
21	333.57	315	104.97
22	342.84	314	107.72
23	250.18	327	81.06
24	240.91	327	78.78
25	250.18	313	78.31
26	259.45	313	79.54
27	277.98	313	86.98
28	277.98	313	86.98
29	277.98	313	86.98
30	277.98	313	86.98
31	277.98	313	86.98
32	277.98	301	83.56
33	277.98	301	83.56
34	213.12	301	63.06
35	101.92	301	30.64
Total:	7902.39	316	2504.91

Grid Square Width = 9.26590 km

Z = 74,131 km²

Sampling Intensity = 3.37903%

SELOUS CENSUS ZONE
WET SEASON - MARCH TO APRIL 1976

FLIGHT DATA

Dates:	3/3/76 to 21/4/76
Aircraft:	5Y-BAD
Pilot:	Iain Douglas-Hamilton
Front Seat Observer:	Alan Rodgers
Back Seat Observers:	Bakari Mbano and George Mgongo
Mean Flying Height (ft.a.g.l.):	248.4
Total Area (km ²):	73959
<i>Transect area</i>	<i>2317</i>
<i>Sampling Intensity</i>	<i>3.13282%</i>

SELOUS CENSUS ZONE
DRY SEASON - AUGUST TO SEPTEMBER 1976
FLIGHT DATA

Dates:	8/26/76 to 9/18/76
Aircraft:	5Y-BAD
Pilot:	Iain Douglas-Hamilton
Front Seat Observer:	Alan Rodgers
Back Seat Observers:	Bakari Mbano and William Summay
Mean Flying Height (ft.a.g.l.):	251.6
Total Area (km ²):	74131
<i>Transect Area</i>	<i>2504.91</i>
<i>Sampling Intensity</i>	<i>3.37903%</i>

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