WET AND DRY SEASONS ELEPHANT (*Loxodonta africana africana*) DENSITY AND DISTRIBUTION IN TRANSMARA DISTRICT, 2007

Photo Sitati Noah

By

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EXECUTIVE SUMMARY

The status of the elephant population in Transmara District was not clear over the last ten years. The first and most recent elephant survey was by Wamukoya et al. (1997) that gave a mean estimate of 200-300 elephants. However, there was doubt on the precision level of these results because of the fewer number of transects used and the elephant programme that was used during data analysis without undertaking dung decay rates. The purpose of these studies was to conduct the first detailed survey of elephant numbers and distribution in Transmara in different forest blocks with improved survey methodologies and statistical analyses.

The elephant surveys were conducted in all major forest blocks namely; Nyakueri, Kirindoni, Laila/Mogor and Esoit Naibor. The line transect technique was used to assess elephant dung pile densities as described by Barnes (1992) and Buckland et al., (1993). Fieldwork for the wet season was conducted in June 2007 while the dry season count was carried out in December 2007. In the wet season, 19 transects totalling 57 Km long were walked while at total of 21 transects (63 km) were done. For each dung pile encountered along the transects, the distance along it and the perpendicular distance were recorded. The data analysis program Distance 4.0 of 2002 was then used to analyze the transect data.

Results of the wet season analyses indicate a mean elephant density of 1.623/km^2 while the dry season analyses show a mean of 2.027/km^2. These translate mean elephant numbers of 513 ± 25 and 640 ± 190 elephants respectively utilizing the range during the two seasons. This shows an increase in elephant population over the last ten since the last survey in 1997 with 200-300 individuals recorded. Two conclusions can be drawn out of these findings: (a) elephant population is growing by 5% which is a normal growth rate; (b) some elephants from the Masai Mara National Reserve and the adjacent group ranches in Narok District utilise Transmara District during the dry season. This is supported by the recent total aerial counts by KWS in the Mara ecosystem which recorded 2072 (June 2007 – wet season) and 1560 (November 2007 – dry season) elephants. However, note that these figures exclude elephants in the unprotected area of Transmara which has a thick vegetation cover hence making the aerial census method unsuitable. Therefore the Transmara forests are crucial elephant dispersal areas during the dry season and provide refuge for elephants from Maasai Mara National Reserve during the dry season besides the resident population. Therefore securing this elephant dispersal area for elephant conservation and management is crucial for future survival of elephants in the landscape.

1.0 INTRODUCTION

Elephants in Africa face increasing threats including human-elephant conflicts, illegal killing and habitat loss. Hence, their conservation is one of the WWF top priority. In order to achieve its objectives, WWF's plan is to scale up its actions to implement the new SAP (WWF Species Action Plan: African Elephant, 2007-2011), across African landscapes. In this Species Action Plan, the Mara-Serengeti-elephant landscape is ranked as one of the top five priority landscape for WWF in eastern Africa. Since 1999, WWF has been supporting a human-elephant conflict (HEC) mitigation work in Transmara District. The HEC project in this landscape which has been identified locally appropriate mitigation methods, and tested these and other novel methods and it recently scaled up in the adjacent Narok District to ensure successful methods are used elsewhere and to help address the broader landscape objective of the SAP. HEC is a contemporary threat to elephant conservation and management in Africa. It results in high elephant mortality and loss of range and critical habitats.

For clear understanding of the intensity of HEC and hence its mitigation, there is need to know the changes in elephant numbers and distribution which have implications for new forms of HEC. HEC can be managed effectively if there is a clear understanding of the status, distribution and movement patterns of the elephant population. Elephants once ranged across most parts of Transmara District and beyond, and covered an area of more than 2,340 km^2. The present elephant range is of scattered, fragmented populations confined to central parts of the district and their overall range now covers 1,158 km^2, which represents a 51% reduction in range. Their core range only covers an area of 342 km^2, some 30% of the overall range. The elephants have been pushed into areas with: lower rainfall; low soil fertility; lower river density; low human density; and, where only forest fragments remain. An increase in elephant numbers and a decline in elephant range increases elephant density and this has implications on the intensity of conflict. The chances of elephants coming in contact with people and crops are very high. There is need therefore to win more space for elephant conservation in order to reduce the density and lower the levels of conflict.

2.0 PROJECT AREA

Transmara District was created from Narok District in 1994. The district occupies a total of 2900 km^2 with 5 administrative divisions namely; Keiyan, Kilgoris, Lolgorien, Kirindon and Pirrar. The Mara River marks its eastern boundary with Narok District. To the south, it is bordered by Tanzania and to the west by Kuria and Migori districts. Kisii and Bomet districts are its northern and north eastern neighbours (Figure 1).

Forests in Transmara cover about 40% of the land area of the district. As a result in this area they are an important natural resource as they provide goods and services to the local people. These include; honey, fruits, timber, poles, posts and other products.

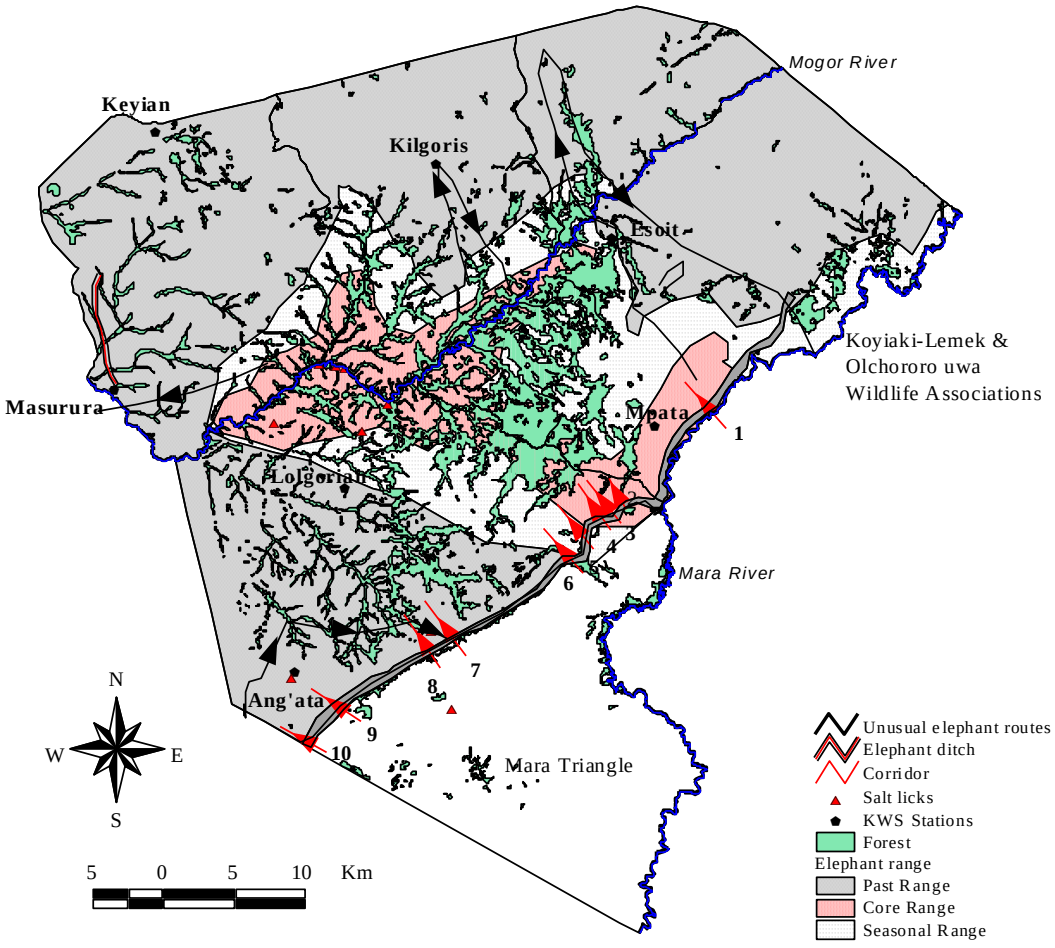

Figure 1: Map showing Transmara District and corridors used by elephants to move up the escarpment.

The forests also have a cultural significance as a sacred place with "operational base" for Maasai Morans. Other important roles for these forests include; as water catchment, soil and water conservation, besides proving important habitats and dispersal areas for wildlife particularly elephants.

However, forests in Transmara are obviously threatened by destruction. This is associated with the socio-economic changes in the livelihood of the Maasai, from traditional pastoralism to commercial land use, which entails converting forests and rangelands to crop production. The depletion of forests is likely to be accelerated with land adjudication and sub-division of group ranches into individual parcels, which not only allows owners to lease, sell and mortgage the land, but also enables them to adopt the modern agricultural practices since Transmara falls predominantly in agro-ecological zone 3 which is the humid climate with medium agricultural potential (Awere-Gyekye, 1996; Kiyiapi, et al., 1996). The area is therefore suitable for cultivation of maize, wheat and sugarcane among other crops.

Transmara District records high cases of conflict incidences despite the mitigation strategies that have been put in place. About 500 farms are raided every year and about 10 people either killed or injured by elephants. The increase in conflict incidences is due to increase in the number of new farms that are not employing the novel strategies to mitigate conflict, habitat loss and an increase in elephant numbers.

3.0 GOAL AND OBJECTIVES

The main goal of the elephant surveys was to build local and KWS capacity to be able to estimate the number of elephants in Transmara District during dry and wet seasons and make recommendations on future elephant conservation and management in the district in order to enhance their conservation.

The specific objectives of the elephant census were:

- To determine the relative densities and distribution of elephants in Transmara District
- To establish permanent transects for future monitoring of elephant numbers and distribution in Transmara District
- To train community scouts and KWS rangers in elephant census.

4.0 TRAINING OF PARTICIPANTS

The people who participated in the census were derived from the local community (Transmara Game Scouts) and the Kenya Wildlife Service staff from Transmara District (Appendix 1). A total of 42 participants were trained on various techniques of censuring elephants by an expert from KWS headquarters (Figure 1). A two day training workshop (Figure 2) culminated into an actual elephant census which took five days comprising of five groups. Each group had eight people (two observers, a recorder, hip chain carrier, transect clearance, two security personnel, a driver).

Figure 2: A group photograph of participants involved in elephant census

Figure 3: Mr. Bitok (trainer) demonstrating how to read a campus and a Geographical Positioning System

5.0 METHODOLOGY

Setting of transects

The only technique currently available for counting elephants in thick forest involves the indirect counts of dung piles using transects. The density of elephants can be extrapolated from dung density. An overall population estimate can be calculated from the density if good sampling has been carried out and the area of available range is known.

The old 14 transects which were used in 1997 by Wamukoya et al., (1997) were used and 5 new transects were added during the wet season and 7 during the dry season. Transects were randomly laid out following Griffiths (1978) using GPS points and a bearing. The distribution of the transects was based on vegetation types and human settlement. Fieldwork for the wet season was conducted in June 2007 while the dry season count was carried out in December 2007. In the wet season, 19 transects totalling 57 km long were walked while at total of 21 transects (63 km) were done (Figure 4). The census took five days comprising of five groups. Each group had eight people (two observers, a recorder, hip chain carrier, transect clearance, two security personnel, a driver). Each transects was walked in the morning and for each dung pile encountered along the transects, the distance along it and the perpendicular distance were recorded (Appendix 2).

Data analysis

Various statistical programs used to calculate dung density have evolved and some of these programmes have tended to overestimate the elephant numbers. For these counts, the more reliable "DISTANCE Programme" (Laake et al., 1993) was used as described by Barnes (1992) and Buckland et al., (1993). DISTANCE allows the selection and use of different models and a range of different options. A data-file containing the data on perpendicular distances was created. The perpendicular distances were used to calculate f(0). This is an estimate of the reciprocal effective strip width (ESW). The density of dung piles, D, is then calculated as:

$$D = \frac{n.f(0)}{2L}$$

Where n is the number of droppings and L is the total length of the transects in which they were recorded. The methods of estimating the variance of D and the confidence limits are given by Burnham et al., (1980) and Buckland et al., (1993). Data was first analysed separately per transect and combined to give an overall estimate for the entire range.

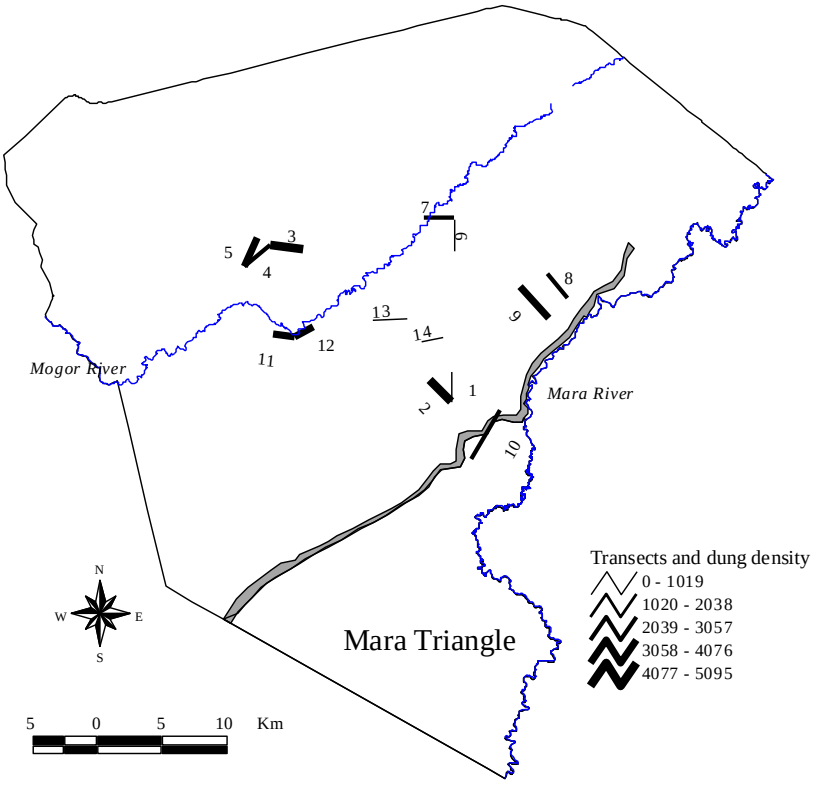

Figure 4: Location of transects used during elephant census

6.0 RESULTS AND DISCUSSION

Results of the wet season analyses indicate a mean elephant density of 1.623/km^2 while the dry season analyses show a mean of 2.027/km^2 (Table 1). These translate mean elephant numbers of 513 ± 25 and 640 ± 190 elephants, respectively, utilizing the range during the two seasons. The two forest counts showed that the Transmara forests are crucial as elephant dispersal areas besides proving corridors and refuge for elephants from Maasai Mara National Reserve during the dry season

These results indicate that mean elephant numbers the first two seasons varied by about 24%. The increase could be attributed to the seasons when the surveys were done. The first survey was during a relatively wet period in which elephants tend to disperse out of the forests because of cold and availability of forage elsewhere as compared to the second survey (dry) when elephants move into the forests.

Table 1: Mean elephant density and mean numbers estimated for wet and dry seasons

Survey period	Mean density	Mean number estimated	SE
June 2007 (wet season)	1.623	513	25
December 2007 (dry season)	2.027	640	190

As shown in table 2 below, elephant usage in Transmara varies spatially between different transects and is seasonal with more elephants using the forest during the dry season. A comparison of dung densities during the two seasons shows higher densities per square metre of dung for each transect. During the dry season, the highest dung densities were recorded in transect 8 while in the wet season; the highest was in transect 12. The mean standard deviation for dung densities between the two seasons was 0.077.

Table 2: Elephant dung densities calculated for each transect during the wet and dry season counts

Transect No.	Elephant dung density		Percentage (%) CV		Mean standard deviation
	Dry season	Wet season	Dry season	Wet season	

1	0.0024	0.001	6.38	50	9.90E-04
2	0.0025	0.0004	9.78	37.97	1.48E-03
3	0.00012	0.0004	22.58	14.82	1.98E-04
4	0.0028	0.0011	11.03	13.33	1.20E-03
5	0.00015	0.0025	7.22	12.89	1.66E-03
6	0.000009	0.0013	11.14	13.62	9.13E-04
7	0.0000028	0.00061	13.87	15.78	4.29E-04
8	0.491	0	9.06	0	3.47E-01
9	0.002	0.0001	10.47	0	1.34E-03
10	0.34	0.0003	15.67	30.98	2.40E-01
11	0.00028	0.0017	32.09	16.3	1.00E-03
12	0.0023	0.0042	8.62	7.32	1.34E-03
14	0.0017	0.00015	6.69	15.67	1.10E-03
15	0.0003	0.00051	21.06	22.91	1.48E-04
16	0.00024	0.00069	32.32	19.65	3.18E-04
17	0.0011	0	15.27	0	7.78E-04
18	0.00037	0.00036	30.19	22.38	7.07E-06
19	0.247	0.0003	20.77	21.07	1.74E-01
21	0.00074	0.00014	19.03	22.81	4.24E-04
22	0.0006	0.0015	12.06	9.09	6.36E-04

The results show that Transmara District as exemplified by the thick forest cover, open bushlands and riverine systems is a good elephant habitat. And as a result, during the dry season, a large number of elephants make an annual migration in order to take advantage of readily available forage and water resources. However from observations during the fieldwork, no serious damage to forests can be attributed to elephants. Most forest destruction observed during the surveys were human related activities such as farming, logging and charcoal burning. The extent of this destruction may continue to increase due to changes in lifestyle of the Maasai community from being pastoralists to agro-pastoralists.

It is therefore evident that Transmara's natural wooded grasslands have co-evolved with their native herbivores as self-perpetuating ecological systems. These wooded grasslands are very productive within the limitations of variable rainfall. A high proportion of the grass biomass is consumed by a variety of wildlife and domestic animals. From field observations, the grassland community in Transmara appeared to be maintained by periodic burning which tends to

suppress shrubs and trees that would otherwise grow into dense woodlands or forests hence the scattered bushes.

Other observations during the field work showed that the advent of sedentary lifestyle among the Maasai's, has led to increased pressure on land necessitating sub-division of the group ranches and have influenced the local people's attitudes towards natural resources use to be largely motivated by self interest. As a result, forest destruction in Transmara for more land to be put under cultivation, human settlement, cattle bomas, charcoal burning and other land use purposes is taking place on an unprecedented scale and at pace greater than ever before. This non-sustainable way of natural resource use may lead to serious ecological imbalances in the future as a result of the lack of forest regeneration due to repeated destruction that depletes the natural stock.

A large proportion of Transmara forests grow on impoverished soils, lacking in humus and deficient in nutrients, making them ecologically fragile systems. Thus, removal of the trees will lead to more impoverished soil (unsuitable for agriculture). Consequently, areas currently being excised from forested areas will inevitably decline. This will make continued agricultural use of the area less attractive than the option of leaving it as a wildlife dispersal area. Even the partial recovery that might be expected within a period of several decades will depend upon the agricultural practices adopted and the exclusion of grazing animals, a measure which may be difficult or impossible to achieve where subsistence pastoralists are short of grazing land.

Subsistence pastoralists frequently experience the added difficulty of occupying communal grazing lands over which they have neither individual control nor responsibility. In attempting to maximize their own herds, owners compete for the available forage, creating conditions in which over-grazing becomes inevitable. Thus the subdivision of communal lands is likely to address this problem but if not carefully handled would lead to over-grazing in small scale farm, holdings among the local people which are bound to be used for both crop production and livestock grazing.

Thus, the challenge facing conservationists in Transmara is to bridge the chasm between on the one hand the economics, imbued with the profit motive and on the other hand, to meet the legitimate requirements and reasonable aspirations of the local people who are struggling to survive. This is as much a social as an ecological problem. However, the conflicting demand between deforestation and biological conservation suggests that the Biosphere Reserve concept that allows forests and farmlands to be managed in harmony with a core area would be the most appropriate system to follow. However, conservation of wildlife and other natural resources in

Transmara are unlikely to succeed unless they are integrated into broader land use strategies involving a complete ecosystem. It is also vitally important that conservation projects should enlist the support of the local people without whose active collaboration and, wherever possible, participation little of permanence will be achieved.

From observations during the fieldwork, land under cultivation in Transmara seems to be on the increase. The same was noted by Awere-Gyekye, (1996a), Mwangi, (1995) and Sitati (2003). The increase in area under cultivation not only results to loss of wildlife habitat, but also intensifies human-wildlife conflict, which has become a common phenomenon in Transmara (Sitati et al. 2003, Sitati and Walpole 2005).

The reduction in wildlife habitat due to deforestation and cultivation will continue to have far-reaching consequences to human-wildlife co-existence for many years to come. This could account for the increased crop raiding incidences in the area, besides the unfortunate loss of life and other destructive activities associated with elephants. This is likely to intensify as more land is put under crop production.

Also, if deforestation in the area continues at the present rate, it is inevitable that this will interfere with the areas rainfall patterns and precipitation with obvious impacts on crop and livestock production. Similarly, deforestation will also enhance soil erosion and soil degradation particularly of the marginal areas due to inadequate vegetation cover.

7.0 CONCLUSION AND RECOMMENDATIONS

The wet and dry season estimate of the elephant population size in Transmara District for year 2007 has been derived and can be used to update the IUCN African Elephant Status report. The present results are based on increased number of transects hence a fairly accurate estimation was derived after covering a bigger area. An increase in the number of elephants by almost 4% was noted is attributed to the superior conservation efforts made by the wildlife sector in collaboration with its stakeholders. Most elephants utilizes the Transmara District during the dry season and disperse out during the wet season. As a result, Transmara District is an important elephant dispersal area and should be conserved in view of the declining elephant range due to encroachment.

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APPENDICES

Appendix 1: List of elephant census participants

1.	Dr. Noah Sitati	-Project Manager
2.	Mr. Elphas Bitok	-Facilitator
3.	Mr George Manono	-Team Leader
4.	Mr. Boaz Burudi	-Team Leader
5.	Dorothy Syallow Masiga	-Team Leader
6.	Leonard Seme	-Team Leader
7.	Elizabeth Wakoli	-Moi University student (Attachment)
8.	Peter Sinkalo	-Scout
9.	Soitanae Ole Nanda	-Scout
10.	James Konchellah	-Scout
11.	Paul Kimeleny	-Scout
12.	Simion Kampah	-Scout
13.	Lentoi Panta	-Scout
14.	Meerashi Kimpai	-Scout
15.	Fredrick Sabaya	-Scout
16.	Saningo Nangoro	-Scout
17.	David Kinampu	-Scout
18.	Dominic Nabaala	-Scout
19.	Phillip Kapio	-Scout
20.	Ole Yantare Kapori	-Scout
21.	Mepukori	-Scout
22.	Ole Santiani	-Scout
23.	Ole Sabara Nangoro	-Scout
24.	Jullius Siparo	-Scout
25.	Michael Samperu	-Scout
26.	David Tobiko	-Scout
27.	LEsingo Nabaala	-Scout
28.	Lemashon Konchory	-Scout

29. Samwel Sankale -Scout
30. William Suju Okoth -Ranger KWS
31. John Wachira -Ranger KWS
32. Philiip Onchari -Ranger KWS
33. Fred Oduor -Ranger KWS
34. Jonn Sironka -Ranger KWS
35. Peter Matindi -Ranger KWS
36. Anne Mathinji -Ranger KWS
37. Abdi Fatah Dek -Ranger KWS
38. Samwel Okumu -Ranger KWS
39. Makario Gitonga -Ranger KWS
40. Jullius Gitonga -Ranger KWS
41. John Wachira -Driver KWS
42. Joel Bii -Driver KARI
43. Bernard Musyoka -Driver KWS

Appendix 2: Elephant census data form

Transect No. ------- **Date** ---------- **Group** ----------

Sheet No. --------- **Bearing** ----------

GPS (Start) x-coordinate ---------- y-coordinate ----------

(End) x-coordinate ---------- y-coordinate ----------

Transect distance (m)	**Perpendicular distance (m)**	**Elephant sign**	**Vegetation type (OG, F, WG)**	**Comments**

[2] **OG**: Open grassland; **F**: Forest; **WG**: Wooded grassland