Ground counts for Medium to large mammals in Lake Mburo Conservation Area, Uganda

Report Prepared
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Table of Contents

1.0. BACKGROUND

1.1. Lake Mburo National Park

In 1983, the Uganda Government, worried by the increased settlement and heavy grazing pressure of the area, created the Lake Mburo National Park, establishing its boundaries as those of the original game reserve. All families living in the area were evicted without compensation and forcefully pushed from their homes. The park opened to the public in 1984; when the government weakened and finally fell, the evicted families returned and joined by others in search of land they drove out the park staff and killed much of the wildlife. By 1986 the entire park had been re-occupied.

1.2. 1987- Today: Lake Mburo National Park

In 1987 the government saw the need to regain control of the park. Aware of the injustices of the past it consulted the local people and their leaders about the park and following these discussions decided to reduce the park's area by 60% and handed that land back to the people. Farmers and pastoralists living in the 40% that remained as park were given permission to stay until the government found them alternative land. Fishing on the lake Mburo was controlled but allowed to continue. Under these new conditions wildlife populations were increasing due to the reduced human impact on the area. Park authorities and local communities now work closely together to conserve Uganda's natural heritage without conflict or confrontation.

Lake Mburo National Park witnessed tremendous changes over the years in terms of conservation. Uganda Wildlife Authority regularly carries out censuses of its protected areas in Uganda aiming at ascertaining how well management efforts are contributing to the well being of the habitats where most of the wildlife is resident. Much as LMCA witnessed many traumatic changes that led to the dramatic reduction of the land under formal protection, these challenges have continued to haunt the park even today.

The animal population has increased over the years, but the area under protection has remained the same size. The human population around the park has also increased. This is causing conflicts as the wild animals continue to interact with the people within this landscape. A number of developments have taken place around the park that range from settlements to farming and fencing off the ranches. This has complicated wild animals' movement through this landscape, and has created mixed feelings among wildlife conservationist today on how best to manage wildlife in this complex environment; aware that animals do not recognize boundaries.

1.4. Wild animal populations and surveys

Wildlife surveys/censuses are key to generating useful information about the status in terms of numbers and distribution of wildlife in the entire ecosystem of LMCA as well as the threats to the species habitat. In LMNP the earlier surveys were aerial and were carried out between 1992 and 2004 when a larger part of LMNP was still open. But with time, a transition from grassland to woodland vegetation became clear. At this time the survey protocol also changed from aerial to ground animal counts to clear the discrepancies in mammal population estimates. Ground counts are excellent for obtaining data in small to medium sized areas on population structures, on the seasonal pattern of distribution within different vegetation types and condition of the animals that can not be obtained from the aircraft. Ground counts are therefore ideal for detailed studies in small study areas, their use being only limited when ground access is difficult or when the area covered is very large (Norton-Griffiths 1978). For example, during the aerial surveys impala and other large wild mammals were counted. Only data on impala and zebra were reliable as the animals were evenly distributed. while data on duiker, bushbuck, reedbuck, eland and buffalo were less reliable (Averbeck 2001).

Dense vegetation and the behaviour of the counted species made it difficult to count from the air. While bushbucks, duikers and reedbuck often rest in bushes and thickets, they can be hardly seen from the air, eland and buffalo are gregarious and most of the animals live in herds. As eland and buffaloes were not so common in the Lake Mburo area it was likely that the observer would either count a herd with many animals or no animals. An aerial survey covers only part of the whole area and by extrapolating from the percentage covered to 100% the population densities are either overestimated or underestimated. In order to monitor population trends in the Lake Mburo area regular ground counts are more cost effective and provide more accurate results for different species than aerial surveys in the Lake Mburo area (Averbeck 2001). Aerial surveys tend to underestimate species population in woodland vegetation due to presence of canopy. Aerial surveys undoubtedly grossly underestimate population of some species for example, the Bushbuck's population density because of its preference for cover and its secretive habits.

However, East (1999) noted that the Bushbuck's tendency to remain concealed probably results in significant undercounting in some ground surveys. It was also important to note that aerial surveys are better at recording animals away from roads but less efficient at detecting individuals or small groups of animals, especially of smaller mammals. For example, the survey carried out in 2004 tried to compare the two methods but it is advisable to restrict comparisons to those studies that use the same methodology, and refrain from comparing ground and aerial surveys (Caro 1999). Nevertheless, though there were improvements in species populations with

ground animal counts in the subsequent ground surveys from 2004, 2006, 2010, 2012 and 2014 questions continued to arise about the populations of certain species such as, the Eland and buffalo. This preempted thoughts to re-design the previous survey protocol for LMNP; from a low sampling intensity (3.5 km spacing between transects) to a high sampling intensity (2km spacing between the transects) in order to bridge the gap. The survey for 2016 provided the basis for monitoring the wild animals in Lake Mburo National Park over the years.

The current survey was carried out at the end of the dry season in September 2019 in line with the UWA Strategic Plan, the Annual Operation Plan and the general survey programme that require a periodic review on species population size, abundance and distribution. The previous ground count was done in November 2016 on medium and large mammals of Lake Mburo National Park and the exercise was solely funded by Uganda Wildlife Authority.

1.5. Objectives for the survey;

(i) To estimate populations of medium to large mammal species in LMNP and the ranches.
(ii) To generate wildlife mammal species distribution patterns in LMNP and the ranches.
(iii) To provide data for monitoring and further assessments for the effectiveness of current conservation strategies (e.g. sport hunting quota setting).
(iv) To provide information about the species structure in this landscape.

2.0. SURVEY AREA AND METHODS

The survey area comprised the park and the ranches adjacent to the park. The park and the adjacent land were divided into three main blocks where the recent ground count was carried out: (1) Block 1 - Lake Mburo National Park, (2) Block 2 - The government ranches/private ranches and (3) Block 3 - Private ranches (See figure 1).

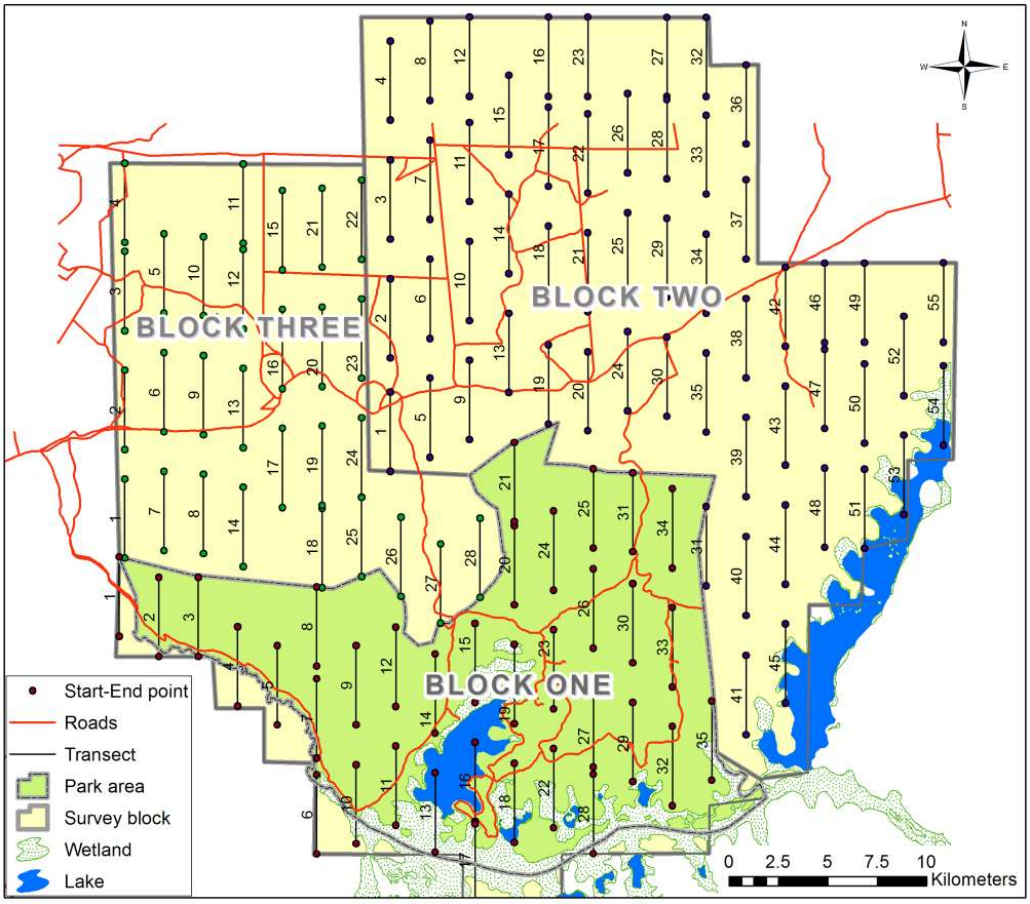

Figure 1. Ground survey map for LMCA

2.1. Survey design

The Transects were made using the DISTANCE software. The program calculated the start and end coordinates that were uploaded in the GPS units to aid in navigation during the survey. A total of 118 transects each measuring approximately 4.0 Kilometers long and spaced at 2 km intervals were covered as used in 2016 (Figure 1). This meant that transects are wholly into one block and do not overlap in the separate blocks. It is assumed that at any given time, the wild animals in the conservation area are evenly distributed. But this is not the reality mainly because of irregular dispersion of animals in relation to availability and distribution of the natural resources thus, implying that the temporal and spatial distribution of animals at any one time is not the same. The stratification shall help appropriate analysis of raw data depending on number of animals sighted in a particular area. (If the spatial distribution is highly divergent, stratification shall be used during analysis).

2.1.1. Data collection

13 survey teams, each headed by a competent staff in using Distance sampling walked along a transect each day to collect data. Waypoints were uploaded on to the GPS to ease identification of the start and end points of each transect during census (Figure 1). Each team collected data in the morning hours between 07:00 AM and 11:30 AM. To ease movement of census teams to the starting point of each transect, given the long distances involved vehicles were used. While at the starting point of each transect, the census teams walked quietly in a straight line from north to the south direction with the aid of a compass and a GPS.

Each individual or a group of mammals sighted were recorded and their perpendicular distances from each transect to the individual or the centre of the animal group was recorded using a range finder. Binoculars were used to provide for clear observations and estimations of species at a distance. Indirect observations such as footprints, droppings and feces were also recorded as opportunistic observations for determination of wild animal absence or presence in the survey area. Data was then recorded on specially designed data sheets.

2.2. Road counts

Road counts were carried out in the morning between 0830hrs and 1140hrs. A four wheel pick up moving at an average speed of 20-25 Km/hr was used. The observers recorded all species sighted on to the datasheets and also marked coordinate references for the locations where animal observations were made using GPS. A distance of 37 km was covered with an area estimate of about 24.35 square kilometers.

2.3. Hippopotamus count

Appropriate information on hippopotamus numbers is best done using a boat. The census was carried out between 07:52 AM and 10:41 AM for hippopotamus, crocodiles and the rare elusive Sitatunga that inhabit lakeshores/ banks and swamp ecosystems with the help of binoculars for sighting at a distance. A motor boat (for total counts) moving slowly to increase chances of observations and to make navigation possible along the lakeshore was used. The observers recorded all species sighted on to the datasheets and also marked coordinate references for the locations where animal observations were made using GPS.

Plate 1. Survey team during the boat census in Lake Mburo National Park

3.0. RESULTS

3.1. Mammal population estimates in LMNP and the ranches

3.1.1. Estimated Population Combined for LMNP and Ranches

The results of the total population estimate for each species in the National park and the ranches is given in Table 1. From the survey results Impala (22,335) were the dominant mammal species followed by Zebra (17,516), Warthog (2,985), Waterbuck (2,743), Buffalo (1,733), Eland (1,702), Bushbuck (1,237) and Topi (739) in the order of reducing species population.

Table 1. Global total population estimates for wild animals both in LMNP and the ranches (**September 2019**)

Species	Global Total (LMNP and Ranches)			
	D	Pop. Est.	95% Confidence	
			LCL	UCL
Impala	16.7	**22,335**	14,050	35,506
Eland	4.9	**1,702**	852	3403
Warthog	8.7	**2,985**	1621	5496
Bushbuck	1.28	**1,237**	572	2674
Topi	0.76	**739**	242	1,128
Buffalo	5.04	**1,733**	598	5,018
Zebra	18.064	**17,516**	10,838	28,309
Waterbuck	2.8	**2,743**	1,603	4,695

3.1.2. Estimated Population in Lake Mburo National Park.

The results of the estimate for each mammal species counted in the National park is given in Table 2a.

Table 2(a). Population estimates for wild animals in the national park only **(September 2019)**

Species	LMNP Block				
	D	Pop. Est.	SE	95% Confidence	
				LCL	UCL
Impala	41.7	**14,334**	4,746	7,560	27,177
Eland	4.9	**1,702**	606.61	852	3403
Warthog	8.7	**2,985**	930.75	1621	5496
Bushbuck	2.17	**748**	435.39	246	2275
Topi	1.17	**404**	162	234	840
Buffalo	5.04	**1,733**	993	598	5,018
Zebra	31.9	**10,953**	3,545	5,802	20,679
Waterbuck	6.6	**2,259**	708	1,228	4,154

3.1.3.Estimated Population in the Ranches

The results of the estimate for each mammal species counted in the ranches (Block 2 and 3 is given in Table 3.

Table 3. Population estimate of mammals in the ranches (September 2019)

Species	Block two					Block Three				
	D	Pop. Est.	SE	95% Confidence		D	Pop. Est.	SE	95% Confidence	
				LCL	UCL				LCL	UCL
Impala	12.3	**7,728**	2,382	4,252	14,046	0.7	**273**	170	85	876
Eland										
Warthog										
Bushbuck	0.78	**489**	221.75	203	1175					
Topi	0.54	**335**	189	95	1,200					
Buffalo										
Zebra	10.478	**6,562**	2,421	3,222	13,367					
Waterbuck	0.8	**485**	268	172	1,367					

3.2. Distribution

3.2.1. Distribution of mammals in LMNP and the ranches outside the park

The fact that human activities are constantly altering areas of species distribution, there was need to understand the distribution of species for monitoring purposes. The distribution of species as recorded during the survey is given (Figures 2, 3 and 4)

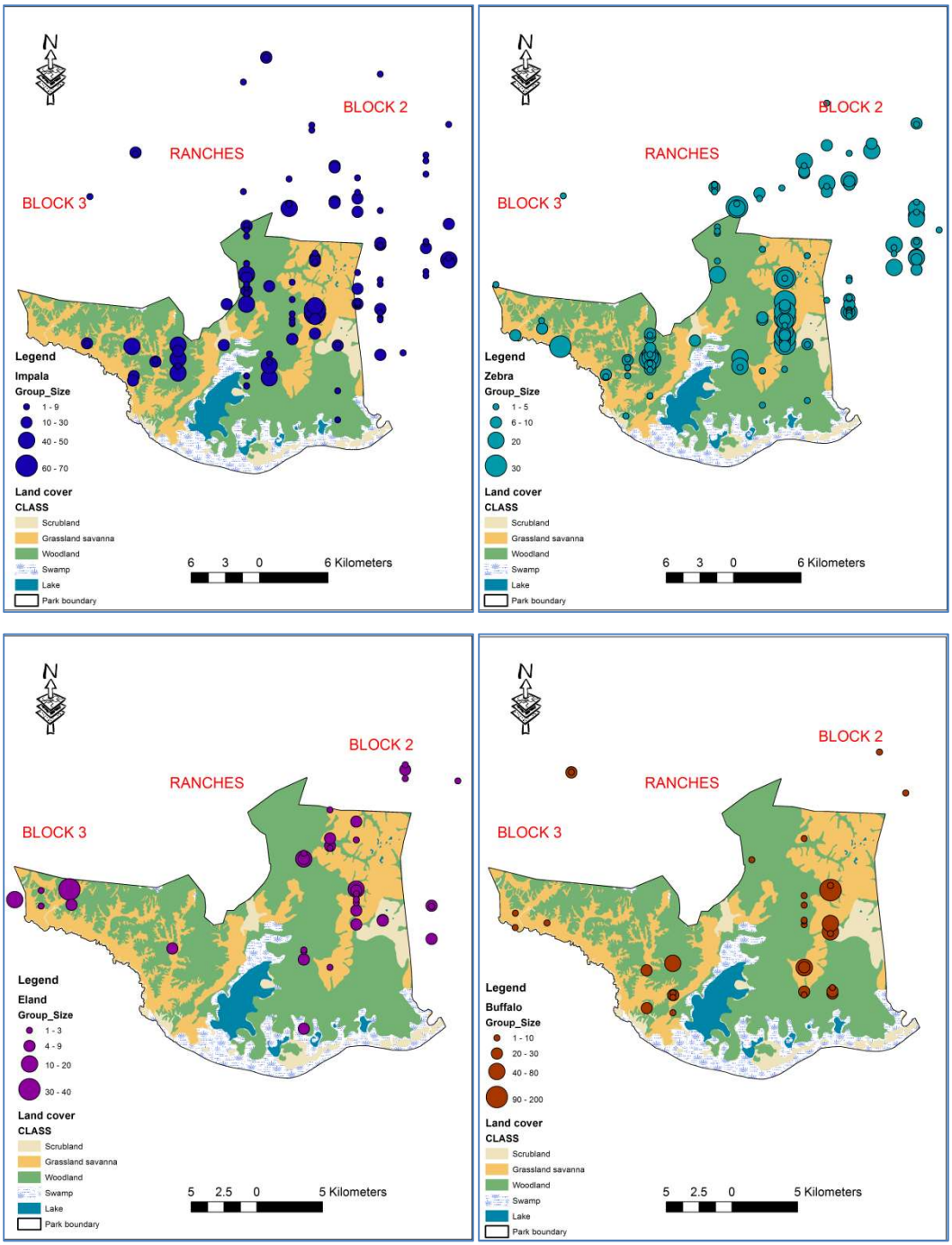

Figure 2. Distribution of impala, zebra, eland and buffalo in LMNP and ranches

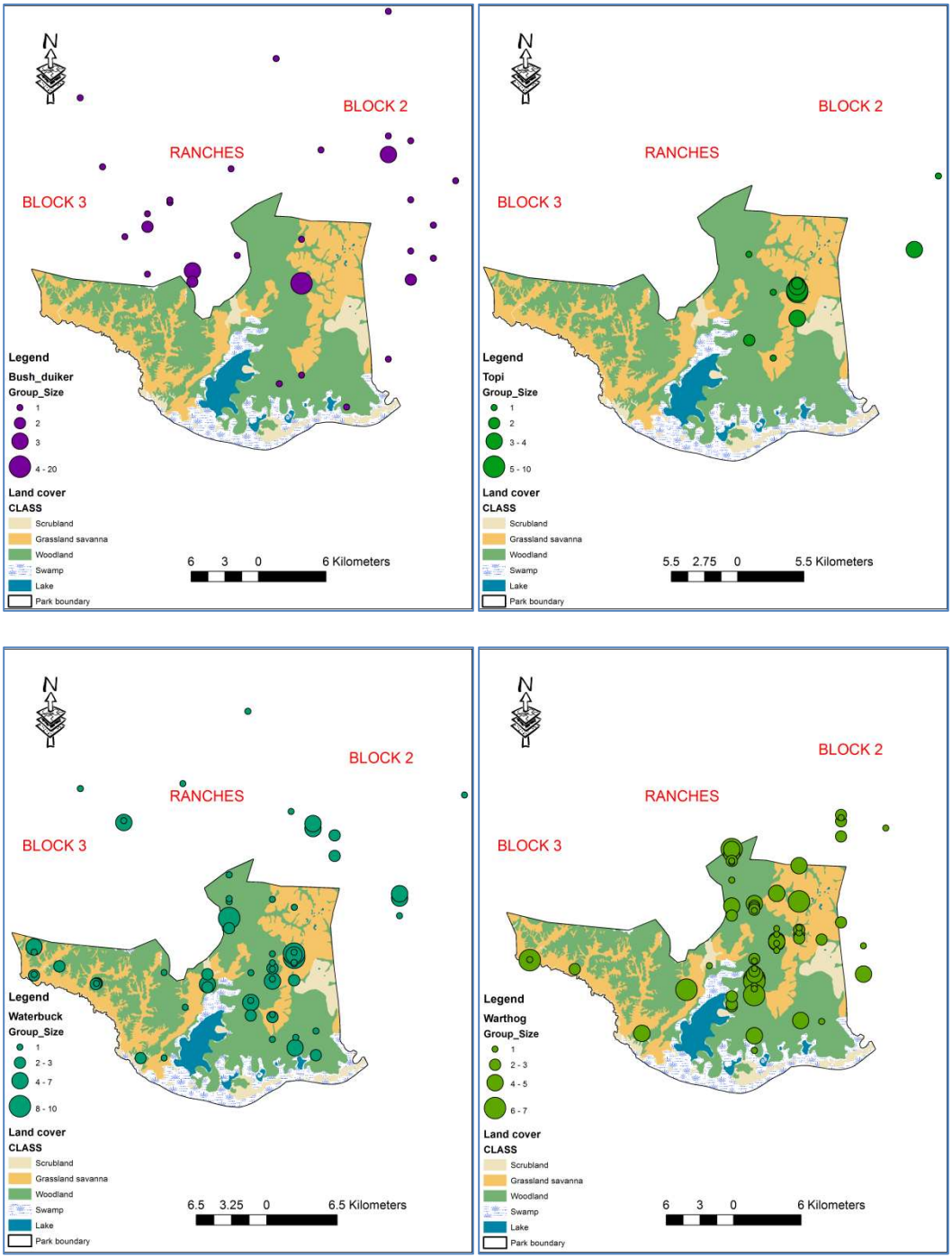

Figure 3. Distribution of Bush duiker, topi waterbuck and warthog in LMNP and ranches

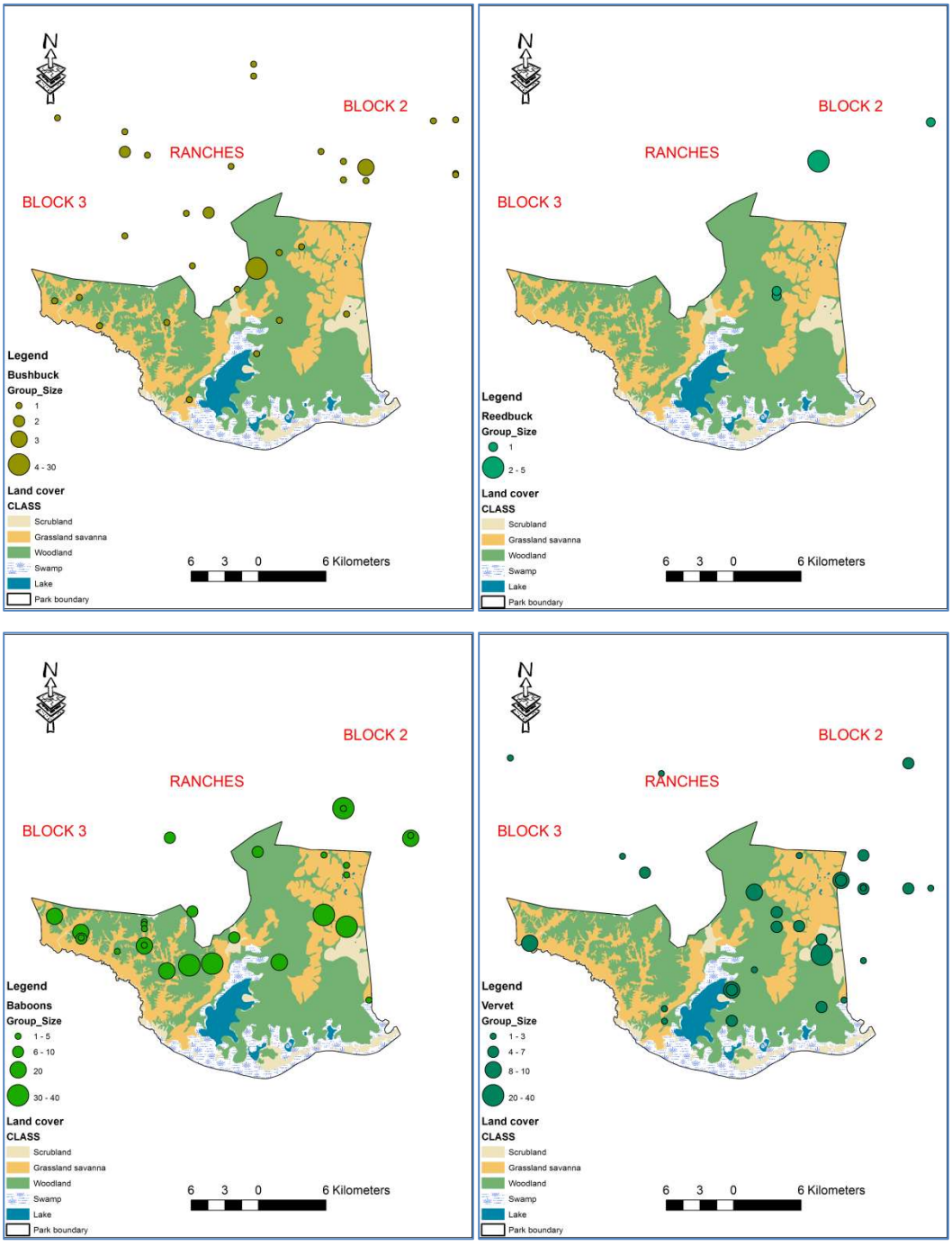

Figure 4. Distribution of bushbuck, reedbuck, baboon and vervets in LMNP and ranches

The giraffe sighted in the park were recorded and their distribution is given (Figure 4)

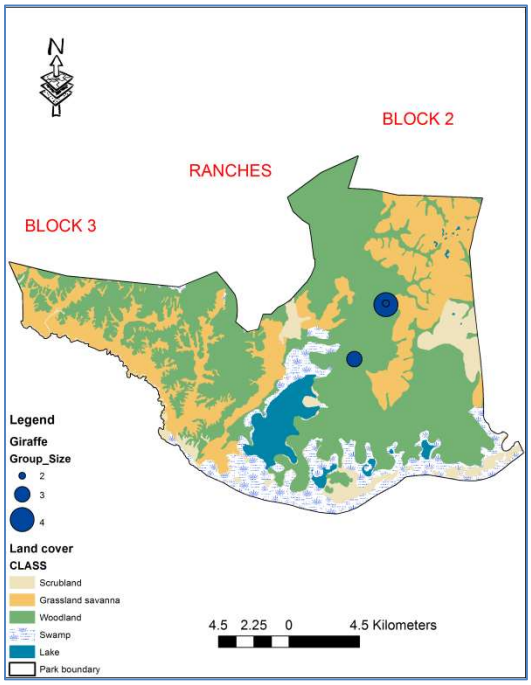

Figure 4. Giraffe distribution during the survey in LMNP

3.2.2. Human Activities in Lake Mburo National Park

The cattle and poaching sign recorded in mburo and their distribution is given (Figure 5)

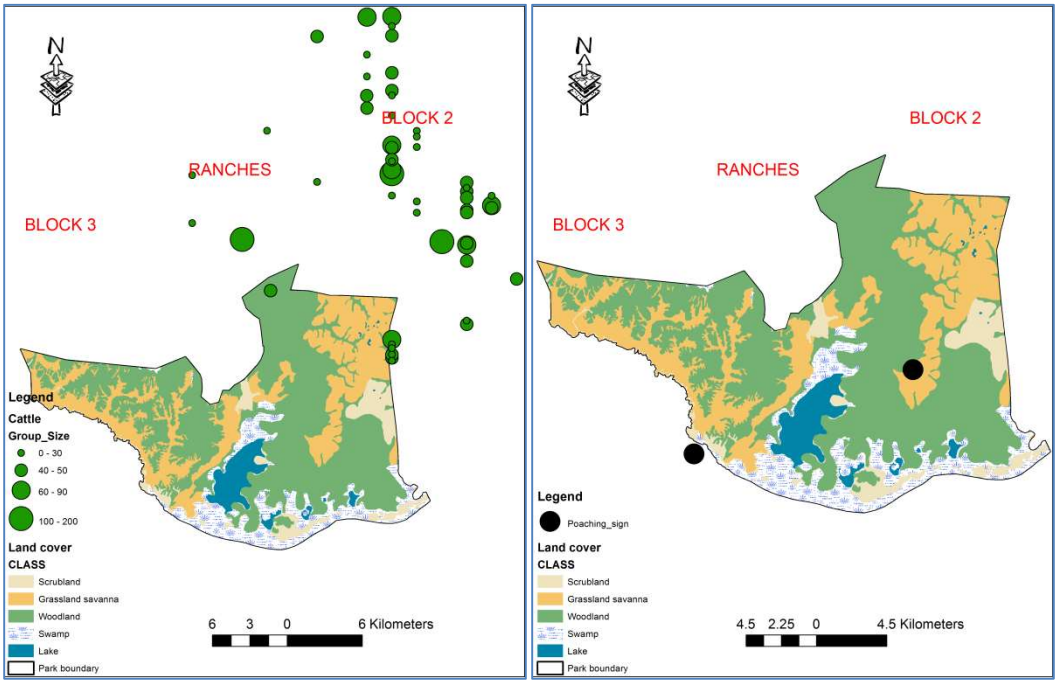

Figure 5. Cattle and poaching sign in LMNP and the ranches

4.0. DISCUSSION

From the general Mburo conservation landscape perspective the survey results showed that the Impala (22,335) were the dominant mammal species in Lake Mburo landscape followed by Zebra (17,516), Warthog (2,985), Waterbuck (2,743), Buffalo (1,733), Eland (1,702), Bushbuck (1,237) and Topi (739) in the order of reducing species population.

Mammal sightings still were more in the national park (block 1) followed by block 2-the Government ranches and then block 3-the private ranches in order of reducing numbers. This was in line with the record for 2016. In summary, most of the mammal species were found in the park than in the ranches (Table 2). Their distribution equally followed the same trend (Figures 2, 3 and 4). Similarly, the current survey recorded sightings for Giraffe, Black and White Colobus, bushpig, jackals, oribi and reedbuck, mongoose, klipspringer and patas monkeys but the numbers were very small for the analysis in program DISTANCE.

There was a general increase in species sightings for impala, buffalo, eland, bushbuck and topi in 2019 (Table 2a) compared to 2016 (Appendix 1) sightings using the line transect method. The trend in sightings and the variations thereafter, could be attributed to the increase in conservation efforts inside the national park as compared to the ranches. Distribution and abundance of wild animals tend to be higher inside than outside the park due to intensive law enforcement inside the park than in the ranches (Rwetsiba and Tumwesigye 2004).

Considering the ranches, we recorded topi in block 2 yet no sightings were made of topi in block2 in 2016. The population of species in block 2 has remained stable for bushbuck, impala, and zebra. However, there was a decline in waterbuck sightings in block 2 from 1,253 individuals recorded in 2016 to 485 in 2019. No sighting was made of the buffalos on block 2 during 2019 though 116 individuals were recorded in 2016. The fact that there was a slight increase in sightings for buffalos in the park could probably explain the movement pattern and the seasonality effects as the buffalos could have moved back to the park. However, the effects of poaching aslo may not be underlated. For block 3, there was a general variation in species numbers hence leading to decimation of species in block 3. This could be due to the poaching and the increasing change in land use observed during the survey. Block 3 (the private ranch) was heavily settled and the observed mammals were few in number compared to block 2 (Government/private ranch) and (block 1)-the national park. There could be a negative correlation between mammal presence and the settlement patterns observed in the ranches in Block 3. Ogutu *et al,* 2010 observed that Settlement activities and daytime livestock watering provide a push that keep wildlife away. This could be true for the observed trend in species decline in block 3 (Table 3).

Poaching still manifests in Lake Mburo landscape (Figure 5). Poaching is known for its negative impact on animal numbers. Andy (2013) observed that the removal of fauna from an area due to poaching flows from the immediate impact of killing an existing animal, the medium term effect of reducing breeding numbers and hence the rate of reproduction, and the long term effects of thinning the gene pool and the symbiotic- and often irreversible – impact this has on overall biodiversity.

An estimated 40 heads of cattle were encountered in the northern and eastern parts of the park during the ground animal count (Figure 5). In 2016 an estimated 348 heads of cattle and while in 2014, 80 heads of cattle were encountered in the park during road count. Over the years cattle has proven to be a challenge to management despite the efforts to prevent cattle entry into the park. Domestication of cattle in wildlife protected areas is condemned in the UWA Act of 2019 as a threat to conservation. Mishara *et al* (2003) also noted that the growing numbers in livestock populations create an overlap of diets and forage competition with wild herbivores, resulting in overgrazing and decline or local extinction in wild herbivore populations.

5.0. CONCLUSION AND RECOMMENDATIONS

Lake Mburo National Park is an important wildlife area that needs to be protected all through. On the other hand due to intensive law enforcement inside the park other than in the ranches, tend to make distribution and abundance of wild animals to be higher inside than outside the park.

- Because of increased poaching and change in land use, few mammals were sighted outside the park especially in block 3 -cultivation, road construction, increased population of human and livestock.
- Concentration of mammals was more in the central and eastern sector than in the western sector
- Obstacles in terms of fences made it difficult to maneuver along the transects
- Ranch owners could have contributed to decimation of mammals that were on their ranch.

The following conservation measures are recommended:

1. Prioritize invasive species management in the park to improve wildlife habitat.
2. Encourage conservation management enterprises that improve relations with the communities and minimize human-wildlife conflicts.
3. Construct more water holes (dams) that can store water long enough while ensuring adequate water supply at all times within the park.

4. Strengthen intelligence information gathering to avert illegal activities
5. Strengthen community awareness protocols in LMCA.

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7.0. APPENDICES

Appendix I: Population estimate of mammals in the national park (November 2016)

Species	Block 1(National Park)				
	D	Pop. Est.	SE	95% Confidence	
				LCL	UCL
Buffalo	3.5	**1,206**	607	464	3,132
Bushbuck	1.6	**591**	143	365	954
Eland	4.3	**1,484**	780	246	8,965
Impala	30.7	**10,556**	2,396	6,750	16,505
Topi	1.0	**344**	156	144	822
Warthog	8.9	**3,083**	808	1,843	5,160
Waterbuck	10.0	**3,730**	1,210	1,993	6,981
Zebra	**35**	**12,200**	4,302	6,150	24,202

Appendix II: Some of the survey team members

Appendix III: One of the training sessions before the census

Appendix IV: Field challenges during the survey

Appendix V: LMNP Ground Survey Data Sheet

Observer …… Date ……

Transect no…… Transect length ……

Time	Animal species	Perp. Dist (m)	Run No.	Easting	Northing	Group size	Species Structure				REMARKS
							M	F	Young	Old male	

Appendix VI: Block one coordinates - LMNP

Name	Easting	Northing	Block
1S	252672	9937208	Block 1
1E	252672	9933208	Block 1
2S	254672	9932187	Block 1
2E	254672	9936187	Block 1
3S	256672	9936187	Block 1
3E	256672	9932187	Block 1
4S	258672	9933699	Block 1
4E	258672	9929699	Block 1
5S	260672	9928744	Block 1
5E	260672	9932744	Block 1
6S	262672	9922220	Block 1
6E	262672	9926220	Block 1
7S	262672	9927069	Block 1
7E	262672	9931069	Block 1
8S	262672	9931698	Block 1
8E	262672	9935698	Block 1
9S	264672	9932738	Block 1
9E	264672	9928738	Block 1
10S	264672	9926738	Block 1
10E	264672	9922738	Block 1
11S	266672	9923681	Block 1
11E	266672	9927681	Block 1
12S	266672	9929681	Block 1
12E	266672	9933681	Block 1
13S	268672	9922315	Block 1
13E	268672	9926315	Block 1
14S	268672	9928315	Block 1
14E	268672	9932315	Block 1
15S	270672	9933869	Block 1
15E	270672	9929869	Block 1
16S	270672	9927869	Block 1
16E	270672	9923869	Block 1
17S	270672	9923745	Block 1
17E	270672	9919745	Block 1
18S	272672	9922797	Block 1
18E	272672	9926797	Block 1
19S	272672	9928797	Block 1
19E	272672	9932797	Block 1
20S	272672	9934797	Block 1
20E	272672	9938797	Block 1

Name	Easting	Northing	Block
21S	272672	9938997	Block 1
21E	272672	9942997	Block 1
22S	274672	9923545	Block 1
22E	274672	9927545	Block 1
23S	274672	9929545	Block 1
23E	274672	9933545	Block 1
24S	274672	9935545	Block 1
24E	274672	9939545	Block 1
25S	276672	9941658	Block 1
25E	276672	9937658	Block 1
26S	276672	9936615	Block 1
26E	276672	9932615	Block 1
27S	276672	9930615	Block 1
27E	276672	9926615	Block 1
28S	276672	9926238	Block 1
28E	276672	9922238	Block 1
29S	278672	9925872	Block 1
29E	278672	9929872	Block 1
30S	278672	9931872	Block 1
30E	278672	9935872	Block 1
31S	278672	9937470	Block 1
31E	278672	9941470	Block 1
32S	280672	9924659	Block 1
32E	280672	9928659	Block 1
33S	280672	9930659	Block 1
33E	280672	9934659	Block 1
34S	280672	9936659	Block 1
34E	280672	9940659	Block 1
35S	282672	9925956	Block 1
35E	282672	9929956	Block 1

Appendix VII: Block two coordinates-Ranches

Name	Easting	Northing	Block
1S	266400	9941546	Block 2
1E	266400	9945546	Block 2
2S	266400	9947260	Block 2
2E	266400	9951260	Block 2
3S	266400	9953260	Block 2
3E	266400	9957260	Block 2
4S	266400	9959260	Block 2
4E	266400	9963260	Block 2
5S	268400	9942251	Block 2
5E	268400	9946251	Block 2
6S	268400	9948251	Block 2
6E	268400	9952251	Block 2
7S	268400	9954251	Block 2
7E	268400	9958251	Block 2
8S	268400	9960251	Block 2
8E	268400	9964251	Block 2
9S	270400	9943145	Block 2
9E	270400	9947145	Block 2
10S	270400	9949145	Block 2
10E	270400	9953145	Block 2
11S	270400	9955145	Block 2
11E	270400	9959145	Block 2
12S	270400	9960457	Block 2
12E	270400	9964457	Block 2
13S	272400	9945515	Block 2
13E	272400	9949515	Block 2
14S	272400	9951515	Block 2
14E	272400	9955515	Block 2
15S	272400	9957515	Block 2
15E	272400	9961515	Block 2
16S	274400	9964456	Block 2
16E	274400	9960456	Block 2
17S	274400	9959916	Block 2
17E	274400	9955916	Block 2
18S	274400	9953916	Block 2
18E	274400	9949916	Block 2
19S	274400	9947916	Block 2
19E	274400	9943916	Block 2
20S	276400	9943578	Block 2
20E	276400	9947578	Block 2

Name	Easting	Northing	Block
21S	276400	9949578	Block 2
21E	276400	9953578	Block 2
22S	276400	9955578	Block 2
22E	276400	9959578	Block 2
23S	276400	9960456	Block 2
23E	276400	9964456	Block 2
24S	278400	9944600	Block 2
24E	278400	9948600	Block 2
25S	278400	9950600	Block 2
25E	278400	9954600	Block 2
26S	278400	9956600	Block 2
26E	278400	9960600	Block 2
27S	280400	9964455	Block 2
27E	280400	9960455	Block 2
28S	280400	9960310	Block 2
28E	280400	9956310	Block 2
29S	280400	9954310	Block 2
29E	280400	9950310	Block 2
30S	280400	9948310	Block 2
30E	280400	9944310	Block 2
31S	282400	9939765	Block 2
31E	282400	9935765	Block 2
32S	282400	9964454	Block 2
32E	282400	9960454	Block 2
33S	282400	9959517	Block 2
33E	282400	9955517	Block 2
34S	282400	9953517	Block 2
34E	282400	9949517	Block 2
35S	282400	9947517	Block 2
35E	282400	9943517	Block 2
36S	284400	9962048	Block 2
36E	284400	9958048	Block 2
37S	284400	9956247	Block 2
37E	284400	9952247	Block 2
38S	284400	9950247	Block 2
38E	284400	9946247	Block 2
39S	284400	9944247	Block 2
39E	284400	9940247	Block 2
40S	284400	9938247	Block 2
40E	284400	9934247	Block 2

Name	Easting	Northing	Block
41S	284400	9932247	Block 2
41E	284400	9928247	Block 2
42S	286400	9951845	Block 2
42E	286400	9947845	Block 2
43S	286400	9945845	Block 2
43E	286400	9941845	Block 2
44S	286400	9939845	Block 2
44E	286400	9935845	Block 2
45S	286400	9933845	Block 2
45E	286400	9929845	Block 2
46S	288400	9952045	Block 2
46E	288400	9948045	Block 2
47S	288400	9947702	Block 2
47E	288400	9943702	Block 2
48S	288400	9941702	Block 2
48E	288400	9937702	Block 2
49S	290400	9952047	Block 2
49E	290400	9948047	Block 2
50S	290400	9946952	Block 2
50E	290400	9942952	Block 2
51S	290400	9941648	Block 2
51E	290400	9937648	Block 2
52S	292400	9949354	Block 2
52E	292400	9945354	Block 2
53S	292400	9943354	Block 2
53E	292400	9939354	Block 2
54S	294400	9942858	Block 2
54E	294400	9946858	Block 2
55S	294400	9948052	Block 2
55E	294400	9952052	Block 2

Appendix VIII: Block three coordinates-Ranches

Name	Easting	Northing	Block
1S	252941	9937151	Block 3
1E	252941	9941151	Block 3
2S	252941	9942632	Block 3
2E	252941	9946632	Block 3
3S	252941	9948632	Block 3
3E	252941	9952632	Block 3
4S	252941	9953087	Block 3
4E	252941	9957087	Block 3
5S	254941	9953531	Block 3
5E	254941	9949531	Block 3
6S	254941	9947531	Block 3
6E	254941	9943531	Block 3
7S	254941	9941531	Block 3
7E	254941	9937531	Block 3
8S	256941	9937389	Block 3
8E	256941	9941389	Block 3
9S	256941	9943389	Block 3
9E	256941	9947389	Block 3
10S	256941	9949389	Block 3
10E	256941	9953389	Block 3
11S	258941	9957055	Block 3
11E	258941	9953055	Block 3
12S	258941	9952732	Block 3
12E	258941	9948732	Block 3
13S	258941	9946732	Block 3
13E	258941	9942732	Block 3
14S	258941	9940732	Block 3
14E	258941	9936732	Block 3
15S	260941	9955712	Block 3
15E	260941	9951712	Block 3
16S	260941	9949712	Block 3
16E	260941	9945712	Block 3
17S	260941	9943712	Block 3
17E	260941	9939712	Block 3
18S	262941	9935672	Block 3
18E	262941	9939672	Block 3
19S	262941	9939829	Block 3
19E	262941	9943829	Block 3
20S	262941	9945829	Block 3
20E	262941	9949829	Block 3

Name	Easting	Northing	Block
21S	262941	9951829	Block 3
21E	262941	9955829	Block 3
22S	264941	9956230	Block 3
22E	264941	9952230	Block 3
23S	264941	9950230	Block 3
23E	264941	9946230	Block 3
24S	264941	9944230	Block 3
24E	264941	9940230	Block 3
25S	264941	9940221	Block 3
25E	264941	9936221	Block 3
26S	266941	9939226	Block 3
26E	266941	9935226	Block 3
27S	268941	9937876	Block 3
27E	268941	9933876	Block 3
28S	270941	9939166	Block 3
28E	270941	9935166	Block 3

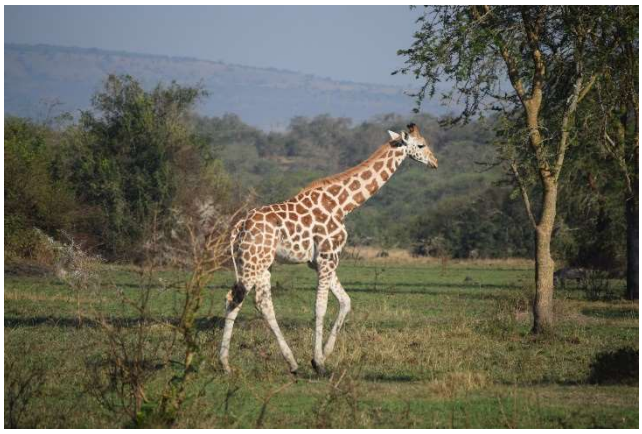
Appendix XI: Some of the encountered wildlife species during the survey

Buffalos

Bushbuck

Eland

Giraffe

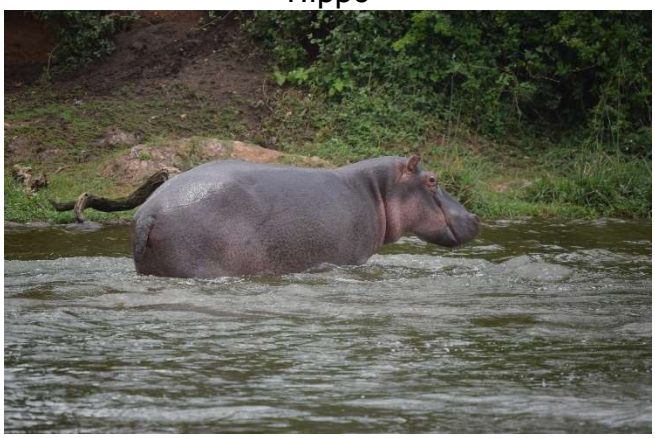


Baboons

Black and White colobus monkey

Crocodile

Hippo



Impala

Dwarf mongoose

Topi

Warthog

Waterbuck

Zebra