Total Aerial Count of Elephants in Laikipia-Samburu Ecosystem in November 2008.

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ACRONYMS

AWF	African Wildlife Foundation
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
GZT	Grevy's Zebra Trust
KWS	Kenya Wildlife Service
LWC	Lewa Wildlife Conservancy
LWF	Laikipia Wildlife Forum
MIKE	Monitoring Illegal Killing of Elephants
NRT	Northern Rangelands Trust
STE	Save the Elephants

SPECIES CODES

Code	Species Name
B	Buffalo
BN	Baboon
BEF	Bat Eared Fox
C	Cattle
CH	Cheetah
CM	Camel
CR	Crocodile
DD	Dik dik
DK	Duiker
DN	Donkey
E	Elephant
ED	Eland
F	Fresh Carcass
G	Giraffe
GG	Grants Gazelle
GK	Greater Kudu
GN	Gerenuk
HP	Hippo
HY	Hyena
IM	Impala
LN	Lion
LK	Lesser Kudu
O	Old Carcass
OS	Ostrich
OX	Oryx
R	Recent Carcass
RH	Rhino
SH	Shoats
VO	Very Old Carcass
WB	Waterbuck
WH	Warthog
Z	Zebra
GZ	Grevy's Zebra
BB	Bushbuck
JK	Jackal

ACKNOWLWDGEMENTS

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We would also like to thank KWS Mountain and Eastern regions Assistant Directors and their staff for their support on the ground. To the drivers, rangers, aircraft attendants without whom the survey would not have been easy we applaud their dedication. Finally, to all those who participated in anyway and have not been mentioned, we thank you for your contribution towards the 2008 elephant and Grevy's zebra aerial census.

EXECUTIVE SUMMARY

The total aerial count of Elephants in Laikipia-Samburu Ecosystem and for the second time in Marsabit was conducted between 24th and 28th November 2008. Total counts of elephants, their carcasses and Gravy's Zebra were done. Livestock and other wildlife species mainly the large herbivores were also counted. Coming six years after the preceding total count of Omondi *et. al.* 2002, the data provides a basis for assessment of the trends in the ecosystem. Within Laikipia-Samburu ecosystem, 7415 elephants were counted, up from 5447 elephants counted in 2002, an estimated annual growth rate of 5.3%. West Isiolo/Samburu block hosted 26% of the elephant population in Ewaso Ecosystem at the highest density of 1.332 elephants per square kilometer. Most of these elephants were encountered in Buffalo Springs National Reserve. Ninety five elephant carcasses were recorded. Marsabit area had 319 elephants at very low densities. Some 2400 Grevy's zebra were counted mostly within central part of Laikipia district, Lewa and Marti. The number of buffaloes counted in Laikipia-Samburu ecosystem was 5331 up from the 2279 counted in 2002. The bulk of these, 4282, were in Laikipia district which by itself recorded an increase of 140% from the 1785 buffaloes counted in 2002. One hundred and forty eight rhinos were counted, up from 138 in 2002, and most of these were in Solio. A total of 521,844 livestock (cattle and shoats) were counted in the Laikipia-Samburu ecosystem. Shoats accounted for 73% of the livestock.

1. INTRODUCTION

The Laikipia-Samburu ecosystem has the second largest population of elephants, (*Loxodonta africana*) in Kenya after the Tsavo ecosystem. The ecosystem is an important elephant range as it currently harbors the largest population of free ranging elephants in the country (Omondi *et. al.*, 2002). Long-term monitoring of elephant numbers offers the most comprehensive method for recording elephant population change in the country. Elephant population surveys in Kenya are undertaken every four years. The censuses incorporate the international system for Monitoring Illegal Killing of Elephants (MIKE), instituted under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The Laikipia-Samburu region encompasses one of the 55 MIKE sites in Africa. This helps provide baseline information for monitoring elephant poaching levels in the country. A previous elephant survey conducted in 2002 within Samburu-Laikipia ecosystem estimated the elephant population at about 5,447 and detected approximately 60 elephant carcasses within the ecosystem.

Although it is recommended a national elephant survey be carried out after every four years, the status of elephant population within Samburu-Laikipia ecosystem had not been established for the last six years.

The Grevy's zebra (*Equus grevyi*) population of which 93% of global population occurs in Samburu-Laikipia ecosystem has experienced an approximate 85% decline over the last 27 years (Nelson, 2003; Rowen & Ginsberg, 1992). The last comprehensive survey of Grevy's zebra in Kenya was undertaken in the year 2000 (Nelson & Williams 2003), resulting in an estimated national population of about 2,571. In 2004, information contributed by various Grevy's zebra conservation stakeholders suggested that the population had dropped to between 1,567 and 1,976 (Williams & Low 2004). A second stakeholder workshop in 2007 suggested that the number of Grevy's zebra in Kenya was between 1,838 and 2,319 (Mwasi & Mwangi, 2007). However, both the 2004 and 2007 estimates were guesses based on summing tallies over different Grevy's zebra populations.

In response to the sharp decline in Grevy's zebra population, Kenya Wildlife Service (KWS) in collaboration with other stakeholders intensified conservation efforts for the zebra species. It was apparent that without effective accounting of present status of Grevy's zebra numbers in the country, it would be unfeasible to plan future conservation actions effectively. A National

Survey of Grevy's zebra throughout Kenya was implemented using standard aerial total count techniques. The Grevy's zebra survey is intended to be repeated at four year intervals.

This five day aerial survey concentrated on elephants and Grevy's zebras within the Samburu-Laikipia ecosystem and was conducted on 23rd to 28th November 2008. The survey was extended to parts of Marsabit District to ascertain the status of elephants beyond the MIKE site (Fig. 1). It has been reliably established by the Save the Elephants tracking program that the Laikipia/ Samburu elephant range is connected to that of elephants in Marsabit. The exercise also captured data on other large herbivores including livestock. A series of total aerial counts have been carried out since 1992 (Thouless, 1992, Mpala Research 1996, Kahumbu *et. al*. 1999, Omondi, *et al*. 2002.). In addition while sample counts were carried for the southern part of the MIKE site, Laikipia, in 1997, 2005 and 2008 (DRSRS and Mpala Research unpublished). The 1992 counts (Thouless, 1992) were exclusive to Samburu district while in 1996 it covered mainly the Laikipia district.

2. OBJECTIVES OF THE SURVEY

The 2008 Samburu-Laikipia survey was intended to;

- Determine the present status of elephant population
- Establish elephant poaching levels through observation of carcasses within the ecosystem
- Detail changes in the elephant population size and their distribution since the last aerial survey of 2002.
- Determine population status and distribution of Grevy's zebra
- Identify trends in the Grevy's zebra populations by locations
- Establish a baseline for Grevy's zebra for future surveys in Kenya
- Document distribution and numbers of other animal species such as the buffaloes and livestock.

3. STUDY AREA

Most of the region is typically dry savanna, hot and dry for most of the year with highly variable bimodal rainfall, 90% of which falls in April and November (Barkham and Rainy 1976). It has a high diversity of habitats ranging from the lowland, xeric scrub bush lands comprising *Acacia* and *Commiphora* species to the highland, mesic cedar and camphor forests. Ewaso River and its tributaries is the lifeline for wildlife providing dry season food resources in the dry season.

Major land uses through the census area include national reserves, community conservation areas, undeveloped government-owned trust land, forest reserves, private ranches and sanctuaries and agricultural settlement (Kahumbu *et. al.,* 1999). Samburu is mainly a low lying pastoral grazing land with forested ranges (Kirisia/Leroghi/Mathews). The district has three protected areas; Samburu, Buffalo Springs and Shaba National Reserves. Several Community Wildlife Conservancies; Namunyak, Kalama, Meibae and Il Ngwesi were included in the survey area.

The private ranches in Laikipia host a lot of resident wildlife populations that either have been confined by fencing or are free ranging. The fencing influences movement patterns of wildlife. Subdivision of some of the ranches and the subsequent settlement in the western and southern parts of the district has led to intense human-wildlife conflicts as the migratory corridors have been blocked. Ol Pajeta, Ol Jogi, Lewa and Solio Conservancies host rhinos. The count was focused on the designated MIKE survey sites and extended to the known Grevy's zebra range.

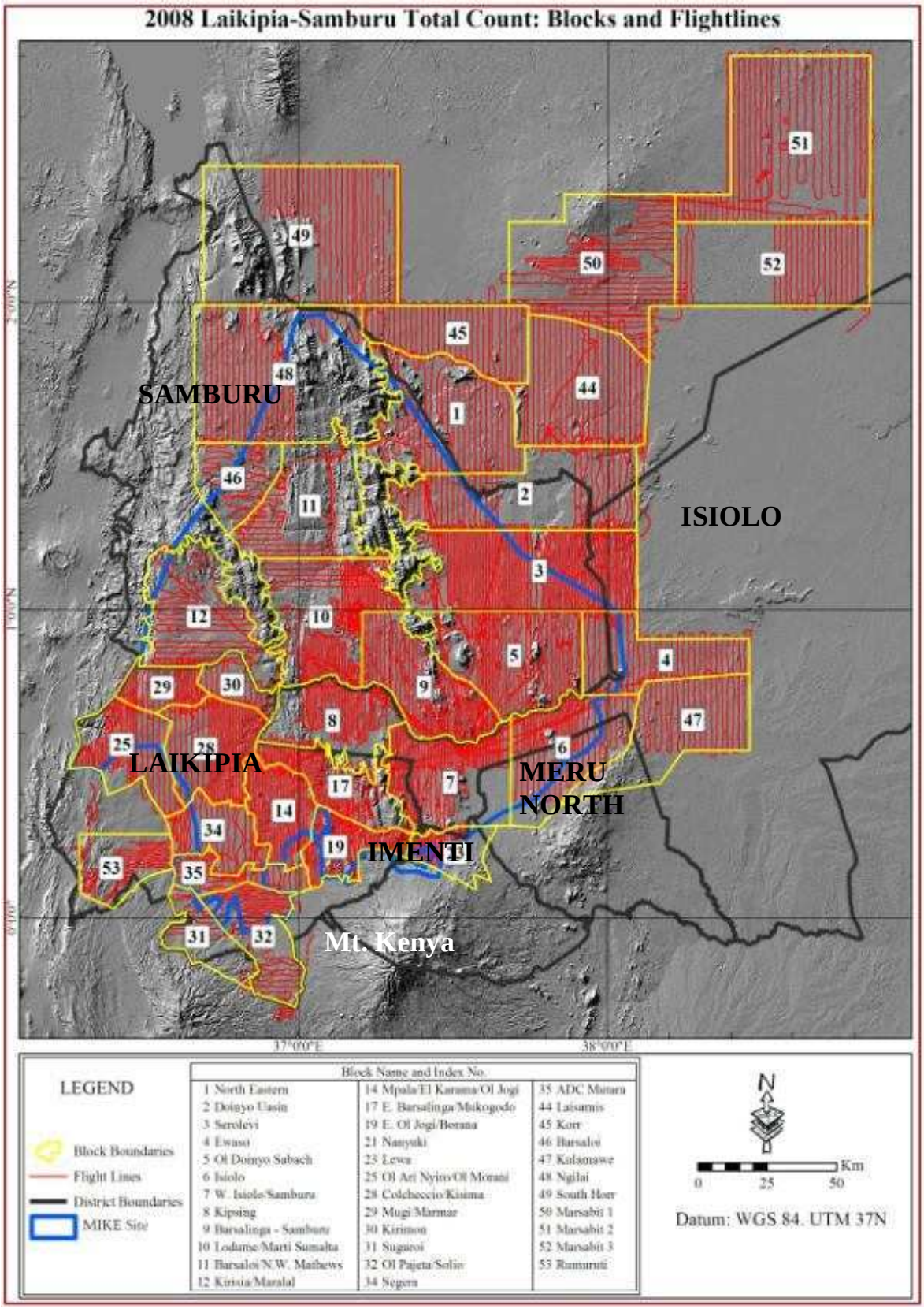

Figure 1. MIKE site boundary, 2008 census blocks and flight lines. Blocks 50 to 52 are new establishments to add onto previous census area.

4. METHODOLOGY

The method adopted for the 2008 total aerial count for wildlife and livestock was as described by Douglas-Hamilton *et al.* (1994) and Douglas-Hamilton (1997). Pathfinder software used for plotting species distribution maps. A total of 10 aircrafts were used in the count. All observations made were saved in the GPS as waypoints with the geographical location referenced and were used in producing species distribution maps. Repeat counts along block boundaries were corrected before data analysis. The exercise started every morning at 7.30am and ended late in the evening. Breaks were taken during refueling of the aircraft and at lunch. Fueling sites were strategically distributed in survey area to cut down on ferrying time. Each survey crew consisted of 1 observer and a pilot for 2 seater aircraft and a pilot, 1 FSO and 2 Rear Seat Observers (RSO) for a 4 seater aircraft.

The interval between the flight lines varied between one and three kilometers depending on the visibility and terrain, but constancy in direction and interval was observed whenever possible for each block. The wider spacing of flight lines was predominantly towards the northern part of the census area. These flight paths varied in length to conform to block delineations and topography (Fig. 1). Fifteen wildlife species and livestock and elephant carcasses were counted.

Since the block boundaries did not necessarily coincide with district administrative boundaries a spatial join of the census waypoints and formal district boundaries was made to enable summarization of results by districts (Table 3). A similar spatial join was made likewise for known land uses and a respective summary prepared (Table 4).

5. RESULTS

5.1 Live Elephants

A sum of 7734 elephants was counted in the week long exercise; 7,415 elephants in the Laikipia/Samburu (Ewaso) ecosystem, registering a 27% increase since 2002, and a further 319 in the Marsabit Blocks 1 to 3. The results for 2008 aerial census for elephants and other species are shown in Table 1. Within the ecosystem, 26% (n=7415) of the elephant population was recorded in W. Isiolo/Samburu block, followed by Ol Doinyo Sabach (block 7) with 15% of the population (Figure 2). Most of these elephants in the W. Isiolo/Samburu (block 7) were sighted in Buffalo Springs National Reserve, Il-Ngwezi and Lekuruki. The block had the highest density of elephants at 1.332 elephants Km^{-2}, followed by Mpala/El Karama/Ol Jogi block with a density of 1.019 elephants Km^{-2} (Table 2 and Figure 4).

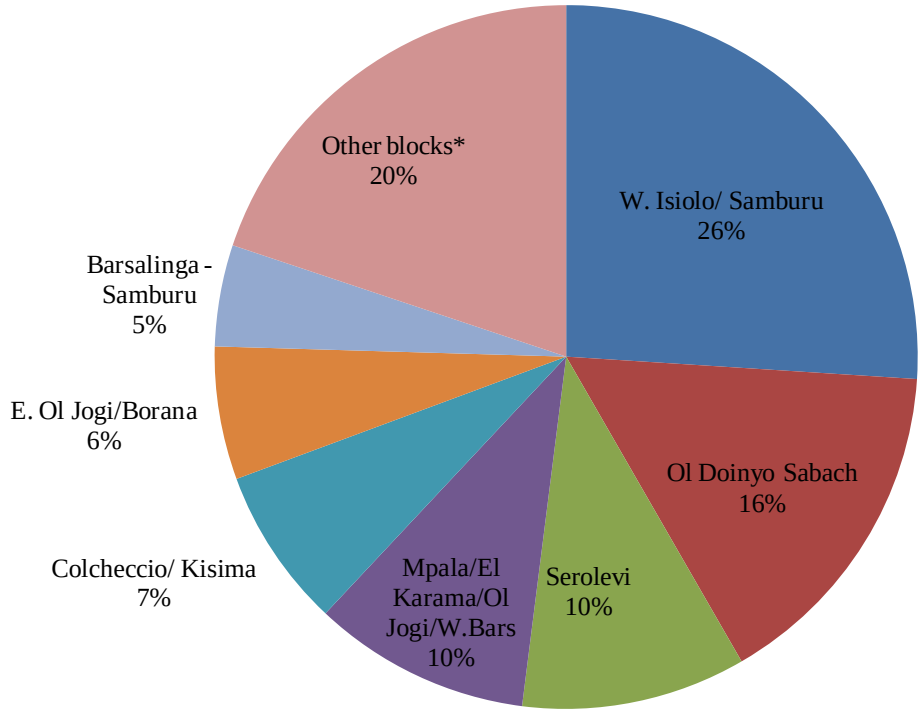

Figure 2. Proportional distribution of elephants in various blocks expressed as percentage of total count (n=7415).
*All other blocks with less than 5% of total count on each.

5.2 Elephant Carcasses

During the count, 95 elephant carcasses inclusive of old (O), very old (VO) and recent (R) were recorded. Most of these carcasses (20%) were found in North eastern (block 1) and within the W. Isiolo/Samburu (block 7) which had the highest concentration of live elephants (Map 4). Other carcasses were recorded in block 14 (12%) and Isiolo (block 6) accounting for 11%. Four recent carcasses were recorded in W. Isiolo/Samburu, while blocks Kirisia/Maralal (block 12) and Kipsing (block 8) recorded one recent carcass each.

Table 1. Block totals of animals counted

No.	BLOCK NAME	Area Km2	EL	O+R	SH	CT	CM	DD	BF	ED	GF	GG	GK	GN	GZ	IM	KG	LK	O	OS	OX	R	RH	RHW	ST	TG	VO	WB	ZB
1	North Eastern	1,954	52	19	11,821	5,495	2,593	2	0	0	0	347	0	0	0	0	0	8	19	42	6	0	0	0	489	0	1	0	0
2	Doinyo Uasin	915	77	0	1,285	1,875	142	3	0	0	23	240	0	7	0	0	0	0	0	9	5	0	0	0	32	0	2	0	0
3	Serolevi	2,345	785	2	5,150	3,560	177	15	18	0	414	132	0	35	21	1	0	9	2	19	86	0	0	0	77	114	0	0	0
4	Ewaso	1,167	11	1	956	0	0	0	14	0	51	148	2	10	1	0	0	0	1	12	24	0	0	0	1,162	0	0	0	0
5	Ol Doinyo Sabach	1,354	1,141	1	10,289	4,696	109	7	359	0	173	36	0	12	7	0	0	6	1	13	34	0	0	0	188	12	2	0	0
6	Isiolo	1,442	206	10	18,200	16,144	585	0	295	2	61	913	7	24	20	23	0	0	10	64	121	0	0	0	149	0	2	0	102
7	W. Isiolo/Samburu	1,448	1,929	12	17,701	6,045	2,655	0	233	33	144	736	0	29	124	238	0	7	8	89	206	4	0	2	359	0	0	14	279
8	Kipsing	1,140	0	1	21,464	7,710	685	0	0	0	0	22	0	15	20	24	0	0	0	13	0	1	0	0	387	0	2	0	15
9	Barsalinga - Samburu	1,263	347	2	71,978	18,948	2,208	0	10	0	107	107	0	71	294	3	0	0	2	55	45	0	0	0	1,978	0	0	0	24
10	Lodume/Marti Sumalta	1,674	30	0	31,980	5,934	577	2	30	0	0	31	0	11	627	0	0	5	0	75	0	0	0	0	260	0	0	0	99
11	Barsaloi/N.W. Mathews	1,547	0	0	7,730	2,250	327	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	104	0	0	0	0
12	Kirisia/Maralal	1,537	0	2	5,020	240	16	0	0	0	0	0	0	0	40	63	0	0	1	0	0	1	0	0	61	0	0	0	1,040
14	Mpala/El Karama/Ol Jogi/W.Bars	727	741	11	6,861	6,526	231	3	1,074	243	402	277	0	1	408	525	46	0	11	15	34	0	0	0	10	25	0	0	1,487
17	E. Barsalinga/Mukogodo	830	10	0	23,343	2,998	221	0	7	0	0	56	0	0	1	62	0	0	0	1	5	0	0	0	74	0	0	0	350
19	E. Ol Jogi/Borana	586	453	0	7,285	4,666	165	0	147	375	337	318	0	7	20	1,216	12	0	0	0	107	0	0	5	9	8	0	89	5,503
23	Lewa	444	57	0	1,290	1,200	0	0	155	120	83	175	0	0	206	117	0	0	0	5	48	0	8	16	0	0	0	39	2,313
25	Ol Ari Nyiro/Ol Morani	956	243	2	14,391	7,214	80	0	605	0	3	68	0	0	10	12	0	0	2	13	2	0	0	0	151	125	1	0	1,173
28	Colcheccio/Kisima	1,072	547	0	4,219	7,374	458	4	67	207	293	131	0	31	89	642	113	0	0	30	437	0	0	0	78	486	0	19	2,383
29	Mugi/Marmar	421	147	0	6,006	2,050	60	0	943	138	105	57	0	1	15	85	29	0	0	9	45	0	10	2	88	179	0	4	866
30	Kirimon	355	0	7	13,862	7,040	21	0	0	54	0	110	0	0	267	873	88	0	7	24	155	0	0	0	40	1,162	0	0	8,042
31	Suguroi	573	0	0	1,450	766	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	209	0	0	0	209
32	Ol Pajeta/Solio	876	222	1	2,010	710	0	0	908	227	213	0	0	0	4	0	121	0	1	15	2	0	105	0	55	0	4	0	3,359
34	Segera	681	175	1	7,380	5,116	43	0	381	38	79	103	0	0	50	20	7	0	1	25	30	0	0	0	43	34	1	8	1,227
35	ADC Mutara	443	105	0	17,640	3,070	130	0	70	104	2	3	0	0	0	0	0	0	0	0	0	0	0	0	515	10	2	0	1,718
44	Laisamis	1,932	0	0	11,260	3,425	668	0	0	0	54	1,931	4	136	65	0	0	0	0	35	32	0	0	0	42	0	0	0	0
45	Korr	1,207	0	6	12,583	815	912	0	0	0	0	7	0	13	70	7	0	0	6	55	19	0	0	0	36	0	0	0	0
46	Barsaloi	742	0	0	680	430	20	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	Kulamawe	1,464	0	0	23,944	1,460	4,503	0	0	0	10	63	0	56	0	0	0	23	0	17	8	0	0	0	140	0	0	6	0
48	Ngilai	3,215	0	0	12,250	13,660	544	2	0	0	0	6	0	2	16	0	0	0	0	97	0	0	0	0	47	0	0	0	91
49	South Horr	3,518	0	0	5,535	365	380	0	0	0	3	3	0	28	23	4	0	0	0	60	48	0	0	0	73	0	0	0	0
53	Rumuruti	672	135	0	551	759	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0
	Out	0	2	0	2,360	829	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	7	0	0	0	172
	Total Count	37,360	7,415	78	378,474	143,370	18,512	38	5,331	1,541	2,557	6,020	13	490	2,400	3,915	416	58	72	792	1,509	6	123	25	6,871	2,155	17	179	30,452

Table 2. Densities of animals counted (animals per square kilometer)

No.	BLOCK NAME	Area Kmsq	EL	O+R	SH	CT	CM	DD	BF	ED	GF	GG	GK	GN	GZ	IM	KG	LK	O	OS	OX	R	RH	RHW	ST	TG	VO	WB	ZB
1	North Eastern	1,954	0.03	0.01	6.05	2.81	1.33	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
2	Doinyo Uasin	915	0.08	0.00	1.40	2.05	0.16	0.00	0.00	0.00	0.03	0.26	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
3	Serolevi	2,345	0.33	0.00	2.20	1.52	0.08	0.01	0.01	0.00	0.18	0.06	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.03	0.05	0.00	0.00	0.00
4	Ewaso	1,167	0.01	0.00	0.82	0.00	0.00	0.00	0.01	0.00	0.04	0.13	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
5	Ol Doinyo Sabach	1,354	0.84	0.00	7.60	3.47	0.08	0.01	0.27	0.00	0.13	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.14	0.01	0.00	0.00	0.00
6	Isiolo	1,442	0.14	0.01	12.62	11.20	0.41	0.00	0.20	0.00	0.04	0.63	0.00	0.02	0.01	0.02	0.00	0.00	0.01	0.04	0.08	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.07
7	W. Isiolo/Samburu	1,448	1.33	0.01	12.22	4.17	1.83	0.00	0.16	0.02	0.10	0.51	0.00	0.02	0.09	0.16	0.00	0.00	0.01	0.06	0.14	0.00	0.00	0.00	0.25	0.00	0.00	0.01	0.19
8	Kipsing	1„140	0.00	0.00	18.83	6.76	0.60	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.01
9	Barsalinga - Samburu	1,263	0.27	0.00	56.99	15.00	1.75	0.00	0.01	0.00	0.08	0.08	0.00	0.06	0.23	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.00	1.57	0.00	0.00	0.00	0.02
10	Lodume/Marti Sumalta	1,674	0.02	0.00	19.10	3.54	0.34	0.00	0.02	0.00	0.00	0.02	0.00	0.01	0.37	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.06
11	Barsaloi/N.W. Mathews	1,547	0.00	0.00	5.00	1.45	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
12	Kirisia/Maralal	1,537	0.00	0.00	3.27	0.16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.68
14	Mpala/El Karama/Ol Jogi/W.Bars	727	1.02	0.02	9.44	8.98	0.32	0.00	1.48	0.33	0.55	0.38	0.00	0.00	0.56	0.72	0.06	0.00	0.02	0.02	0.05	0.00	0.00	0.00	0.01	0.03	0.00	0.00	2.05
17	E. Barsalinga/Mukogodo	830	0.01	0.00	28.12	3.61	0.27	0.00	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.42
19	E. Ol Jogi/Borana	586	0.77	0.00	12.43	7.96	0.28	0.00	0.25	0.64	0.58	0.54	0.00	0.01	0.03	2.08	0.02	0.00	0.00	0.00	0.18	0.00	0.00	0.01	0.02	0.01	0.00	0.15	9.39
23	Lewa	444	0.13	0.00	2.91	2.70	0.00	0.00	0.35	0.27	0.19	0.39	0.00	0.00	0.46	0.26	0.00	0.00	0.00	0.01	0.11	0.00	0.02	0.04	0.00	0.00	0.00	0.09	5.21
25	Ol Ari Nyiro/Ol Morani	956	0.25	0.00	15.05	7.55	0.08	0.00	0.63	0.00	0.00	0.07	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.16	0.13	0.00	0.00	1.23
28	Colcheccio/Kisima	1,072	0.51	0.00	3.94	6.88	0.43	0.00	0.06	0.19	0.27	0.12	0.00	0.03	0.08	0.60	0.11	0.00	0.00	0.03	0.41	0.00	0.00	0.00	0.07	0.45	0.00	0.02	2.22
29	Mugi/Marmar	421	0.35	0.00	14.27	4.87	0.14	0.00	2.24	0.33	0.25	0.14	0.00	0.00	0.04	0.20	0.07	0.00	0.00	0.02	0.11	0.00	0.02	0.00	0.21	0.43	0.00	0.01	2.06
30	Kirimon	355	0.00	0.02	39.05	19.83	0.06	0.00	0.00	0.15	0.00	0.31	0.00	0.00	0.75	2.46	0.25	0.00	0.02	0.07	0.44	0.00	0.00	0.00	0.11	3.27	0.00	0.00	22.65
31	Suguroi	573	0.00	0.00	2.53	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.36
32	Ol Pajeta/Solio	876	0.25	0.00	2.29	0.81	0.00	0.00	1.04	0.26	0.24	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.02	0.00	0.00	0.12	0.00	0.06	0.00	0.00	0.00	3.83
34	Segera	681	0.26	0.00	10.84	7.51	0.06	0.00	0.56	0.06	0.12	0.15	0.00	0.00	0.07	0.03	0.01	0.00	0.00	0.04	0.04	0.00	0.00	0.00	0.06	0.05	0.00	0.01	1.80
35	ADC Mutara	443	0.24	0.00	39.82	6.93	0.29	0.00	0.16	0.23	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.02	0.00	0.00	3.88
44	Laisamis	1,932	0.00	0.00	5.83	1.77	0.35	0.00	0.00	0.00	0.03	1.00	0.00	0.07	0.03	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
45	Korr	1,207	0.00	0.00	10.43	0.68	0.76	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.01	0.00	0.00	0.00	0.05	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
46	Barsaloi	742	0.00	0.00	0.92	0.58	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	Kulamawe	1,464	0.00	0.00	16.36	1.00	3.08	0.00	0.00	0.00	0.01	0.04	0.00	0.04	0.00	0.00	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
48	Ngilai	3,215	0.00	0.00	3.81	4.25	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03
49	South Horr	3,518	0.00	0.00	1.57	0.10	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
53	Rumuruti	672	0.20	0.00	0.82	1.13	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00

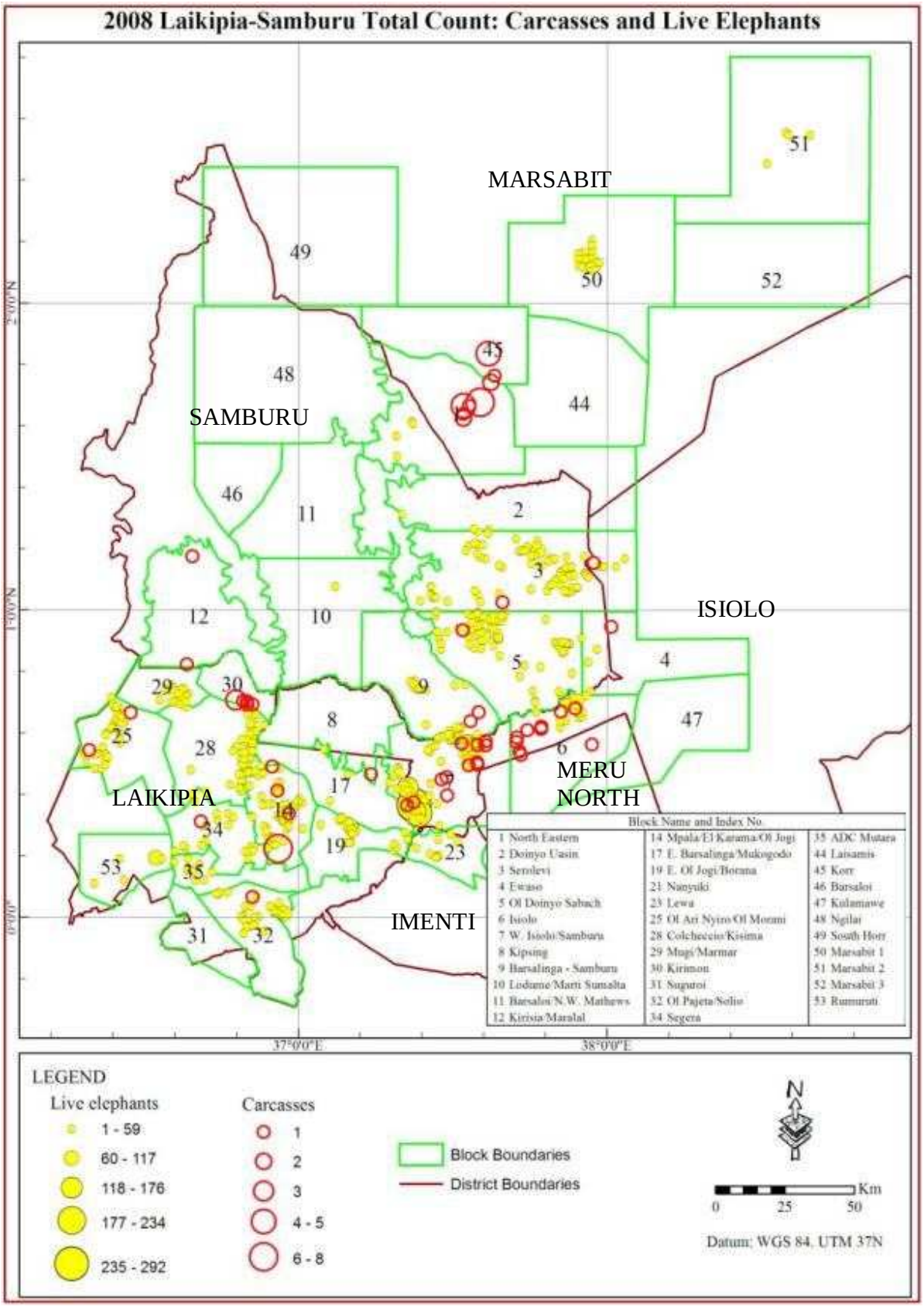

Figure 3. Numbers of live elephants and elephant carcasses recorded in various blocks

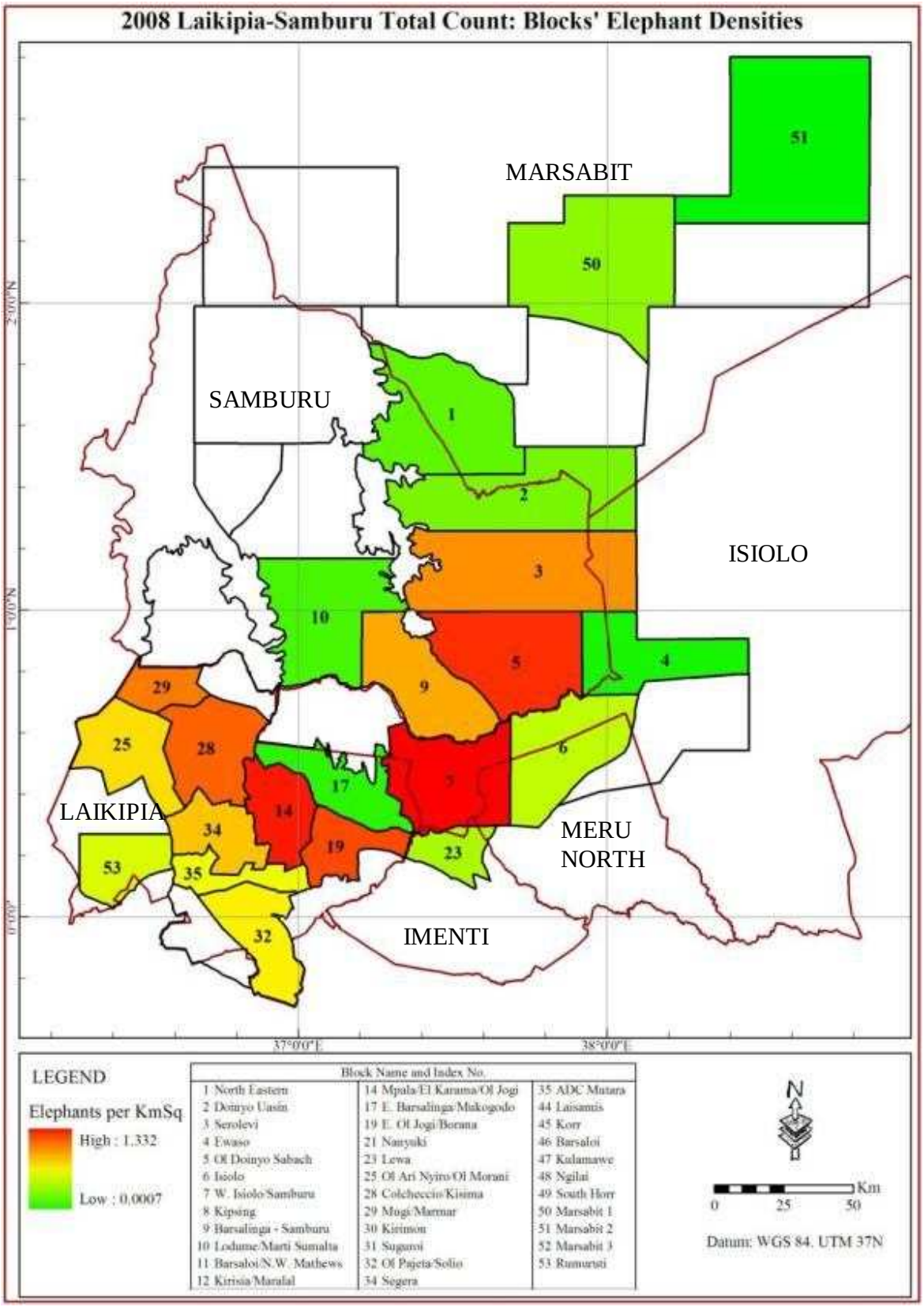

Figure 4. Elephant densities in various blocks. West Isiolo block had the highest density courtesy of the encompassed Buffalo Springs National Reserve.

5.3 Domestic animals

A total of 521,844 livestock (cattle and shoats) were counted in the Laikipia-Samburu ecosystem (Figures 5 and 6). The bulk of the population (73%) was made of shoats. Block 9 (Barsalinga-Samburu) had the highest concentration of cattle (13% of the total counted in the ecosystem) followed by blocks 6 (Isiolo) and Ngilai accounting for 11% and 10% respectively. Block 12 (Kirisia/Maralal) had the least number of cattle (0.2%). Shoats were recorded in all blocks and the highest concentration was counted in Barsalinga-Samburu (block 9), representing 19% of the total shoats. Rumuruti block had the least number of shoats with 0.1% of the sighted population. Most of the cattle were recorded in Isiolo, Barsalinga and Ngilai blocks while shoats were encountered in almost the entire ecosystem except for Ewaso, Barsaloi and Rumuruti blocks, which had less than a thousand shoats.

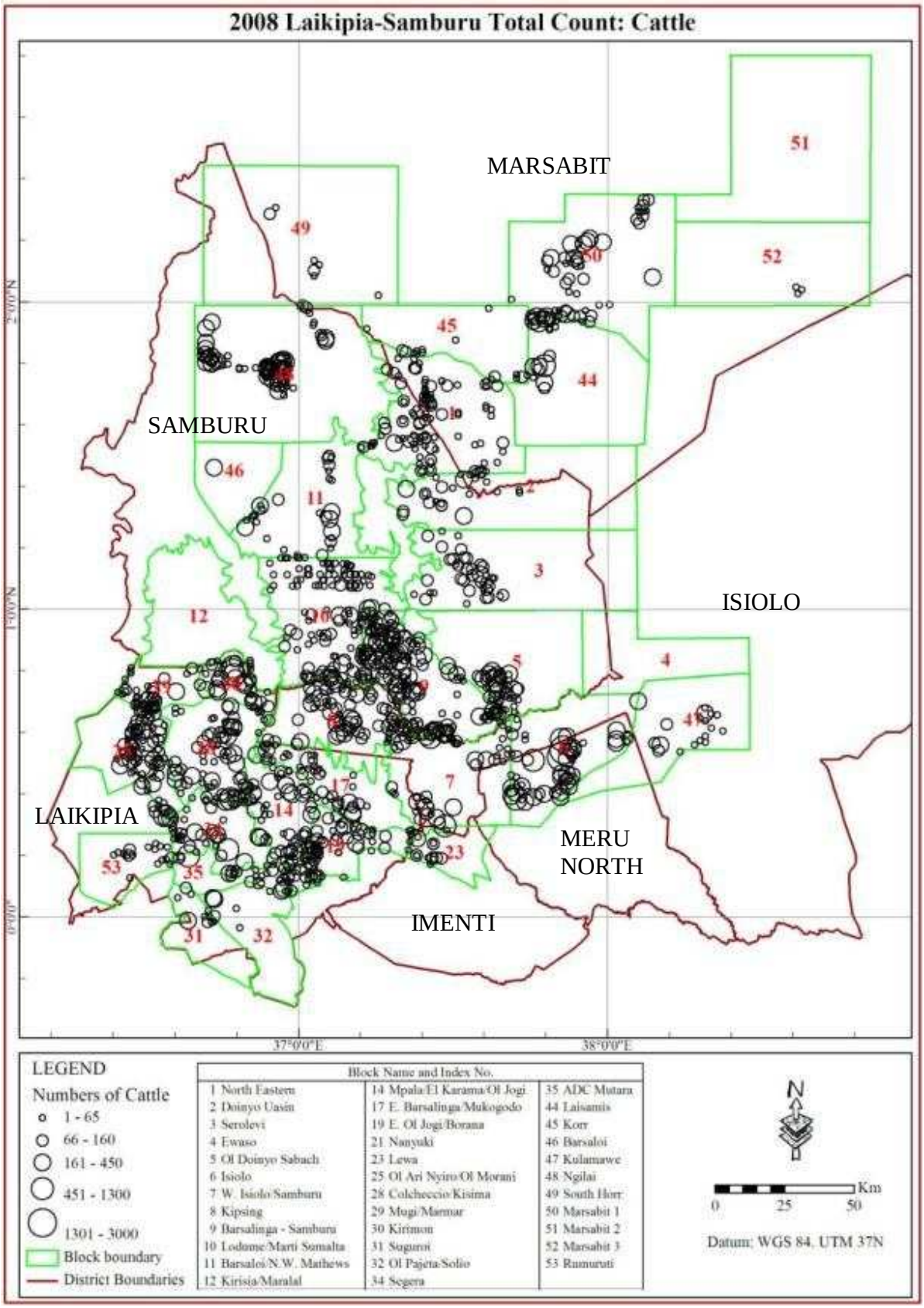

Figure 5. Heads of cattle

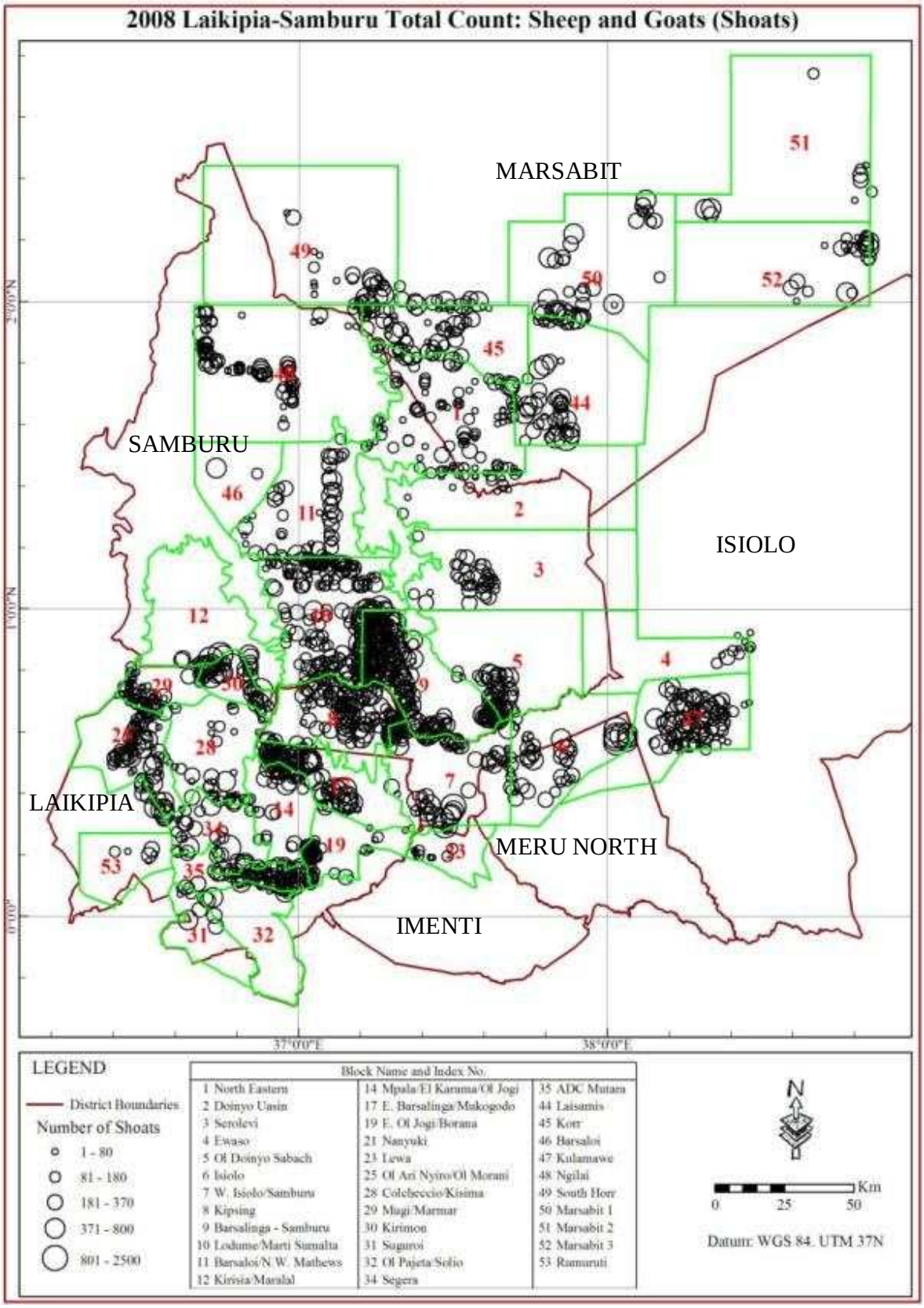

Figure 6. The distribution of shoats (sheep and goats)

Table 3. Number of elephants and domestic animals in areas under various managements in Ewaso ecosystem

Row Labels	Elephants	Elephant Carcasses	Shoats	Cattle	Camels
Private Ranch	2086	11	15621	17363	821
CCA	1915	3	145549	40096	3757
Trust Land	1225	20	75760	26865	3456
National Reserve	1093	7	4280	1932	14
Private Wildlife Sanctuary	663	3	1720	1580	0
Unclassified land uses	357	27	102769	27427	19813
Forest Reserve	68	0	1101	1485	180
Settlements	8	1	49624	31194	482
Swamp	0	0	0	451	0
Urban Center	0	0	550	0	100
Cattle tracks	0	0	500	0	0
Large Scale Farm	0	0	0	0	0
Grand Total	7415	72	397474	148393	28623

Table 4. Number of Elephants, carcasses, and domestic animals in various administrative districts

District	Elephants	Elephant Carcases	Shoats	Cattle	Camels
Isiolo	1351	19	64585	14870	7828
Laikipia	3624	22	106588	49078	1511
Imenti	57	0	1070	1120	0
Meru North	0	1	16840	14744	500
Samburu	2383	5	150372	55208	4254
Grand Total	7415	72	397474	148393	28623

5.4 Other Species

The total number of Grevy's zebra counted during the survey was 2,400 (Table 1). Over 600 Grevy's zebra were counted within block 10 (Lodume/Marti Sumalta), accounting for about 26% of all the individuals counted. Mpala/El Karama/Ol Jogi/W.Bars (block 14) recorded 408 individuals, while Barsalinga-Samburu (block 9) and Kirimon (block 30) listed 294 and 267 Grevy's zebra respectively. The block distribution of 2400 Grevy's zebra counted is displayed in Table 1 and Figure 7. Figure 8 shows the distribution of 30,452 plains zebras counted. A total of 148 rhinos were counted in the Laikipia/Samburu ecosystem (Figure 9). Block 32 (Ol Pajeta/Solio) had the highest concentration (105), followed by block 23 (Lewa) with twenty four (24) rhinos. In Mugi/Marmar, only twelve rhinos, both black and white were counted.

Five thousand, three hundred and thirty one (5,331) buffaloes were counted in the entire ecosystem (Figure 10). Water bucks were encountered largely in Laikipia districts save for a few in W.Isiolo/Samburu and Ngilai Blocks (Figure 11). Despite having no elephants at all, 'Marsabit 3' block had a considerable number of Oryx (12). Thirteen greater kudus and 58 lesser kudus were counted, in remarkably sparsely distributed herds as shown in figures 13 and 14. Impalas were almost eclusively found in Laikipia District where herds as high as 400 were counted (Figure 15). A total of 3,915 Impalas were recorded, of which block 19 (E. Ol Jogi/Borana) accounted for the highest number (1,216). A total of 6, 020 Grant gazelles and 490 Gerenuks were counted during the survey distributed as shown in figures 16 and 17 respectively. The highest concentration of Grant gazelles (1,931) and Gerenuks (136) were recorded in Laisamis block. Distribution of Giraffes, Elands and Baboons in the ecosystem is displayed on figures 18, 19 and 20 respectively.

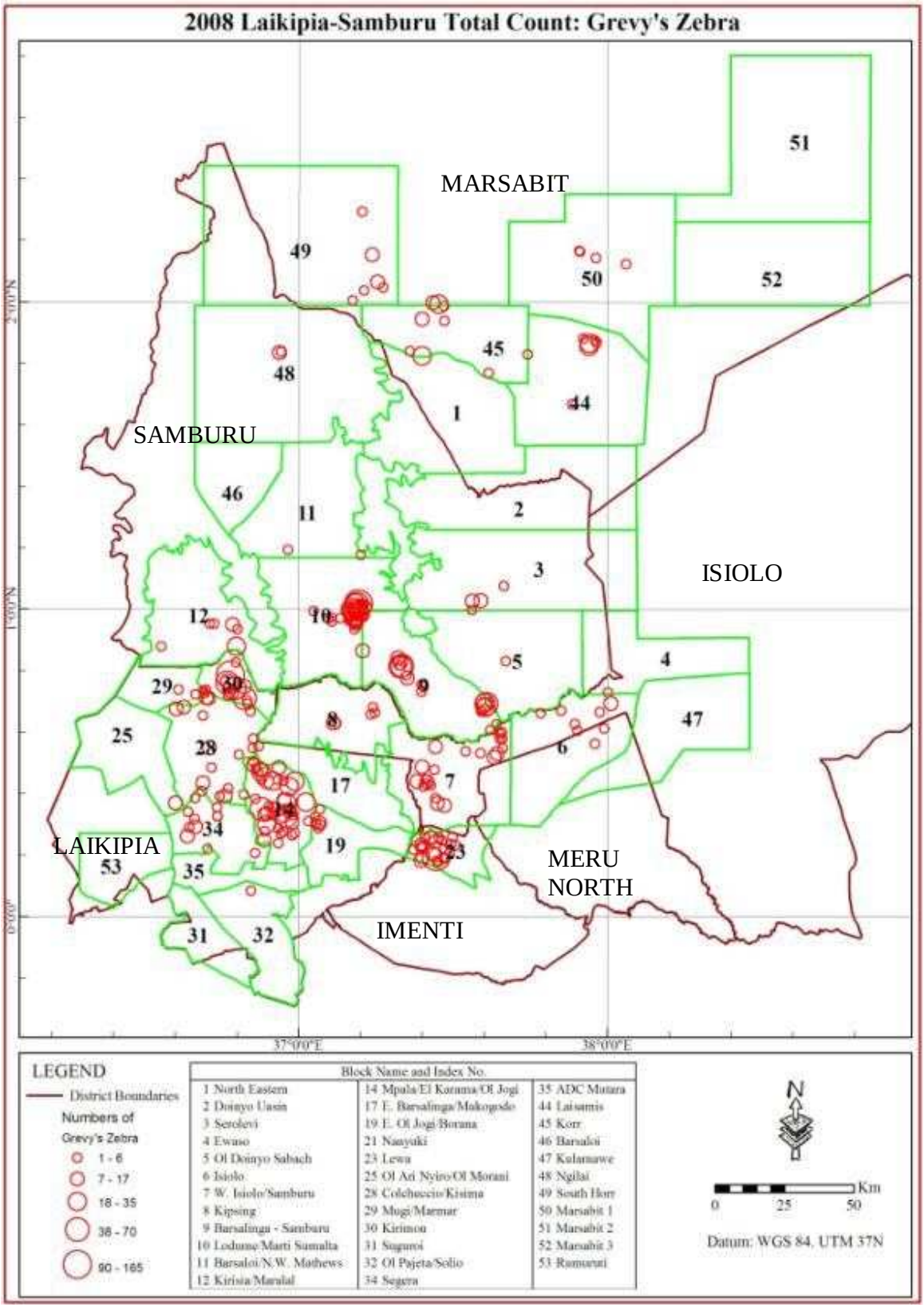

Figure 7. Numbers of Grevy's Zebra counted. Te bulk of the population is notably to the southern part of the ecosystem.

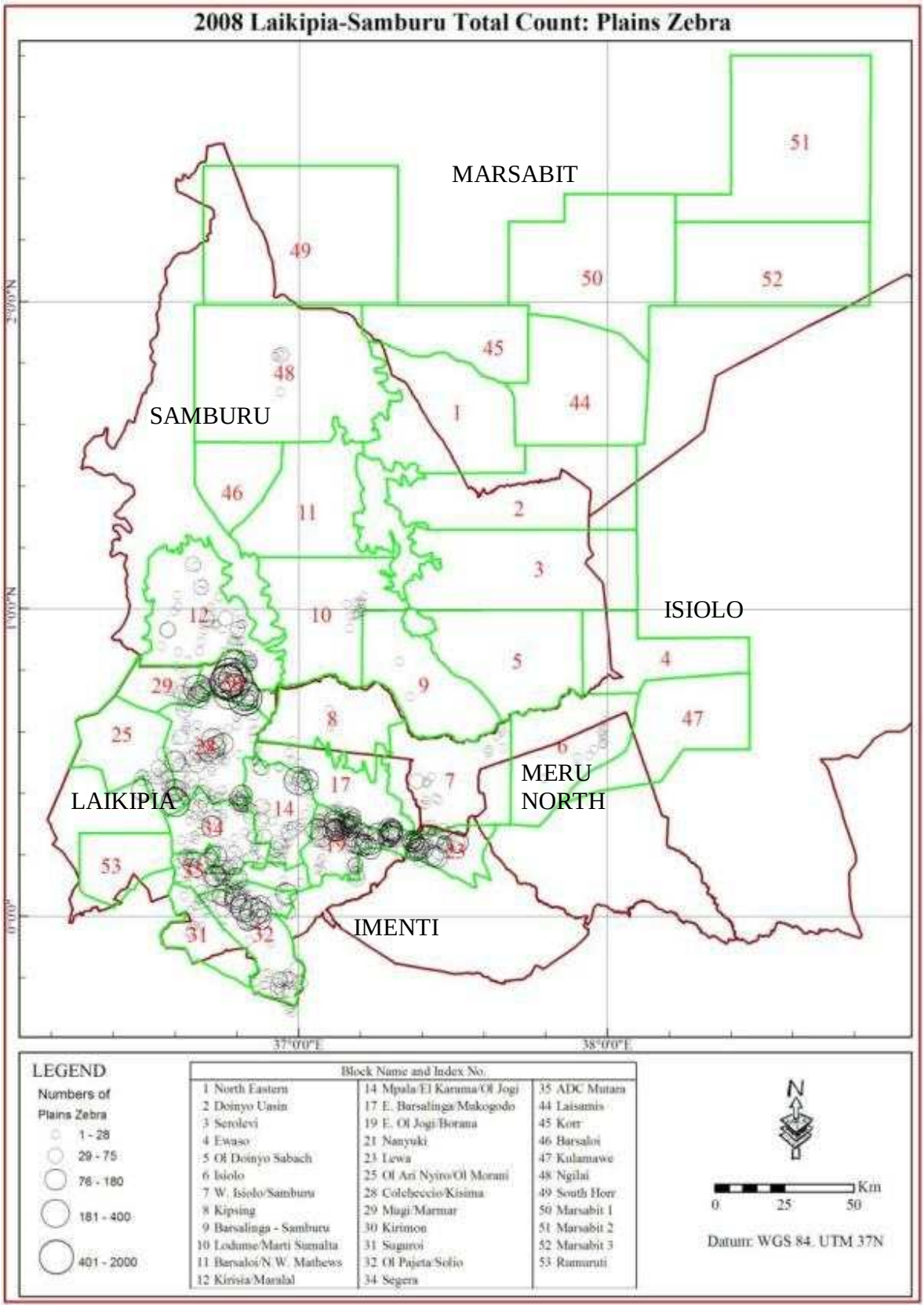

Figure 8. Plains Zebra

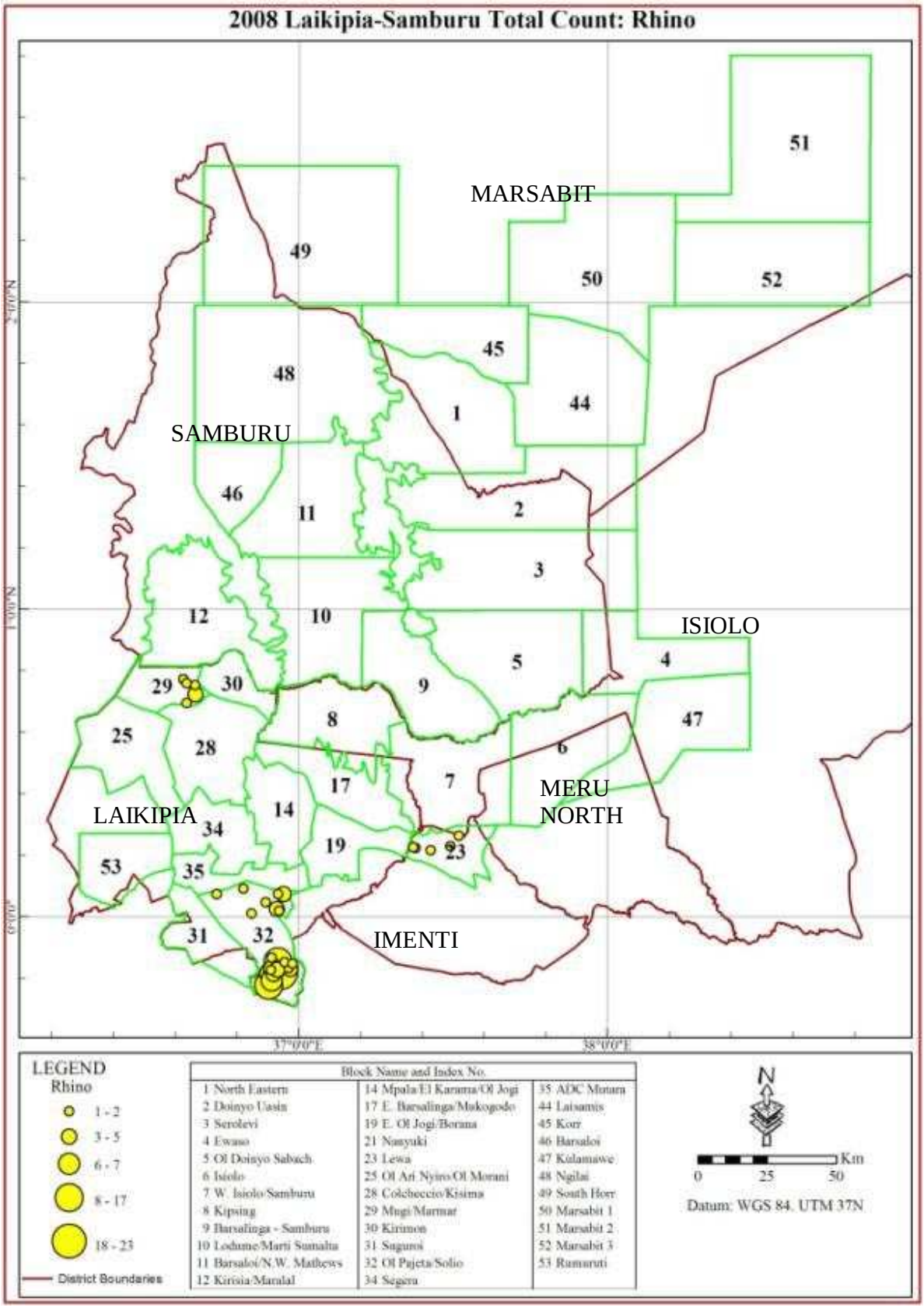

Figure 9. Numbers of Black and White Rhinos counted. Solio Ranch in Block 32 had the highest numbers.

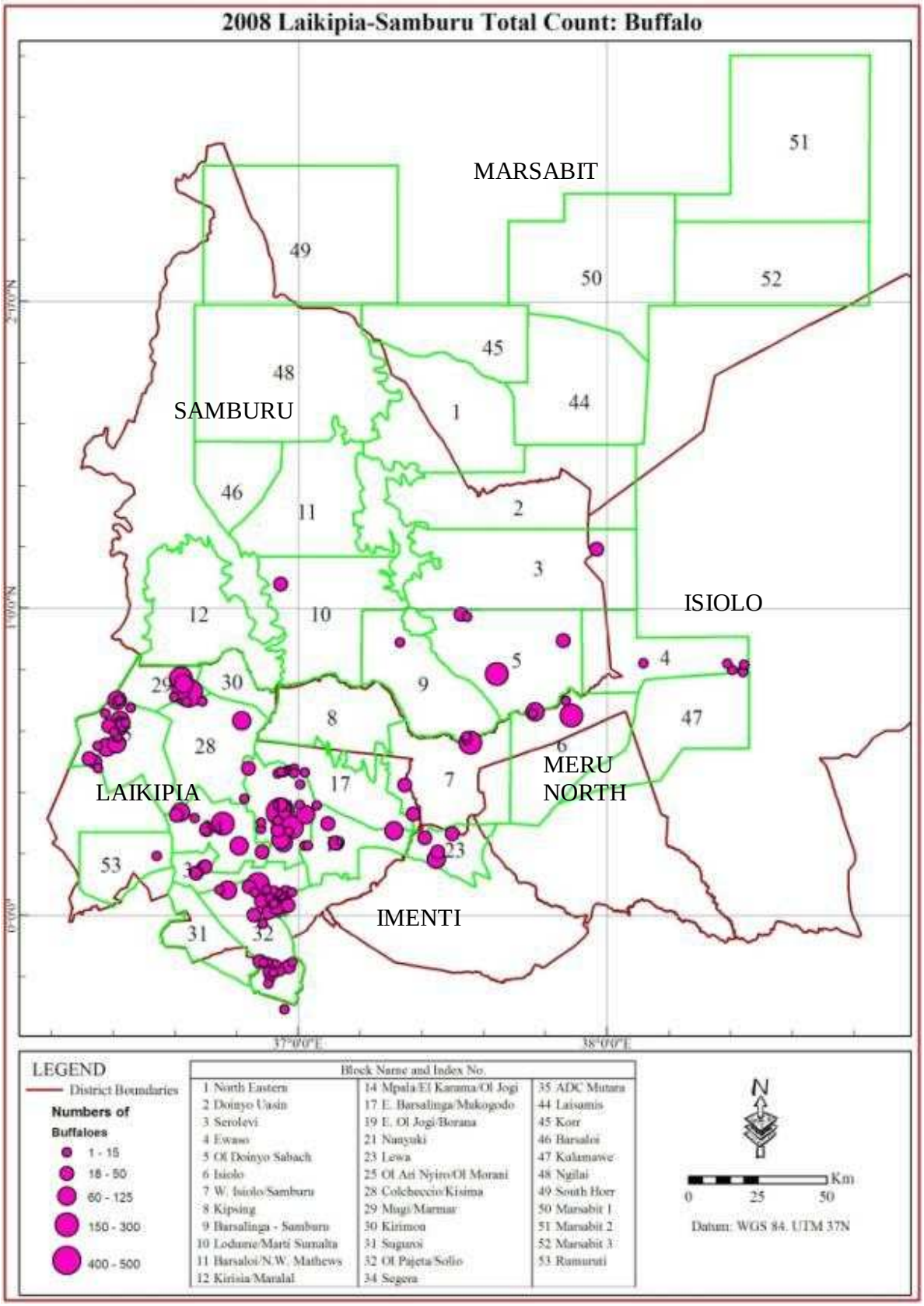

Figure 10. Numbers of buffaloes counted. The bulk of buffalo population seemingly resides in Laikipia District.

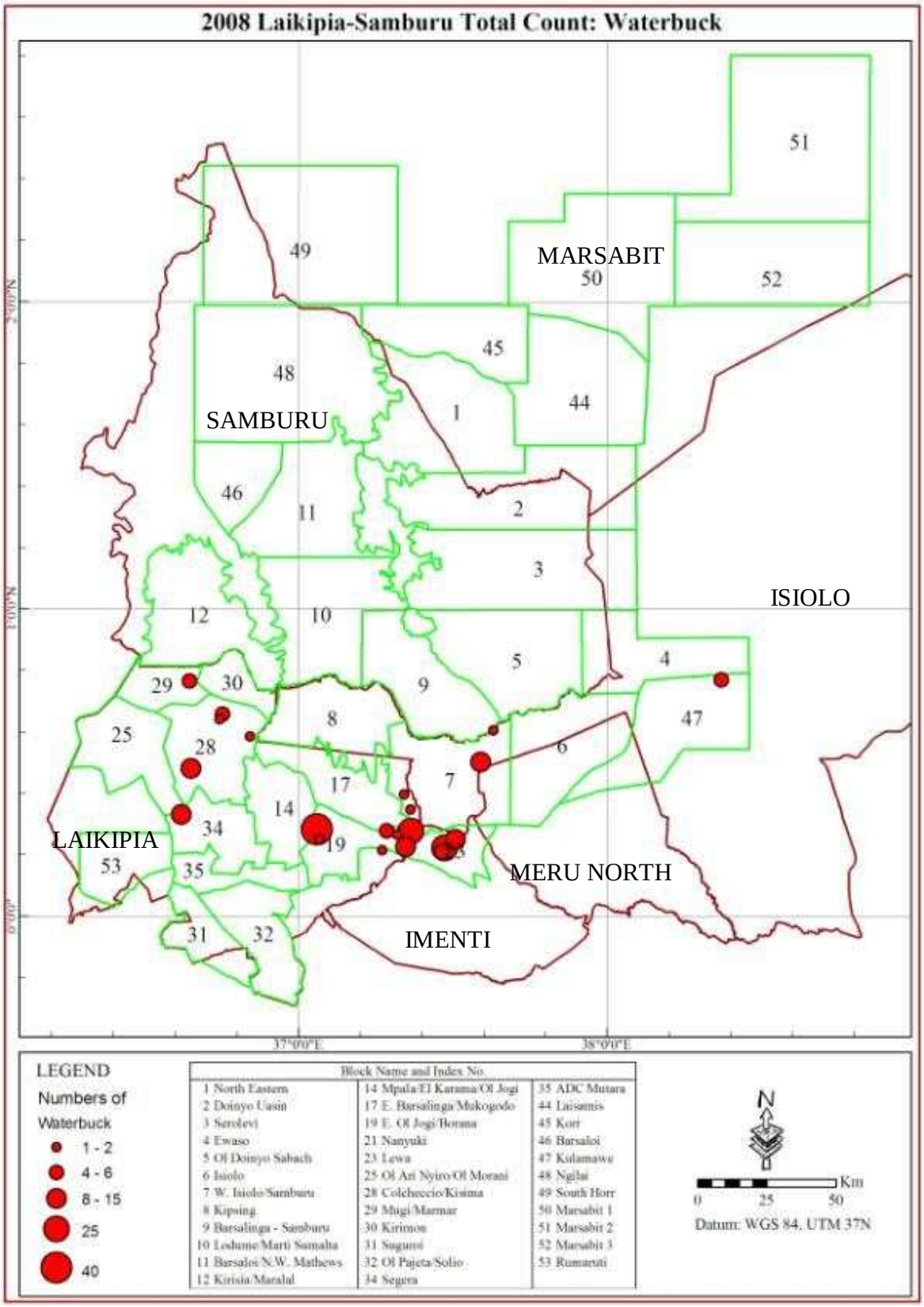

Figure 11. Waterbucks

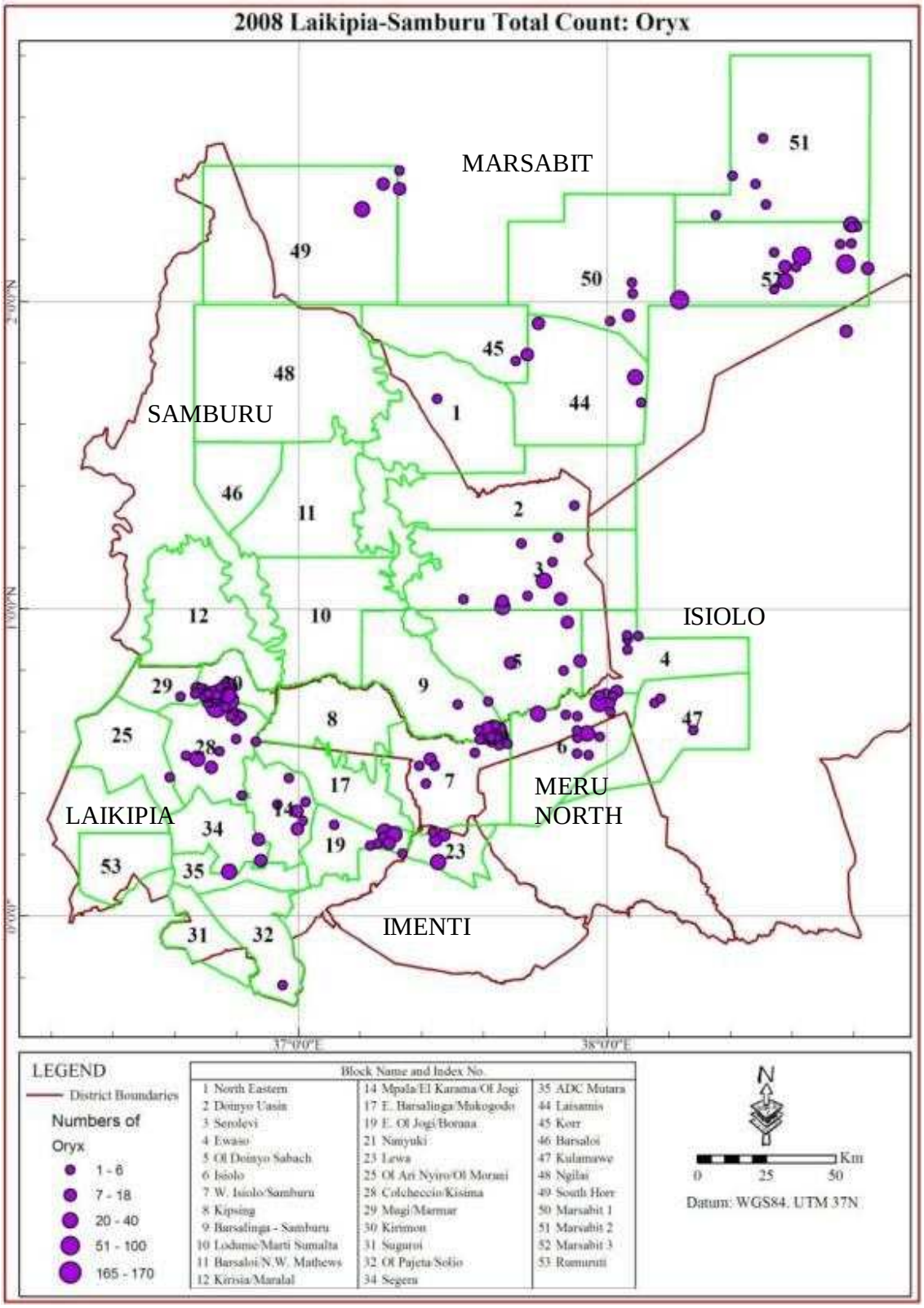

Figure 12. Oryx

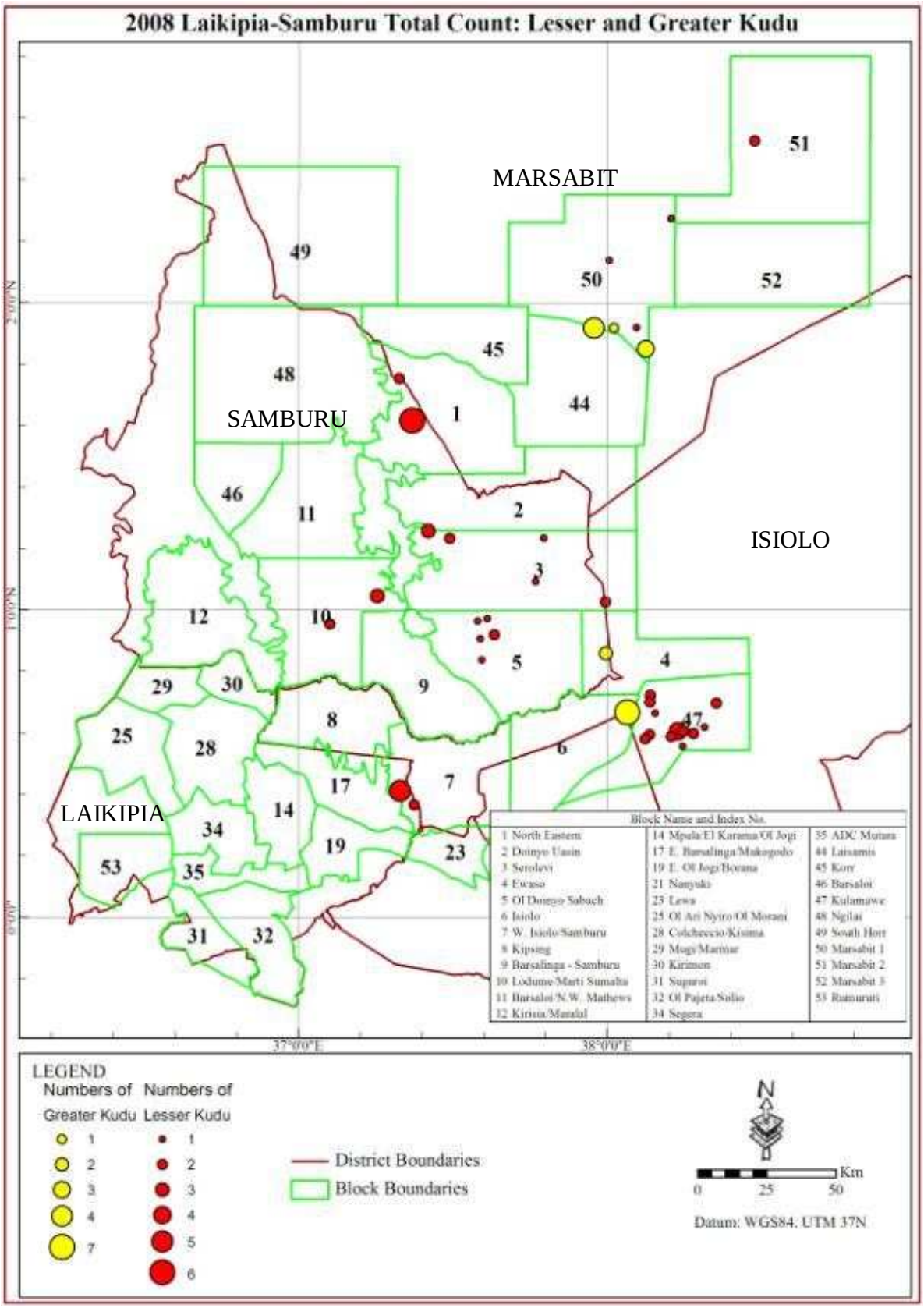

Figure 13. Greater and Lesser Kudu

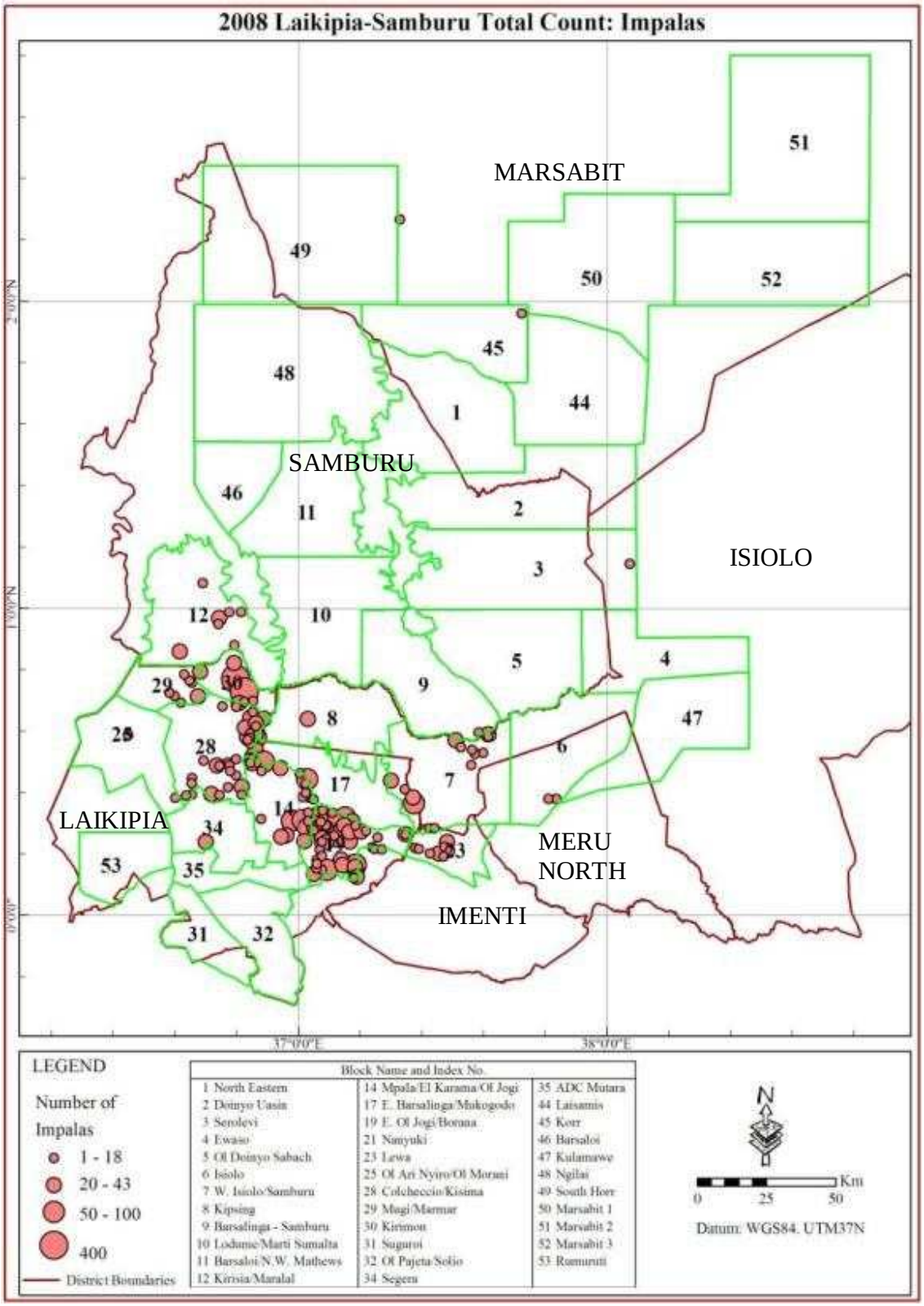

Figure 14. Impalas

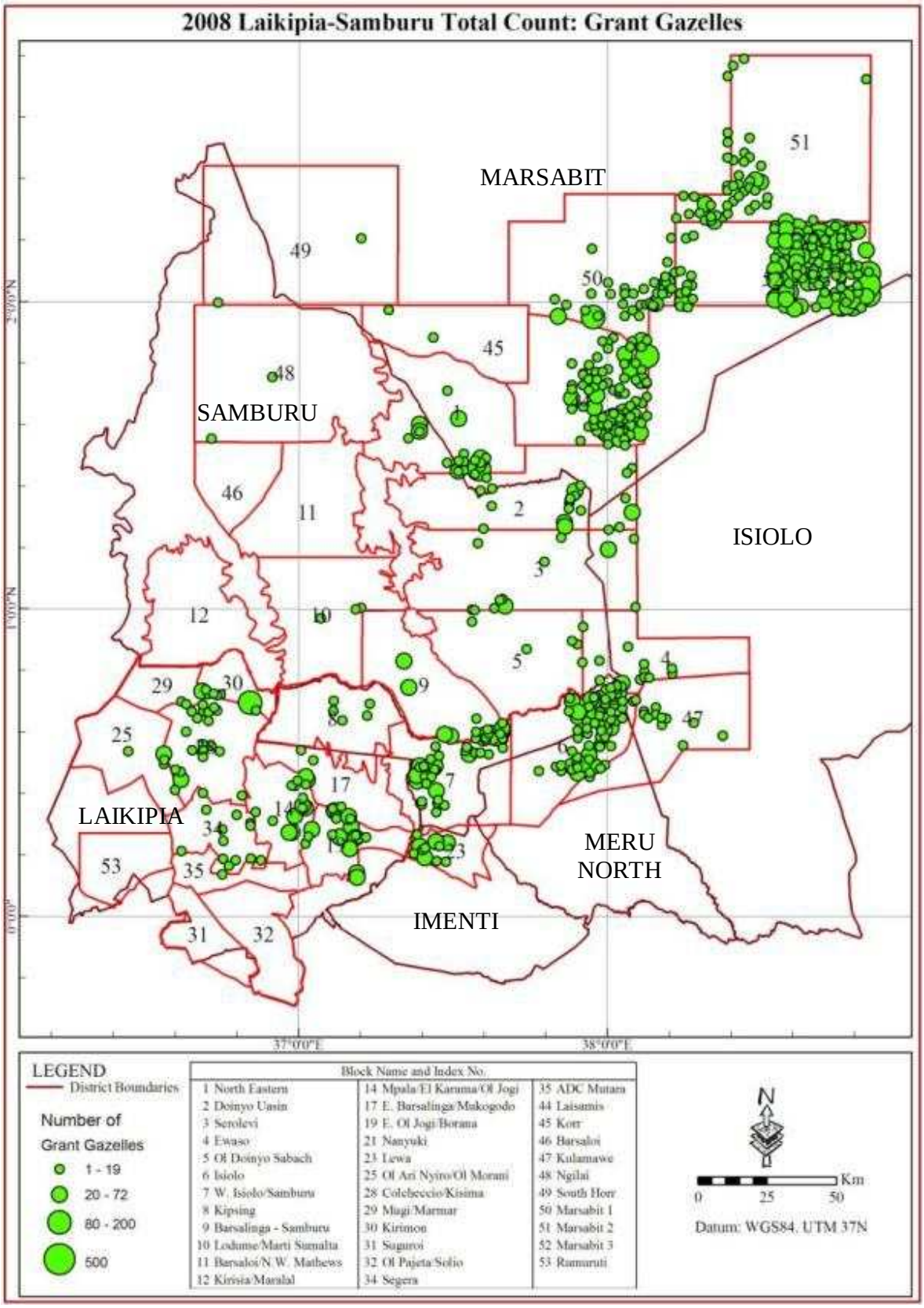

Figure 15. Grant Gazelle

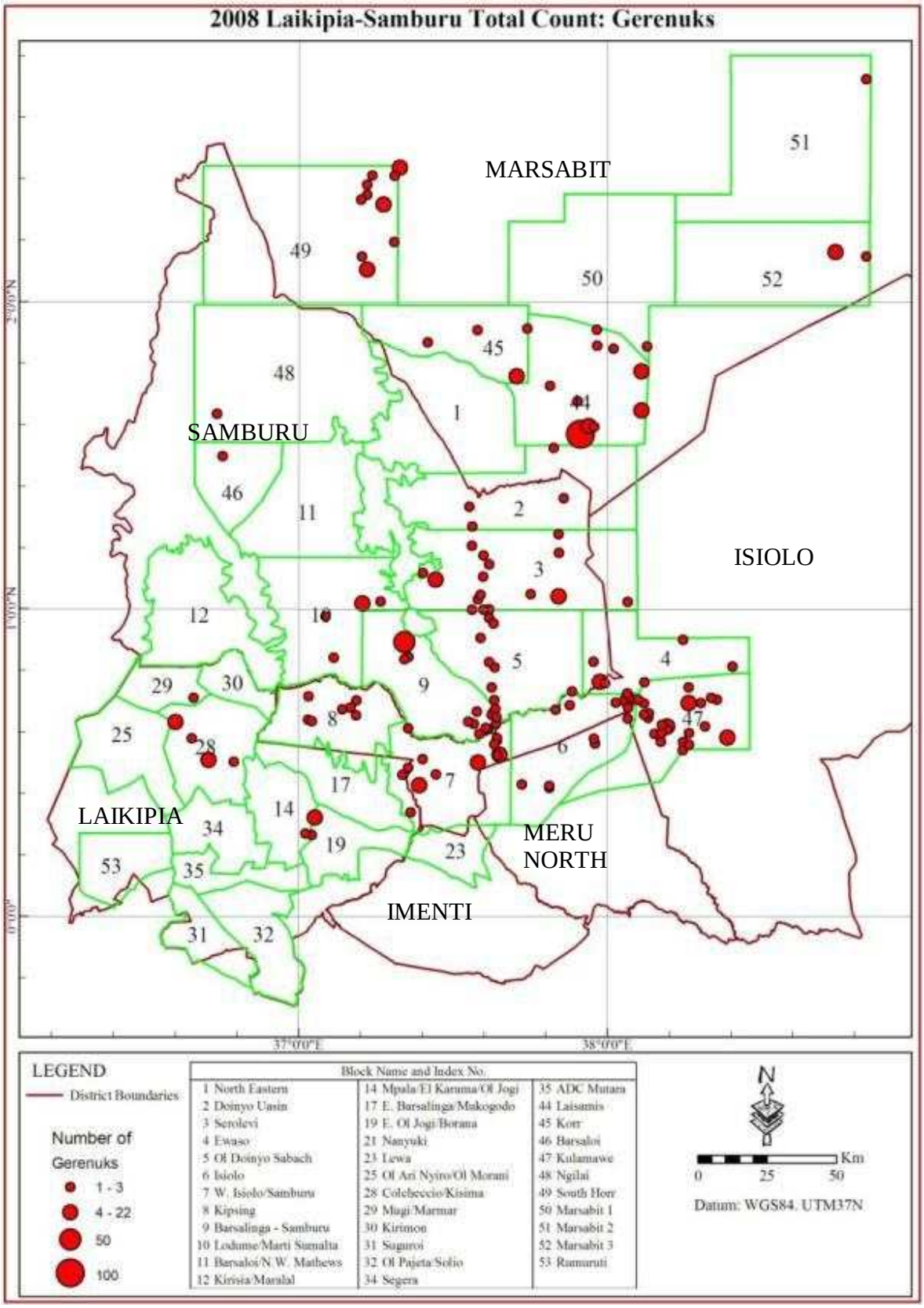

Figure 16. Gerenuks

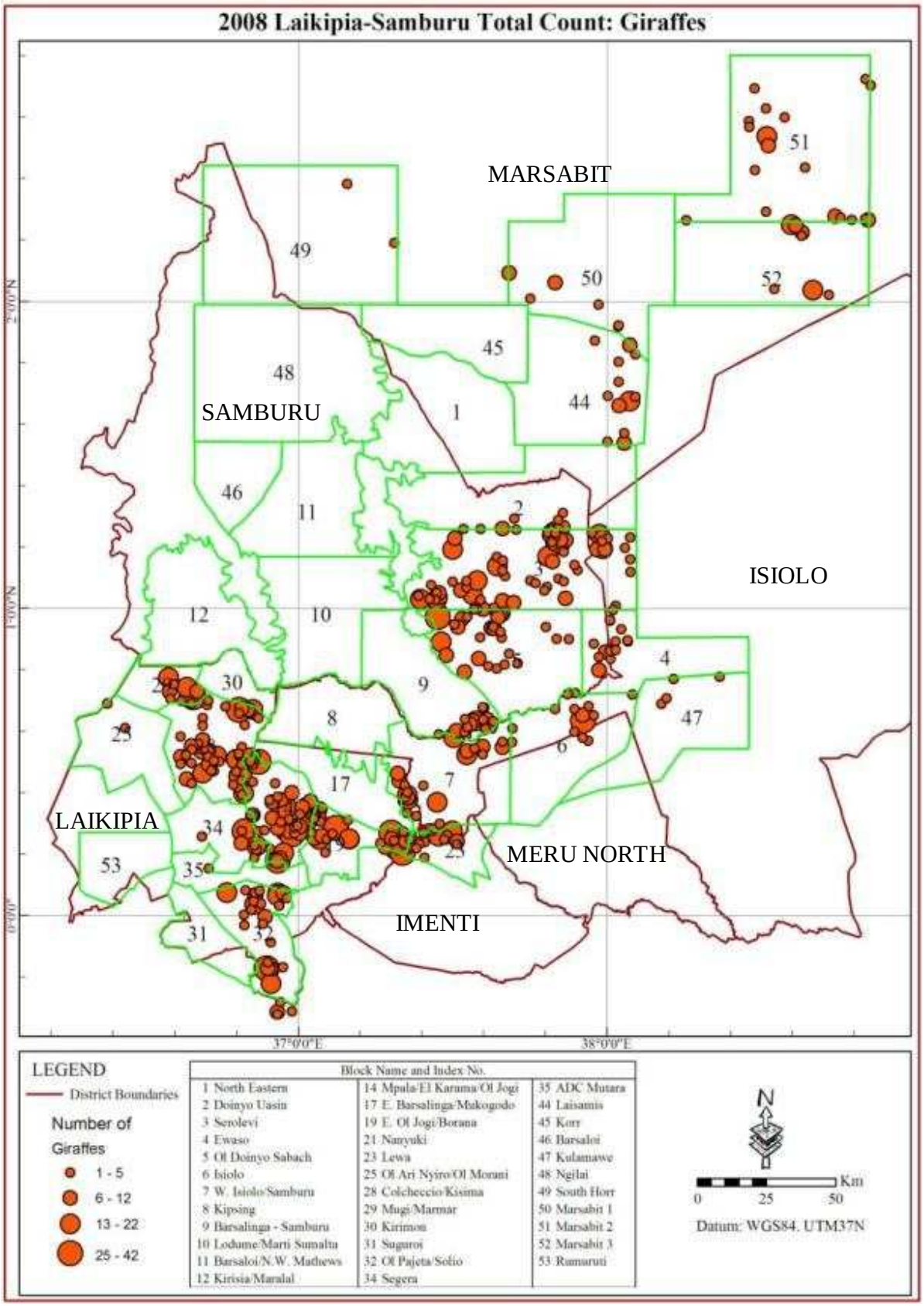

Figure 17. Giraffes

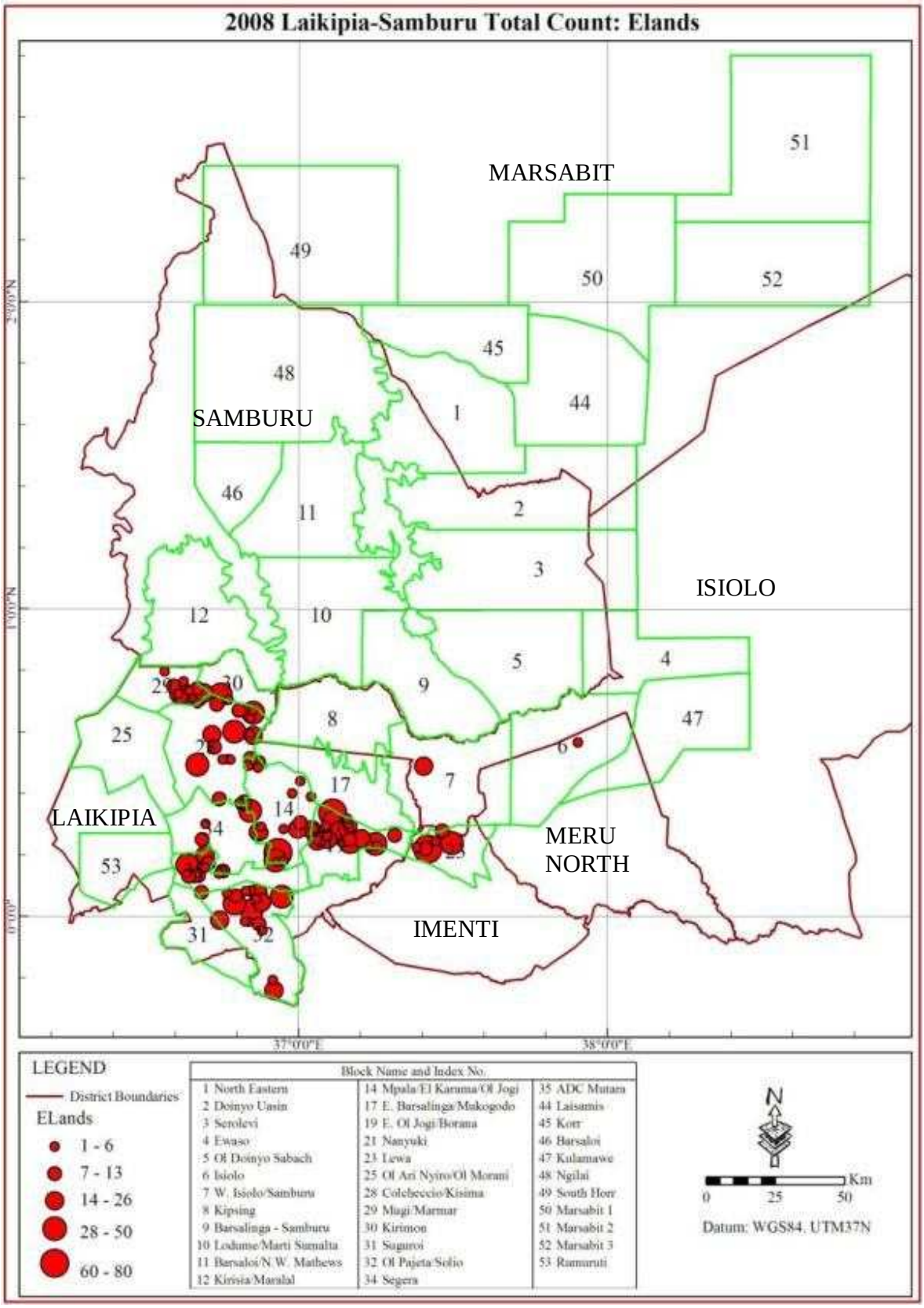

Figure 18. Elands were almost exclusively found in Laikipia and neighboring blocks.

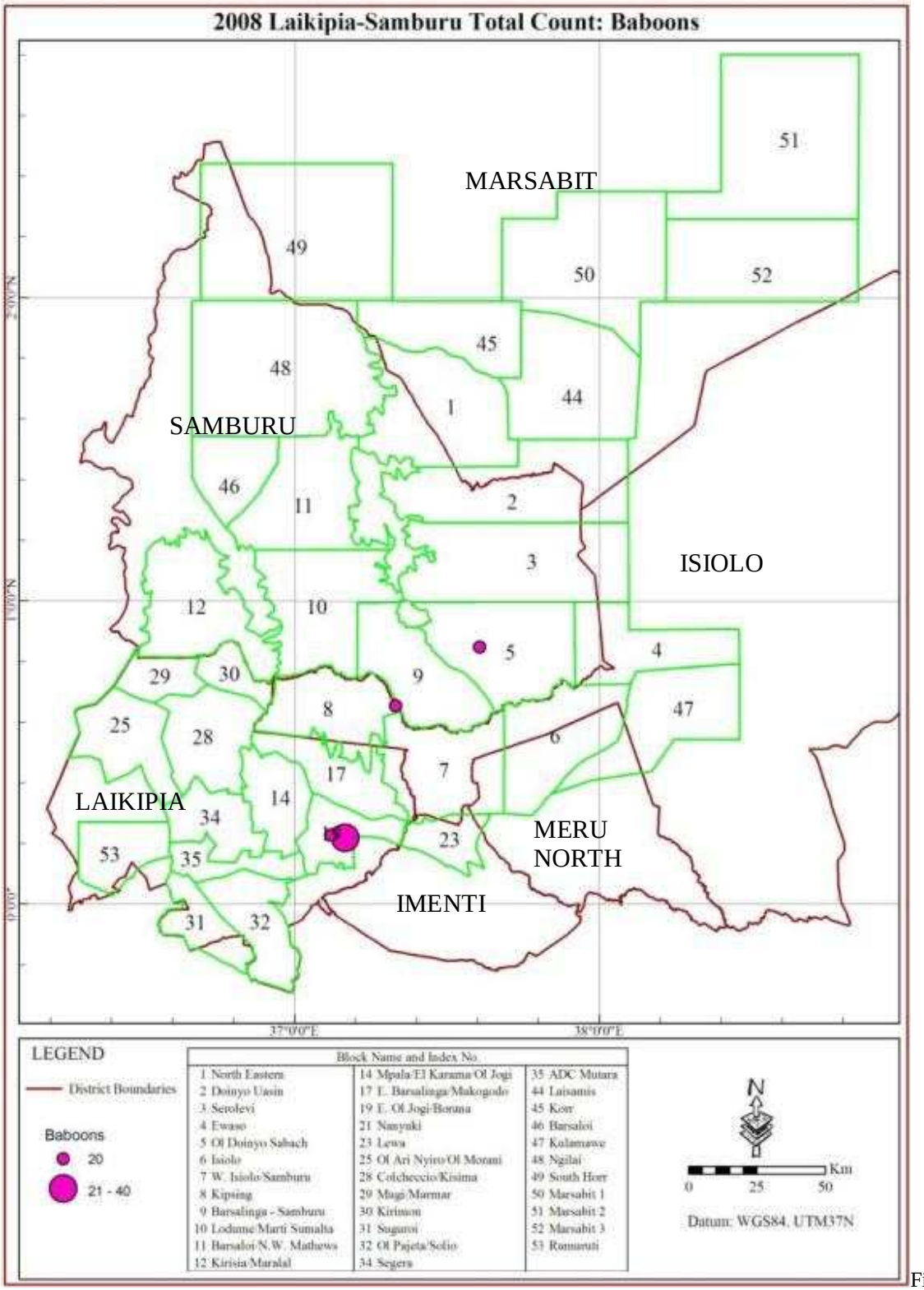

Figure 19. Baboons

5.5 Marsabit Blocks

In addition to the usual Laikipia Samburu blocks, three blocks were surveyed in Marsabit. The last time the blocks had been surveyed was in 1994 when 267 elephants were counted (Litoroh *et al.* 1994). These blocks encompassed Marsabit National Park and part of Marsabit National Reserve (Figure 20). A total of 319 elephants were counted in two of the three blocks, 'Marsabit 1' and 'Marsabit 2' (Table 5). Most of these were in 'Marsabit 1' and specifically within Marsabit National Park. The most abundant wildlife species in the three blocks were the Grant Gazelles. Marsabit 3 block had a relatively high numbers of Oryx, 344 compared to 20 and 5 in blocks 1 and 2. Seven Grevy's zebras were counted in Marsabit 1 block but no plains zebras were seen in that or the other two blocks.

Table 5. Numbers of elephants and some of the other species counted in Marsabit Blocks

	Marsabit 1	Marsabit 2	Marsabit 3	Total
Elephants	295	24	0	319
Shoats	11570	2250	5080	18900
Cattle	4973	0	50	5023
Grevy's Zebras	7	0	0	7
Grant Gazelles	566	347	4351	5264
Greater Kudus	4	0	0	4
Gerenuks	2	1	7	10
Lesser Kudus	3	2	0	5
Oryx	20	5	344	369

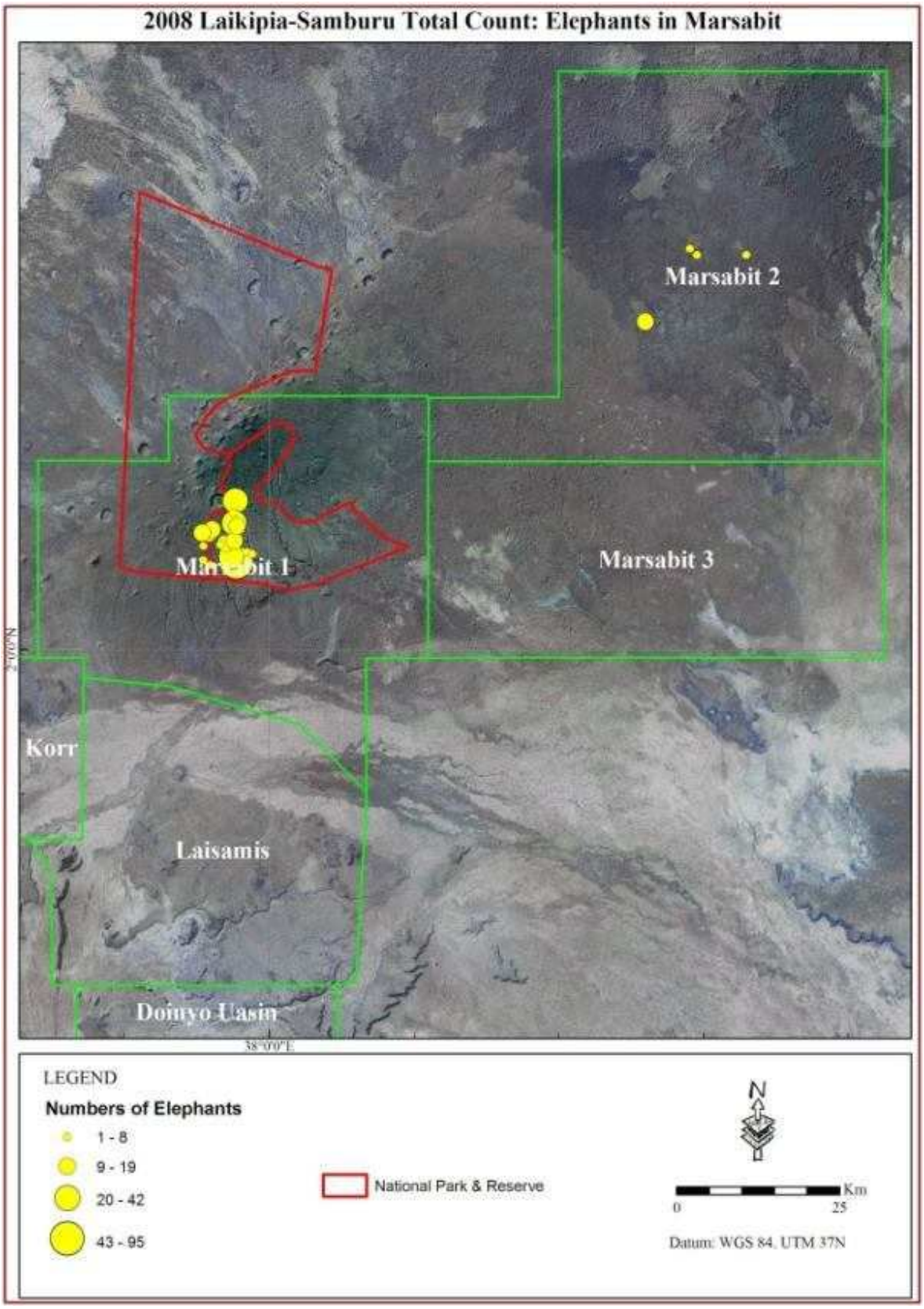

Figure 20. Elephants in Marsabit National park and a few at Bulemarmar in 'Marsabit 2' block.

6. DISCUSSION

Elephant Trends:

The Laikipia/Samburu elephant population continues to show significant increment since 1992 as shown in Table 2. In 1992, 2,969 elephants were recorded in the Laikipia/Samburu ecosystem, a much lower figure compared to the current one of over 7000 elephants. A projection of the growth indicates that the figure might surpass the 10,000 mark in another five years.

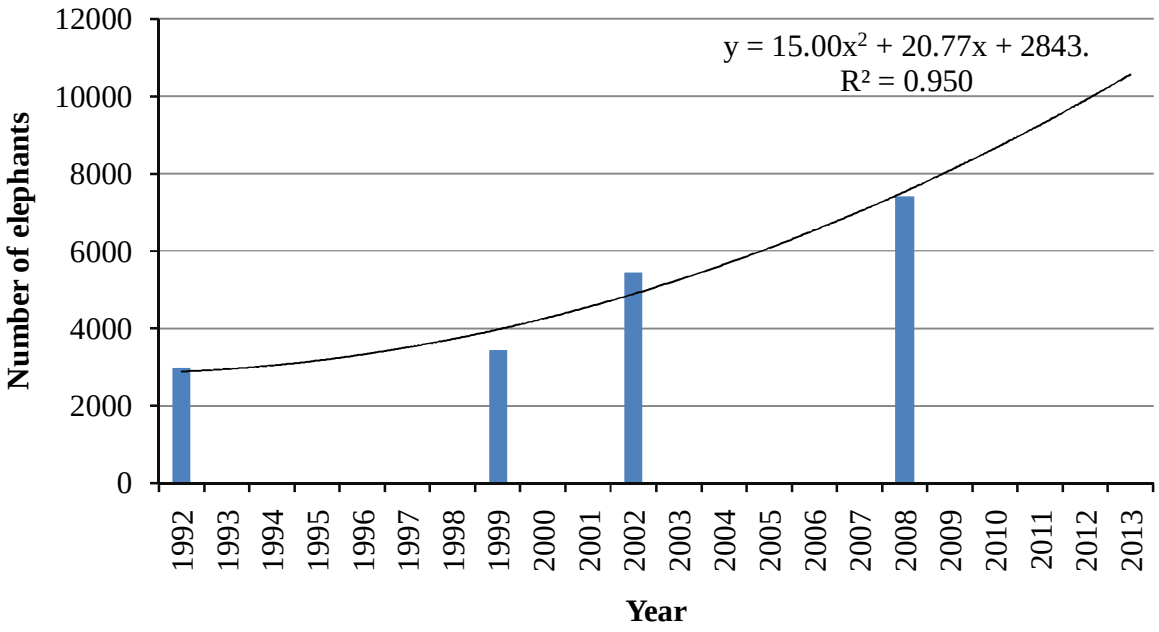

Figure 21. Elephant population trends for Laikipia/Samburu ecosystem from 1992 to 2008. A second order polynomial confirms an increasing population with a potential of exceeding 10,000 elephants by 2013.

Potentially as a function of this seasonal difference between the dry 2002 and this wet 2008 count, certain land use categories demonstrated increases across the two counts while others showed declines. In total, elephant numbers demonstrated an annualized growth rate of around 6% between the two counts. This rate of increase is unlikely to be a function of intrinsic growth alone, given the relatively high mortality detected for the period (n = 1124) by Kahindi *et. al* (2009), Douglas-Hamilton (2010) and the lower rate of increase observed of the elephants living in the optimal habitat and high protection comprising the Samburu and Buffalo Springs national reserves (Wittemyer *et. al*. 2005). It is thought that numbers were in part increased by movement of elephants into the site. Furthermore, radio tracking data in the ecosystem demonstrates that some elephants use quite different areas seasonally, with some relying on forests (excluded from the counts) during the dry season and low land savannahs included in the count during the wet

season (Douglas-Hamilton et al. 2005; Thouless 1996). Because forest areas and settlements were not adequately covered in the aerial counts, due to poor visibility in the first case and low expectations of seeing elephants on account of the nocturnal behavior in the second, these results are best treated as minimal estimates.

Within the 14 year time difference since the previous census of 1994, Marsabit elephants increased by a marginal 52 animals from 267 to 319, a 19.5% overall increase (Figure 22).

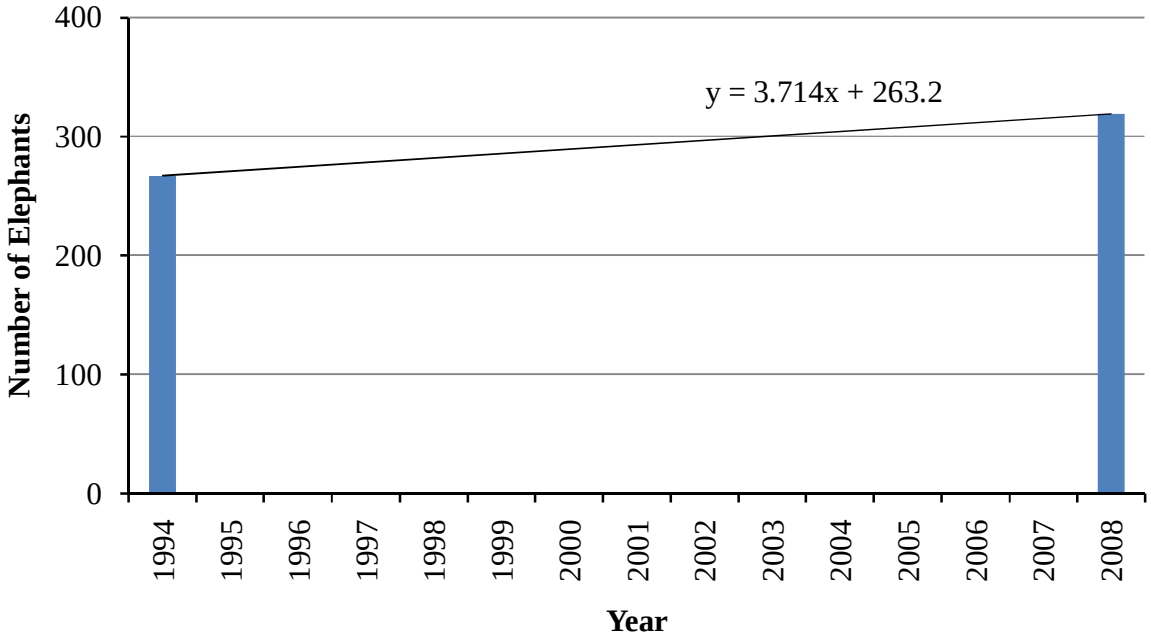

Figure 22 Elephant population trends for Marsabit region from 1994 to 2008.

Despite the time difference between the censuses in Marsabit, the percentage increase in elephant population is far much less than the 150% increase recorded for the Laikipia-Samburu elephant population over a period of 16 years from 1992 to 2008. A more frequent survey routine is vital to observe the trends as a lot is bound to change within a decade which is missing for the Marsabit region.

7. CONCLUSIONS

The elephant population of Laikipia-Samburu ecosystem is on the increase despite serious challenges of poaching and drought leading to notably high mortality. This is due to the good will of the land owners, which is encouraging news for the conservation fraternity. The major challenge that stands out against the future of the elephants is the availability of space in the wake of expanding human foot print that constricts the traditional home range and breaks elephants' historical migratory routes. Ongoing telemetry research has in the recent past confirmed critical corridors. Encroachment of corridors increases the incidences of human wildlife conflicts which may be fatal for both elephants and humans. There is need for high level sustenance of security, joint planning initiatives on land uses involving the government, local people, development agencies and researchers among other stakeholders. The Marsabit population needs constant monitoring to understand its dynamics, possible linkages with other neighboring populations and possible threats considering its relatively small size.

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9. APPENDIX I. LIST OF PARTICIPANTS

	Name		Institution	Responsibility
1	Samson	Sanare	KWS	Aircraft technician
2	Juliet	King	NRT	FOS
3	David	Kones	KWS	FSO
4	Elphas	Bitok	KWS	FSO
5	Lekishon	Kenana	KWS	FSO
6	Moses	Litoroh	KWS	FSO
7	Samuel	Andanje	KWS	FSO
8	Salome	Gachago	KWS	FSO
9	Shadrack	Ngene	KWS	FSO
10	Onesmus	Kahindi	STE	FSO
11	David	Daballen	STE	FSO
12	Monica	Chege	KWS	GIS
13	Belinda	Low	GZT	GIS
14	Peter	Lelampaa	GZT	GIS
15	George	Tokro	KWS	GIS
16	Guy	Parker	Marwell Zoo	GIS
17	Siva	Sundaresan	MPALA R C	GIS
18	Dorminic	Lesmidarda	NRT	GIS
19	Max	Graham	Private	GIS
20	Festus	Ihwagi	STE	GIS
21	Rose	Mayienda	AWF	GIS
22	Bernard	Ochieng	KWS	Ground Team
23	Chrispin	Ngesa	KWS	Ground Team
24	Damaris	Thairora	KWS	Ground Team
25	Emily	Atai	KWS	Ground Team
26	Jacquline	Bernard	KWS	Ground Team
27	Sylvia	Wambui	KWS	Ground Team
28	Zannet	Zannet	Private	Ground Team
29	Martha	Fischer	St. Lois Zoo	Ground Team
30	Charles	Ooro	KWS	Media
31	Paul	Udoto	KWS	Media
32	John	Munyori	KWS	Pilot
33	Kenneth	Ochieng	KWS	Pilot
34	Kenneth	Mwiti	KWS	Pilot
35	Moses	Lelesit	KWS	Pilot
36	Robert	O'Brien	KWS	Pilot
37	Samuel	Muchina	KWS	Pilot
38	Richard	Moller	LEWA	Pilot
39	Peter	Zannetti	Private	Pilot
40	Iain	Douglas-Hamilton	STE	Pilot (Pilot Briefing)
41	Paul	Mouria	AWF	RSO
42	Nick	Oguge	Earthwatch	RSO
43	Rikapo	Rikapo	GZT	RSO
44	Antony	Wandera	KWS	RSO
45	Cedric	Khayale	KWS	RSO
46	Ben	Okita	KWS	RSO
47	Geoffrey	Bundotich	KWS	RSO
48	Jared	Lumbasi	KWS	RSO
49	Nashu	W/Isiolo	KWS	RSO
50	Peter	Serem	KWS	RSO
51	Peter	Mwangi	KWS	RSO
52	Sospeter	Kiambi	KWS	RSO
53	Jeremiah	Letimir	Meibei W C	RSO
54	Sinyati	Lesowotir	NRT	RSO
55	Alice	Leslie	STE	RSO
56	Gilbert	Sabinga	SRE	RSO
	Stephen	Lenantoiyie	WESTGATE	RSO