2010

Parque Nacionale do Limpopo
AERIAL WILDLIFE CENSUS

PARQUE NACIONAL DO LIMPOPO
MOÇAMBIQUE

Index

Introduction

Boma Helicopters of Grahamstown were contacted by staff of the Parque Nacionale do Limpopo to do a helicopter and/or a fixed wing aircraft wildlife survey of the Park. Previously there has been no complete aerial census of Parque Nacionale do Limpopo (Limpopo National Park or PNL) in Mozambique. Three partial surveys were conducted prior to this survey, two in the south western region (Whyte 2004, Hofmeyr 2005) and a fixed wing survey of the Shingwedzi Basin using the Kruger National Park Cessna 206 (Whyte & Swanepoel 2006).

Due to the high costs of using a helicopter and the large size of the Park (1.1 million ha) it was decided to use a fixed wing aircraft and only survey 30% of the park to contain costs.

All large mammal species were recorded as well as burnt areas, domestic stock, villages and any other information that could be of value. Large raptor nests, Crested Guinea Fowl and Ground Hornbill were also included in the survey. Baboons were recorded as single troops.

Methodology

A six seat Cessna 210 Centurion RG was used due to its ability to operate off relatively short unpaved runways. The seating included the pilot in the front left seat, data capture and controller in the front right seat and four observers in the rear seats. The pilot and controller also looked for game when not busy with flying, monitoring instruments or entering data. All data was recorded on a laptop computer using a dedicated census program linked to a Garmin Geographic Positioning System (GPS). At each sighting the program would log the species, sector observed, number, time, date, latitude, longitude, speed and altitude. Any other observations could also be logged in the same way. This data was downloaded as text files and transferred into Microsoft Excel and then uploaded to Arcview Geographic Information Systems (GIS) for the compilation of distribution maps. Only every third transect was flown but the whole park was covered.

Due to cost constraints only 1/3 of the park was counted. The transects were plotted using GIS at 2400 meters apart within the park boundaries and the observers counted any animals seen out to a distance of 400 meters from either side of the aircraft. This would give a transect of 800 meters wide and 2400 meters apart or 1/3 of the total survey area. All transects were calculated and

downloaded to the laptop and the GPS so that the pilot and data capturer could follow the aircrafts path along the transects. The aircraft flew at approximately 100 knots (185 km/h) and at an altitude of 250' (76 m) above ground level. This was according to the methodology as used by the Kruger National Park fixed wing surveys.

Prior to the census each observer was seated comfortably in the seats and the eye line level marked on the aircraft window. By measuring the height of each eye line level from the ground in the stationary aircraft, this measurement was equated to 76.2 meters.

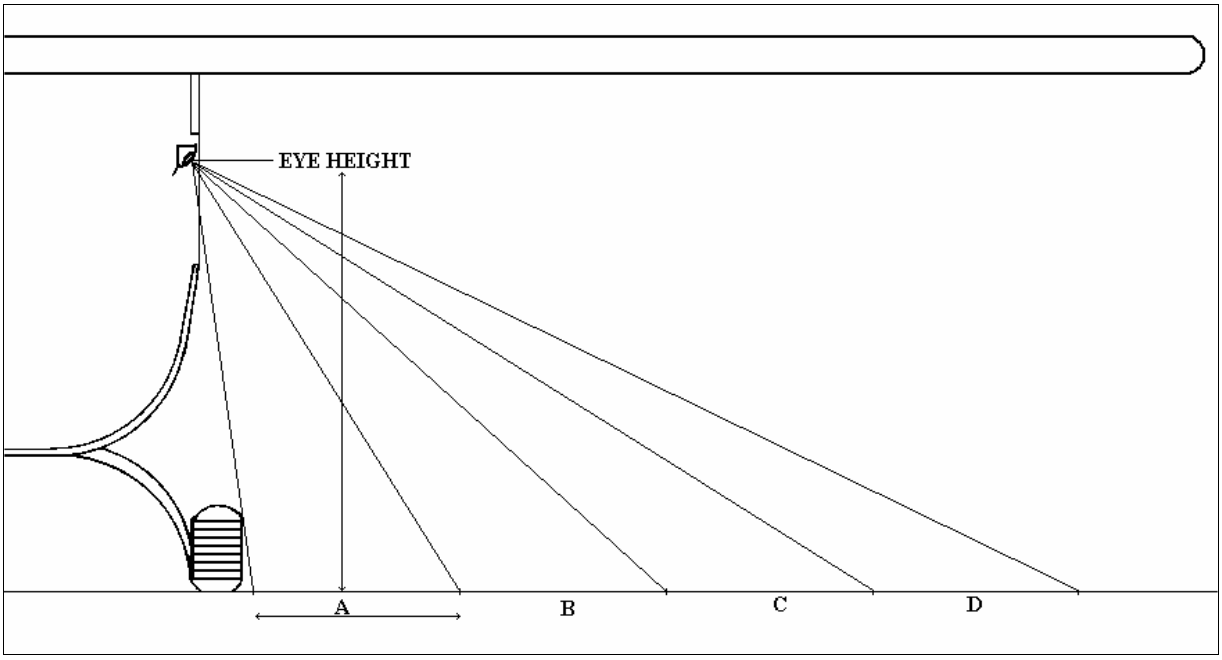

Figure 1: Distance measurements of the observers.

The corresponding measurement was then transcribed to a measurement equating to 100, 200, 300 and 400 meters ranging out from the aircraft. This would then give the observer a guideline when spotting an animal as to how far it was from the aircraft. Each 100 meter sector from the aircraft was recorded as A, B, C and D with A being the first 100 meters. Measurements were taken from the stationary aircraft approximating every 100 meters away. The observer would then indicate where the outward lines were according to his sighting and a line was drawn on the aircraft window and marked accordingly.

Figure 2: Marks on aircraft window to assist with range.

On the first flight a demonstration was conducted to familiarize the observers with the methodology and a laser range finder was used to check distances as seen by the observers.

Throughout the census a laser range finder was used to ensure that the height and distance were reasonably correct.

As the aircraft flew along the transects the observer would see an animal or animals and call out the species, sector distance in A if within 100 m of the aircraft and the number of animals if more than one. The coordinator/data capturer would check initially to see if the distance was correct using a laser range finder and acknowledge each observation.

The transects were loaded onto the GPS which the pilot could follow and were also visible on the laptop computer. As each sighting was recorded this information could be seen on the laptop and indicated the species as well as number that had been observed.

Results

Wildlife

Species	Count	Estimate	Density[#]
Baboon troops	13	39	0.004
Buffalo	348	1035	0.096
Bushbuck	7	21	0.002
Crested Guinea Fowl flocks	5	15	<0.001
Crocodile	1	3	<0.001
Duiker	63	187	0.017
Elephant	479	1425	0.133
Giraffe	39	116	0.011
Hippo	3	9	<0.001
Hornbill Ground	60	178	0.017
Impala	119	354	0.033
Jackal BB	2	6	<0.001
Klipspringer	2	6	<0.001
Kudu	211	628	0.058
Nyala	307	913	0.085
Ostrich	91	271	0.025
Sable	40	119	0.011
Steenbuck	24	71	0.007
Warthog	50	149	0.014
Waterbuck	14	42	0.004
Wildebeest Blue	105	312	0.029
Zebra	166	494	0.046
TOTAL	2149	6393	

Domestic Stock

Species	Count	Estimate	Density[#]
Cattle	7551	22456	2.092
Goats	2418	7191	0.670
Sheep	119	354	0.033
TOTAL	10088	30001	

[#] **Density is animals/flocks/troops per km^2**

Statistical Analysis

Jolly's method for unequal sized sampling units was used to calculate estimates and its variance where;

1. **Species**
2. y = count
3. Z = total area km^2
4. z = area of sampling unit km^2
5. R = mean density of animals in sampling unit ($\sum y/\sum z$)
6. n = number of sampling units in stratum
7. N = number of possible sampling units in stratum
8. s^2_y = variance between numbers of animals counted in sampling units(see animal sheets)
9. s^2_z = variance between areas of units
10. s_{zy} = covariance between animals counted and areas of units
11. ∫ = estimate of animals in stratum (Z.R)
12. $\sum y^2$
13. $\sum(y^2)$
14. 1) N(N-n)/n
15. 2) $(s^2_y\text{-}2.R.s_{zy}+R2.s^2_z)$
16. 1*2 = var ∫ population variance of stratum
17. Standard deviation of Var∫ (the standard deviation is the square root of Var∫)
18. Standard deviation X 0.95 (***t***)*2 (n degrees of freedom) ±
19. Upper estimate
    Lower estimate (where lower estimate is less than count then count is lower estimate)

Maps

Distribution maps of all the species recorded are given below including density maps for the more numerous species such as elephant, buffalo, nyala and a map of all wildlife observed excluding domestic stock.

The density maps were calculated using 0.05 degree cells and the animal density plotted in each cell. One cell was approximately 5.5km X 5.5 km as requested according to the Niassa Report (Craig & Gibson, 2004). Each cell was then classed according to the density of animals per km^2 in that cell. The ranges were 0.001 – 0.125, 0.126 - 0.5, 0.51 – 1.0 and 1.001 – 2.0. This would equate to 1-6 animals in a cell for the first range, 7-12 in the second range, 13- 25 in the third range and 26 and more in the last range.

An aircraft 'snail trail' is also indicated in a map showing all the flight paths taken while doing the census except for the ferry flights which were deleted so as not to confuse the detail.

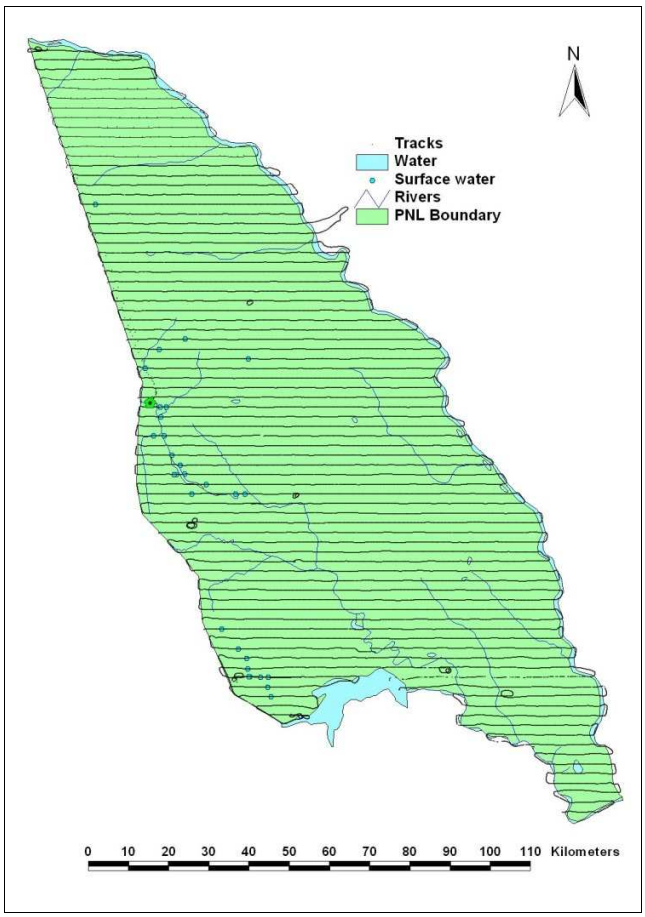

Figure 3: Aircraft flight path during census. Trails to and from airstrips are removed for clarity.

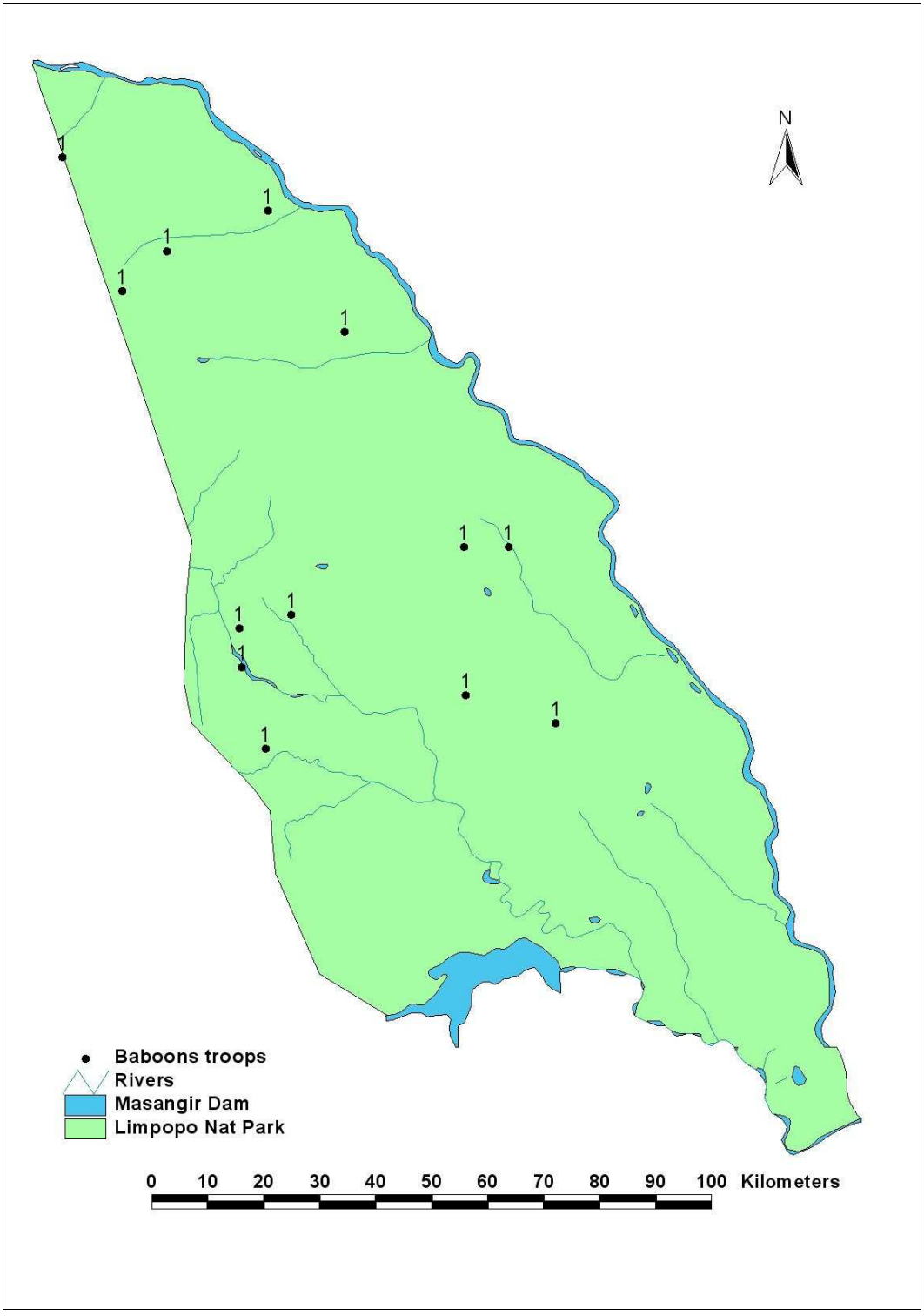

Figure 4: Baboon troop sightings. Each single sighting is one baboon troop and individual animals were not recorded.

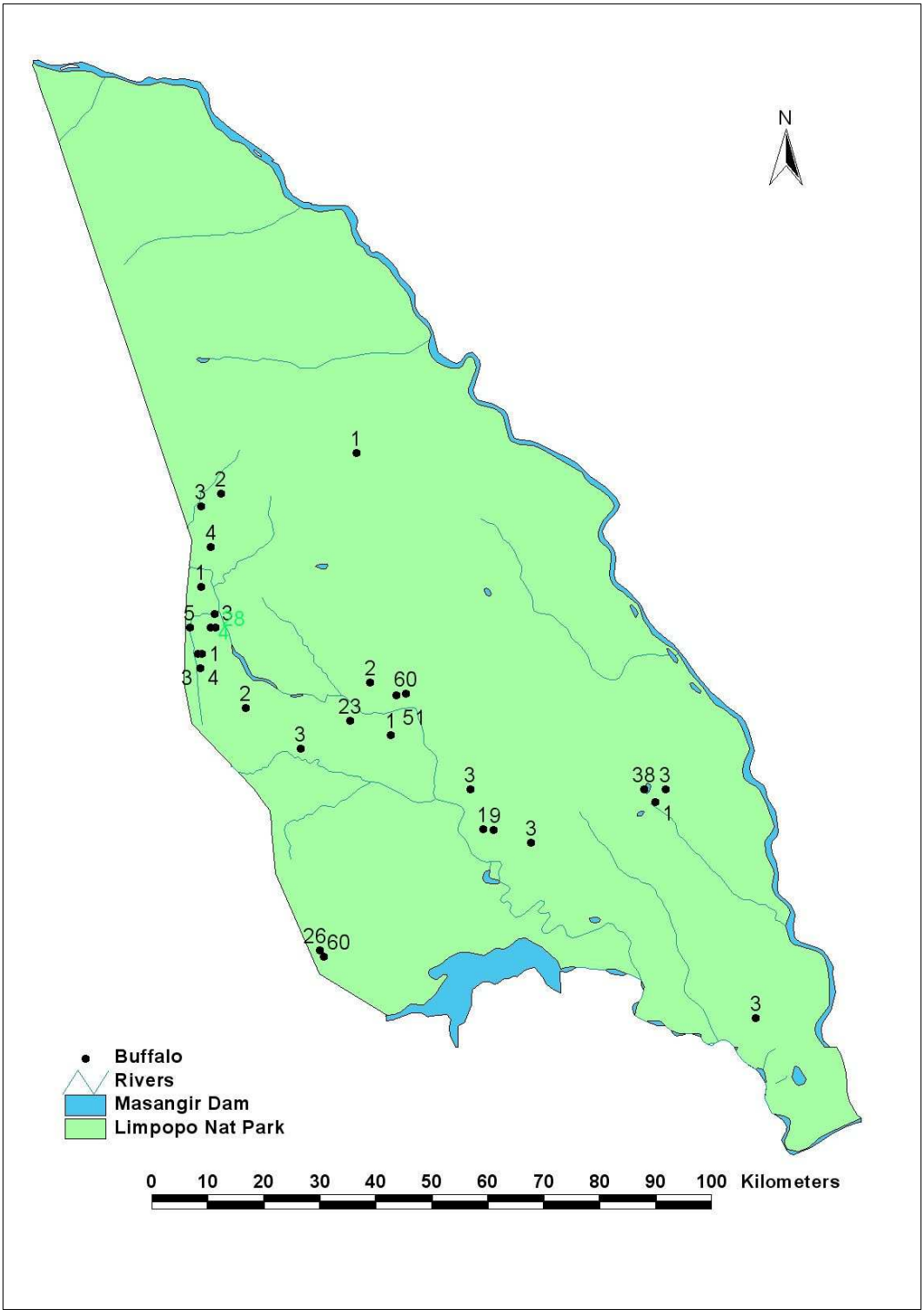

Figure 5: Buffalo sightings with actual numbers observed. Most sightings were close to water except for some lone bachelor bulls.

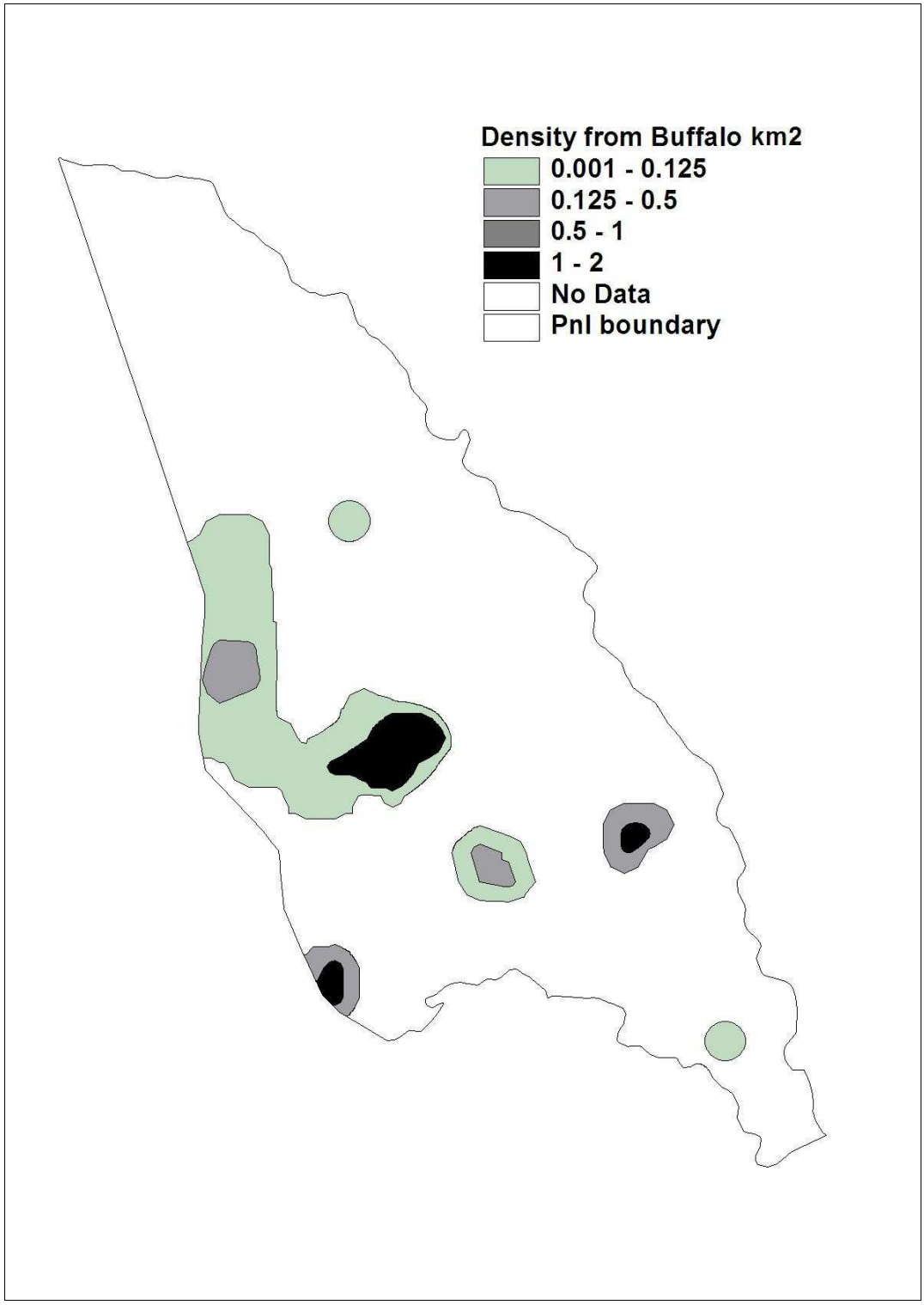

Figure 6: Buffalo density map. Buffalo density varied according to available water as this was the dry season and the animals would probably disperse after the rains.

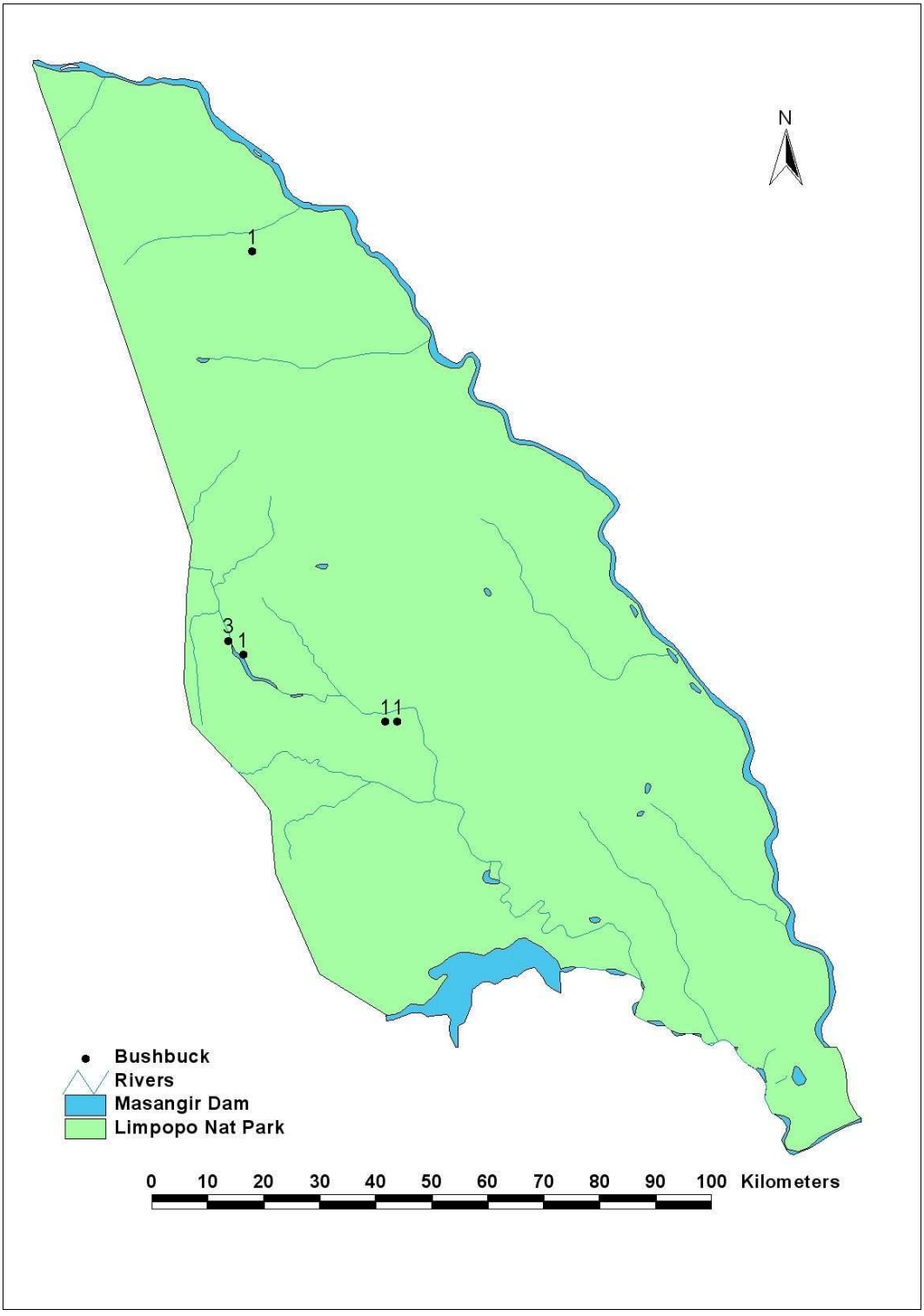

Figure 7: Bushbuck sightings. Probably under counted further away from the flight path as they tend to run easily from the aircraft and the white tail is very visible.

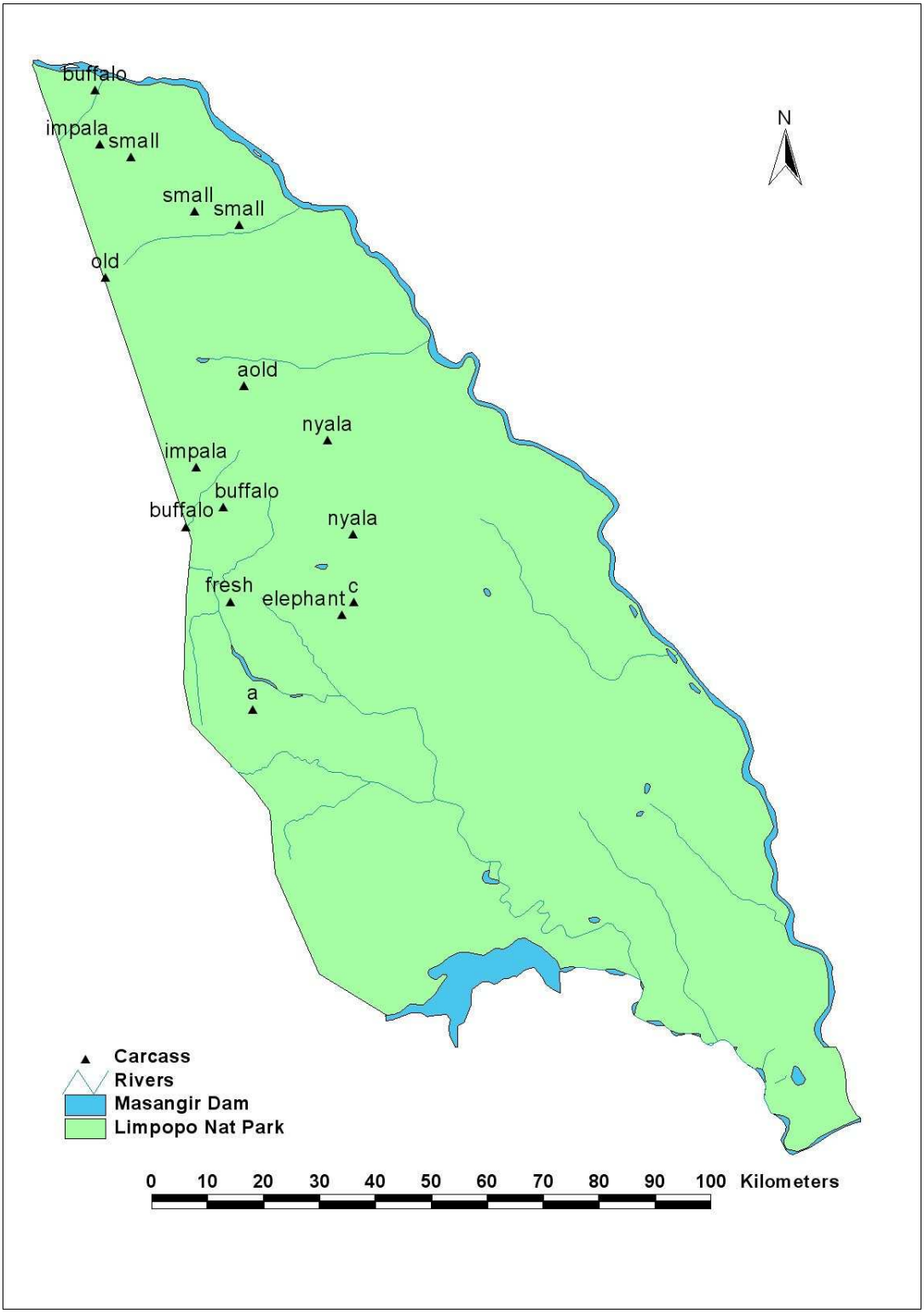

Figure 8: Carcasses observed with comments. Some carcasses could not be identified due to limited observation time. Observations are mostly in the north-west for an unknown reason.

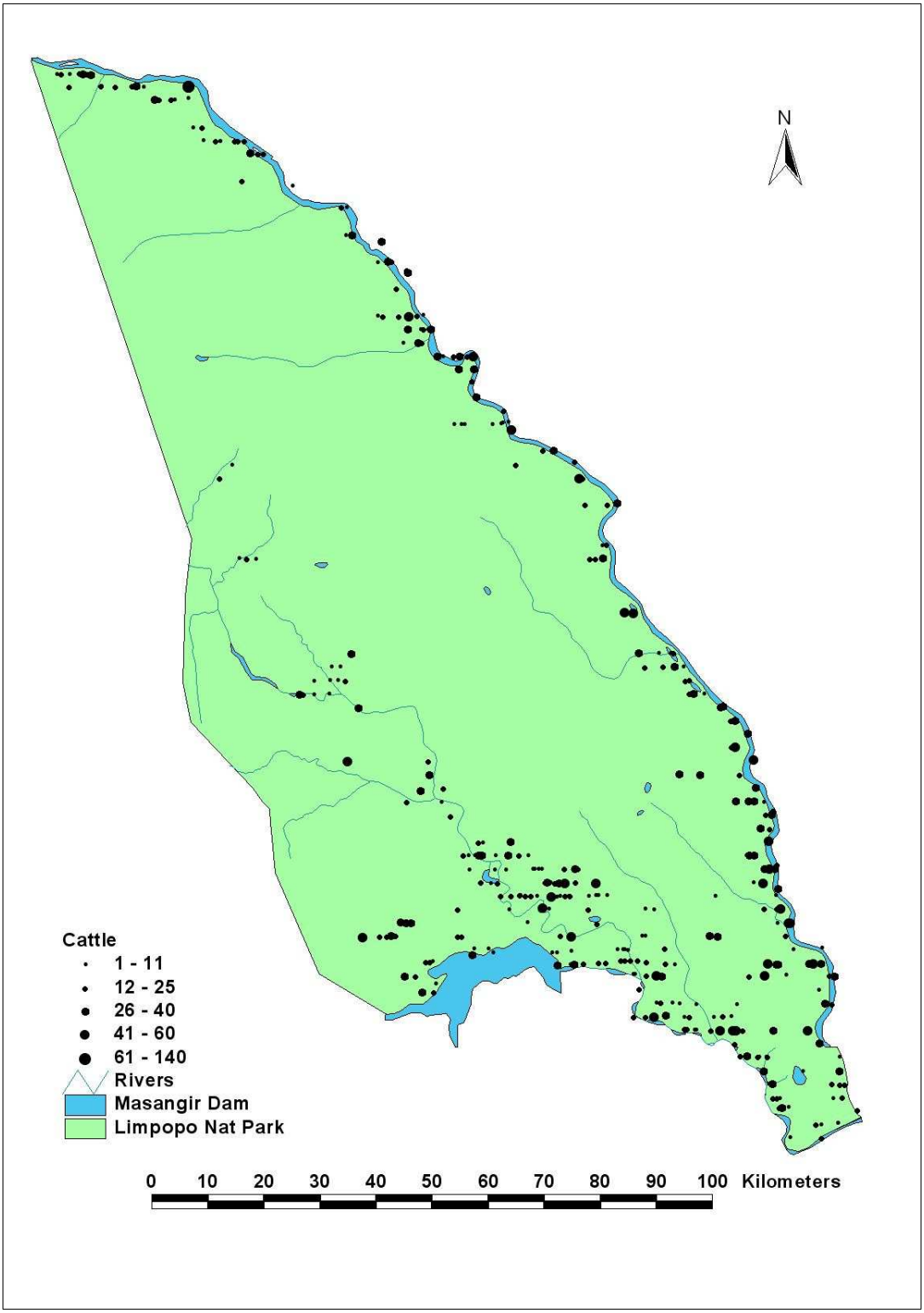

Figure 9: Cattle observed. Cattle concentrated mostly along rivers where water is available.

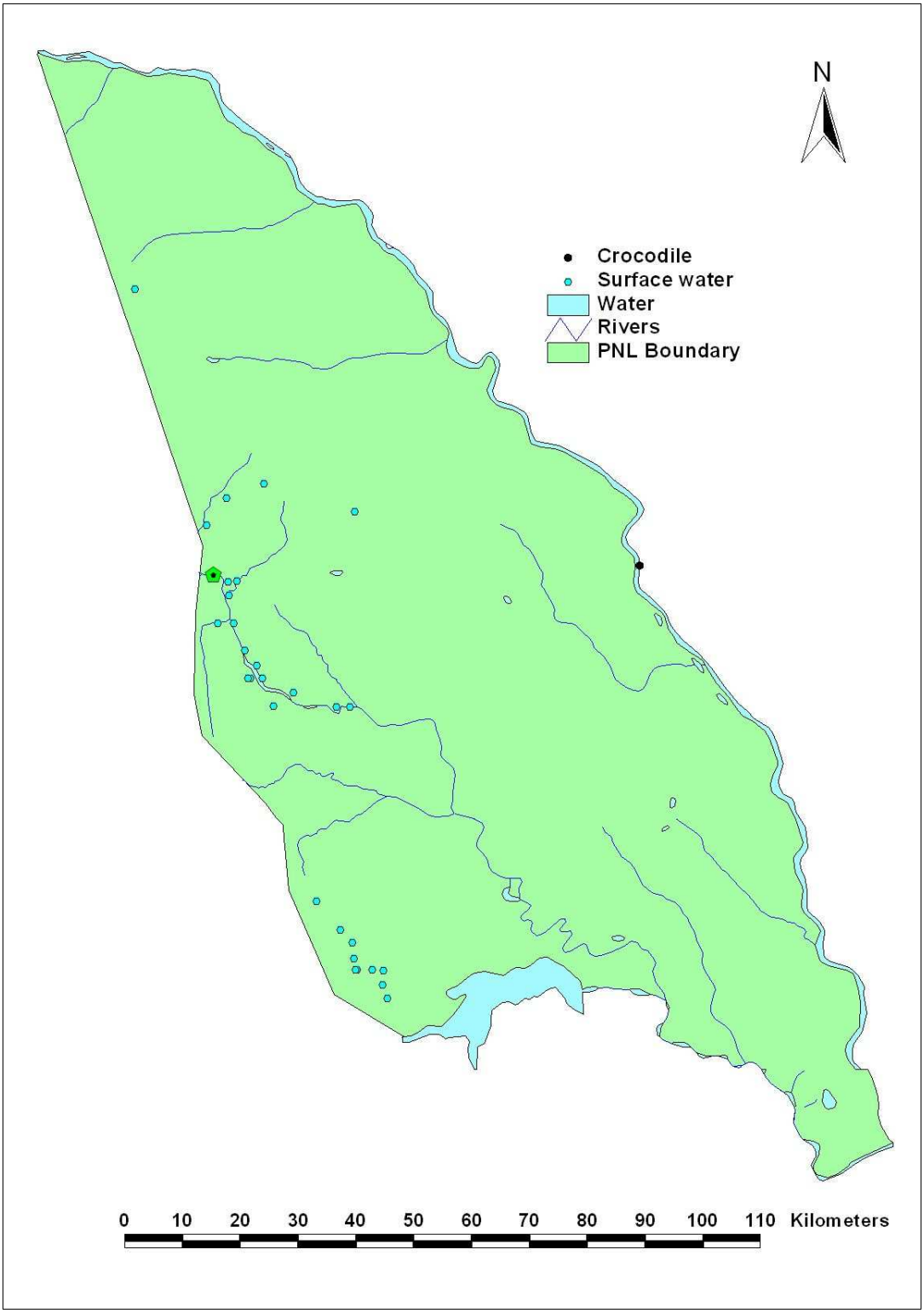

Figure 10: Crocodile sighting. Crocodile sightings probably undercounted.

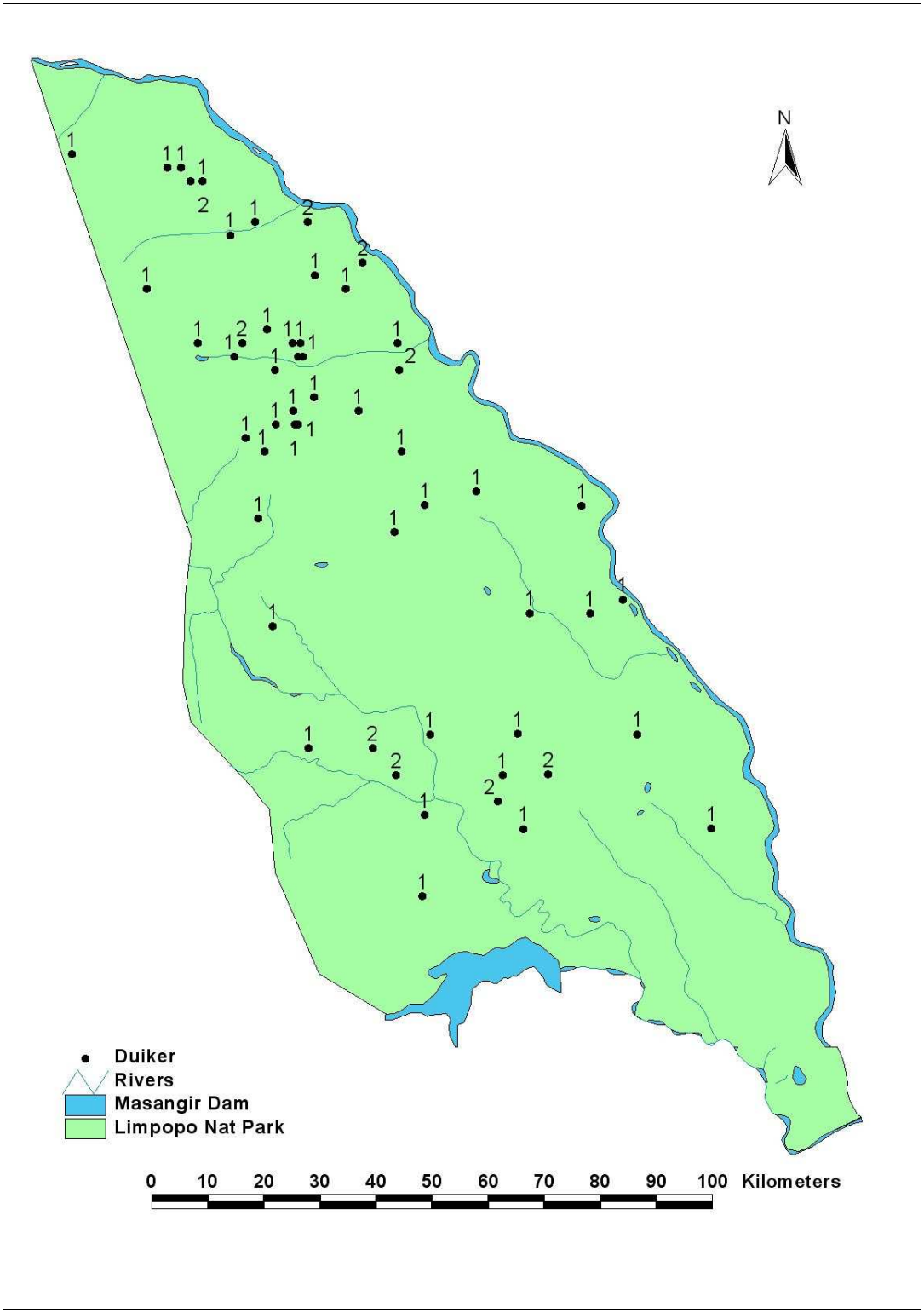

Figure 11: Duikers. Some sightings of Grey Duiker especially in the north could be confused with Suni as they are known to occur in the region.

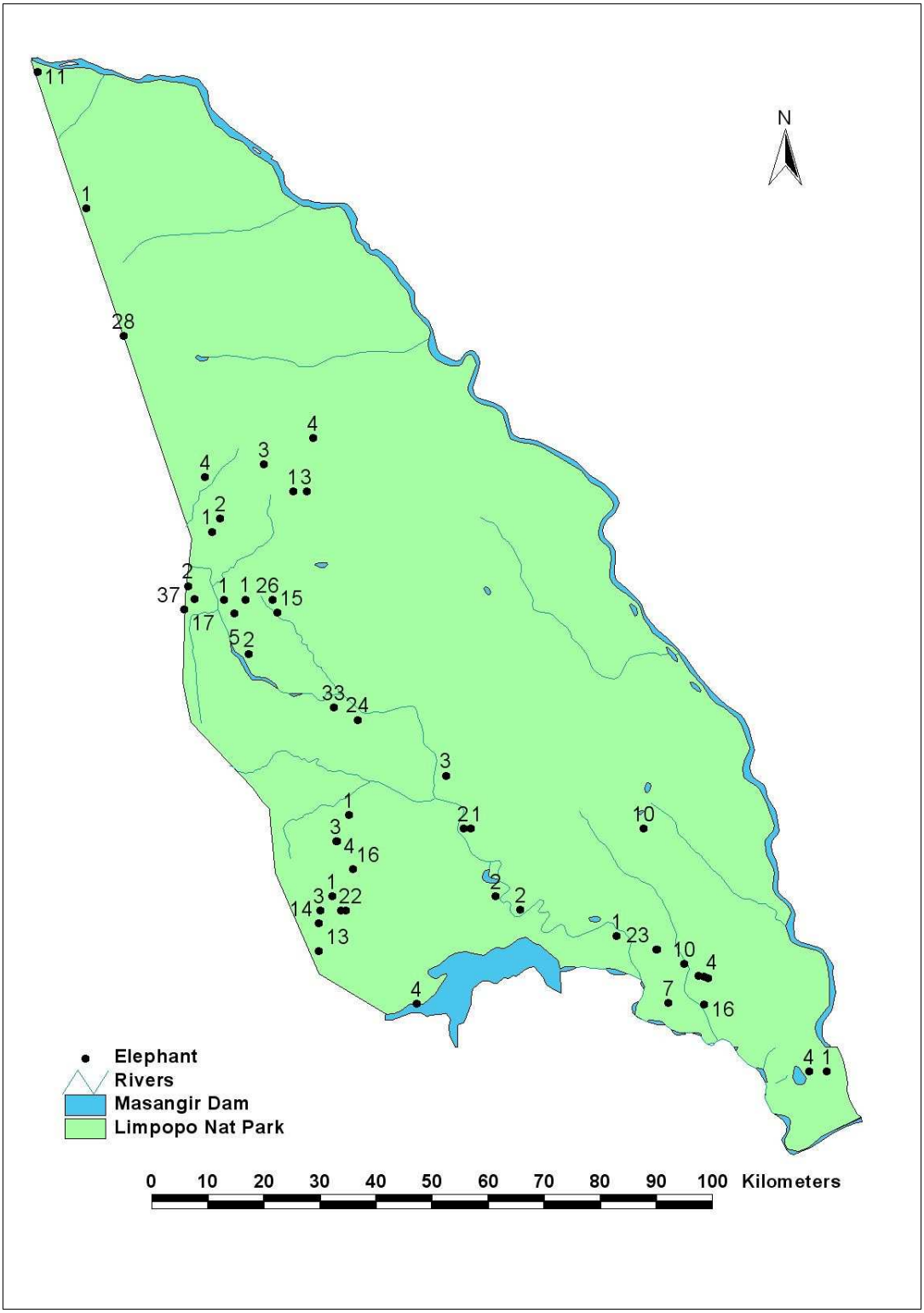

Figure 12: Elephant observations. Elephant sightings also tend to be correlated with available water.

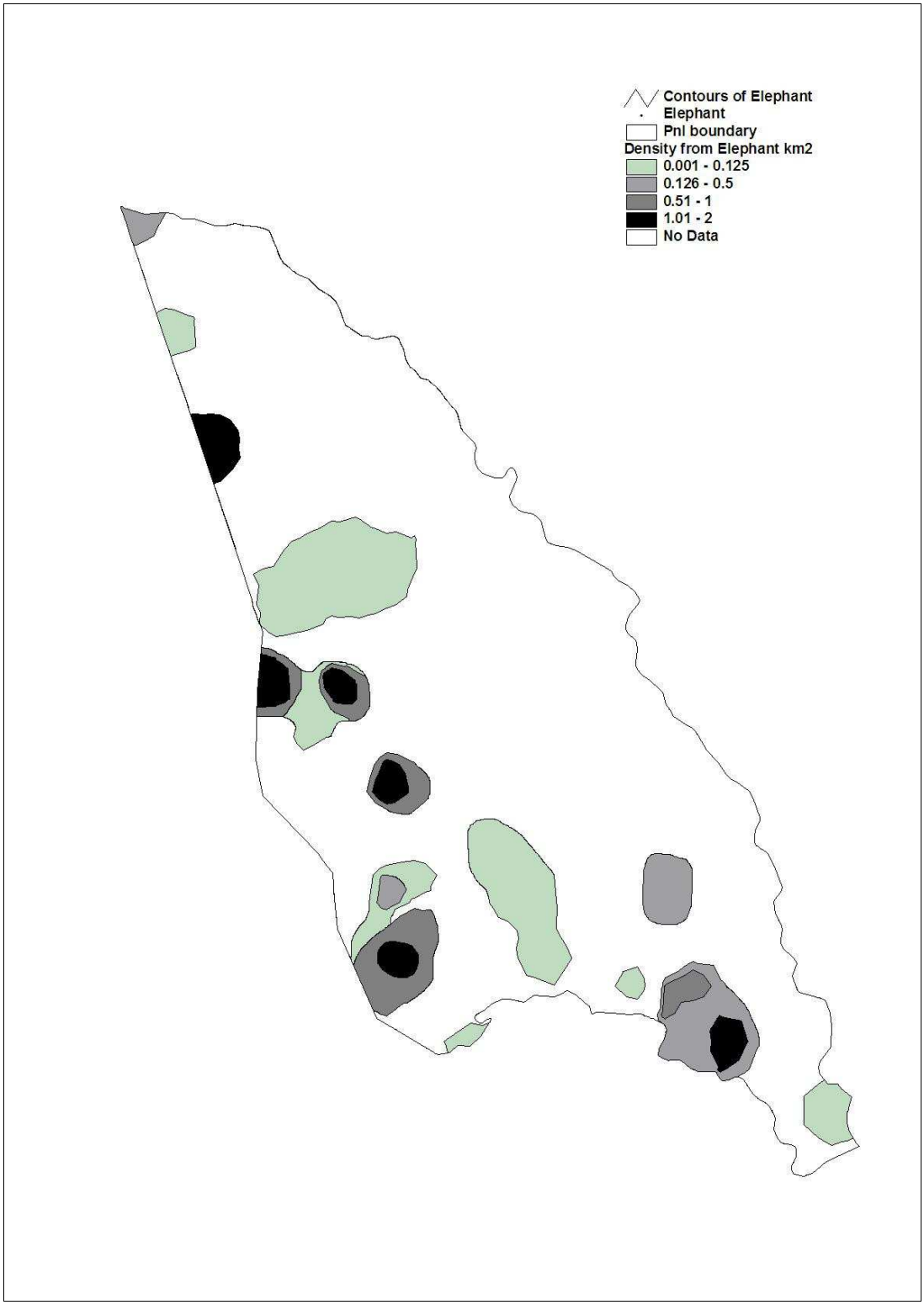

Figure 13: Elephant density.

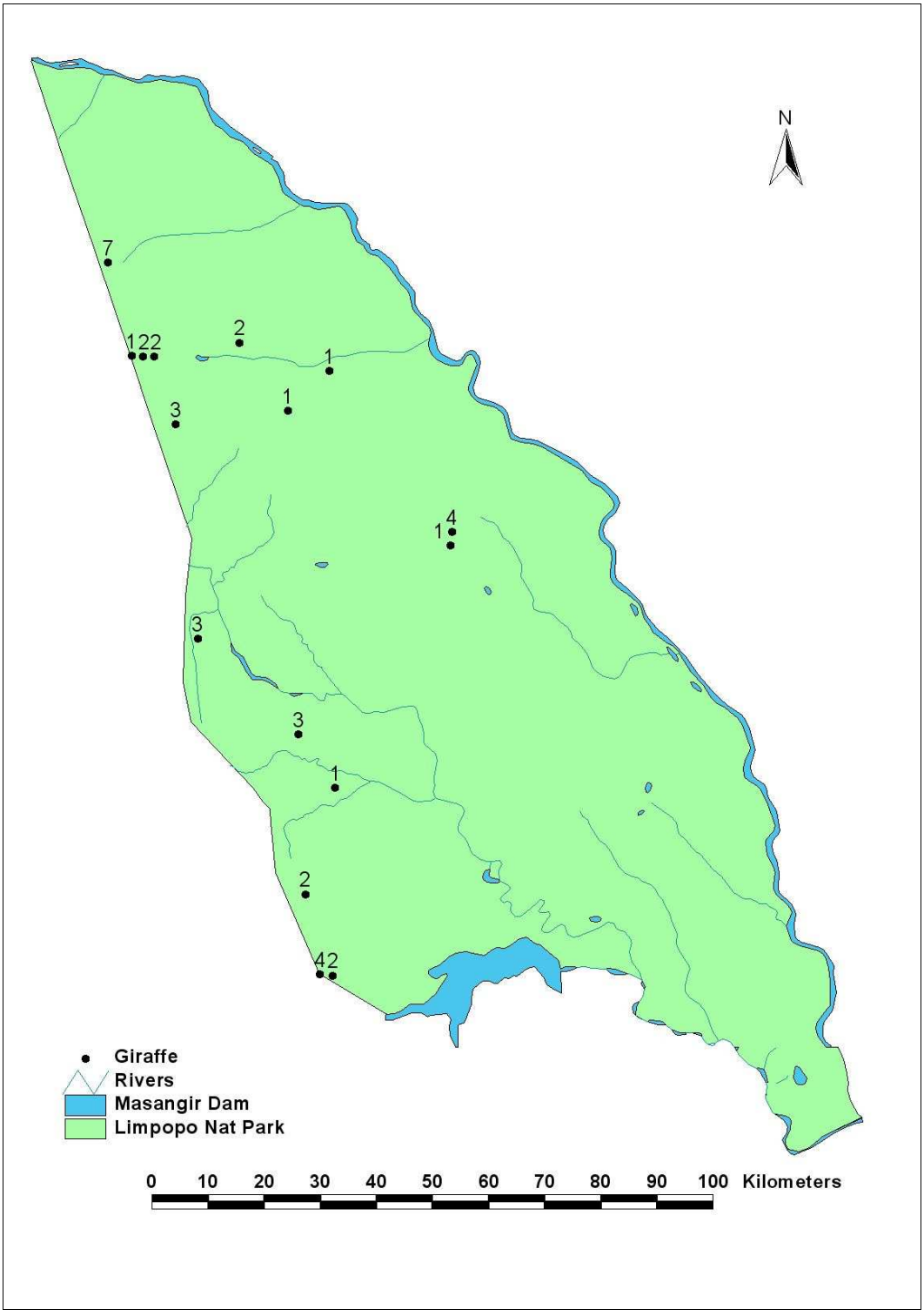

Figure 14: Giraffe.

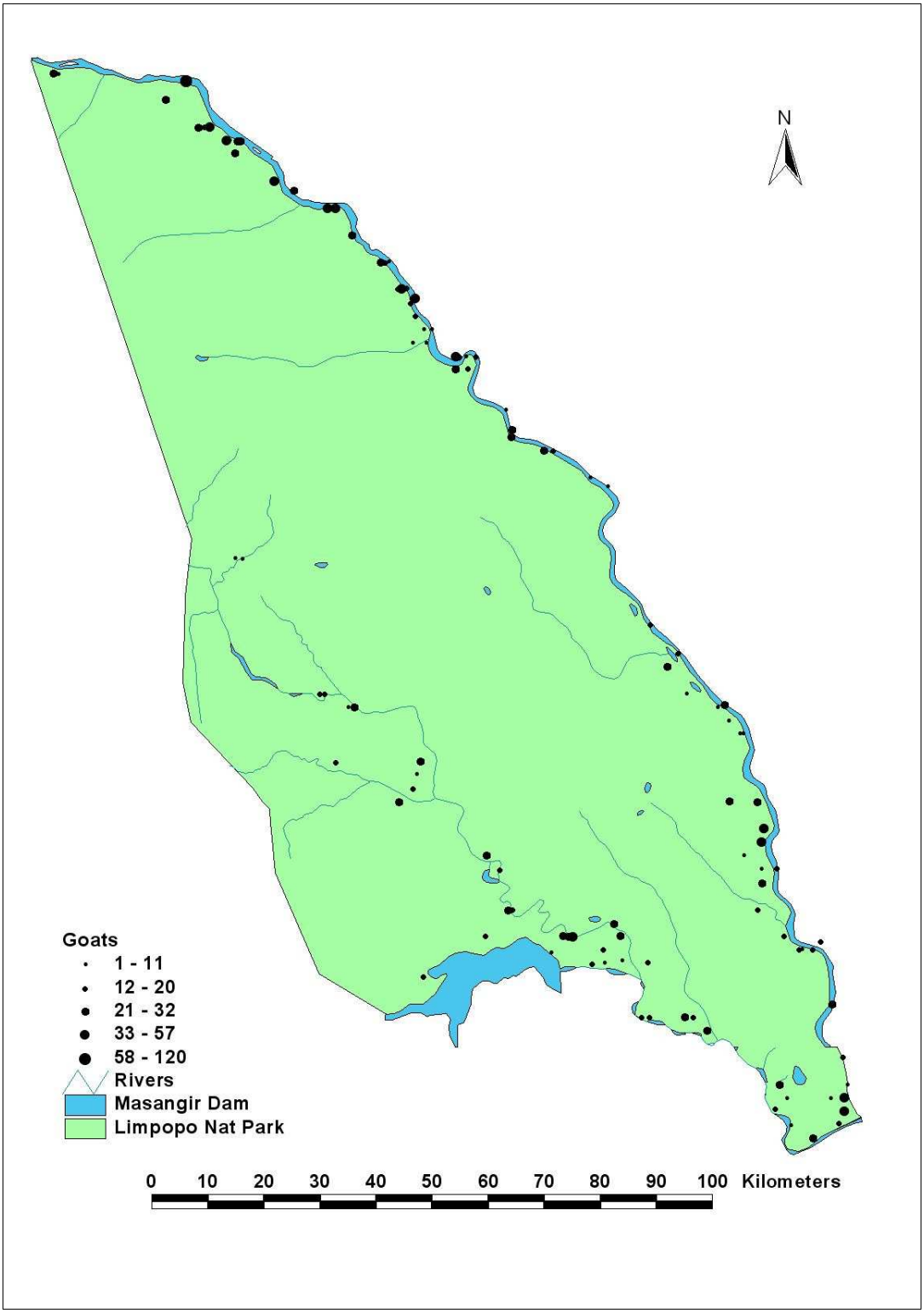

Figure 15: Domestic goats. Distributed along rivers close to human settlements.

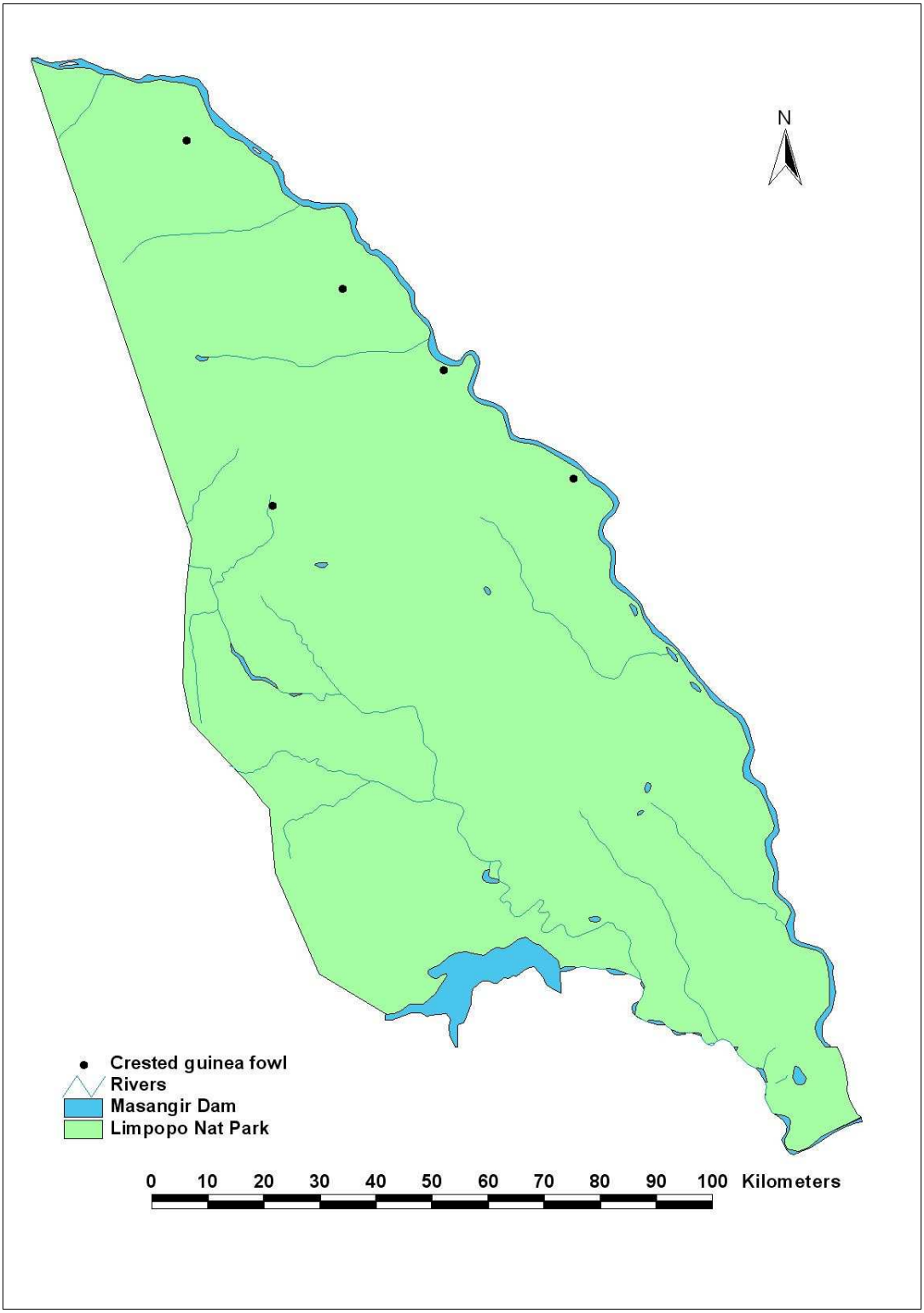

Figure 16: Crested Guinea Fowl flocks. Very visible if close to the flight path of the aircraft as they flushed but probably missed if they did not flush.

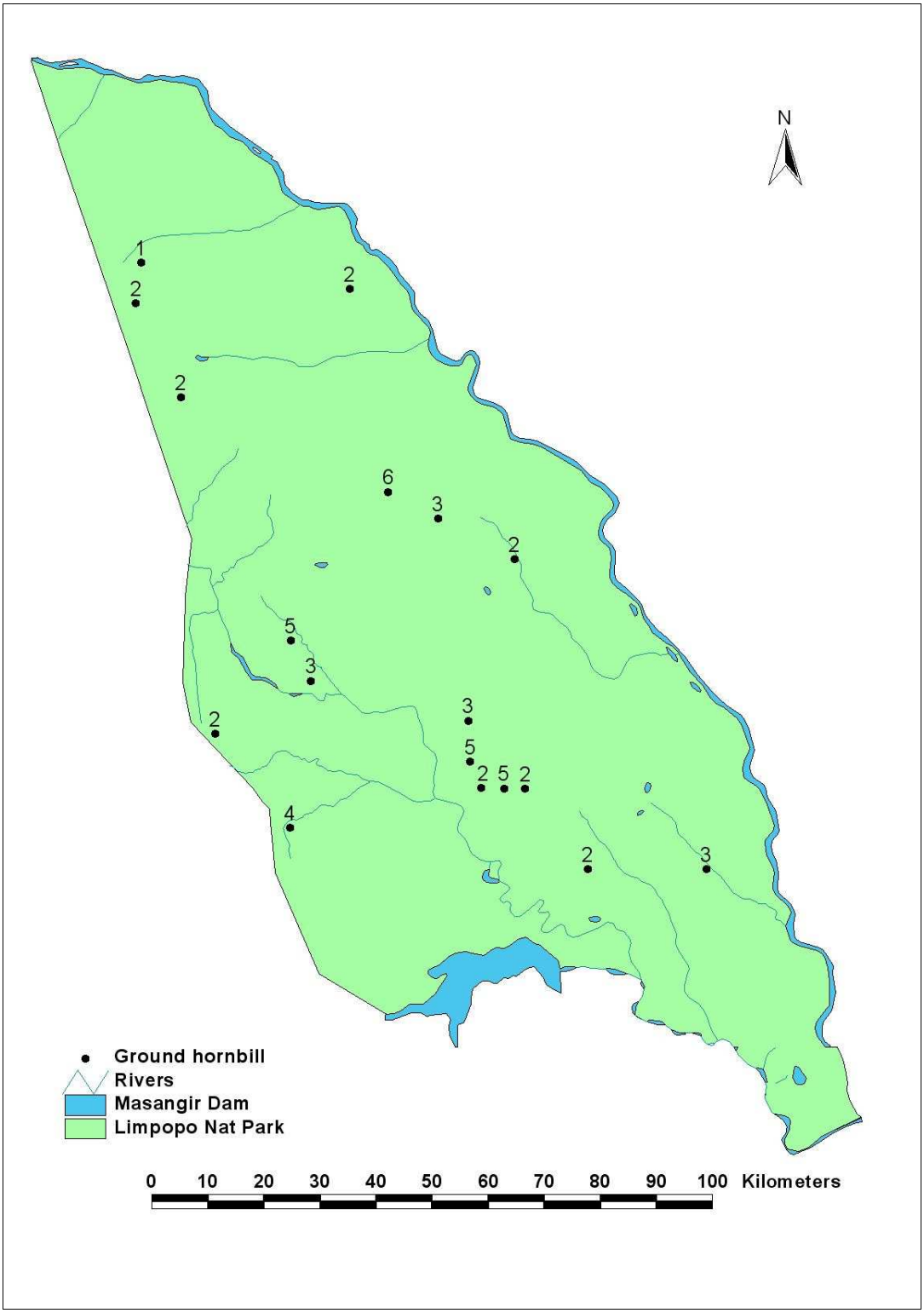

Figure 17: Ground hornbills with group size indicated. Similar to guinea fowl their flash pattern when they flew was highly visible but if they remained on the ground could easily be missed.

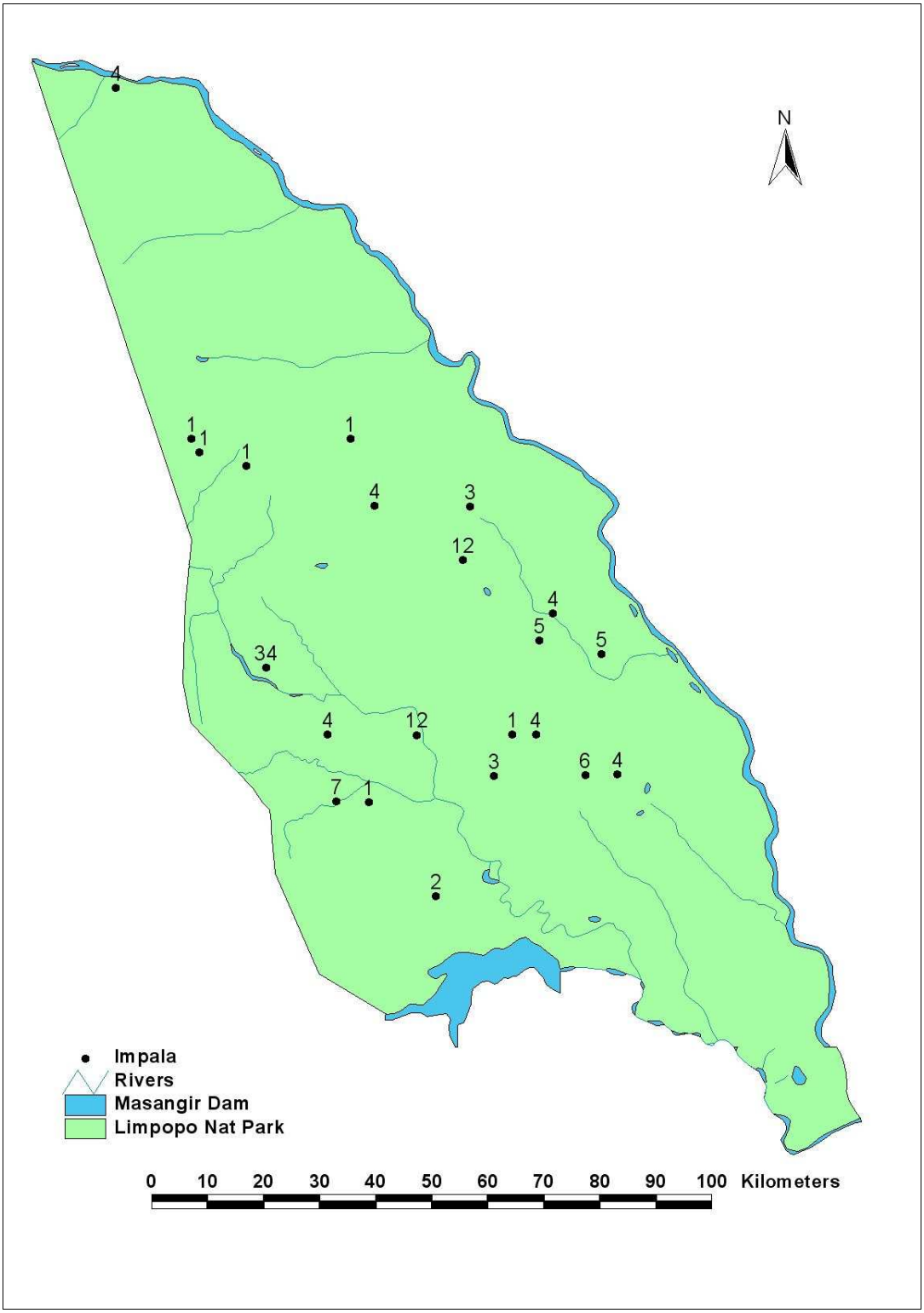

Figure 18: Impala. May have been undercounted due to low visibility although visible group size was very small except for one group of 34 animals.

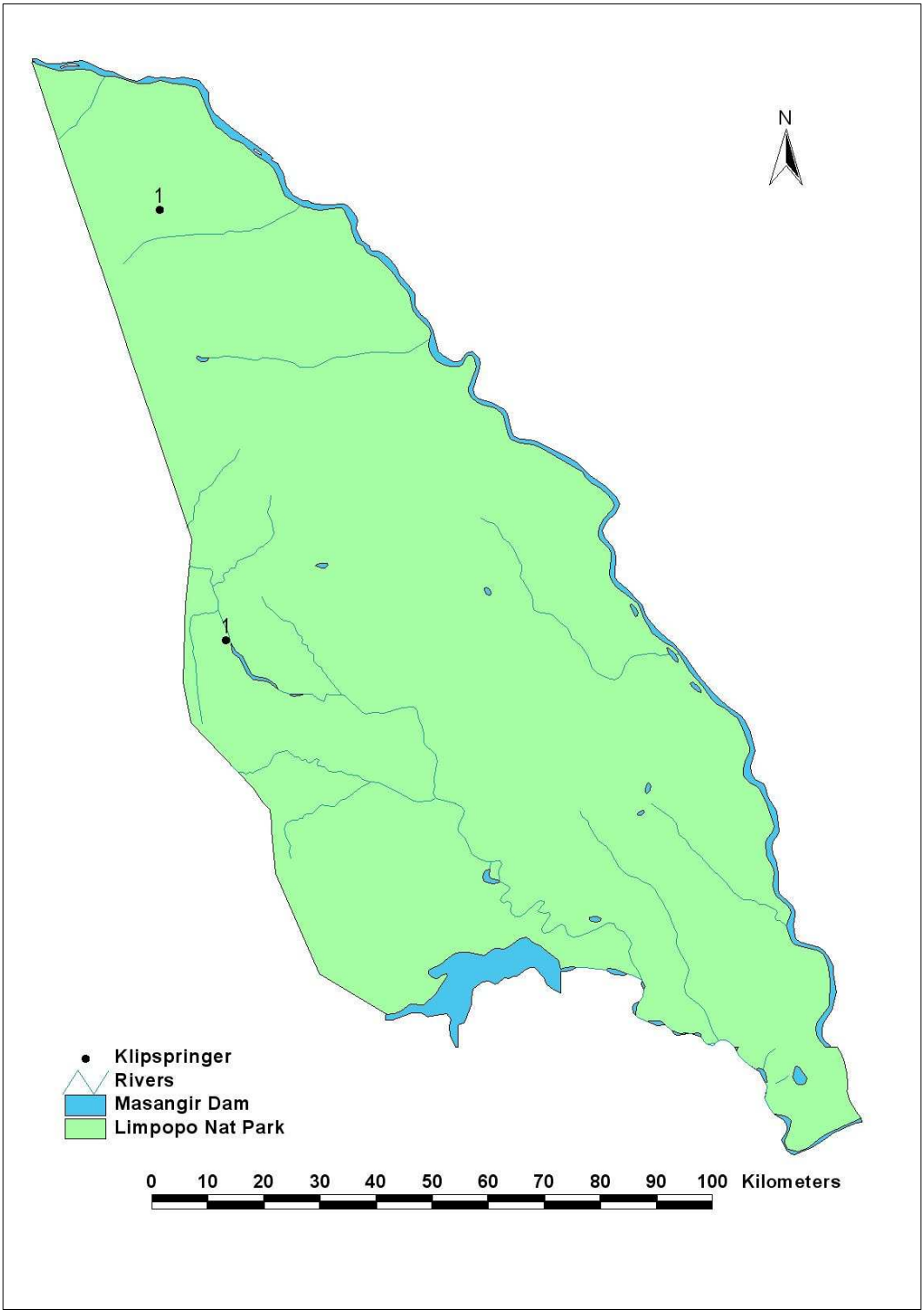

Figure 19: Klipspringer. Not easily observed and would usually be found in pairs. Probably occur in much higher numbers

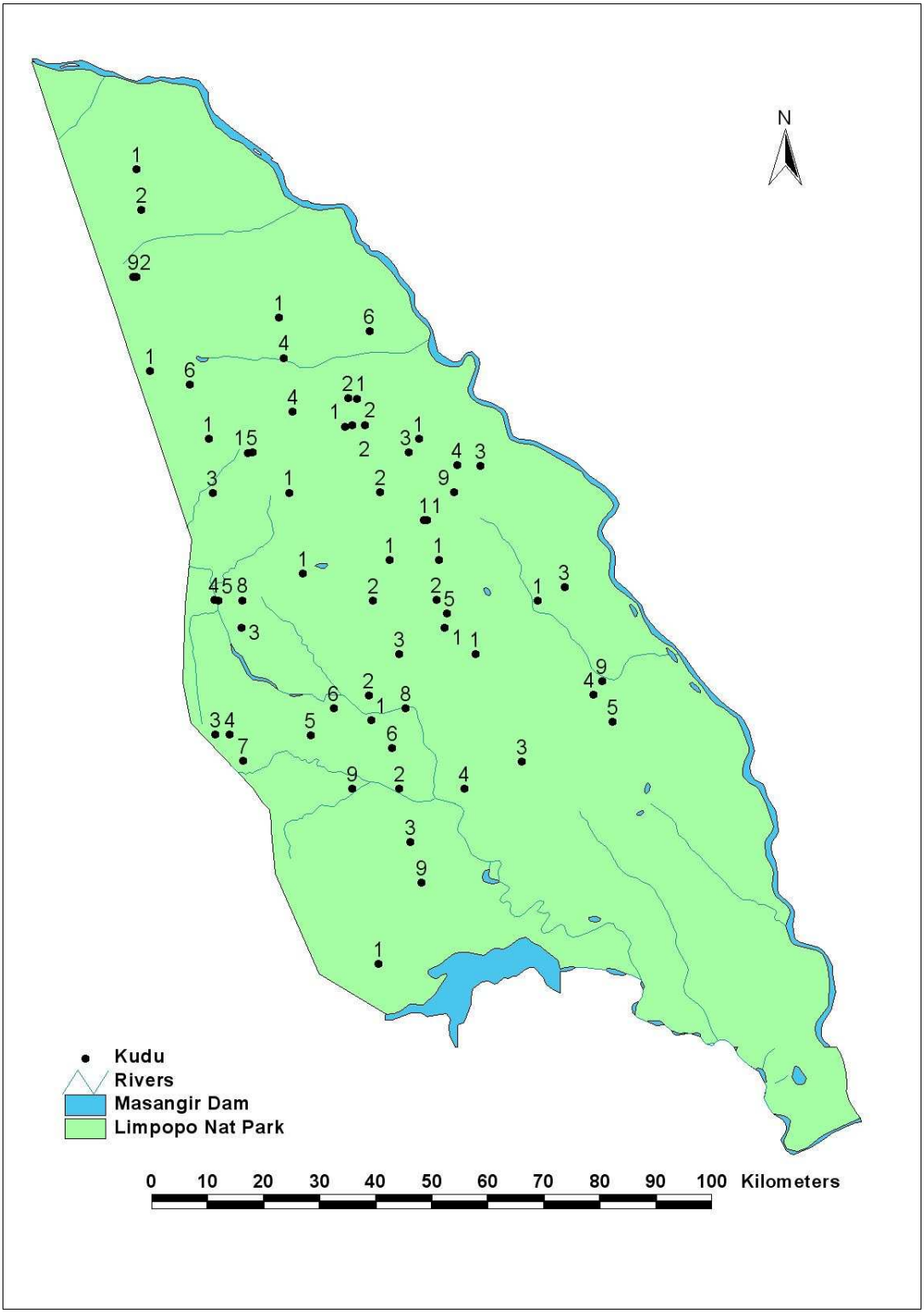

Figure 20: Kudu are evenly distributed in the park and are not reliant on water like other antelope. Good group sizes were observed.

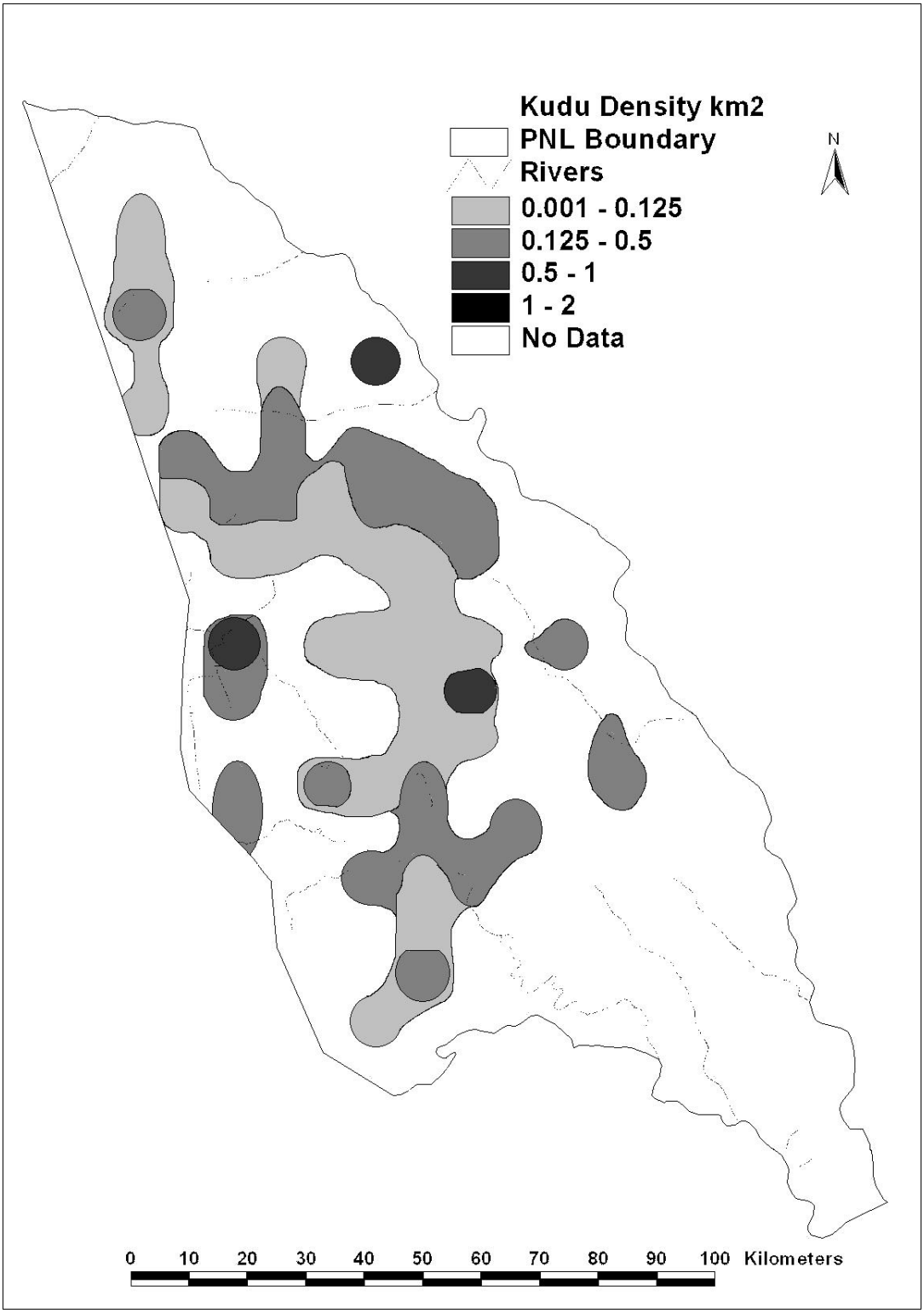

Figure 21: Kudu density

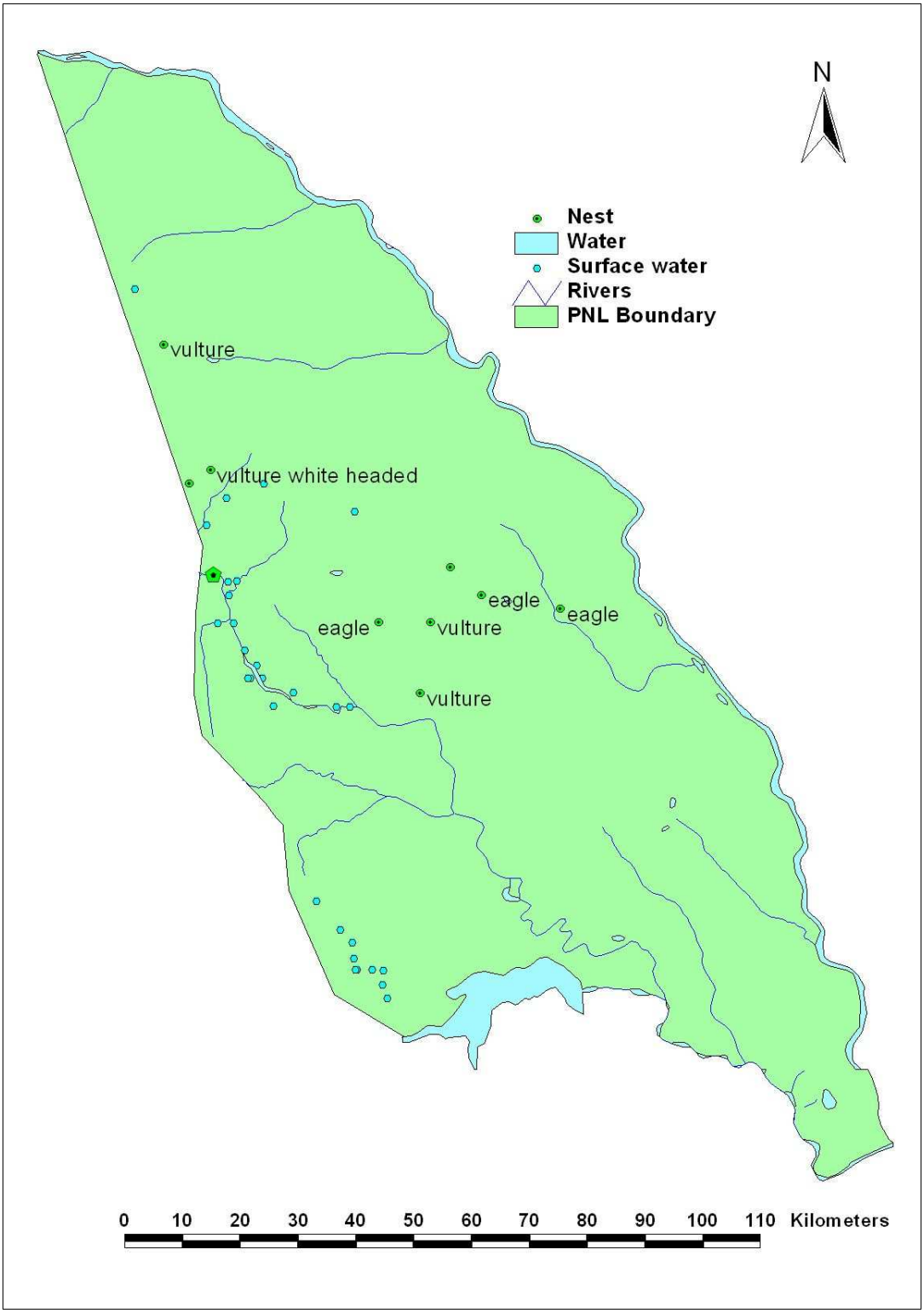

Figure 22: Nests of large eagles and vultures. Large nests where birds were seen incubating were recorded and where possible the species identified.

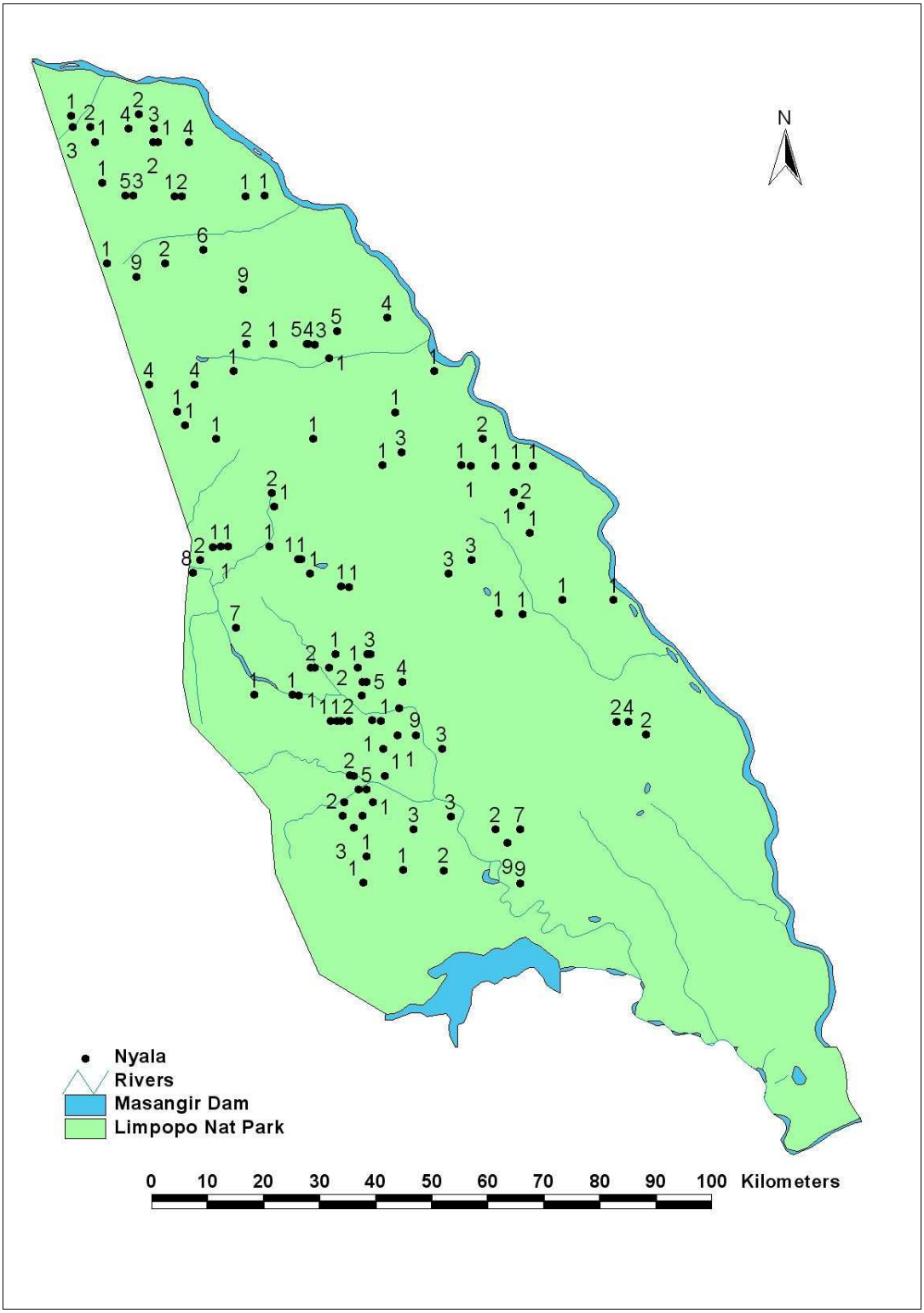

Figure 23: Nyala. Well dispersed throughout the park except for the southern area where human disturbance is higher.

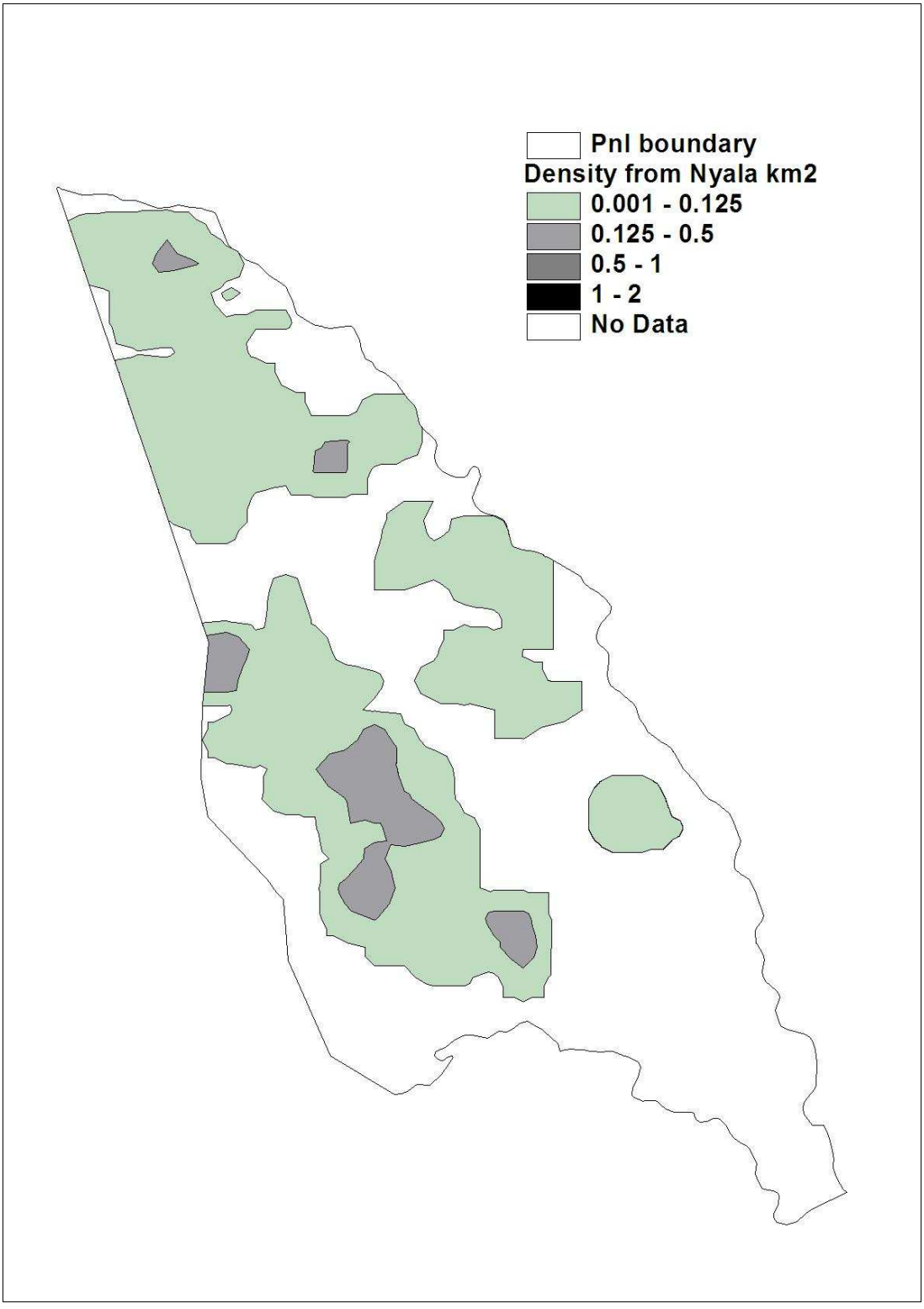

Figure 24: Nyala density.

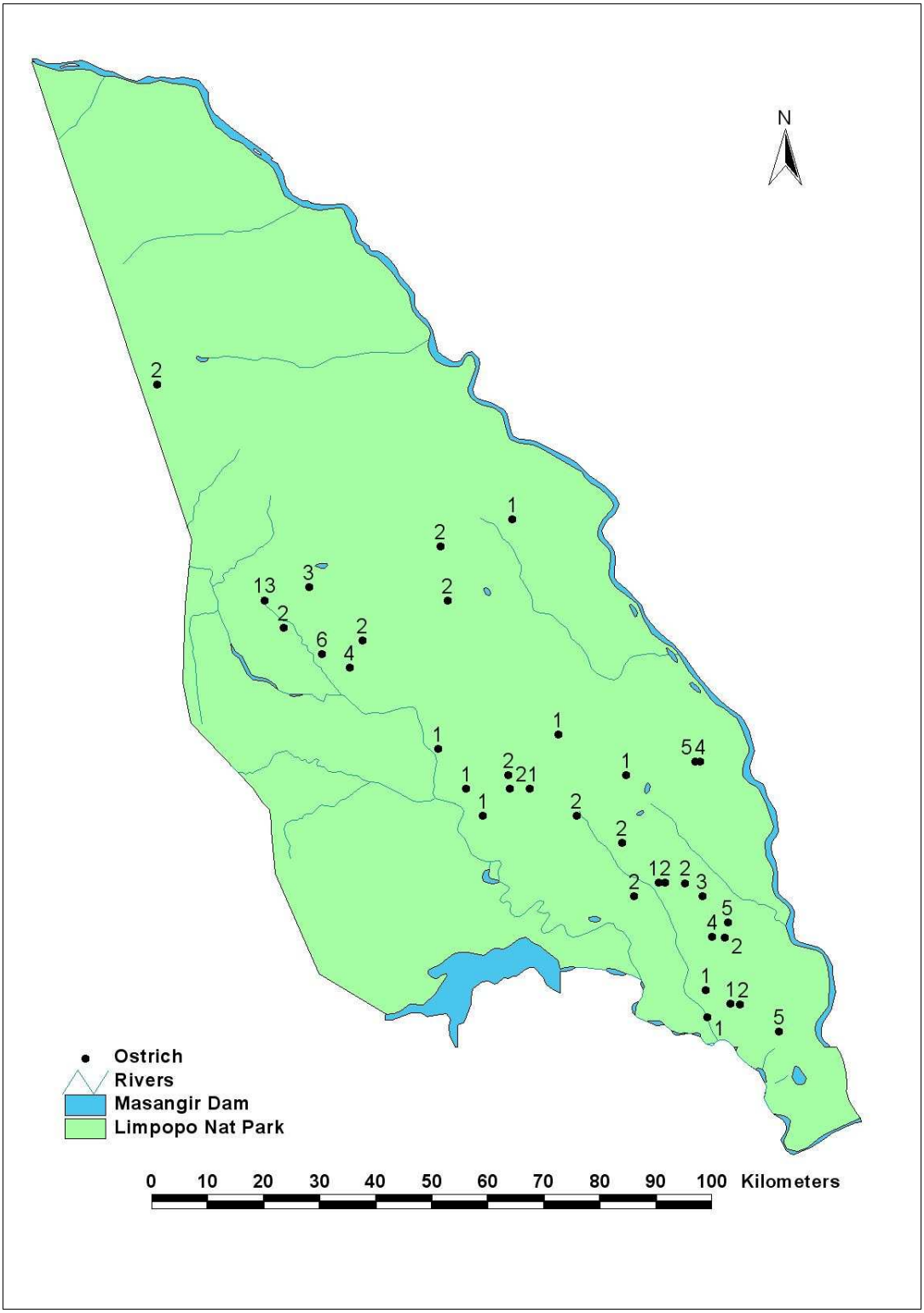

Figure 25: Ostrich. Mostly in the southern region of the park for reasons unknown as suitable habitat exists in the north.

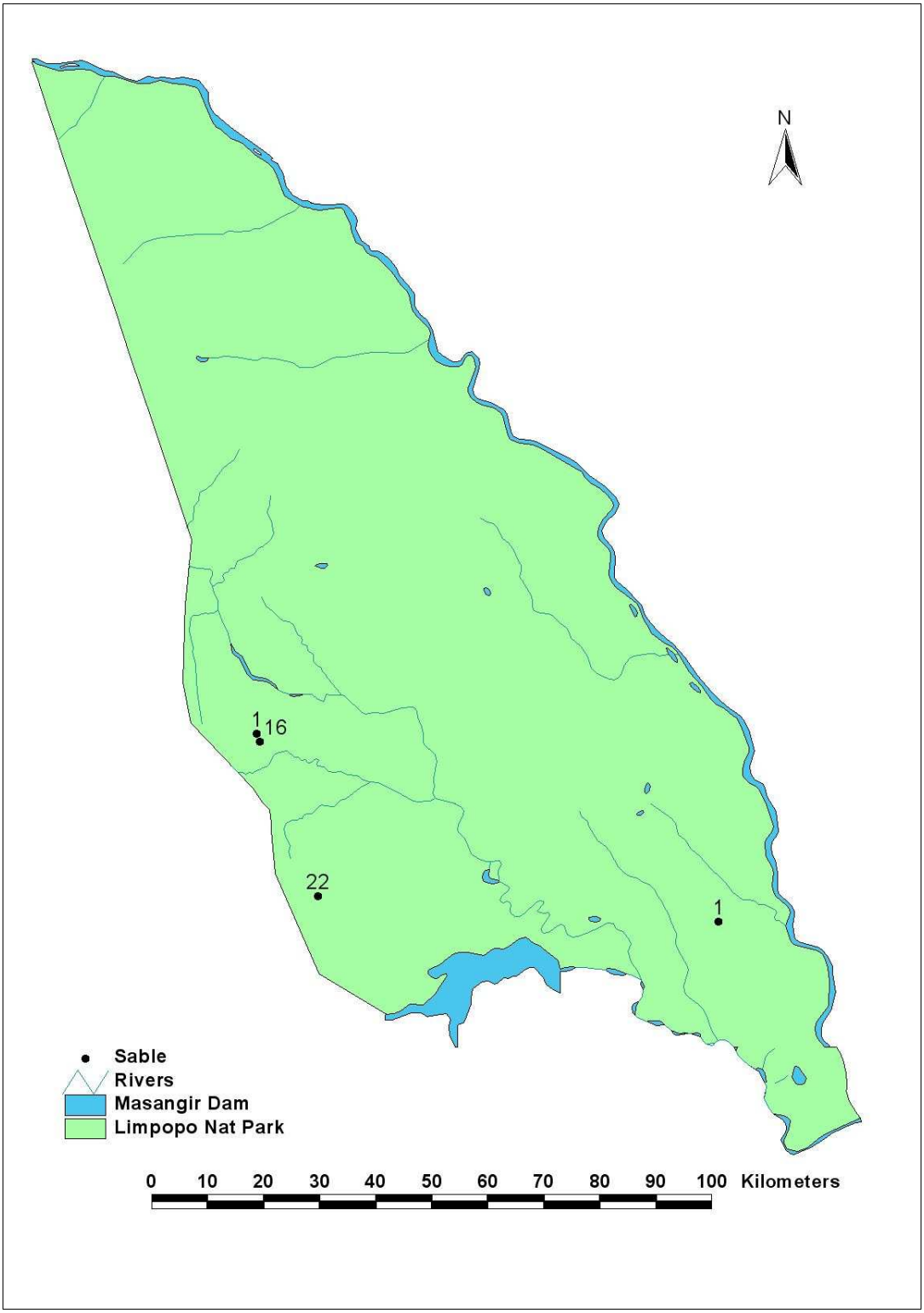

Figure 26: Sable antelope. Only two groups in the south-west probably due to introduction from the KNP. The single sighting in the south-east was a lone bull.

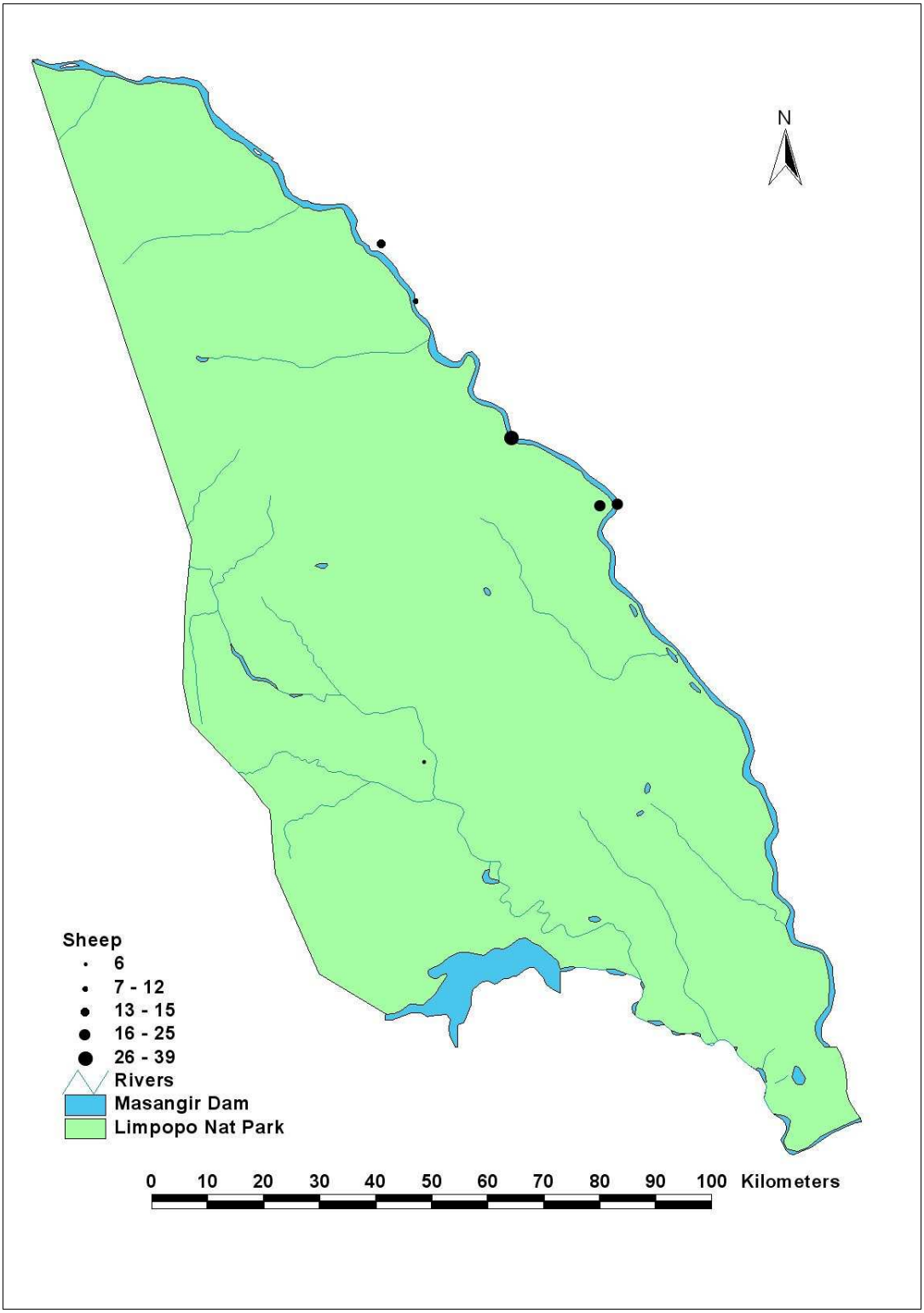

Figure 27: Domestic sheep. Relatively small numbers of sheep compared to goats and cattle.

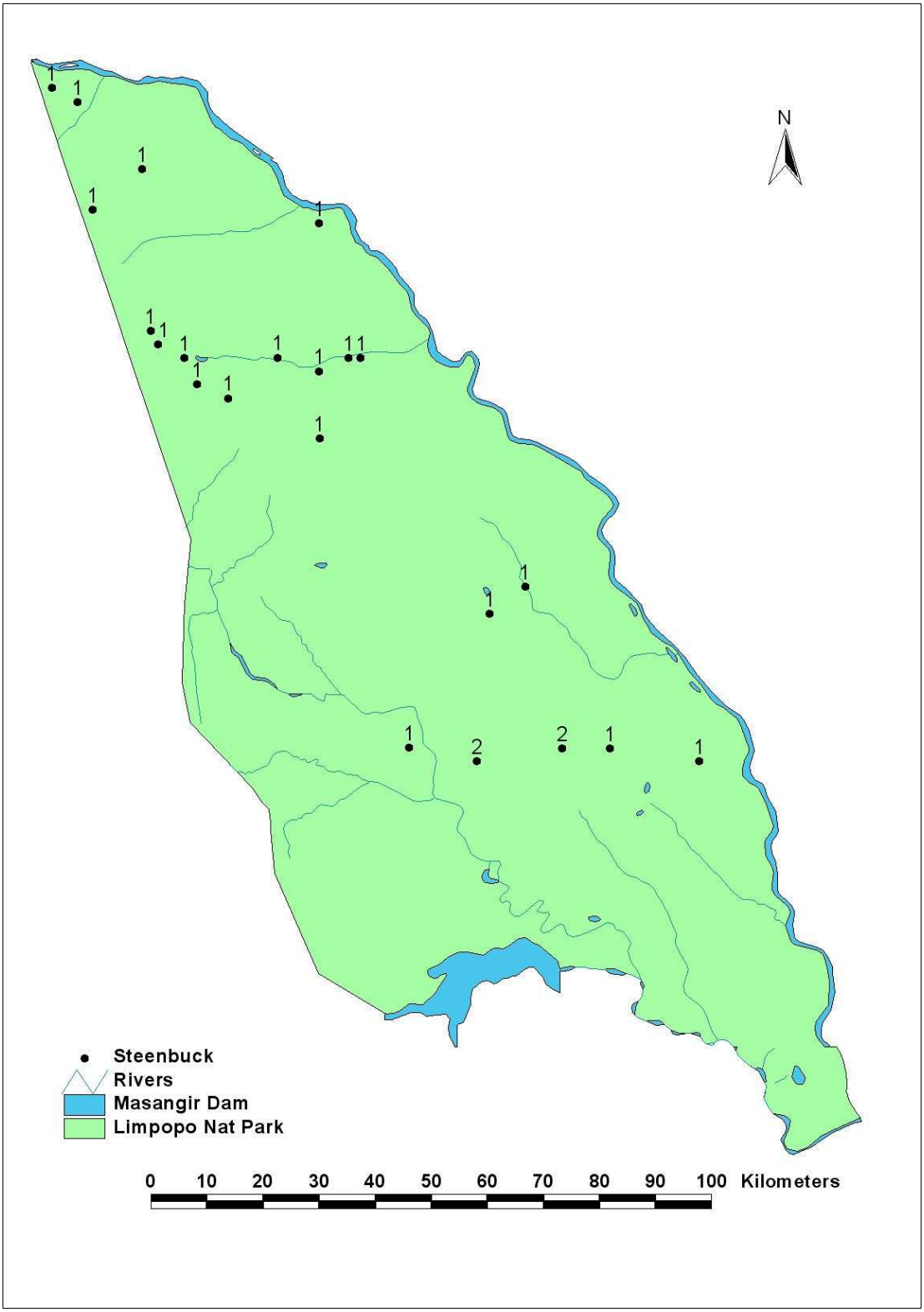

Figure 28: Steenbuck. Sightings in the more open grassveld in the north and central area and not reliant on water.

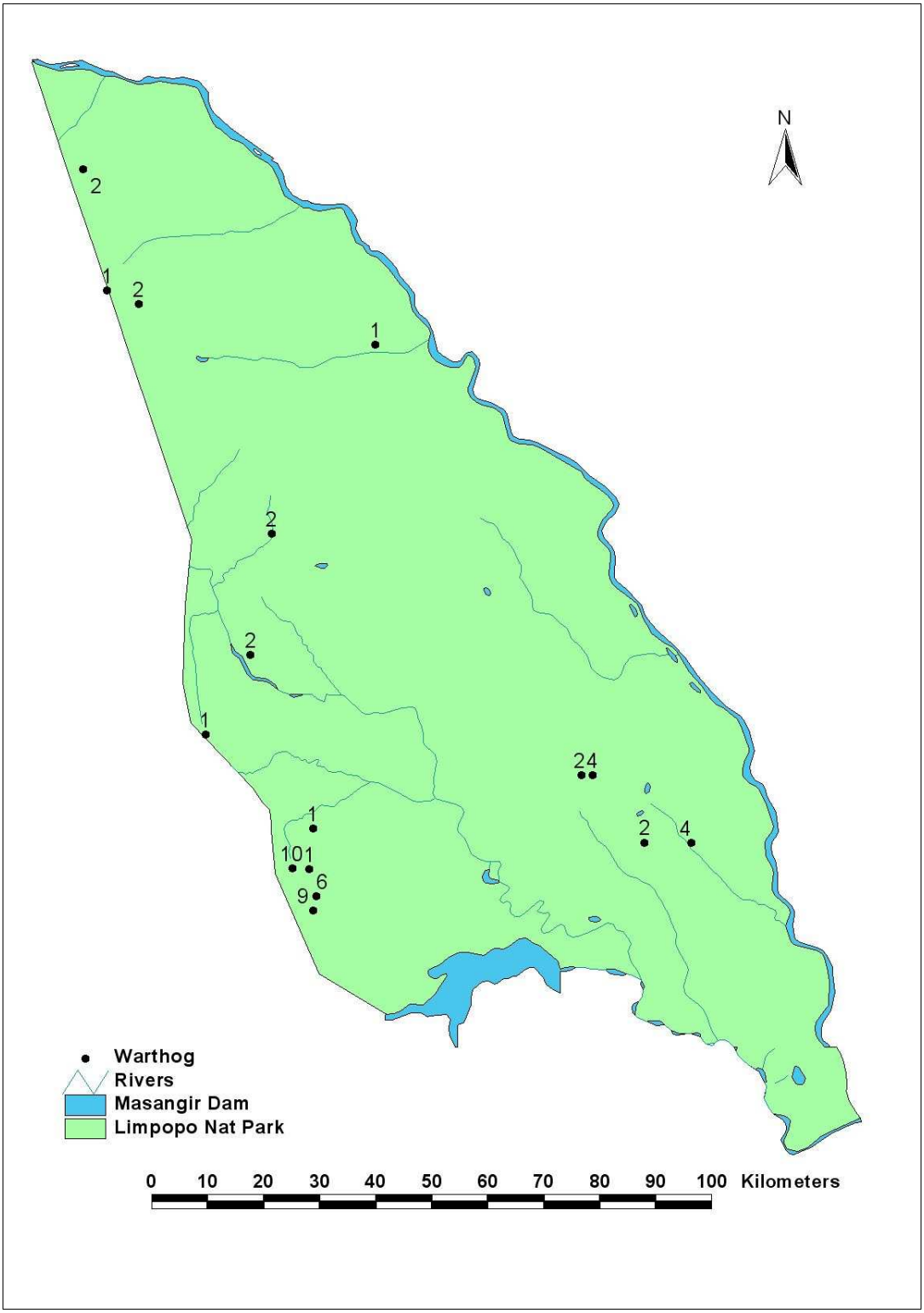

Figure 29: Warthog. Surprisingly small numbers of warthog observed and also reliant on available water.

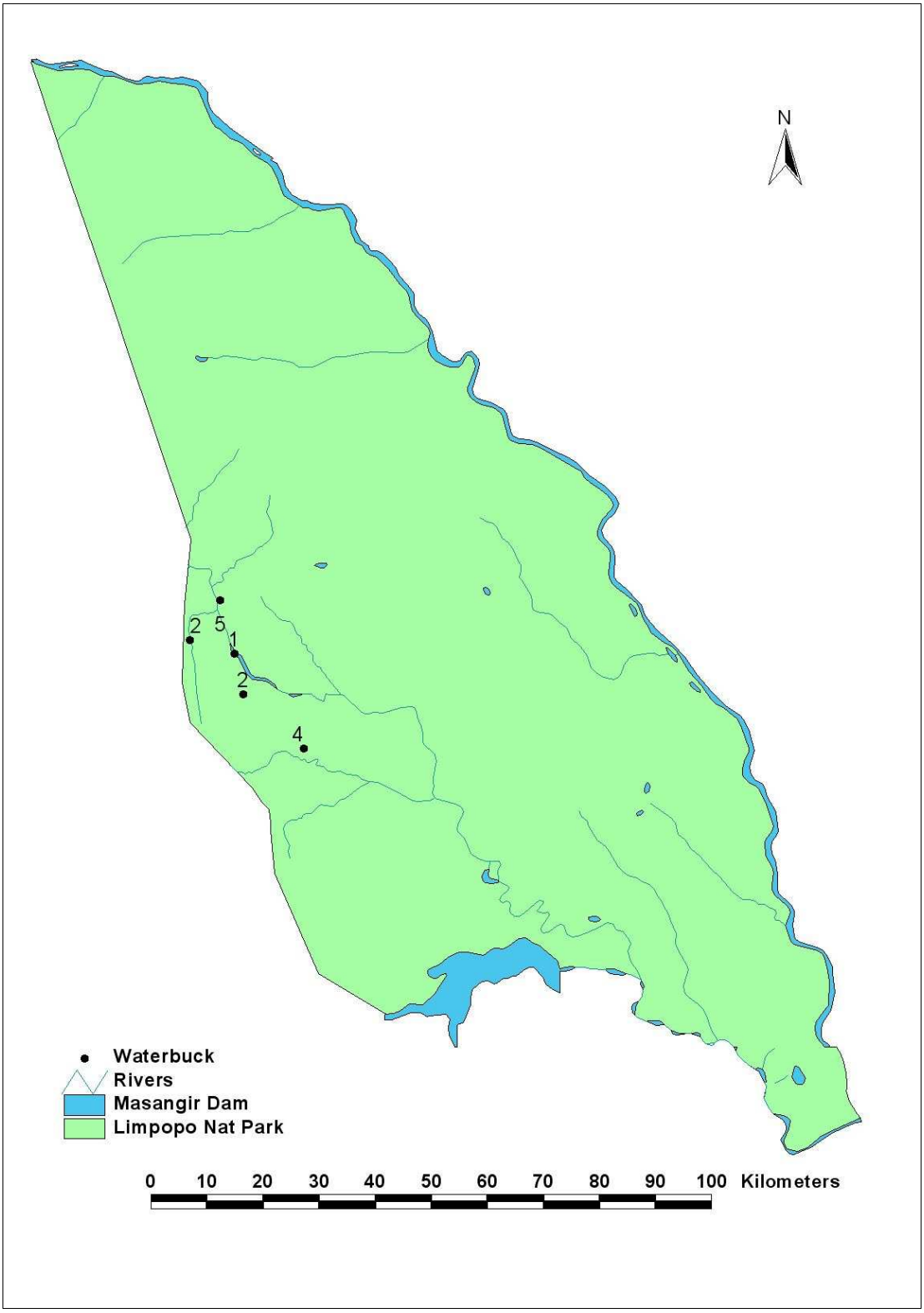

Figure 30: Waterbuck. Can easily be overlooked but small numbers from the KNP.

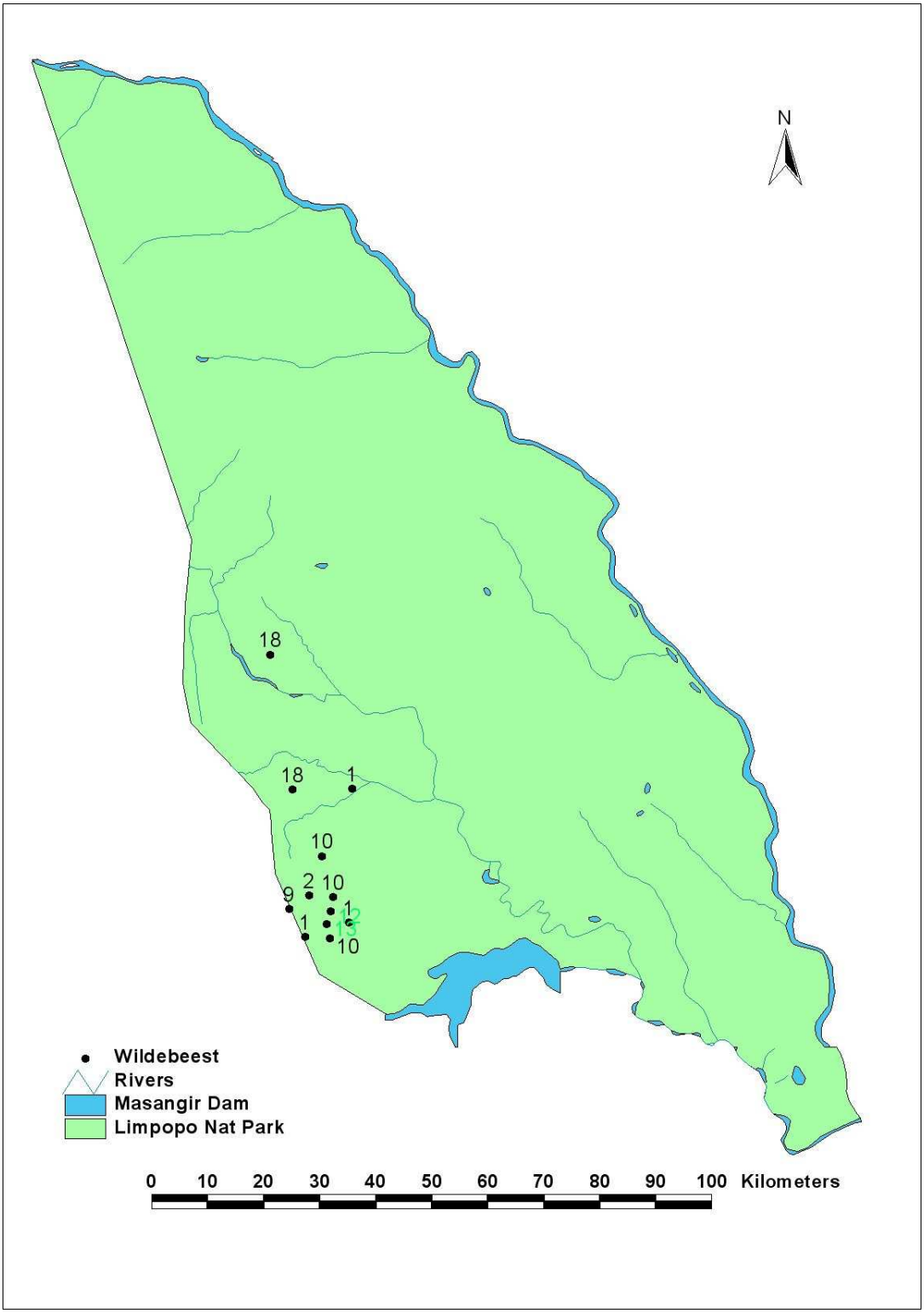

Figure 31: Blue Wildebeest. Only occurring in the south-west probably due to introductions from the KNP.

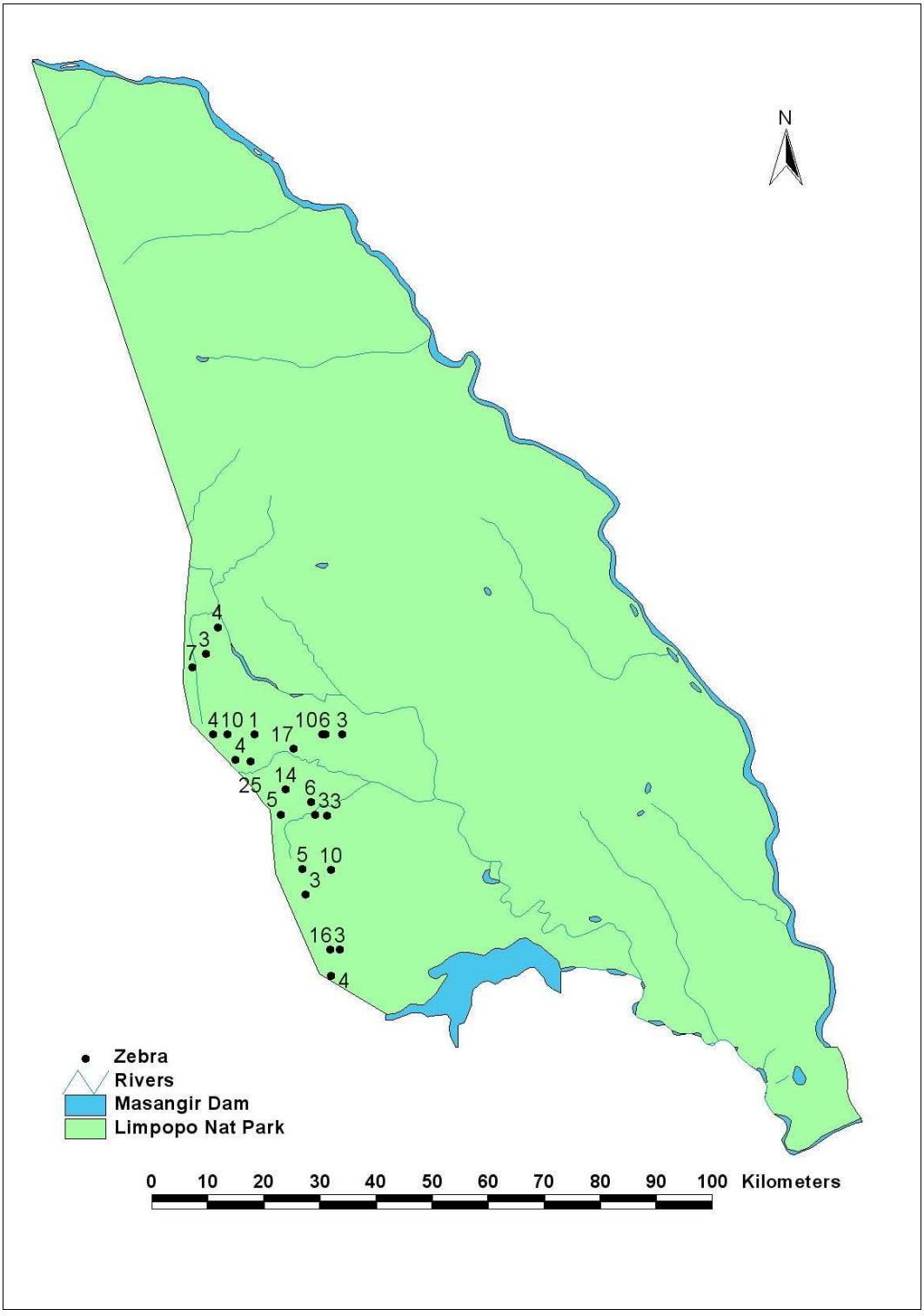

Figure 32: Zebra. Similar to Wildebeest the population is most probably from introductions from the KNP.

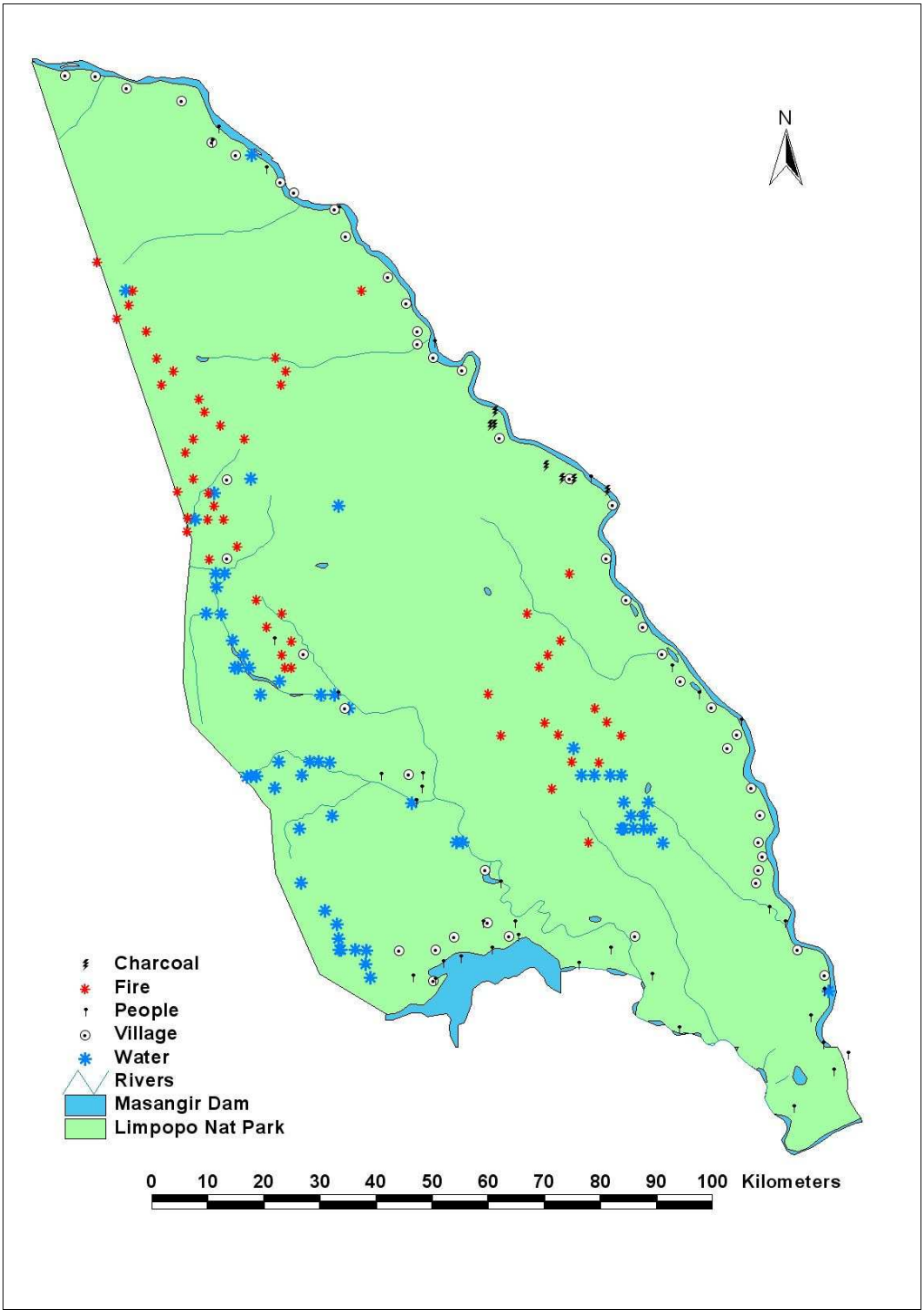

Figure 33: Surface water and human impact - villages, fire and charcoal manufacturing. Villages dispersed along available water and large areas of the reserve were recently burnt or burning. In the central Limpopo large stacks of charcoal were observed which appears to be a localized industry.

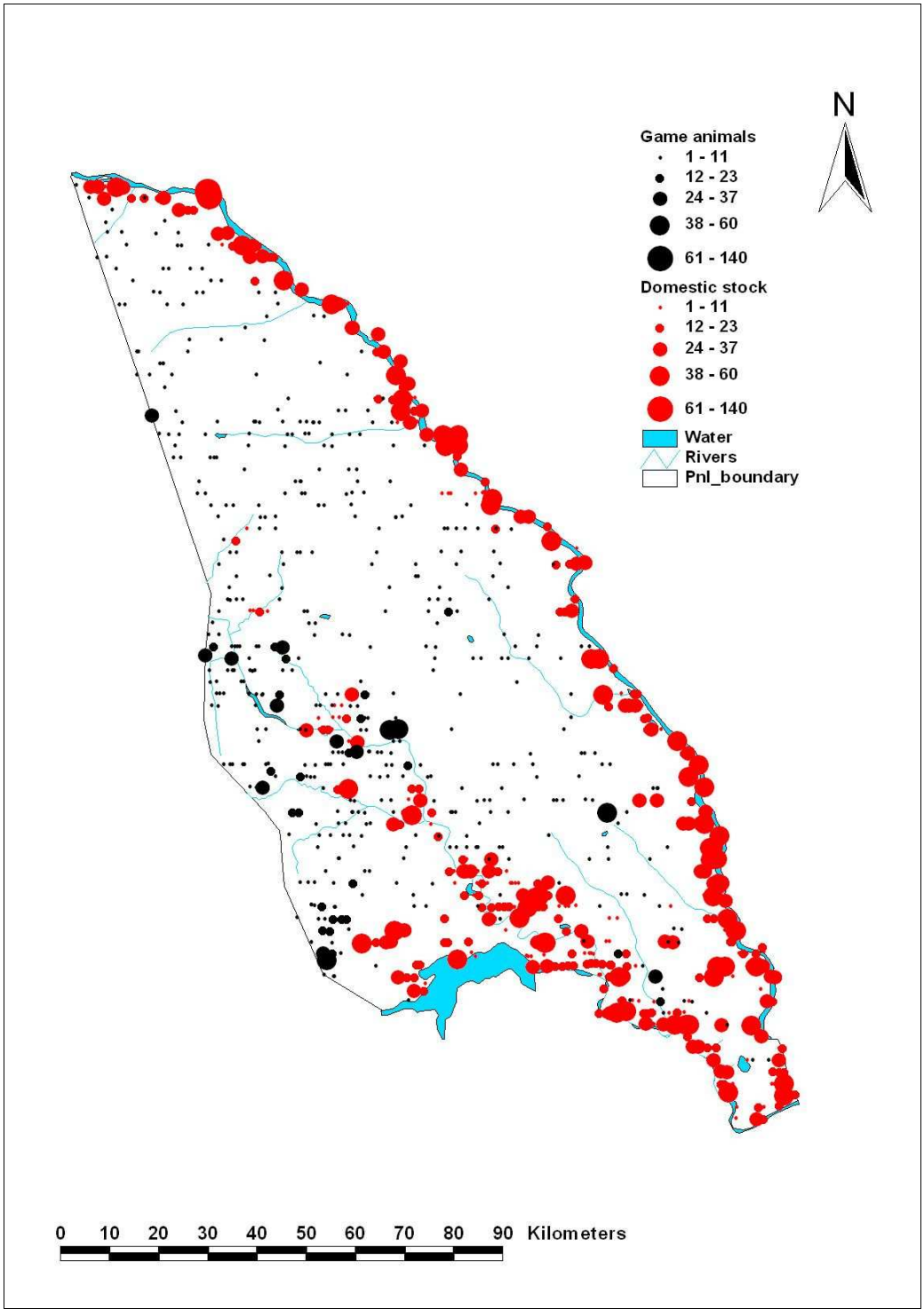

Figure 34: Game & domestic Stock distribution. The south-western region shows high densities of game animals especially along the Shingwedzi River.

Discussion & Comments

Initially the observers were not giving correct ranging partly due to turbulence as the aircraft was not stable and the wings moved up and down, which also made the marks on the windows lift or rise. Regardless of distance they tended to give the sector according to the window markings even if the animal was right below and the wing had moved down. By using a laser range finder and correcting these distance from the aircraft they soon settled down to giving accurate sightings.

Most of the vegetation (Mopani *Colophospermum mopane*) is deciduous and lose their leaves in winter which made observations easy, even out to 400 meters from the aircraft.

The exception was in the large patches of Lebombo Ironwood *Androstachys johnsonii* in the north which is very dense. Large animals such as elephant and buffalo would have been seen but it is suspected that smaller animals up to the size of nyala may not have been observed if they hid in these thickets .

Figure 35: Lebombo Ironwood thickets

Observations of the Grey Duiker may have included Suni as they occurred in the area and it was difficult to distinguish between the two species.

Kudu and Nyala were evenly though sparsely distributed throughout the park with higher numbers in the north. These two species are successful and even due to high human pressure still maintained good populations. Zebra and Wildebeest occurred in the southwest region of the park, most likely due to introductions from the KNP. Some species such as waterbuck and impala may have been undercounted due to their habit of not moving for a passing aircraft and being cryptically coloured.

Statistical data was calculated and reported as requested according to Craig & Gibson, 2004 but is recorded elsewhere.

Acknowledgements

The Park Warden, Mr Baldeu Chande and Antony Alexander for contracting us to do the census.

Paul Davies of Boma Helicopters for the logistics and arranging the Cessna 210, Pilot Dave Hart who kept the plane on track and flying even though conditions were sometimes harsh, Billy Swanepoel, coordinator, observer and for arranging everything including fuel, accommodation, entertainment (fishing & birding), Amos Utui for transport and logistics, observers Albino Chauque, Guilermo Maluleke, Tomas Machel, aircraft guard Sam Maluleke, cook Lourenco Rozario and Bernard Jackson at Gaza Camp.

Figure 36: Census crew back row left to right; Dave Hart, Alan Stephenson, Billy Swanepoel, Tomas Machel, Guilermo Maluleke, Albino Chauque and in front Amos Utui and Sam Maluleke.

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