A PILOT SURVEY OF NIMULE NATIONAL PARK NEW SUDAN

THE NEW SUDAN WILDLIFE SOCIETY

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LIST OF ABREVIATIONS

CRS:	Catholic Relief Services
IDEAS:	Institute of Development, Environment and Agricultural Studies
IDPs:	Internally Displaced Persons
NNP:	Nimule National Park
NS:	New Sudan
NSWA:	New Sudan Wildlife Authority
NSWS:	New Sudan Wildlife Society
REDSO:	Regional Economic Development Service Office
SPLA:	Sudan People's Liberation Army
SPLM:	Sudan People's Liberation Movement
USAID:	United States Agency for International Development
UWA:	Uganda Wildlife Authority

ACKNOWLEDGEMENTS

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ABSTRACT

The survey of Nimule National Park was conducted in July – August 2000, to established baseline information about the current status of the Park in general and three species in particular that is elephants, hippopotamus and Uganda kob; and to test the validity of the methodology for future use. The survey collected data on animal numbers, habitat and human attitude and impact.

The results of the survey indicated that the animal populations have dropped considerably. With proper protection and management they can easily recover.

The human activities although in the increase, can be controlled and reduced. There is a strong support for the continued existence of the Park and conservation programs in he area.

A number of recommendations were suggested, short and long terms have been included, which if implemented would improve the management and conservation of the Park and its surroundings. This will ultimately lead to the restoration of the previous status of the Park and also act as a stimulus for the conservation efforts of the NSWA in other protected areas of the NS.

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INTRODUCTION

The Rationale

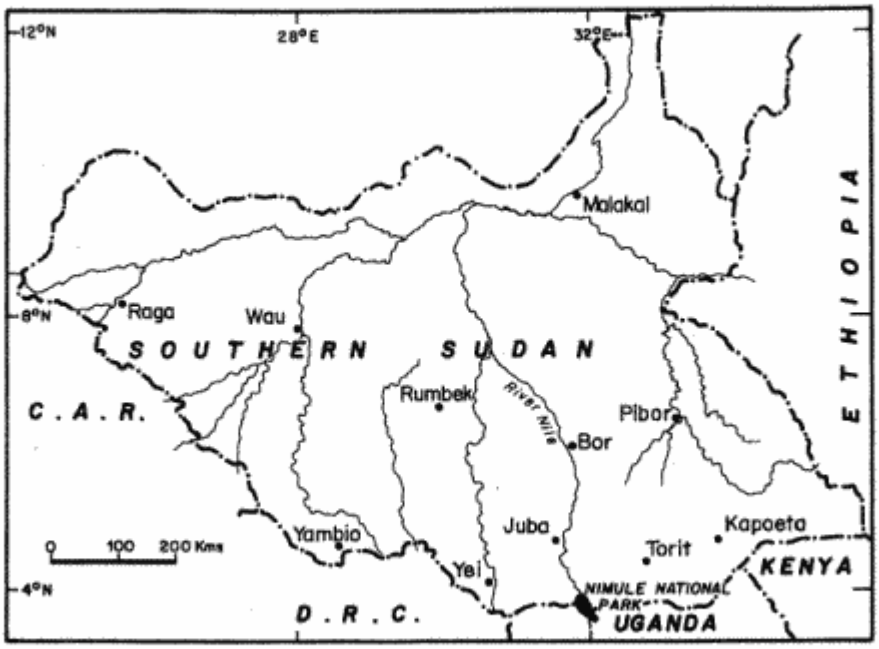
The purpose for the pilot project for the Nimule National Park (NNP) was/is for an ecological study of NNP and its surroundings. It included ground surveys involving indirect and direct counts of the fauna and vegetation description as well as examining the human impact.

The major part of the work was to test the methodology, estimate changes in NNP since 1980's, document the human activities and impact on the Park and train the park personnel on data collection using the same methodology. The output was to come up with the current status of NNP-upon which management and conservation interventions would be made as well as perfection of the methodology for use in other conservation and protected areas of the New Sudan.

Although other animals and the park vegetation were included in the survey the targeted species were the elephants, hippopotamus and the common kob, due to a variety of reasons. The elephants for their endangered status and changing habits [from sedentary to migratory], the hippopotamus for the high hunting pressure for food and the Uganda kobs for their historical high numbers and also excessive hunting pressure for food and trade. Attempts were made to answer questions like:

- How many animals are there in Nimule National Park?
- How are these numbers compared to the past?
- What impact has the hunting on the animals?
- How has the migration habit of the elephants affected their utilization of the park as well as their safety within and outside the park?
- What is the impact and magnitude of human activity in the park?
- Is the methodology suitable for this kind of survey and can it be applied in other areas?
- Does the park system have the qualified personnel needed to monitor and carry out the surveys and what are the probable results of this exercise?

The report therefore documents the answers to the above questions as well as provides arguments for the conservation of the resources in NNP and recommendation for their management.


12°N
28°E
32°E
8°N
4°N
Malakal
Raga
Wau
SOUTHERN SUDAN
C.A.R.
Rumbek
River Nile
Pibor
Bor
ETHIOPIA
Juba
Kapoeta
Torit
Yambio
0 100 200 Kms
Yei
KENYA
NIMULE NATIONAL PARK
D.R.C.
UGANDA

1. STUDY AREA

1.1 Location and Area

The NNP is located between 3° 35:3, 3° 49:2N and 31° 48:3 and 32° 2:2 E at the extreme south of Sudan-Uganda border (Fig 1and 2). The northern border runs along River Kayu and the Nile, the eastern border along the River Nile while the Southern border is along the Uganda borders from the River Nile and the western border runs along the Illungwa Mountain ranges to River Kayu.

NNP was established in 1935 as a game reserve and upgraded into a National Park in 1954. (Sudan Government, 1935) The exact area of NNP varies between 251 km^2 (Abdalla, 1988), 256 km^2 (Sudan government, 1935) and 410 km^2 (Hillman, 1985). Hillman's larger area includes the buffer zone, an area between the River Nile and Juba-Nimule road, starting from Onyama Bridge till Assua Bridge, and then the Assua and the Nile confluence.

1.2 Climate

The climate of NNP and its surroundings is not different from that of the southern part of the Sudan especially those of high woodland savanna. It is essentially of continental climate. In this zone it has unequivocal dry season (Lebon, 1965). The rainy season in Nimule area starts in April and ends in November. The dry season runs from December to March. The mean annual rainfall in Nimule varies from 1000 - 1200 mm and the mean daily temperature is 27^0 C. The highest temperatures occur in March 29^0 C while the lowest usually occurs in July 24 C° (Lebon, 1965)

1.3 Topography

The geology of NNP is that of late pre-Cambrian period; much of the topography is the formation of the product of the geology and the climate operating throughout the Pleistocene and into the Holocene. The area is hilly and undulating interspersed with annual and some perennial rivers and streams. The hills are well rounded with few cliffs or scrap an indication of weathering and denudation processes as well as resistance to greater chemical weathering. The characteristic here is that of high temperature and frequent rainfall.

The drainage of Nimule area and its surroundings is that of a dendritic pattern with well-rounded interfluves. Water erosion curves are dominant with often or complete deep mantle of weathered rocks and soils. The general elevation of the area is between 500 to 800 m above sea level. The main topographic features are Faula Rapids on the Nile and Illungwa hills on the western side of the park.

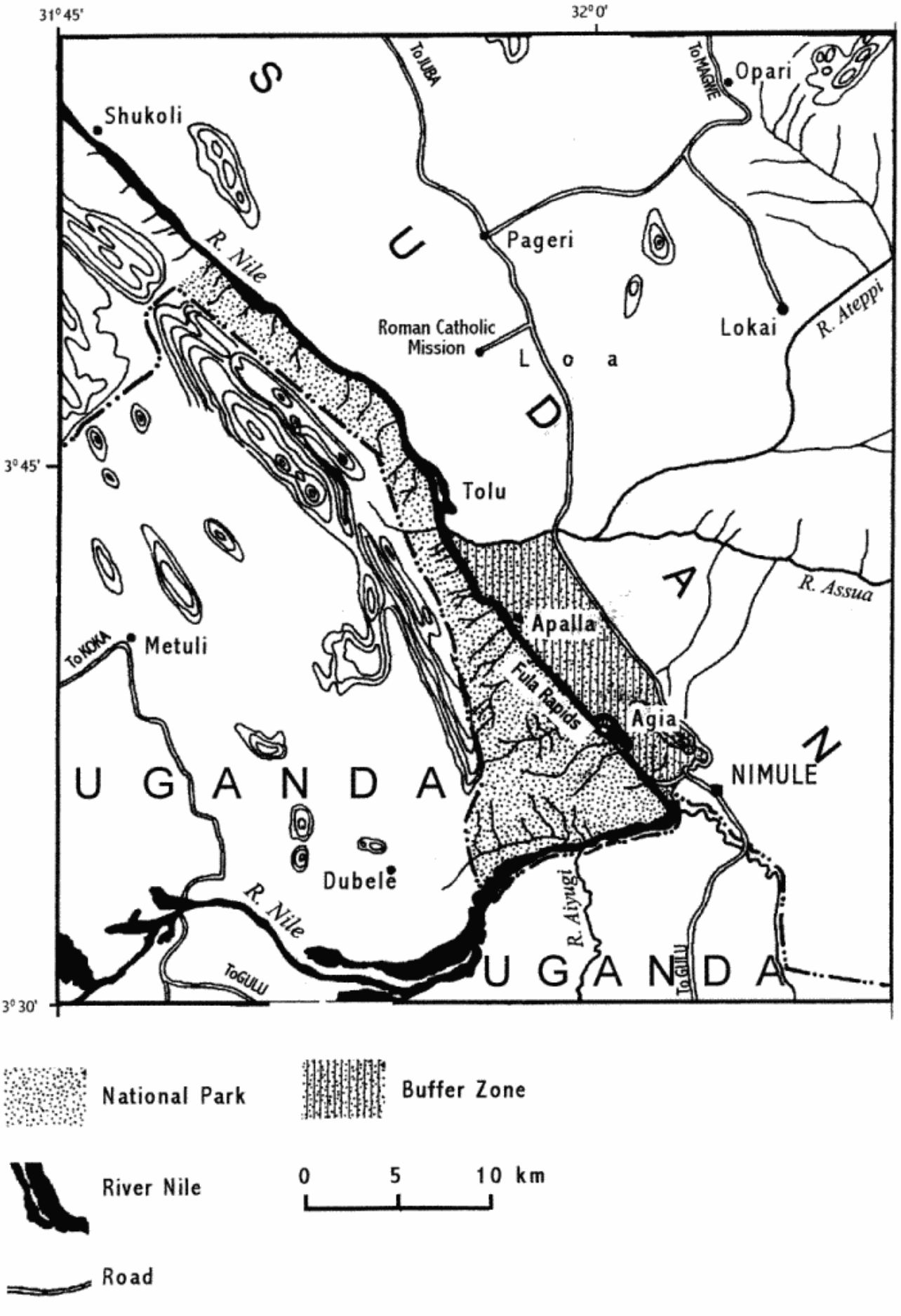
1.4 Soils

Soils are normally influenced by climate, the nature of the parent rock, relief, drainage and vegetation.

According to Mefit's (1978) and Noordwijk (1984), the soils of NNP and its surroundings belong to those of iron stone plateau zone. This zone is part of Archaean basement complex geologically. The complex is composed of very old sediments and volcanic formations.

These soils are extensions of Lotosols soils found in high woodland savanna and are of intermediate lands. The soils are characterized by red mottles and discrete modules on top of the horizon of clay and highly weathered materials rich in iron and aluminum oxides. The soils here

Fig. 2: The study area.



have lower pH values and more organic matter. They become more acidic only after exposure and cultivation (Morison et al, 1948). Most soils occurring in NNP and the surroundings are free draining and have good crumb-structure, except where the laterite soil itself is exposed or is near the surface. The clay component of the soils is predominantly kaolinite. They belong to the great class of tropical soils that developed in hot humid climates, from which the soluble substances derived from chemical weathering and biological activity have been bleached (Morison et al, 1948).

1.5 Vegetation

N.N.P is mainly in an area of deciduous high woodland savanna characterized by high, broad leafed and more foliage trees some of, which are deciduous, others evergreen. The grass grows to a height of 4 - 8 feet and most of the grass species are perennial.

The most important and dominant vegetation categories in NNP are mainly three:

The wooded grassland - this is made of *Hyperrhenia filibendula, Hyperrhenia rufa* and Combretum species mainly *Combretum collinum.* This occurs mostly on the western half of the park especially the areas next to open grasslands.

Bushed grassland the main feature of this type of the vegetation category, is the strong presence of Combretum species, interspersed by *Hyperrhenia rufa, Hyperrhenia filibendula* grass. This type occupies the areas on the highest, well-drained grounds.

The Riverine woodland this type of vegetation category occurs along both the seasonal and permanent rivers and streams. This type of vegetation is dominated by *Acacia siberiana* (Abdalla, 1988) and (Noordwijk, 1984).

1.6 Fauna

Although NNP was established for the now locally extinct white rhino, *Ceratotherium simum cottoni,* there are other mammals of importance among which are: elephant *loxodonta africana,* hippopotamus *Hippopotamus ampibius*, waterbuck *Kobus defassa*, Uganda kob *Kobus kob,* bush buck *Tragelaphus scriptus*, common duiker *Sylvicapra grimmia,* oribi *Ourebia ourebi,* warthog *Phacochoerus aethiopicus,* baboon *Papio anubis,* Vervet monkey *Cercopi*thecus *aethios,* hyrax *Procavia capensis*, common jackal *Aureus sp.* and leopard *Panthera pardus* although sporadic visitor (Myers 1976). Nile crocodile *Crocodylus niloticus*, python *Python sibae* and monitor lizards are the main reptiles occurring in NNP.

The bird life is very rich in the area. Most bird families in Africa are represented here include even the Palaearctic migratory species from Europe, Asia, and North Africa, such as Ciconiidae family.

1.7 Human Activities

Human activities in a given area are as old as the time of the arrivals or settlements themselves. These activities vary according to time and space and NNP is no exception.

Before the current civil strife, the human population of Nimule and the surroundings was approximately 2,000 made up of farmers, fishermen, government employees and businessmen. Today the population is estimated to be 40,000 (Payam Administrator pers. Com.) most of whom are internally displaced persons (IDPs). The IDPs are mainly dependent on relief supply. Quite a few are fishermen. The livestock population is considerable.

With the tremendous increase in the population in Nimule, the human activities have increased in intensity and variation with detrimental effects on the fauna, flora as well as the physical structure. Among the human activities connected with or that affect the park are:

Heavy fishing in and outside park waters, this is carried out by the local communities and internal displaced persons. In order to preserve the fish, much fuel wood is needed as such much of the tree base fuel wood in and around the fishing camps has been heavily depleted. The use of explosive fishing technique, does not only affect the fish but has killed more fishermen, leave alone other side effects associated with such a fishing technology.

There is heavy grazing and utilization of the park and its surroundings for building, firewood and other purposes.

Poaching is very rampant in the park and in areas around it, by both the locals and IDPs. Incidences of fire in and around the park are usual practices and are much more severe in the dry season.

This is not the first time NNP has suffered armed destruction. During the first civil war (1955 – 1972) poaching was carried out by Anya-nya forces in order to obtain logistics of the war. This led to the local extinction of the northern white rhino species and decimation of the elephant population. Current effects on the animal population have resulted at first from war pressure on Nimule in mid 1990's but now it is poaching activities from individuals who sneak into the park from both Nimule and Ugandan sides.

Current Management

NNP is managed by the NSWA. There are 4-5 staff members including one senior staff. They lack all field provisions necessary for the management of a national park. Many of the staff have only military experience and little if any conservation knowledge.

2. METHODOLOGY

2.1 The Line Transect

Due to the small size of NNP (Fig 2) and the inaccessibility by other means than on foot, ground survey using line transect method was utilized to get most of the data except for hippo counts, human attitudes and utilization of the Park.

A total of 13 permanent line transects were run one in the buffer zone and 12 inside the Park (Fig 3). Each transect had two marks one at the stars and the other one at the end, with additional markings at 100m intervals. Regular cuttings and clearance were advised. The line transects were carried out in three different habitats viz.: the Riverine woodland, Combretum scrub grassland and Acacia association. Each line transect run for a distance of 2.5 km on average and had a varied width from 20 to 600 meters for direct animal counting depending on vegetation thickness. Transects spacing were set at between 0.5 to 1 kilometer depending on habitat change. Most of indirect count data was gathered from the start of the line transect to the end.

Elephant dung data were collected based on method developed by Jensen and Barns (1987). The vegetation data was obtained using the PCQ method (Meuller-Dombois and Ellenburg, 1974) along the line transects.

2.2 Data collected

2.2.1 Animal

The animal data collected along the line transect were of two types: the indirect and the direct counts. The indirect information gathered was the footprints, dung and pellets, the carcasses and habitat utilization. The direct data include the species, numbers, population structures, activities and habitat types.

2.2.2 Vegetation

The vegetation data particular for each habitat type include species type, distances to sampling point, height, diameter at breast height, phenological status, level of utilization and damages and impacts of animal and fire on the plant.

2.2.3 Human activity data

These were collected along the line transect, which, include poaching signs such as meat drying stoves locally made from stones, empty bullet cartridges, plastic bags, cigarette remains, foot paths, tree cuttings and fire places.

2.3 Direct count and observations

2.3.1 Hippo counts

The direct total counts for hippos was done using the method utilized by Tembo (1987) in Luangwa River in Zambia, through visits to known hippo pools within the Nile. The distance covered was three- (3 km). The following information was collected: numbers, group size and other attributes of population structure.

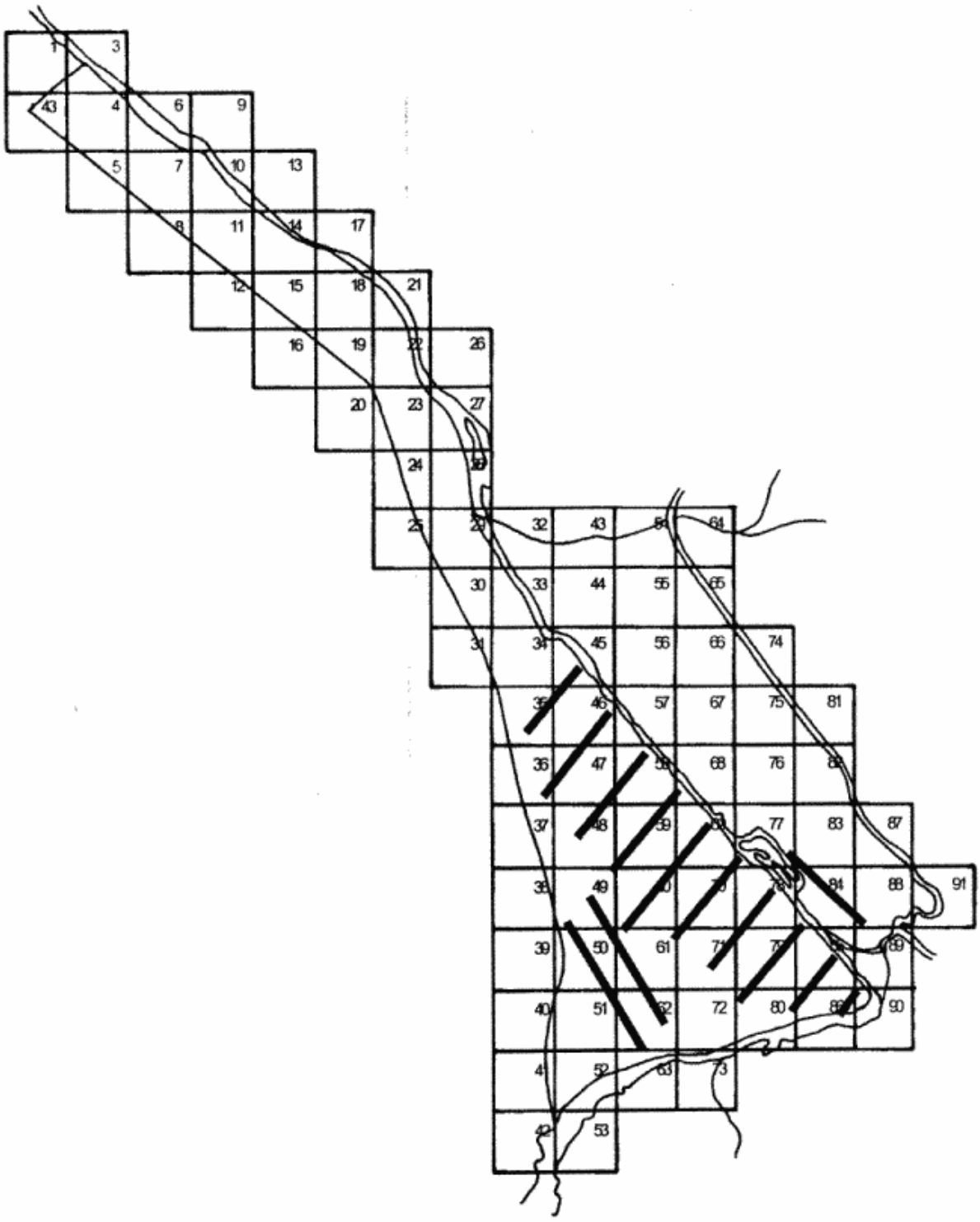
2.3.2 Human study

Human activity study was done through direct observation and other means through the questionnaire administered survey and direct discussions with both the local communities and officials in Nimule area. Apart from actual hearing of gunshots, much of the other information pertains to human activities within and outside the NNP and the buffer zone were recorded e.g. firewood and building material collection, fishing in the Park, livestock presence. Human attitude for or against the Park was based on the level of education, the kind of profession, age and the period of stay in the area.

2.4 Data processing and analysis

Data collected and observations were loaded from data sheets to excel spreadsheets. The elephant dung data was analyzed using a Fourier series program "ELPHANT" software (Dekker et. al, 1994) to obtain density per km^2 and population estimate. Other animal data were converted into density per km^2 except for hippo which, was calculated per km of river (Tembo, 1987). The PCQ data were converted to tree density, frequency and dominance from which, importance values were obtained and used to describe the habitat. Descriptive and inferential statistics were used to describe the data and detect significant differences.

Figure 3: Transects walked during the Survey.



3. RESULTS

Animal numbers and confidence limits of estimates are given in Table (1). Densities and distributions are shown in Maps (3-9). Trends of animal populations as compared to studies carried out by Kenyi (1983) and Abdalla (1987) are shown in figures (1-8).

Table (1): Population estimates from direct counts:

Species	Density/Km^2	Population estimate	Standard Error ±
Elephant*	-	-	-
Hippo	1.61	413	2.517
Uganda kob	7.14	1829	6.508
Duiker	0.46	118	0.63
Warthog	1.04	265	1.797
Bushbuck	0.12	30	0.28
Oribi	0.12	30	0.28
Baboon	10.6	2713	12.724
Vervet monkey	2.07	531	2.534
Jackal	0.12	30	0.28
Hyrax	0.12	30	0.28

* Elephants number was estimated by use of dung method.

Table (2) Population from indirect counts:

Species	Density/Km^2	Population estimate	Standard Error ±
Elephant	0.61	156	69
Hippo	3.33	853	8.707
Uganda kob	6.67	1706	8.509
Duiker	2.4	617	5.487
Warthog	4.08	1044	6.912
Bushbuck	0.85	217	2.088
Oribi	0.32	82	0.751
Baboon	0.21	55	1.198
Vervet monkey	-	-	

Figure 4: Elephant Dung Distribution and Percentage of Occupancy over the Park's Area.

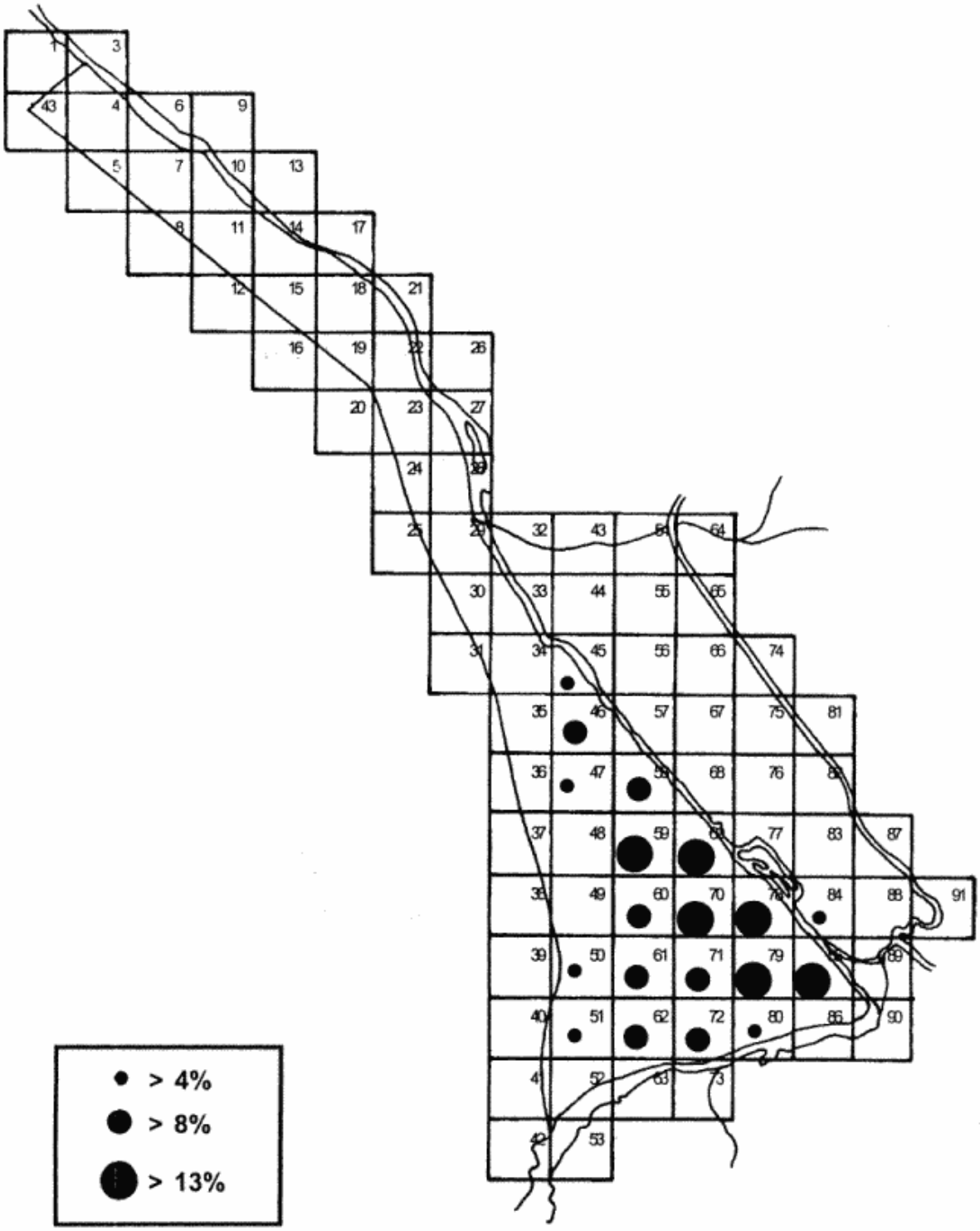


Fig. 5: Elephant movements in and arround Nimule National Park

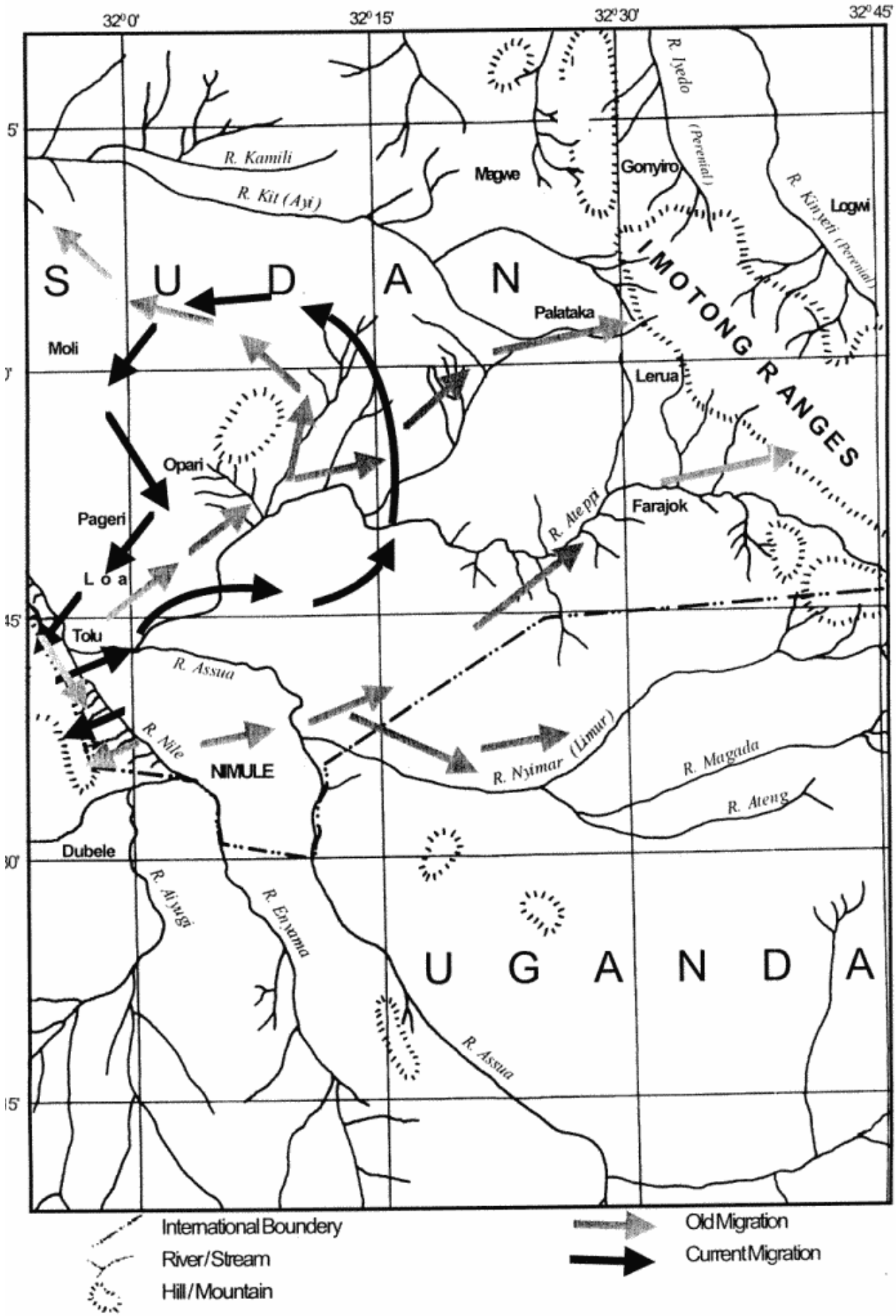


Figure 6: Distribution of Hippopotamus.

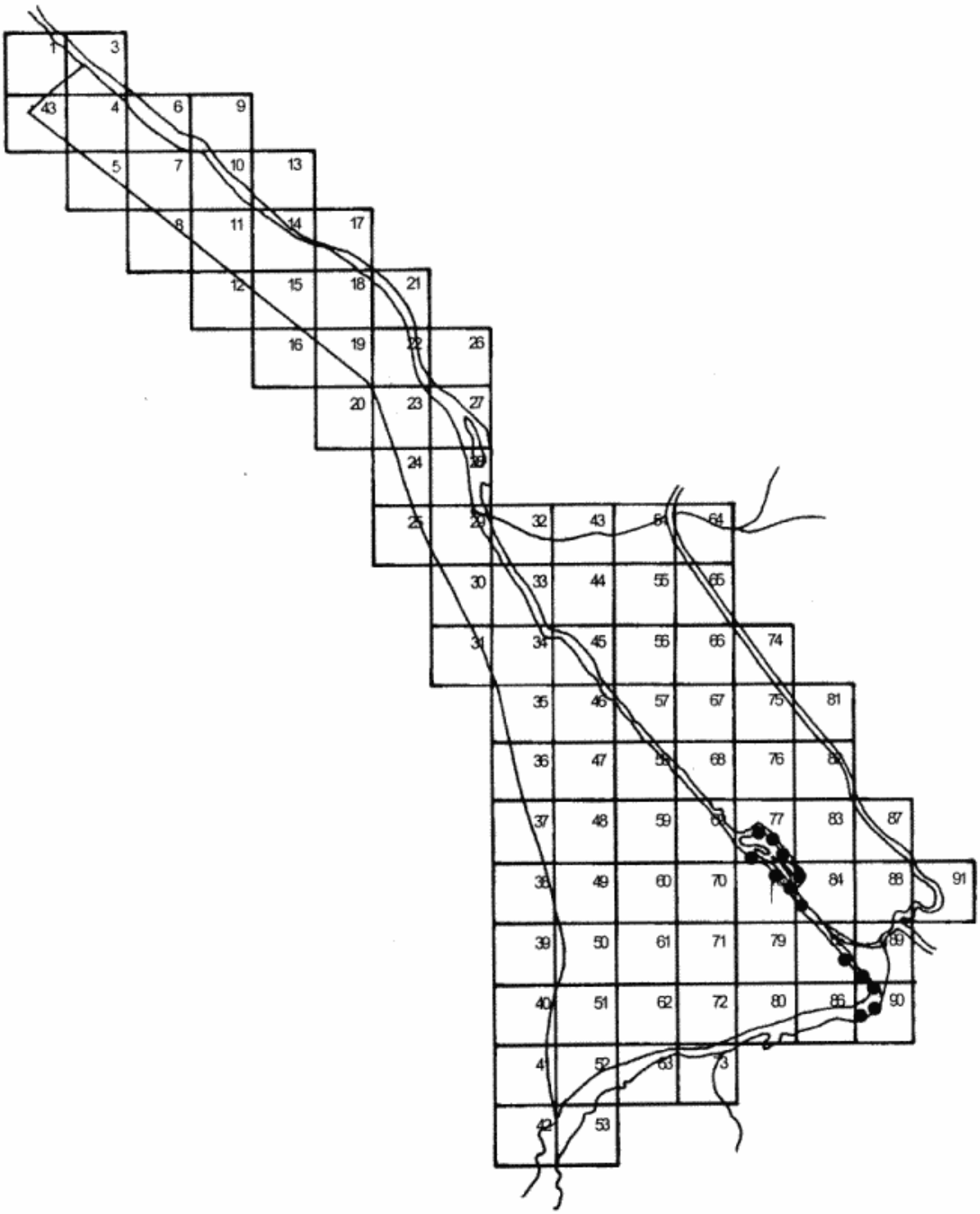


Figure 7: Distribution of Uganda Kob.

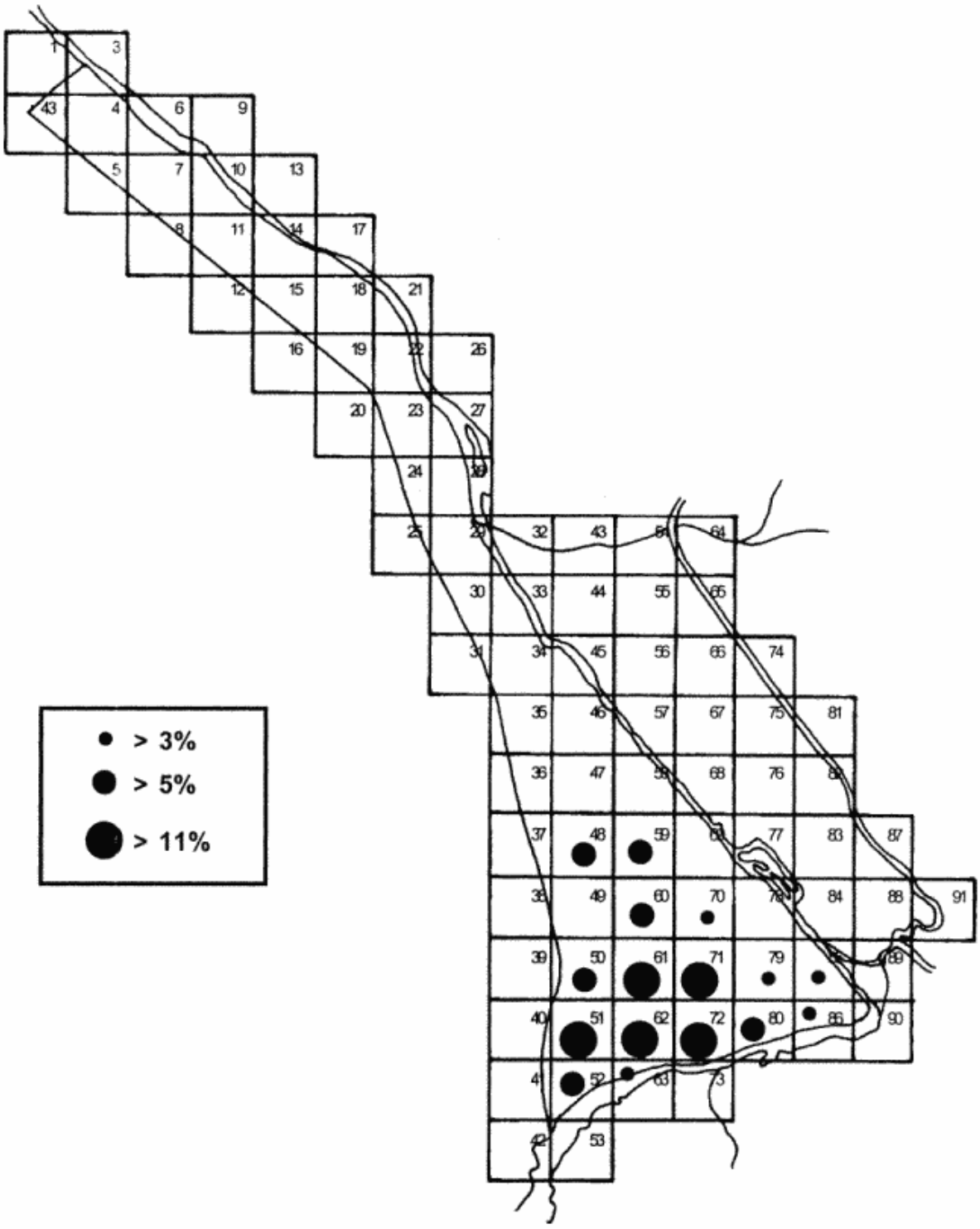


Figure 8: Distribution of Warthog.

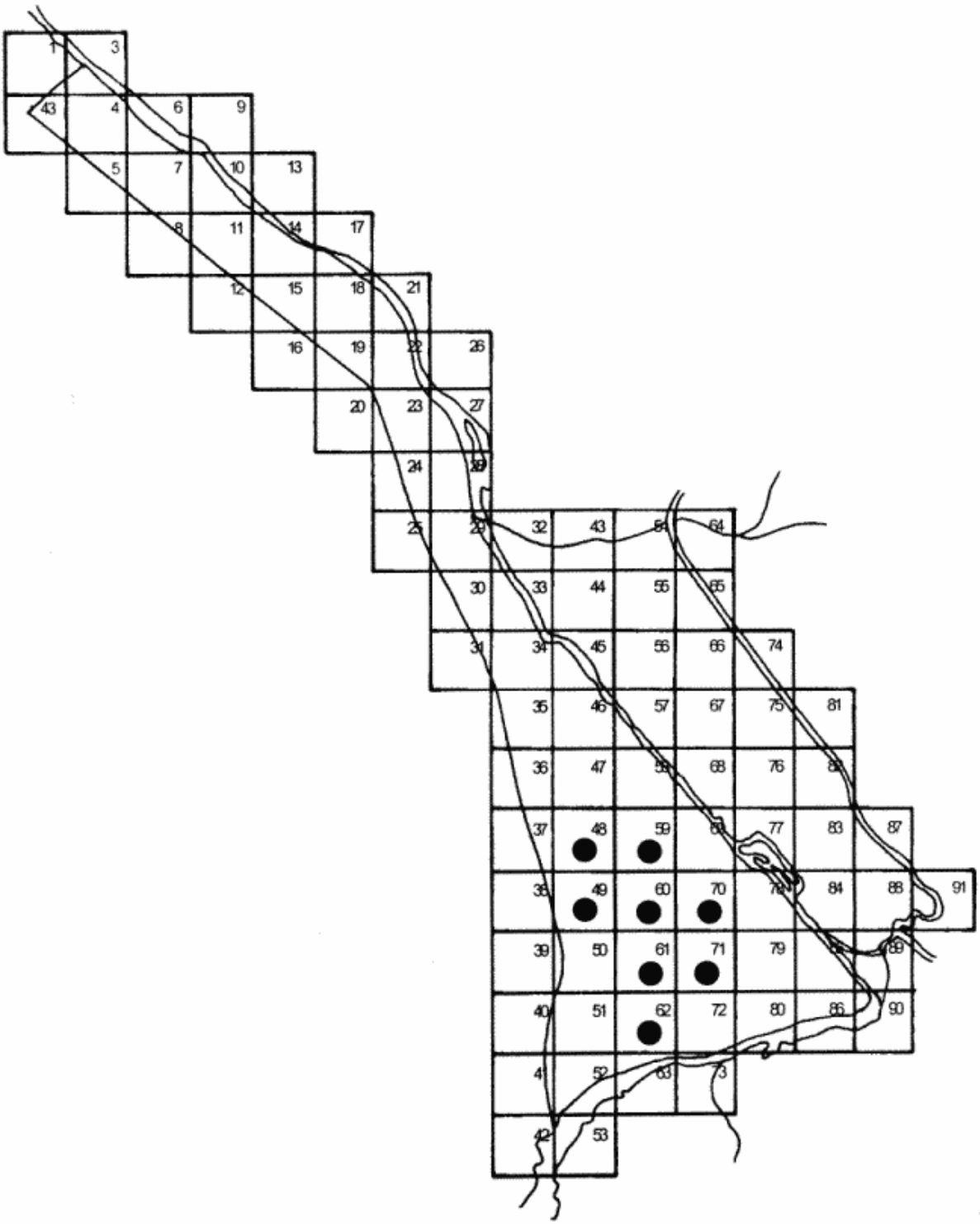


Figure 9: Distribution of Duiker.

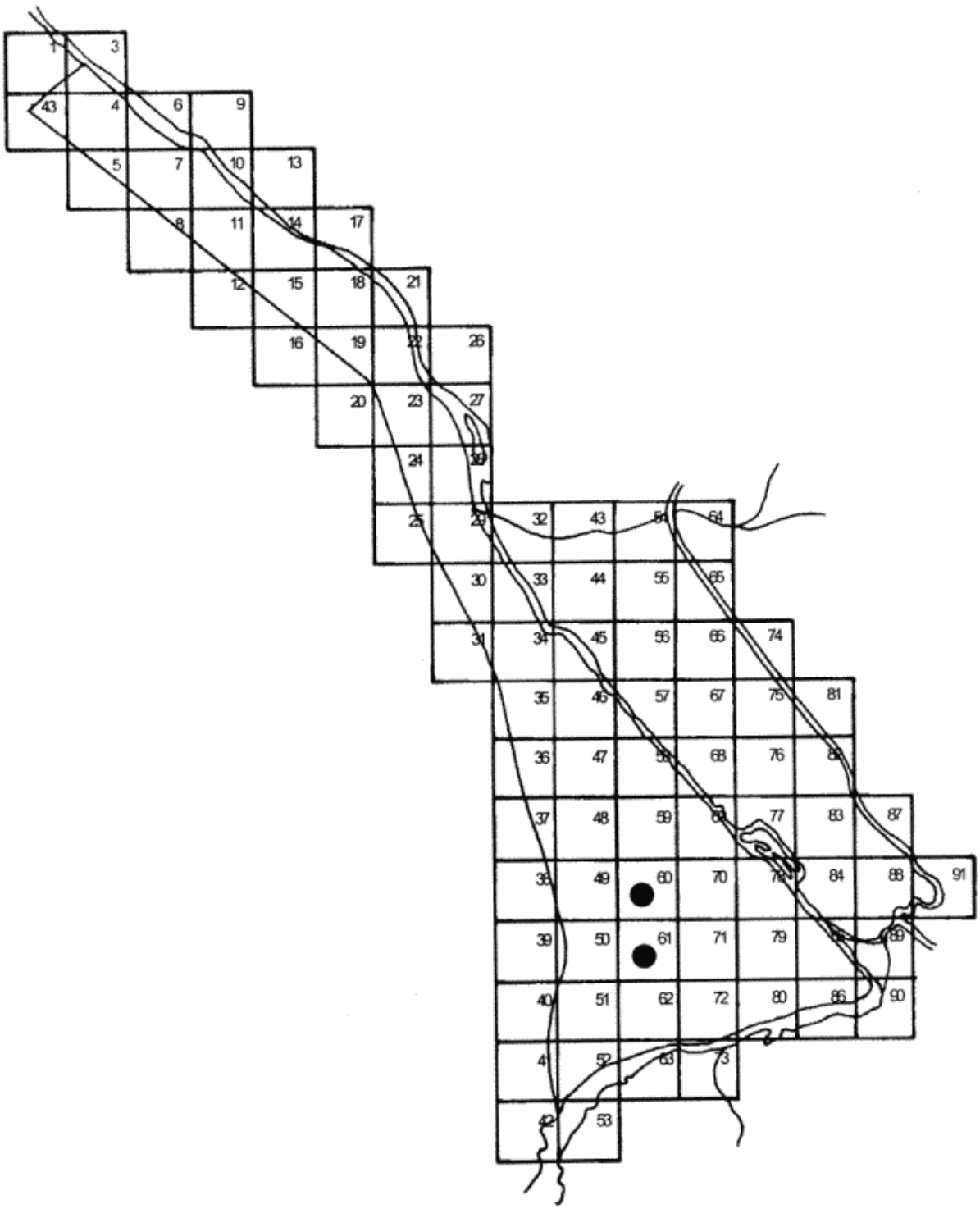


Figure 10: Distribution of Oribi.

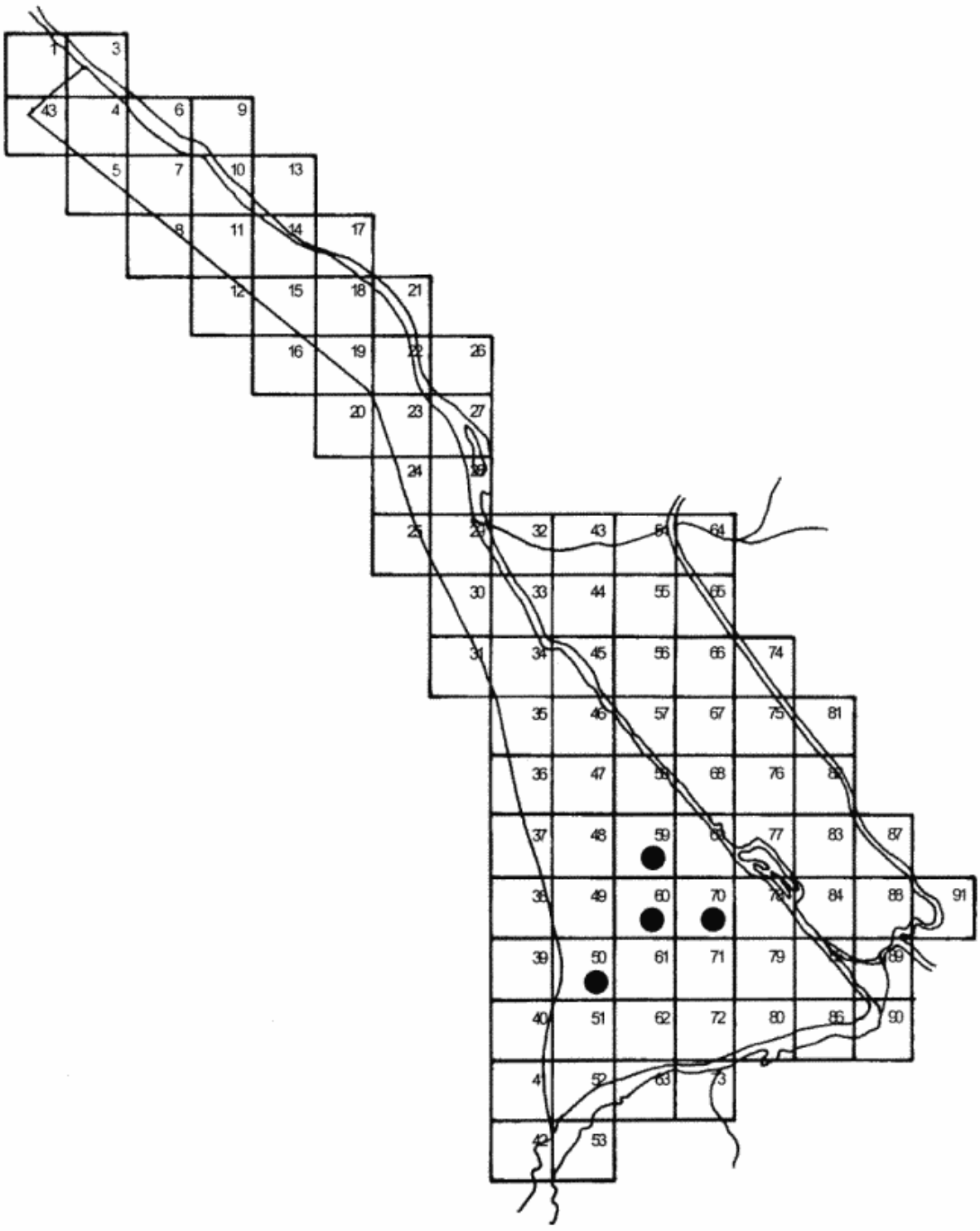


Figure 11: Distribution of Bushbuck.

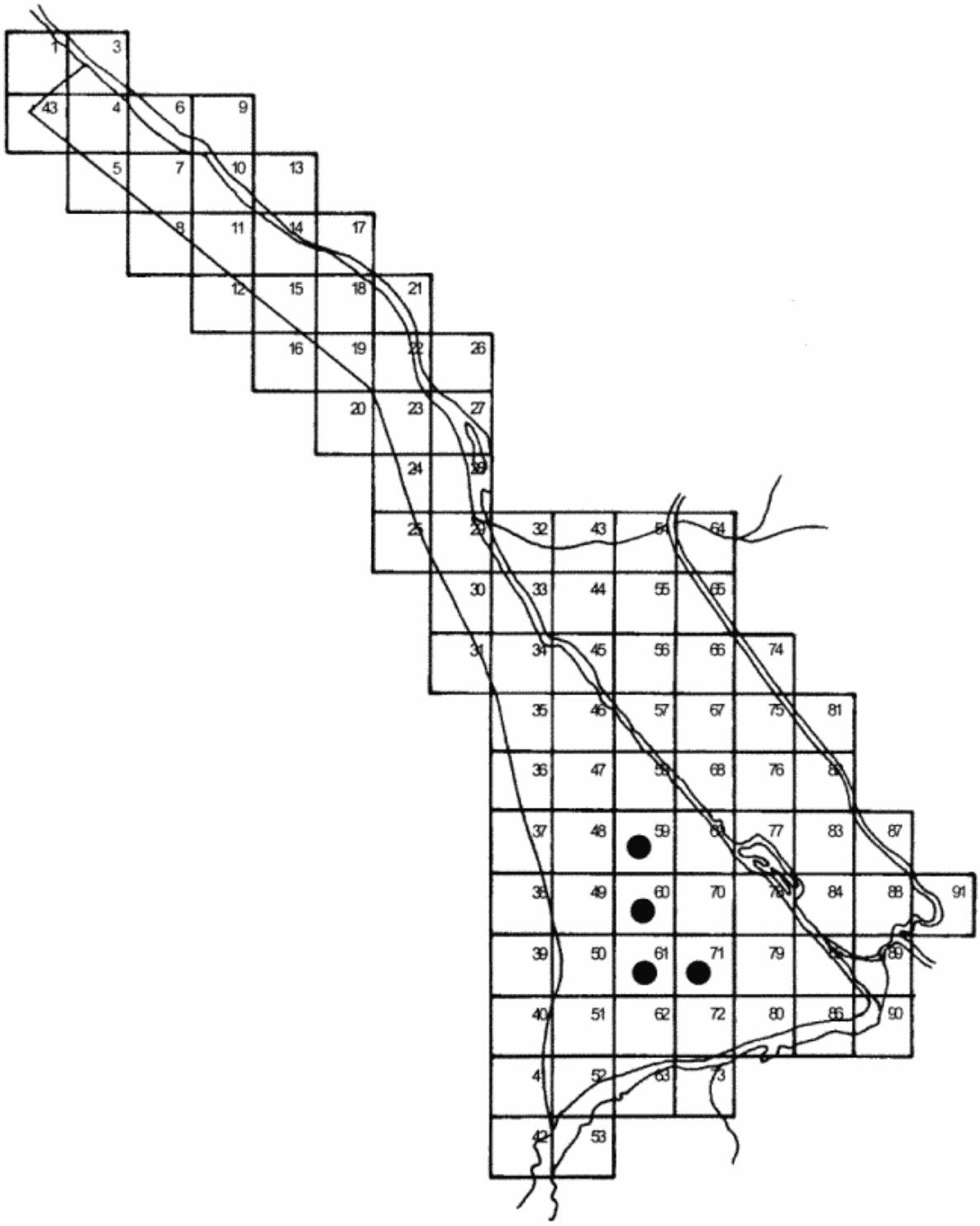
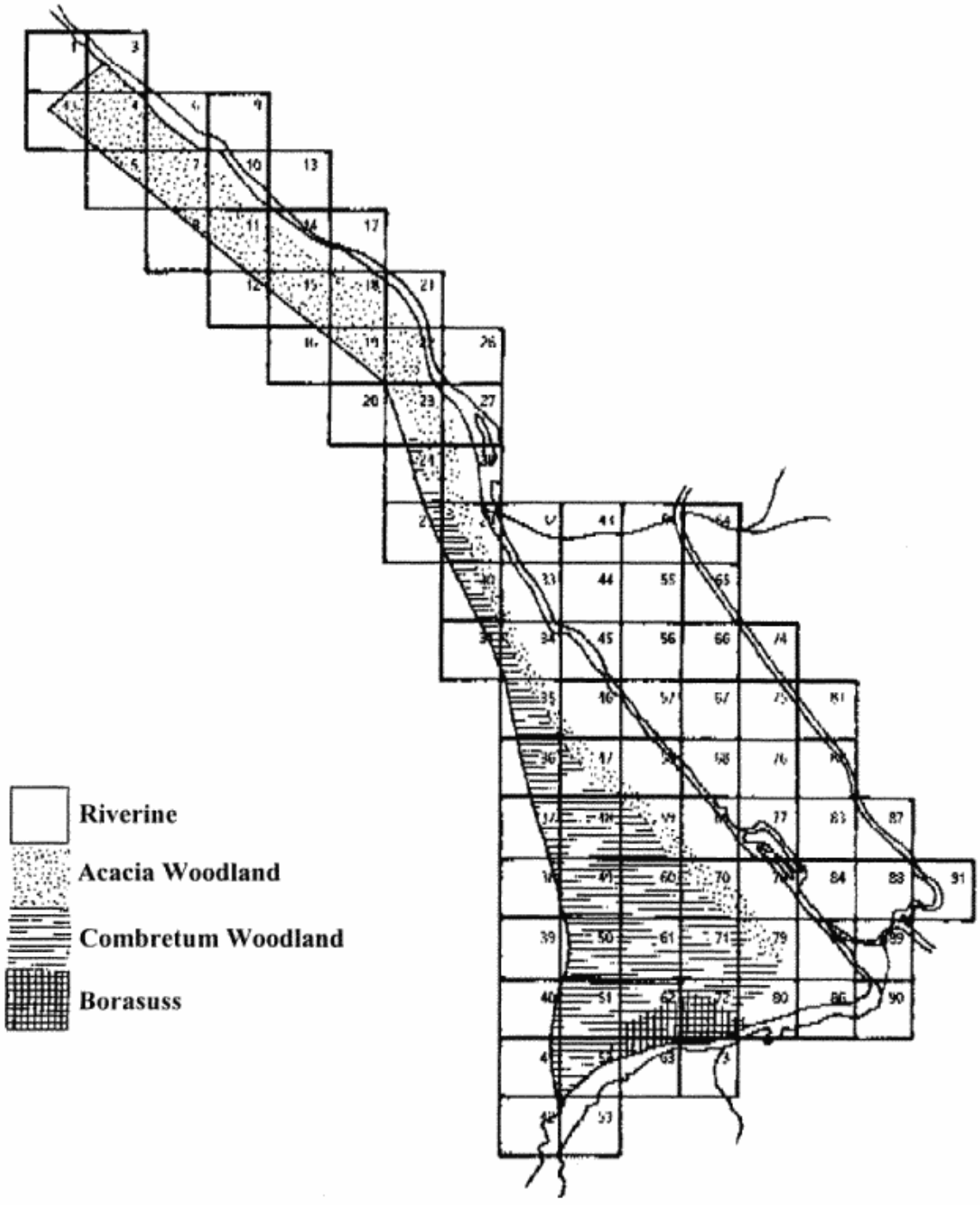


Figure 12: Major Vegetation Types



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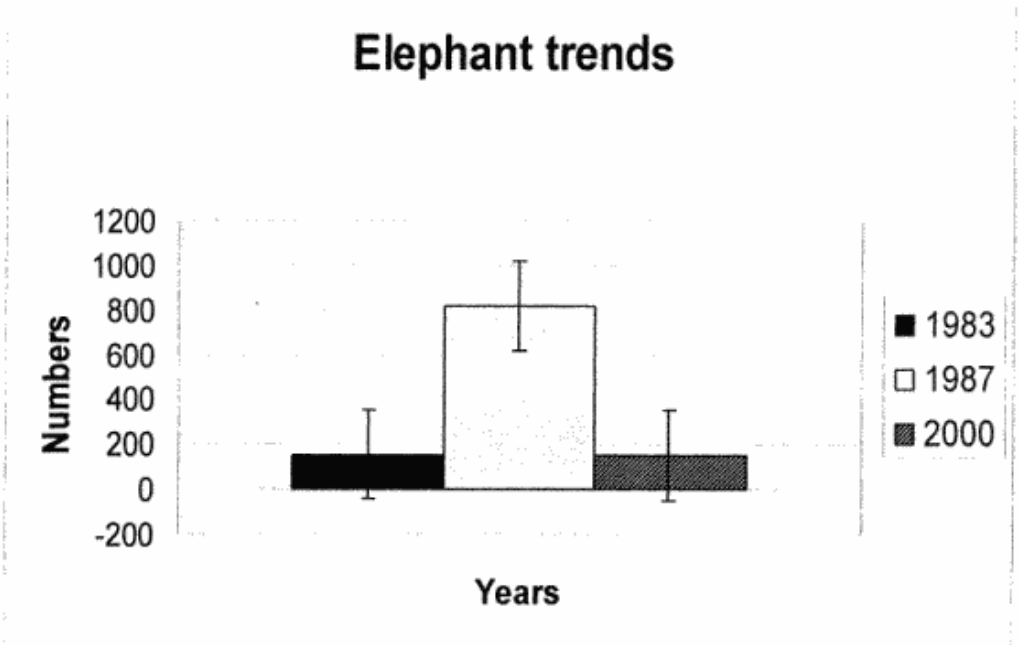

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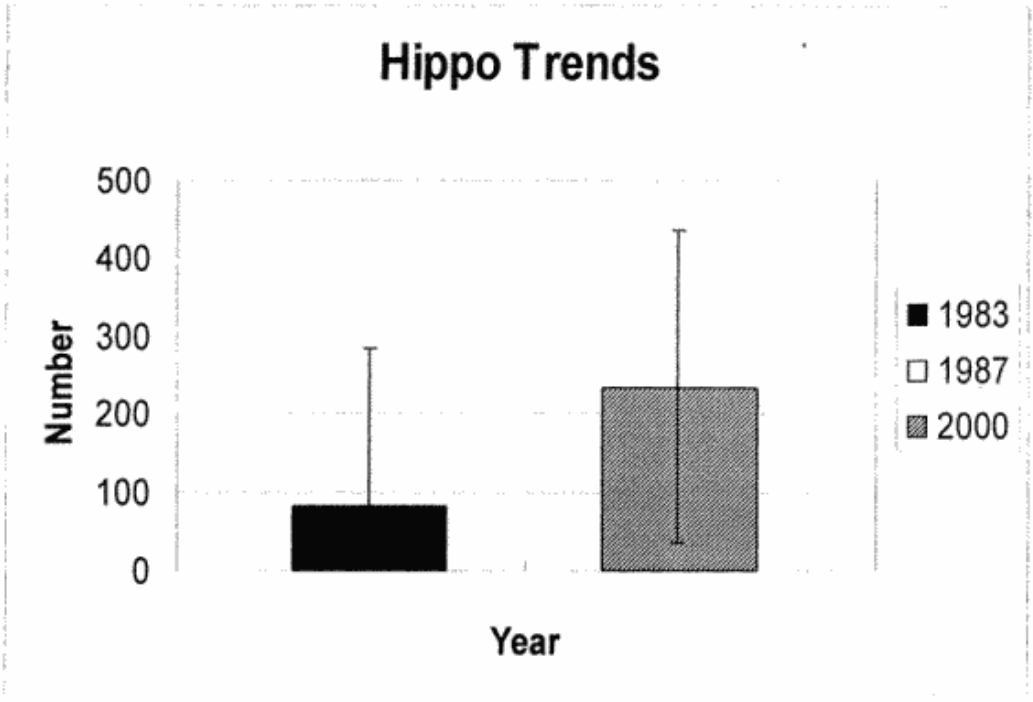

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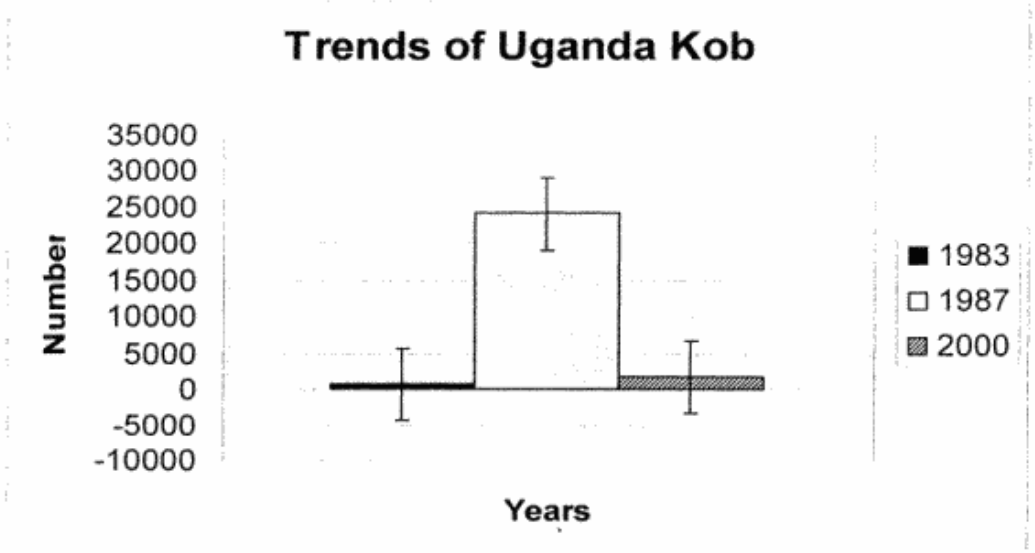

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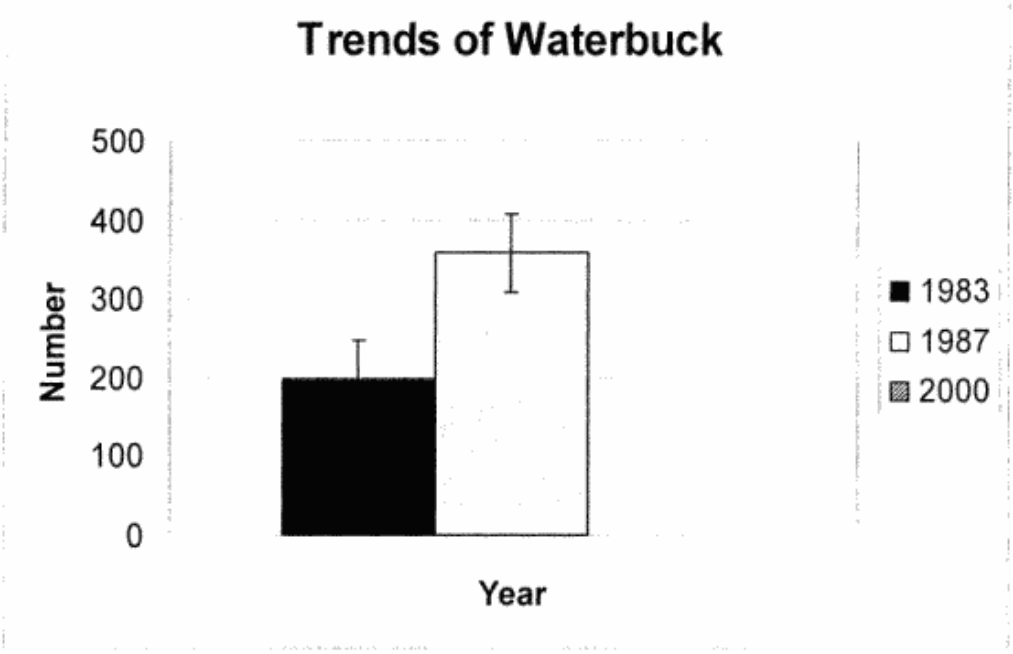

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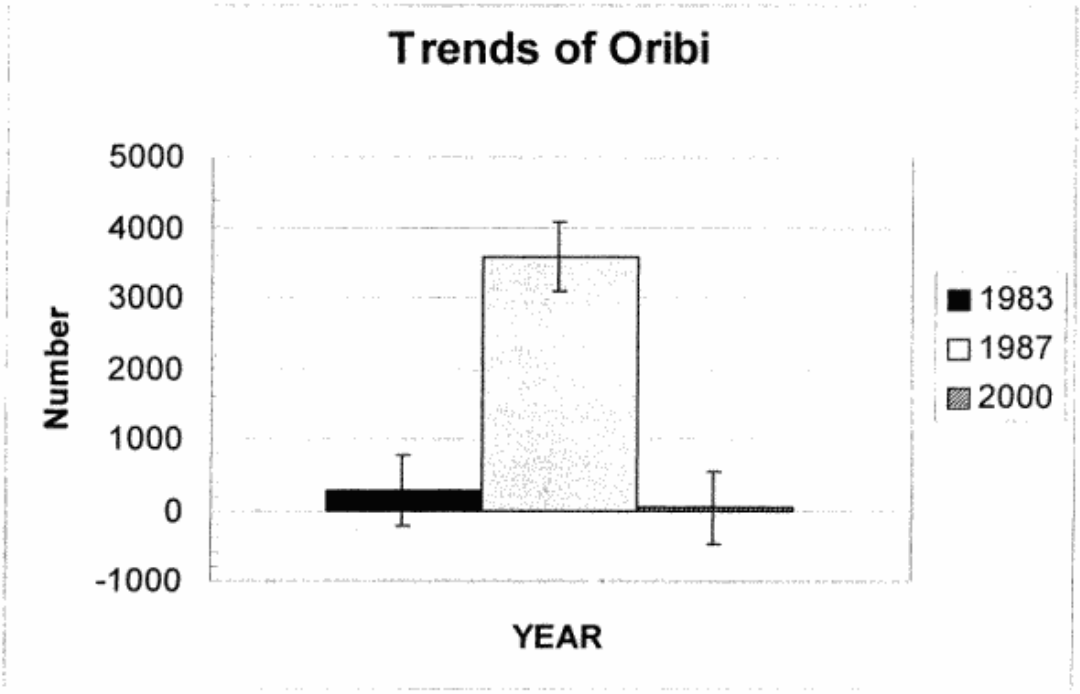

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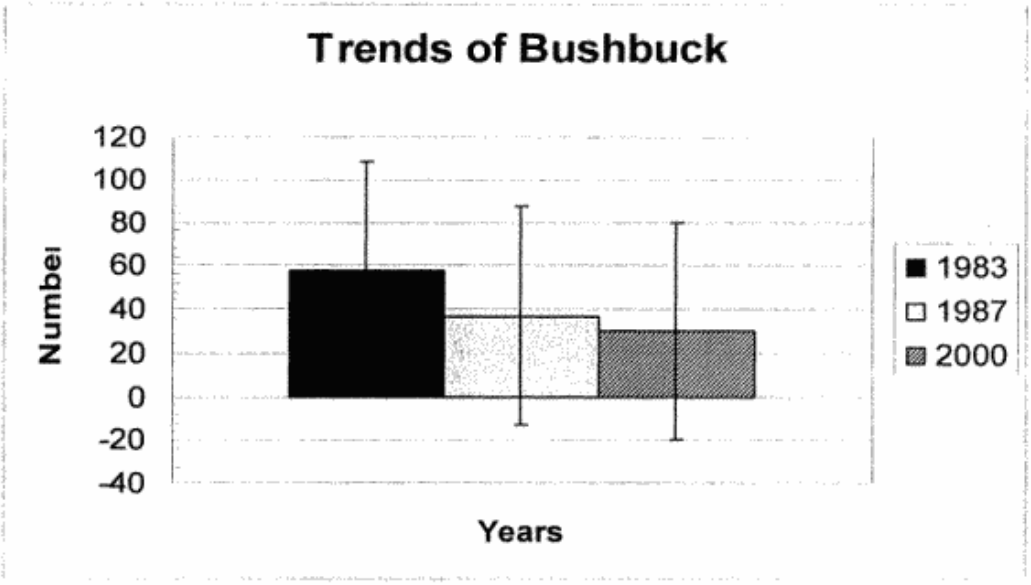

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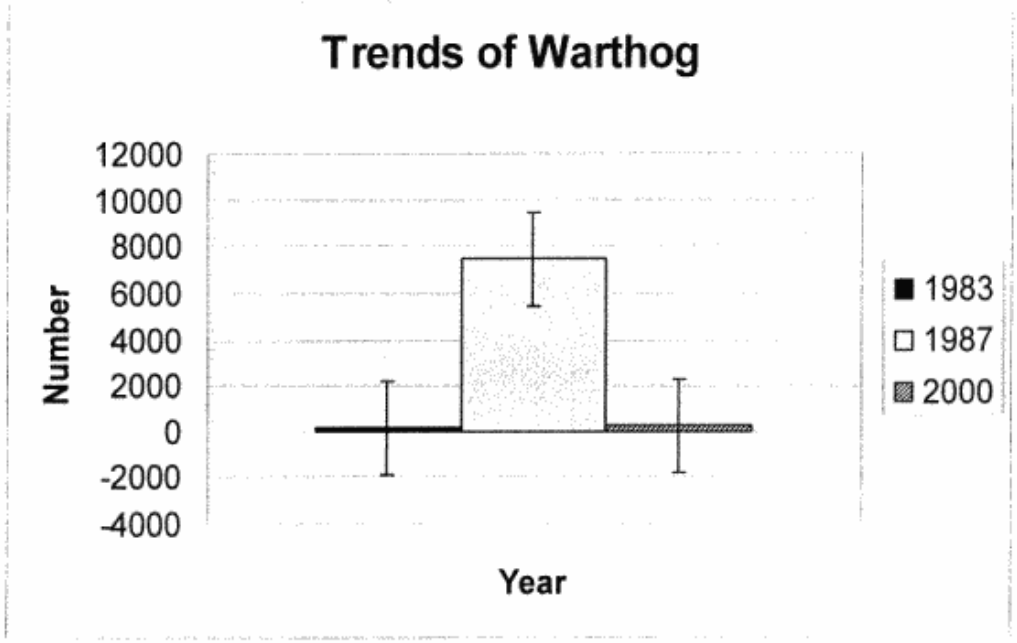

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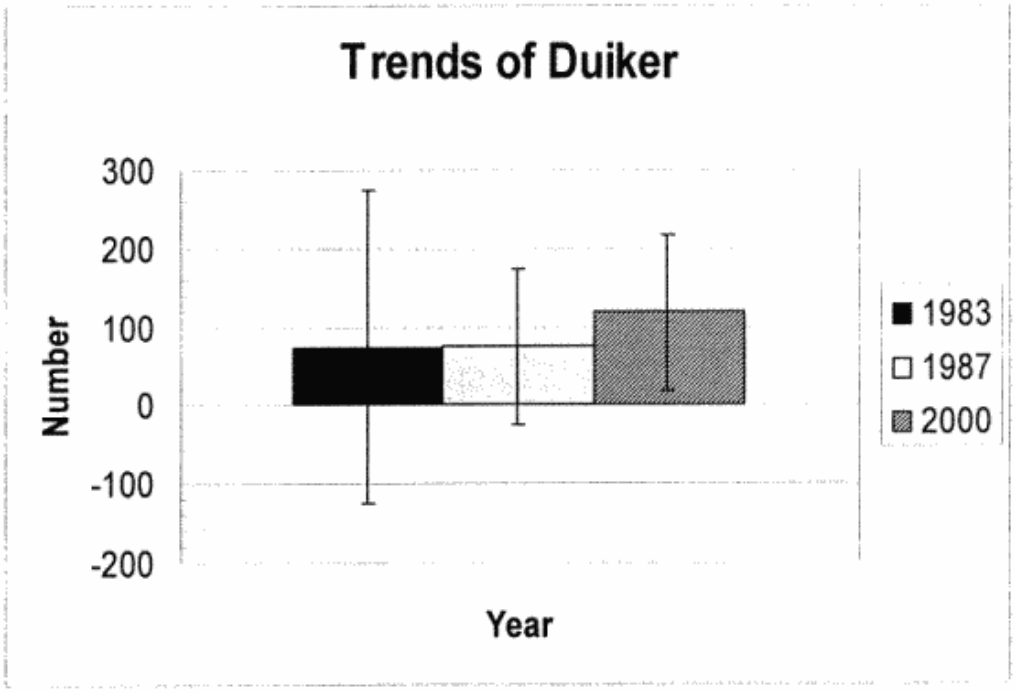

DISCUSSION

The results of this survey indicated the following:

4.1. Methodology

Line transect method was used throughout the period of the survey. Although total ground counting technique on foot was proposed in the original methodology, the thickness and height of vegetation made it difficult. The survey was conducted in the rainy season where the height of grass and vegetation thickness affected visibility and animal sightings were impaired. Animals in the park are so nervous that the flight distances was great (>300m). These two factors affected direct counting results. The indirect count on the other hand had the advantage of the season, as it was easy to see and identify footprints and other animal signs. There were no significant differences in the results of these two techniques for Uganda kob ($t=5.07$, $p>0.05$).

The foot technique facilitated the survey overcoming the problems of inaccessibility for vehicles. It was made easier due to the small size of NNP. It would be suitable for other protected areas in South Sudan because the situations are more or less similar as all Protected Areas suffered from lack of ecological management over the last two decades.

The direct count figures are believed to be underestimated; the Park is a highly disturbed area and as such animals are weary, any sight of human being sends the animal running away. There were too many accompanying guards who at times are noisy. This could have sent many animals away before being spotted.
There was the element of grass and vegetation height and thickness. All these meant that fewer animals were seen than the actual numbers.

The indirect count may have been over estimated; repeated count of dung piles, footprints, pellets or droppings. There was also a possibility that some animal species were included into other species as it was difficult to distinguish the footprints or the droppings between two or more species in some cases. The 1983 and 1987 data collected by Kenyi and Abdalla respectively is doubtful as the methodology used and area covered were not clearly explained. This could have affected the interpretation of the population trends between these years to the year 2000. However, future use of this method needs aerial backup where possible especially in large Protected Areas e.g. Boma and the Southern National Parks.

Dr. Günter Merz[1] and students of the University of Juba used elephant dung counting in the NNP in 1984 to estimate elephant numbers in the Park. This method is now mainly used for estimating elephants abundance in forest habitats where sighting elephants is difficult. However, in this study it has been used for estimation of elephant density because at the time of the survey, elephants have already left the Park towards their wet season ranges.

Hippos were counted from the riverbank based on method used by Tembo (1987). This method suffered limitations: (a) hippos in NNP are equally timid like other species and (b) dense vegetation specially the papyrus which, impeded visibility from the riverbank. Hippopotamus graze 5 km from the river frontage and thus has a nocturnal terrestrial density per km^2 (Tembo, 1987). In this study footprints were counted along transect line for distances up to three km from

[1] Dr. Gunter Merz, former Lecturer at the Department of Wildlife Science, University of Juba, South Sudan.

the riverbank with estimated density of 3.33/km^2 and when compared with the direct count there were no significant differences between the results (t=5.766, p>0.05).

4.2 Animal populations and trends

The survey was conducted during wet season by which the migratory species such as the elephants would have normally left the Park. Although the survey targeted three species viz. Elephant, hippopotamus and Uganda kob, other species encountered were recorded. The overall assessment indicated that the area still harbors considerable wildlife resources both animals and bird life and needs urgent protection and management.

4.2.1 Elephants

During the survey period elephants have already left the Park towards their rainy season range. An expedition team was sent tracing them and large herds were found in the area extending between Pageri and Moli. Dung survey indicated total population of 156 ± 69 estimated with a density of 0.61 ± 0.27 elephant per km^2 were using the park prior to the survey.

From Fig (4) elephant distribution covers most areas of the Park closer to the Nile and associated with Acacia vegetation. There is lack of elephant signs at the western and northern parts of the Park. This is because these areas lack enough sources of water on the one hand, and heavy poaching activities on the other hand. Poachers who snick into the park from Uganda always disturb the western side, whereas locals who desert their SPLA units and camouflage into the Park according to local information frequent the northern side. The disturbances that resulted from the 1994/95-war pressure for the control of Nimule Corridor affected the elephants severely to the extent that even the resident herd which, used to remain in the Park throughout the year became migratory (Fig. 5).

Fig (13) shows the elephant population trend for 1983, 1987 and 2000. By this comparison there were more elephants in 1987 than 1983 and 2000 combined. This could be due to a number of reasons: First, the neighboring country of Uganda was at war and many elephants may have moved from there into NNP for safety. Second, at that time also at Sudan's Eastern Equatorial District of Torit, the wet season ranges of (Opari, Moli, Owinybul, and Panyikwara) were populated. And thus their migratory routes may have been blocked so most of them remain in the Park. For 1983 and 2000 figures this could be explained as a result of migration to the neighboring country or movement to the wet season ranges. Currently the main dangers facing the elephants in their movement between the Park and their wet season ranges are landmines and poaching.

4.2.2 Hippopotamus:

There were no counts for 1987; the figures for 1983 and 2000 (Fig 14) differed by the factor of 1:3, despite the fact that hippos have been under heavy hunting pressure since 1994. The reason could have been that Kenyi (1983) only counted hippos at the two known hippo pools. Whereas in the present study a large portion of the Nile (3km) within the Park was covered in addition to the known pools already mentioned above. Heavy cropping of hippo population would result in an increase in calf production through decrease in calving intervals and in age of puberty (Marshall and Sayer, 1975; Tembo, 1987). Therefore, the present hippo population of NNP would recover if given chance to rest from hunting pressure.

4.2.3 Uganda kob:
There were slightly fewer Uganda kob in 1983 than in 2000 (Fig 15), but much more in 1987 almost six times of 1983 and 2000 combined. The smaller figure in 1983 could be due to the smaller area covered (road counts confined to the southern part of the Park). The low figures for 2000 are due to high mortality rate resulting from excessive and intensive hunting during the immediate previous years.

4.2.4 Waterbuck:
Compared to 1983, the waterbuck almost doubled in 1987, and yet there was no any single observation in 2000 (Fig 16). There can only be two reasons: either they have migrated out of the Park to safer areas or have been shot out completely.

4.2.5 Oribi:
The rise of the population of oribi from 1983 to 1987 and the subsequently decline in 2000, can be attributed to good previous protection of the Park and heavy hunting thereafter until 2000 respectively (Fig 17).

4.2.6 Bushbuck:
The retrogressive decline of the population trend of the bushbuck from 1983 to 2000 can be due to two reasons; the outbreak of Foot and Mouth Disease (FMD) and heavy hunting pressure after 1987 (Fig 18).

4.2.7 Warthog:
The population trends for warthog is similar to that of Uganda kob, low in 1983 and 2000 and high 1987. The reasons are that smaller area covered in 1983 and heavy hunting pressure from 1994 to 2000 (Fig 19).

4.2.8 Duiker:
Since 1983 to 200 (Fig 20), there seem to be slight increase in population of duiker. The increase from 1983 to 1987 was due to protection provided for the Park. The increase thereafter, can be explained by the fact that duikers are cryptic by nature and can easily change their behavior. It is possible that they adapted to hiding during the day as such they managed to escape the hunting pressure.

4.2.9 The Monkeys and Other Animals
The numbers of monkeys continued to increase due to the fact that there is no market for their meat and they are arboreal and hard to hunt. Other animals are nocturnal and they can not be easily hunted.

4.3 Vegetation: (Fig 12)

Vegetation sampling was carried out with the aim of obtaining an overview of plant distribution, species composition and structure. This would give a clear indication of the status of habitat and tree communities in the Park. Three types of vegetation associations were investigated viz.: Riverine, Acacia and Combretum woodlands. Observations on impacts of elephants, fire and human were also recorded and analyzed as well.

Plants were classified as trees based on the diameter at breast heights (>20cm) regardless of their heights. This is because most of the Park's area suffered heavy burning and woody vegetation are regenerating with shrubs and multi-stem shrubs and there was a need to assess tree habitats which, are important for elephants. Importance values (the sum of frequency, density and dominance) were used to assess the importance of dominant trees and description of habitats within the Park. Tree mortality observed were caused either by fire or elephants which, uproot or push trees down. Most trees were of heights less than 7m; therefore the habitats were of scrub type according to Pratt (1969); and Elton and Miller (1954). Scrub habitat type is a vegetation community composed of tree stands between 2-8m high, include scrub, shrubs and saplings. This gives the impression of a younger and healthier plant community.

4.3.1 Acacia Association

This habitat extends along the Nile and up to 1-1.5 km from the riverbank. It consists of mixture of grass and woody plants dominated by Acacia species. *Acacia siberiana* is the dominant species in this vegetation community with relative frequency of 25%. *Acacia hockii* and *Acacia senegalensis* occur intersperse throughout the habitat. *Acacia nilotica* and *Acacia macrocyphalus* are confined to areas north of Faula Rapids. The *Acacia siberiana* dominated habitat is very important for elephants in the Park. Elephants heavily utilize it during their stay in the Park as evident by the damages observed. Other important tree species encountered in this habitat were *Lonchocarpus laxiflorus, Kegilia africana, and Lannea species.*

4.3.2 Combretum Association

This extends from 1km from the river towards the western end of the Park. About 25-30% of the Park's area consists of Combretum woodland, of which, *Combretum collinum* is the dominant species with relative frequency of 48.8%. Most of this habitat is shrubs of 2-5m high regeneration. This regeneration is believed to have been induced by fire. Other combretum species *include Combretum molle, Combretum fragrans, Combretum bracteosum*. Other common species include *Lonchocarpus laxiflorus, Grewia bicolor, Grewia tembensis, Ziziphus spina-christa, Lannea fruiticosa, and Lannea sinensis*. The cryptic animals such as bushbuck use this habitat much for hiding. Also many animal species which, are not adapted to wet conditions take refuge in this habitat during the wet season.

4.3.3 Riverine Habitat

This habitat occurs in a narrow strip of 0.5-1 km along the riverbank. It consists of grass and thickets of Acacia and Combretum woodlands. Right at the riverbank the papyrus grow throughout and forms an important habitat and day hideouts for hippos. The papyrus is also important for human as mats and house roofing materials. From the riverbank, *Acacia siberiana* extends throughout the thicket woodlands. Both of these communities are important for elephants. The thicket woodland is a refuge for bushbuck. Combretum woodland occurs intersperse and forms important habitat for Uganda kob, which uses this area in the wet season as well as a hiding place from poachers.

4.4 Human activities and impacts

Human activities in the area comprise of fishing, livestock grazing, poaching, fire and tree cutting. No cultivation or human settlements observed within the Park.

Fishing

Fishing activities is practiced in the Nile between the Sudan Enclave up to north of Faula Rapids. Fishermen are organized in fishing camps at specific locations with their numbers (average of six persons) controlled by the Local Authorities. These areas also cover known hippo pools south of

Faula Rapids. Fishermen use nets and canoes, other illegal methods such as use of explosives were reported to have been taking place in the far north of Faula. Fish collected are sold at Nimule market either fresh or smoked. Fish are smoked locally at the fishing camps using firewood collected from the Park or the buffer zone depending on the location of the camp. The main impact of fishing is the disturbance and destruction of hippo habitat.

Grazing

Livestock grazing in the buffer zone is an acceptable practice. This is because there are no clear demarcations of the buffer zone on the ground; and that most cattle owners have moved recently into the area and hence the Park is known only to exist at the western bank of the Nile. Although the grazing is year round, its impact is not high as most of the animals grazing in the area were actually brought for trading and local consumption.

Hunting

Originally poaching in NNP was carried by both locals and those crossing from Ugandan (Abdalla, 1988). However, in 1994/5 there was a war for the control of Nimule / Assua Corridor, there was then official orders for some animals to be shot to supply rations. This was then followed by Permits by NSWA to kill hippos. Now it appeared poaching has been rapid and its effect is felt at the western side and in the northern end just few kilometers from Faula Rapids and in the buffer zone. This was evident by the empty bullet cartridges, animal carcasses and the presence of stone-made meat drying stoves found along the line transects. Poaching was spread because (a) arms are readily available; and (b) few ill-equipped game personnel posted in the Park and therefore can not patrol the Park effectively. Animals killed can not be quantified as many killings were neither reported nor recorded due to involvement of many people. But the current animal population trend is an indication of how severe the hunting is. The long term impact of hunting is the depletion of animal population.

Human survey

Human survey was carried once in Nimule Town where a sample of 100 persons was interviewed through questionnaires. The respondents were drawn from six socio-economic groups made up of local communities, IDPs, and civil workers. Number and stability of these groups are estimated as follows:

Socio-economic Group	**Population size**	**Stability**
Local communities	>8000	Increasing
IDPs	>40,000	Decreasing
Civil workers	N/A	N/ A

N/A Not applicable

Results indicated that there is a general sympathy for the protection of the Park. Majority of the respondents has knowledge of the Park's current situation. It appeared that the main uses of the park are fishing, hunting, fruits collection (especially that of Borassus palm), wood collection and/ or passage through to Uganda. Fish was rated was rated as top among the benefits currently derived from the Park followed by wood, grass and game meat (mostly from hippo and kob). For the latter, many expressed willingness to stop and / or discourage hunting. Most respondents have the general feelings that the area should continue to be used for conservation purposes and much expressed readiness to offer support for conservation activities within the means available to them.

Other illegal human activities include cutting of trees especially Borassus species, which, is commonly used for building traditional canoes and also used in roofing houses.

The detrimental effects of human activities require strict control for NNP where there are human population or settlement in the park, but poaching is high. This does not however, restrict some limited use of the buffer zone, such as collection of building materials, fuel wood, grazing and fishing along the river. The goal of the NSWA should be geared to enable the animal populations to recover before any non-consumptive forms of wildlife utilization.

5. CONCLUSION AND MANAGEMENT RECOMMENDATIONS

The survey has established baseline information on the current status of the Park. The Park is still viable and harbors a considerable wildlife resources both animals and bird-life. There is an urgent need for conservation and management measures. The NNP is small in area and under full control of the SPLM/A, the success of protection here poses a challenging measure for the other areas such as Boma and the Southern National Parks which, are rated among the largest in the continent. The following measures are therefore suggested:

Short-term measures

- Protection of the remaining wildlife resources and their habitats through the development of a strong conservation force and effective control of poaching.
- Immediate provision of field supplies to the field force currently deployed in the Park: Food rations on basis of food for work is an important incentive to keep the game rangers in the Park, this can be done through consultation and coordination with NGOs ion the area. Other important supplies include uniforms to, canvas and mosquito nets.
- Opening of more patrol posts and increase of foot patrols especially in the western and northern sides of the Park.
- Provision of a motorboat and fuel for quick and safe mobility.
- Rehabilitation of the guest house, offices and the School buildings, which could be utilized in the training of wildlife conservation forces.
- Provision of communication and transport means.
- Creation of educational and environmental awareness in the area. This to be designed and implemented by the NSWS, NSWA in collaboration with the New Sudan Education Authority as well as the Civil Authorities in and around the area.
- A dry-season count is to be conducted to compare with the current results and to establish facts over what changes take place over a season. Then seasonal game counts to be conducted for monitoring population trends. The current park staff would need further training in order to carry such exercise.

To implement the listed short term recommendations; training, motivation, continuous support for anti-poaching operations and supply of field provisions, there is need for the involvement of the local community and continuous contacts with Uganda wildlife Authority in order to Coordinate programs.

Short/long-term measures

- Improve and encourage the already existing cross-border cooperation with the Ugandan Wildlife Conservation Authorities especially in the field of joint patrol specially between NNP and the adjacent protected Areas on Ugandan side (see appendix III).
- Detailed investigation of elephant situations in their wet season ranges outside the Park.
- Creation of training program for both men and officers of the wildlife services.
- Mobilization of resources from within and outside for the conservation, management and utilization of the wildlife resources in particular and other natural resources in general.
- Draw and maintain master plans for the management of NNP. This can be prepared by the survey team in cooperation with the local community and authority. The document should contain plans for improvement of administration, management of resources and tourism development.
- Encouraging interested parties in the area to develop management plan for tourist industry.

- The NSWS should work closely with the NSWA in order to effect overall rehabilitation and development of the Park.
- Creation of research unit to continue with research programs already in place, follow up the implementation of findings and recommendations and monitor the progress on the ground.

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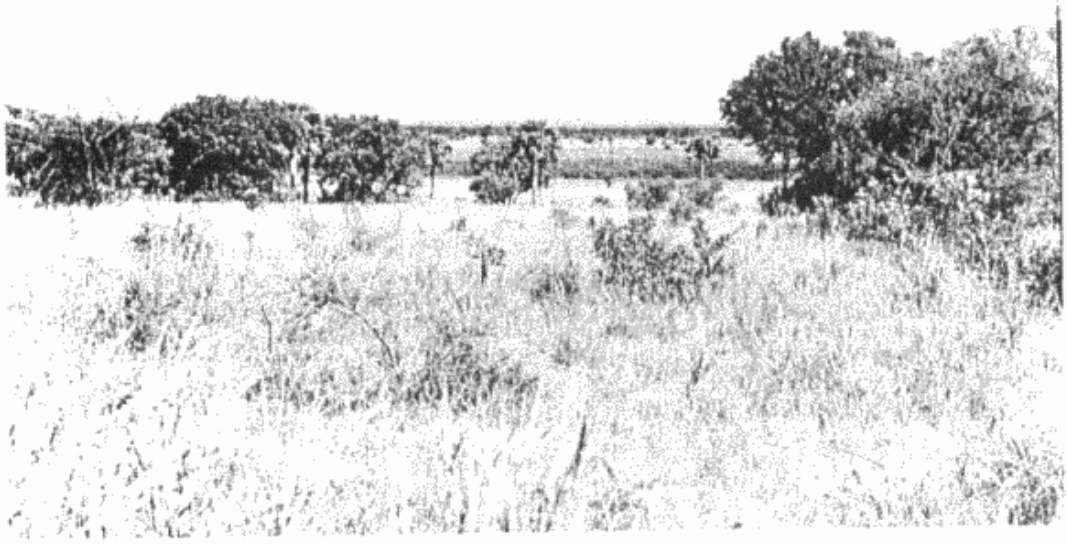
APPENDIX 1: Elephant Dung Analysis

Table 1: Analyzed Transect Data for Elephant Dung in Nimule National Park.

Transect	Length	Sightings	Estimated Density	95% CL	Coefficient of Variation	F(o)	Var (F(0))
1	1.7	3	217.409	363.818	85.38	0.2464	0.024019
2	2	120	13974.447	4164.015	15.20	0.4658	0.003207
3	0.4	0	0	0	0	0	0
4	2	112	13478.18	3852.038	14.58	0.4814	0.002858
5	2.5	37	3789.785	1855.387	24.98	0.4957	0.008691
6	2.5	80	4495.448	1564.076	17.75	0.3266	0.001792
7	2.01	157	15692.412	4127.622	13.42	0.4018	0.001879
8	2.5	28	294.461	1947.683	33.77	0.3801	0.010456
9	2.5	68	5732.770	2890.364	25.72	0.4013	0.008288
10	2.5	46	6268.394	3323.692	27.05	0.6636	0.022219
11	2.5	12	3616.841	4714.984	66.51	0.2025	0.014045
12	2.6	3	317.406	561.71	90.29	0.1904	0.017478
13	2.5	0	0	0	0	0	0
Total	**28.21**	**666**	**67877.55**	**29365.39**	**414.65**	**4.2556**	**0.114932**
Mean	**2.17**	**51.23**	**5221.35**	**2258.876**	**31.89**	**0.3274**	**0.008840**

ANNEX 2: PHOTOGRAPHS.

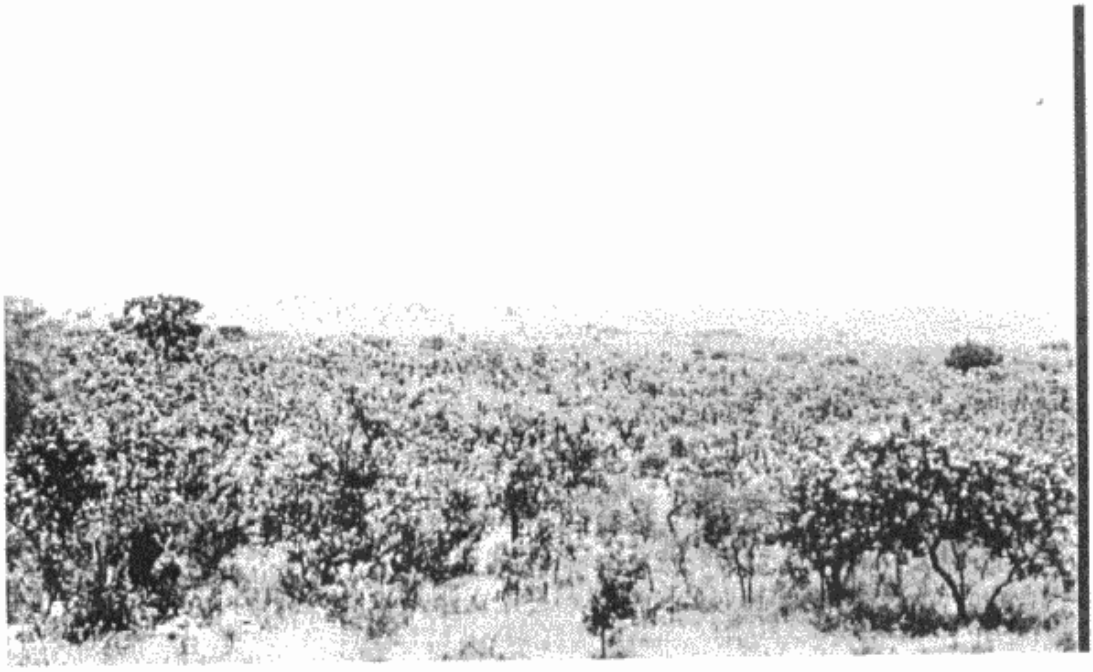
PHOTOGRAPH 1: Acacia thicket preferred elephant habitat.



Photograph 2: View of Bushed grassland at the southern side of the Park. This habitat locally known "Mattar" preferred by Uganda kob.

PHOTOGRAPH 3: Riverine habitat, important for hippopotamus.

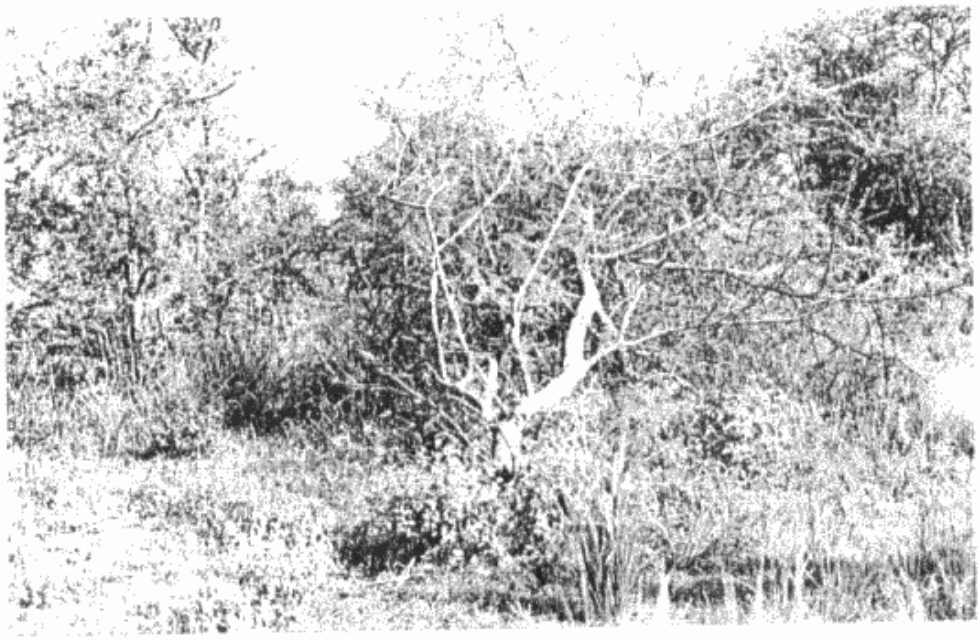
PHOTOGRAPH 4: Faula Rpids – Major attraction for tourist development in the Park.



PHOTOGRAPH 5: Wooded grassland.

PHOTOGRAPH 6: Elephant dung and footprints.

PHOTOGRAPH 7: Tree cutting is one of major human impact in the Park. Borassus Tree is one of the important elephant foods, is being used for canoes and building materials.

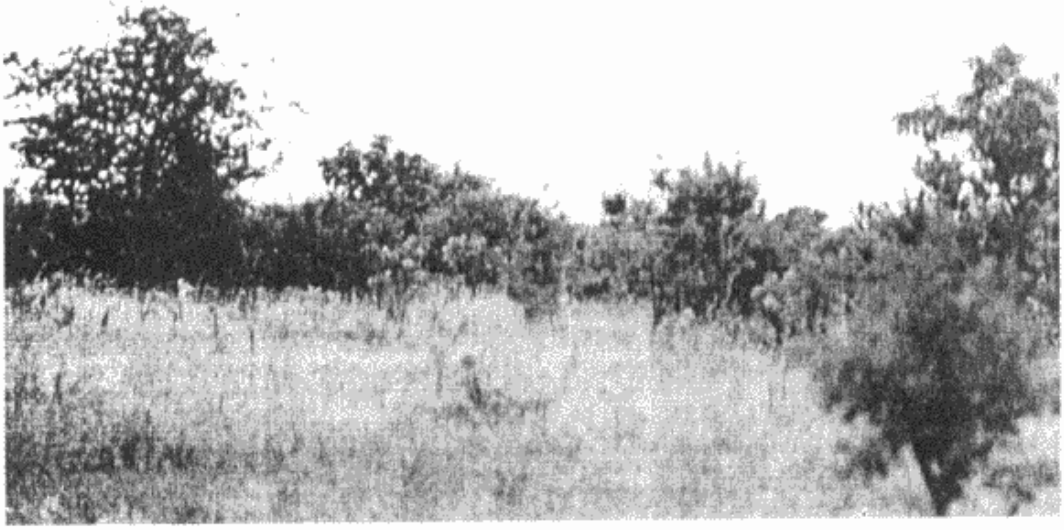


PHOTOGRAPH 8: Acacia tree pushed by elephant damage.

PHOTOGRAPH 9: Elephant damage.

PHOTOGRAPH 10: Fire effect on vegetation.

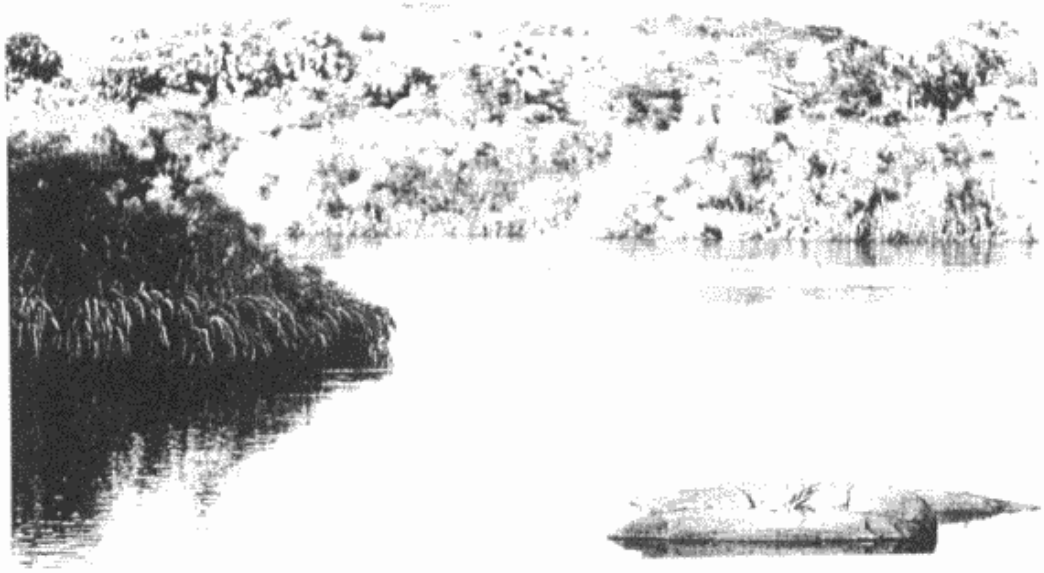
PHOTOGRAPH 11: Herd of Uganda kob.



PHOTOGRAPH 13: Group of alerted Uganda kob.

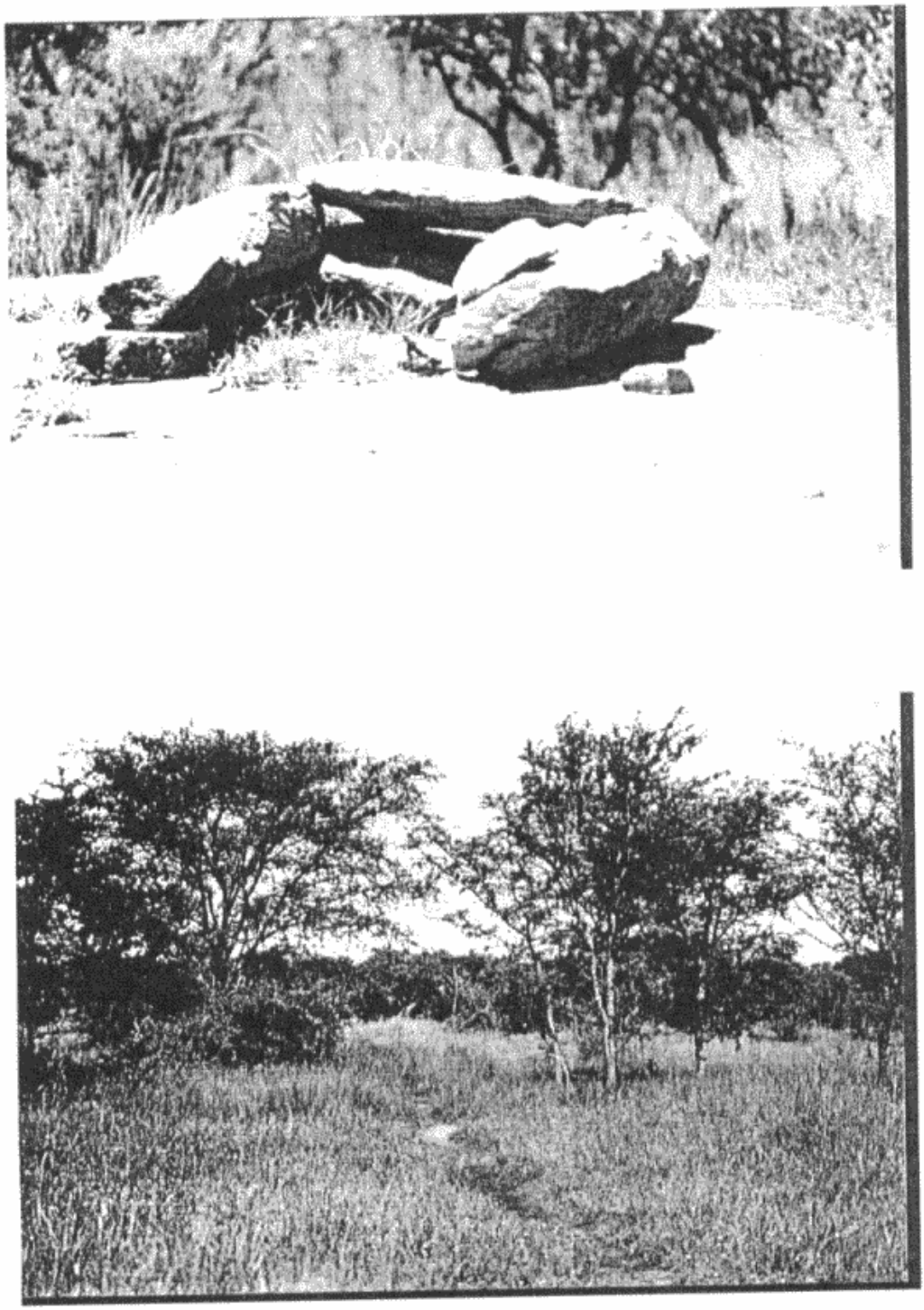
PHOTOGRAPH 14: Uganda Kob feeding in thick bush grassland.

PHOTOGRAPH 15: Hippopotamus submerged in the Nile River.



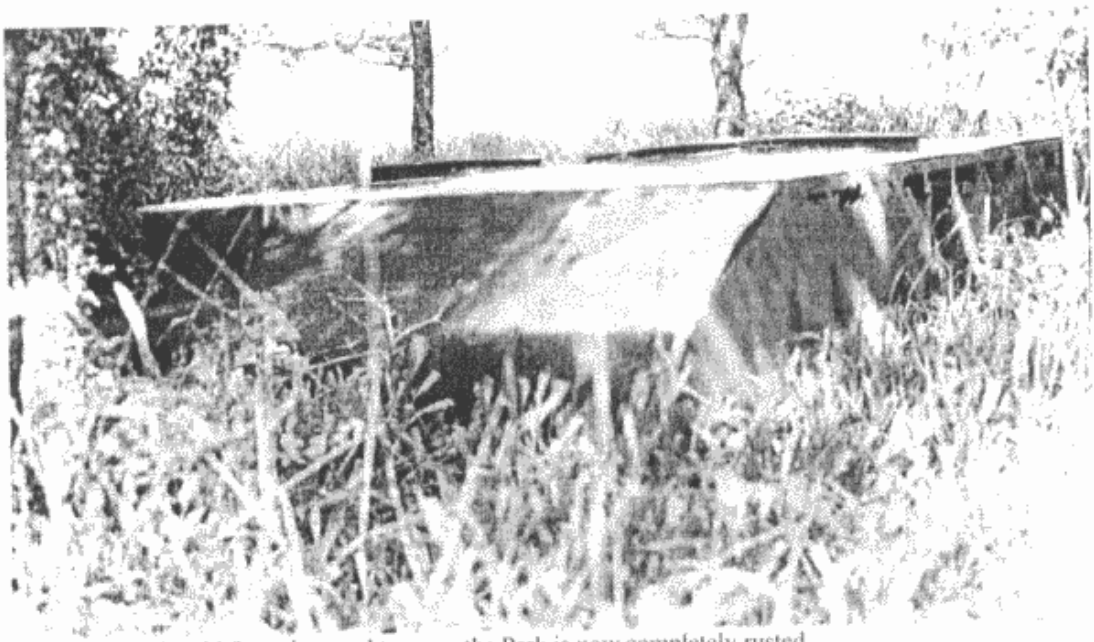
PHOTOGRAPH 17: Hippos swimming in the Nile.

PHOTOGRAPHS 18 & 19: Stove made of Stones used by poachers for drying game meat.



PHOTOGRAPH 20: Human path in the Park used by poachers, sign of illegal human activities.

PHOTOGRAPH 21: Hippo carcass



PHOTOGRAPH 22: The old ferry that used to serve the Park is now completely rusted.

PHOTOGRAPH 23: Fishmongers at fishing camp opposite Faula Rapids.

APPENDAX III

OTZE FOREST WHITE RHINO SANCTUARY
(UWA, 1999)

This is now re-designated the Otzi Wildlife Sanctuary, located adjacent to the western border of NNP, in the Moyo district, Uganda. It covers an area of 187 sq.km. Established by LN No. 106 of 1946, amended by LN No. 117 of 1938 and SI No. 226-9 of 1964. Managed by Forest Department (lead agency) and Uganda Wildlife Authority through Memorandum of understanding.

Current status
It encompasses mount Otze at the border with NNP, Sudan. Vegetation is entirely of *Butyrospermum* savannas. It had supported populations of white rhino, elephant, buffalo and derby's eland. Most of these are now extinct. However, elephants still migrate into the area from NNP in Sudan presumably insearch for the fruits of Borassus palm in the valleys of Otzi Forest. Chimpanzee presence has been confirmed in the riverine forests of Otzi.

The area has been placed in a very high conservation category because of occurrence of high number of restricted range plant species in the area.

There have been contacts between authorities in Otzi and counter part from NSWA in Nimule in Sudan. Also the NSWS has contacted the Department of Wildlife and Animal resource management in Makerere University for joint work between the two protected areas. The potential areas of cooperation identified included:

- Joint anti-poaching efforts.
- Training at various levels.
- Research on transboundary biodiversity programs
- Exchange / sharing of data and information