AERIAL CENSUS OF WILDLIFE AND LIVESTOCK IN EASTERN KAJIADO
February 2010

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7th June 2010

INTRODUCTION

We conducted an aerial census of eastern Kajiado in early February 2010. The area counted matched the area monitored regularly by the Amboseli Conservation Program (ACP) since 1973. The count gives an independent check of the drought mortalities recorded on ground counts in the Amboseli basin during 2009. The February count covered the entire Amboseli ecosystem and extended well into adjacent wildlife concentration areas. The February count gives a measure of wildlife and livestock mortalities for the whole of eastern Kajiado when compared to the 2008 pre-drought count.

METHODS

The aerial survey was flown over three days between 10th February and 12th February 2010. The count date gives a snap-shot of the numbers and distribution of wildlife and livestock a few weeks after the rains of mid-December brought an end to the drought. The count was flown in a Cessna 206 piloted by Toby Dunne. The Department of Resource Surveys and Remote Sensing provided two experienced observers, Hesbon Kamulla and John Wathuo, for the aerial count. Coordinator and front seat observer, Jeff Worden, recorded environmental data.

The count area covered 8,300 square kilometers of eastern Kajiado shown in the species distribution maps, below. The sample design was based on systematic flight lines 5 kilometers apart, overlaid on a 5 kilometer grid system. The aircraft was flown at a nominal height of 91 meters. Counting strips averaged 166 meters for the left observer and 159 meters for the right observer. The counting methodology has been described in full by Western (1976). Population estimates and the standard errors of each species were calculated by treating each transect as a sample unit and using the Jolly method 2 (Jolly ,1969), as described by Norton-Griffiths (1975).

Pasture conditions were green throughout eastern Kajiado during the count. Migratory wildlife herds were widely distributed in areas typically used during the wet season. Additional information was collected on the environmental conditions and human settlement.

RESULTS

Population estimates

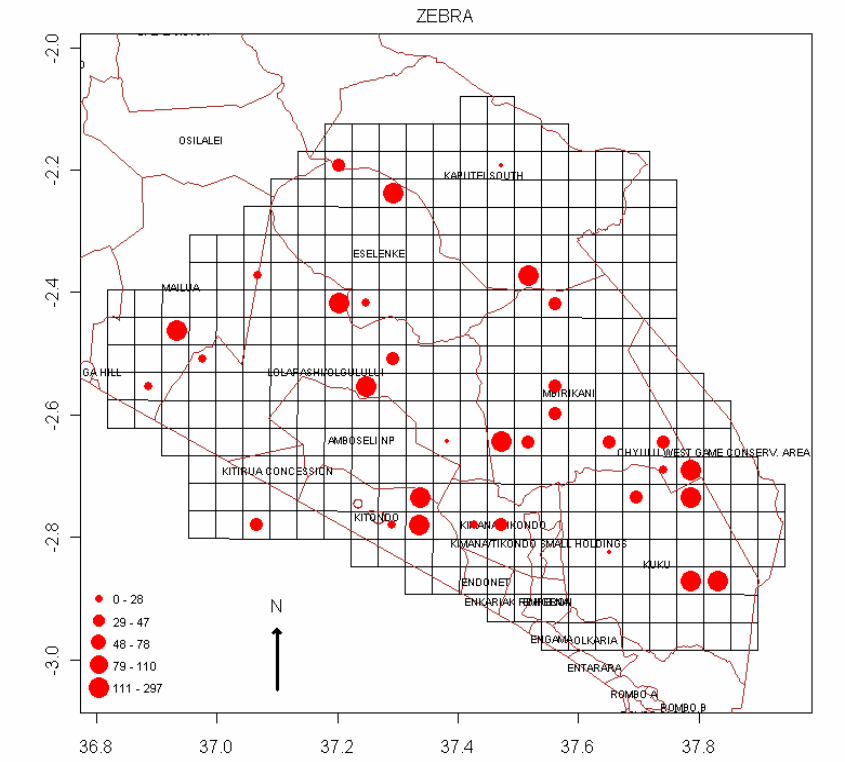
Table 1, below, gives the extrapolated population counts for large ungulates counted in eastern Kajiado.

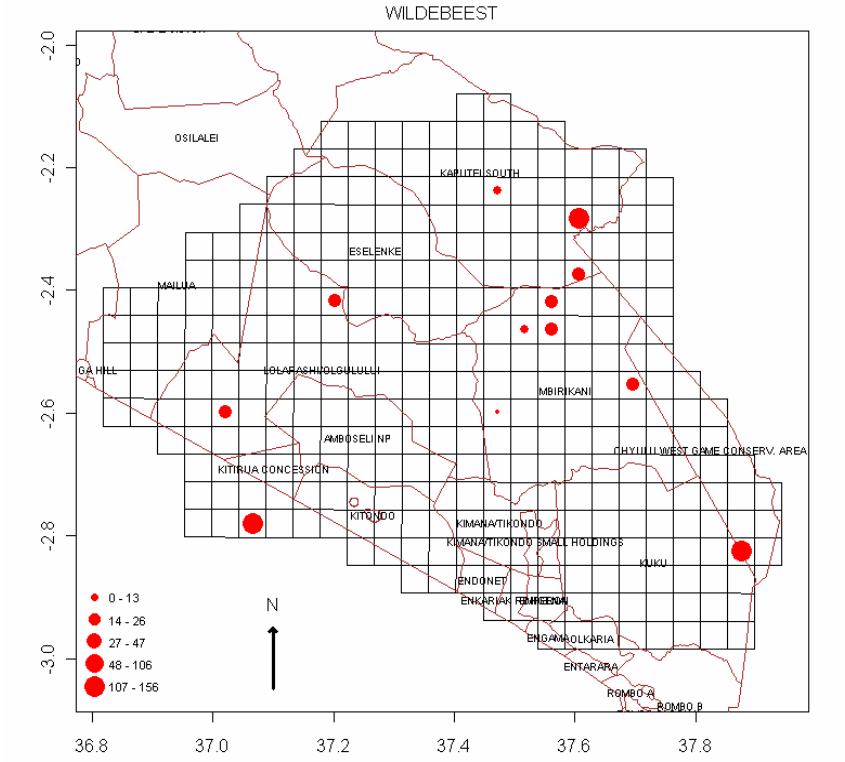
Species Name	Population Estimate	Standard Error
Zebra	3034	575
Wildebeest	802	267
Kongoni	438	219
Thomson's Gazelle	598	206
Grant's Gazelle	2815	451
Impala	890	374
Eland	2494	1307
Elephant	1094	425
Giraffe	2699	470
Cattle	49129	7627
Shoats	97397	12321
Ostrich	1167	242
Donkey	1196	246
Gerenuk	146	45
Warthog	248	106
Lesser kudu	175	64
Hippo	306	180

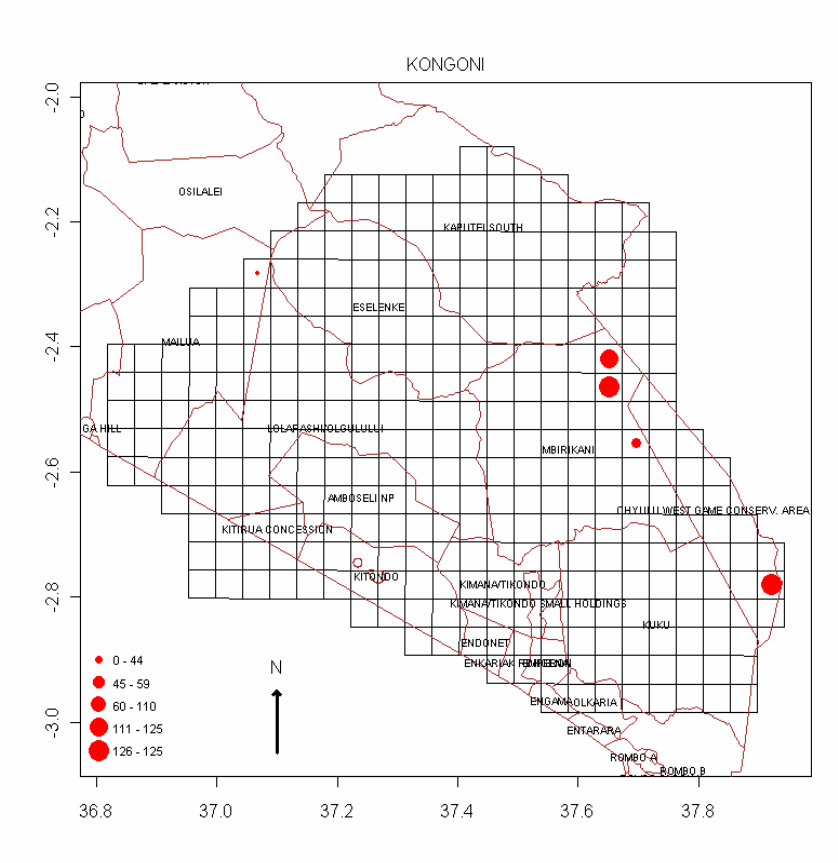
Table 1: The animal population estimates and standard errors for the February 2010 aerial survey.

Species distribution:

The following maps give the distribution of the most abundant herbivores recorded on the counts.



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CHYULU WEST GAME CONSERV. AREA
KITIRUA CONCESSION
KITONDO
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KUKU
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ENKARIAK
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ENTARARA
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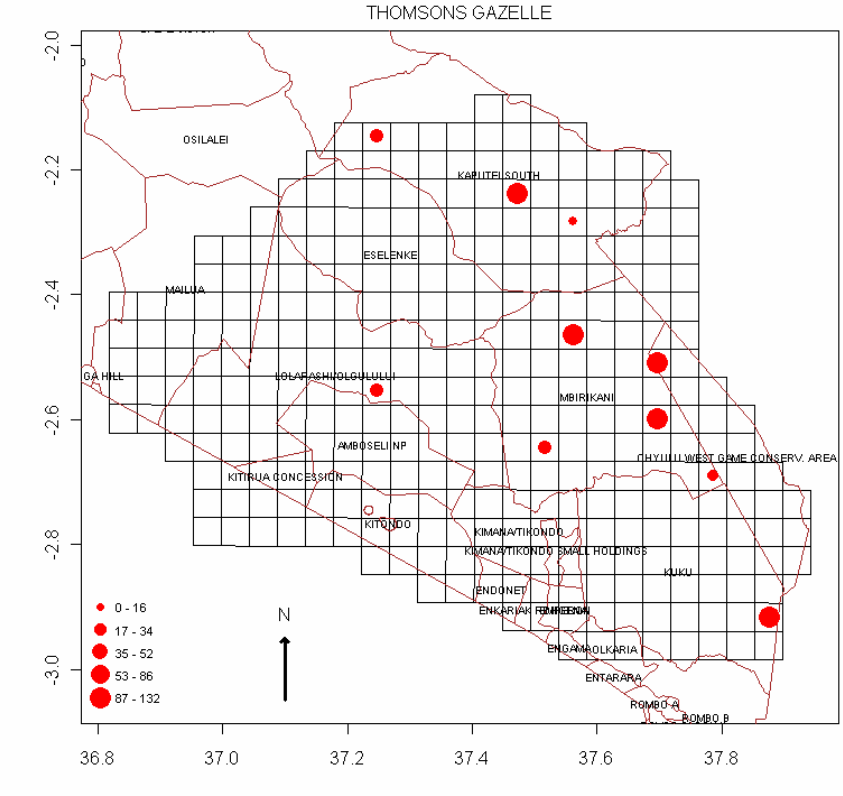
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KIMANA/TIKONDO SMALL HOLDINGS
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ENDONET
ENKARIAK
ENGAMAOLKARIA
ENTARARA
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87 - 132
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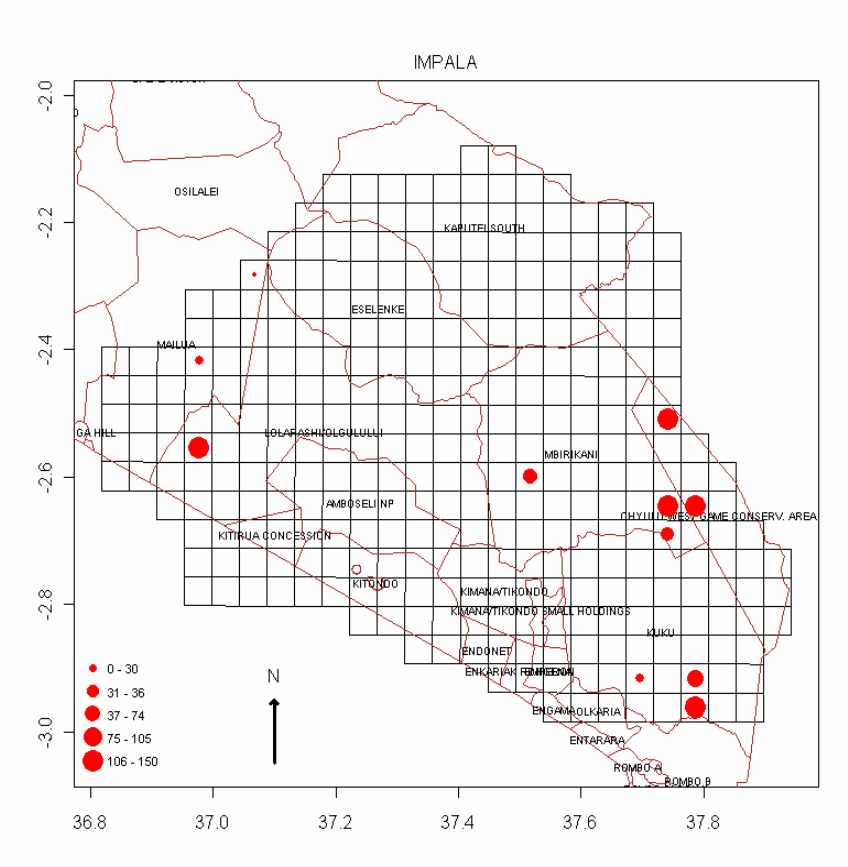
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ENGAMA/OLKARIA
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37 - 74
75 - 105
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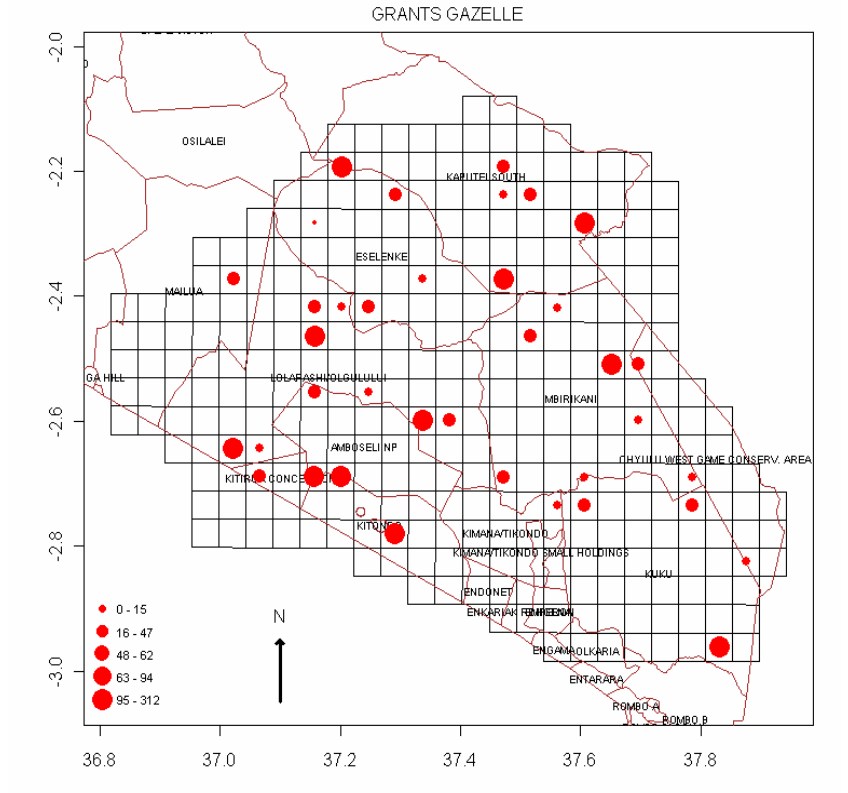
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KIMANA/TIKONDO
KIMANA/TIKONDO SMALL HOLDINGS
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ENDONET
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ENTARARA
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95 - 312
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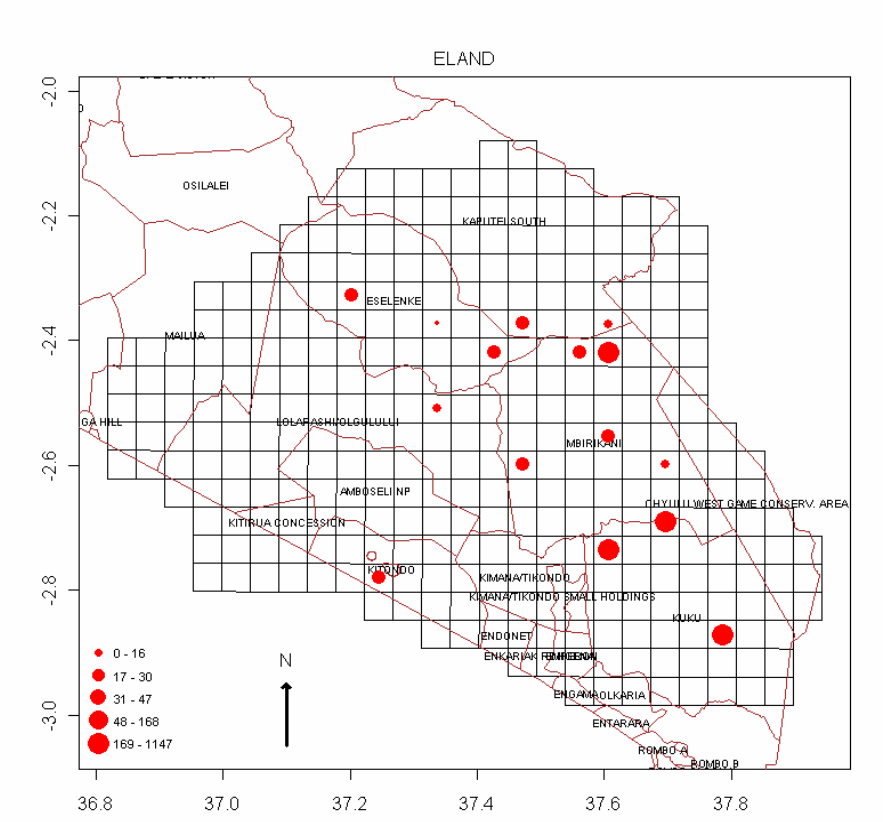
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KIMANA/TIKONDO SMALL HOLDINGS
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ENDONET
ENKARIAK
ENGAMAOLKARIA
ENTARARA
ROMBO A
ROMBO B
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31 - 47
48 - 168
169 - 1147
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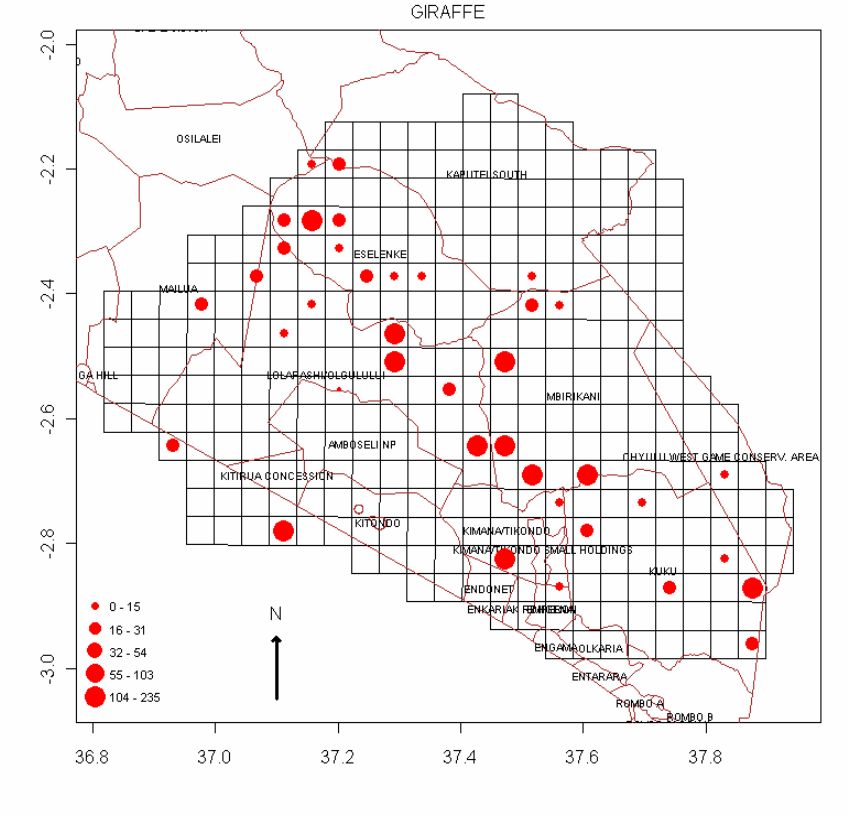
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ENDONET
ENKARIAK
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ENTARARA
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ROMBO B
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16 - 31
32 - 54
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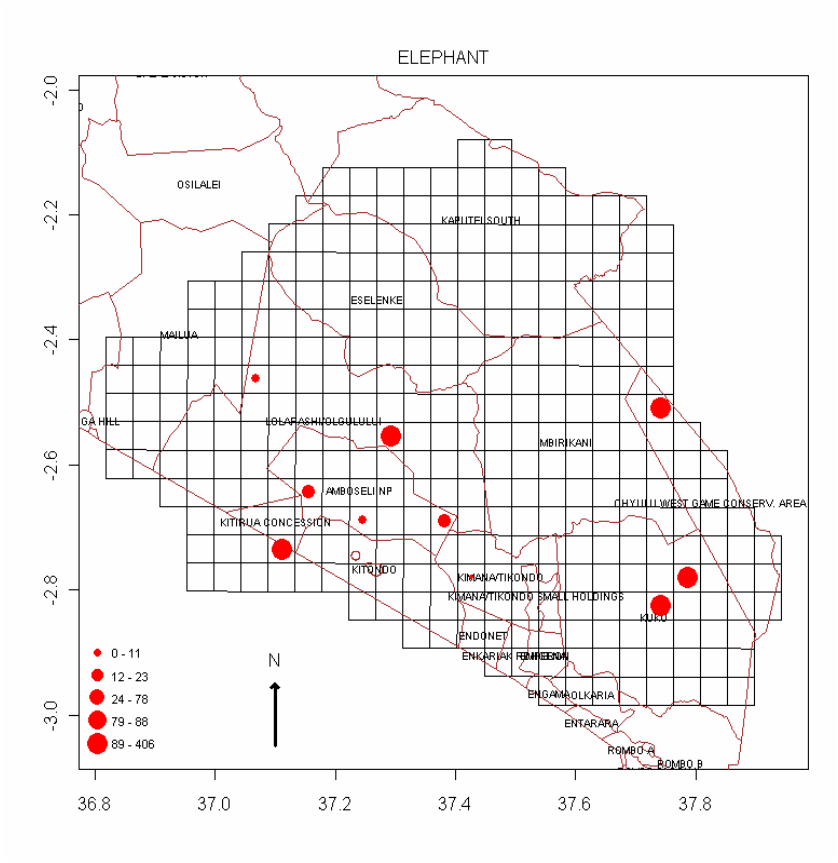
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KITONDO
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KUKU
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ENGAMA OLKARIA
ENTARARA
ROMBO A
ROMBO B
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79 - 88
89 - 406
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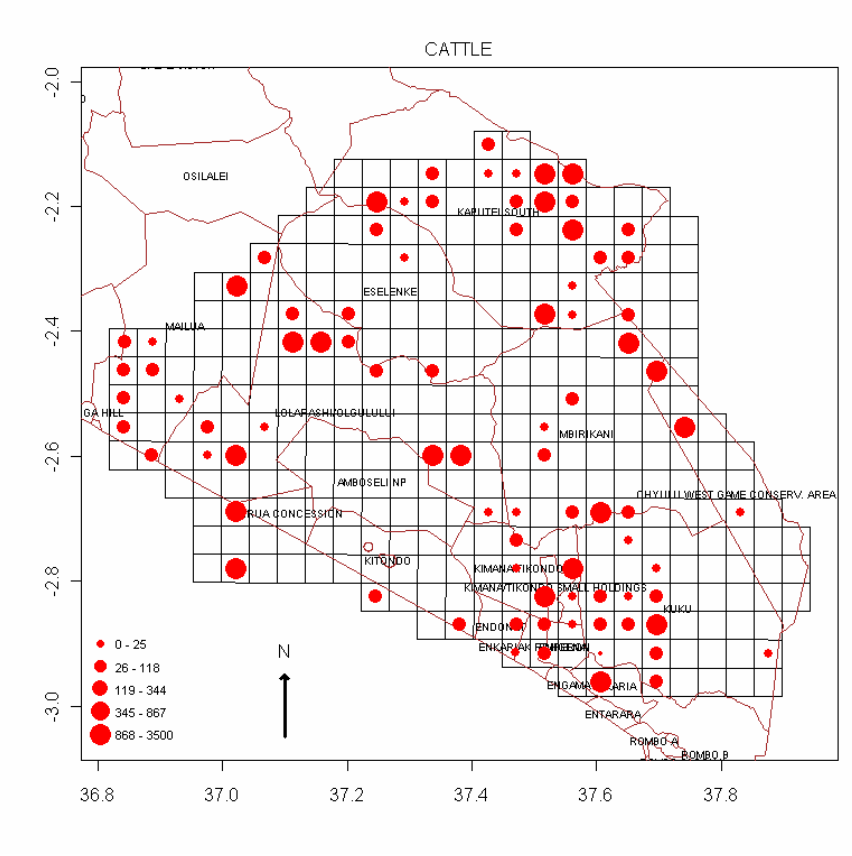
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ROMBO B
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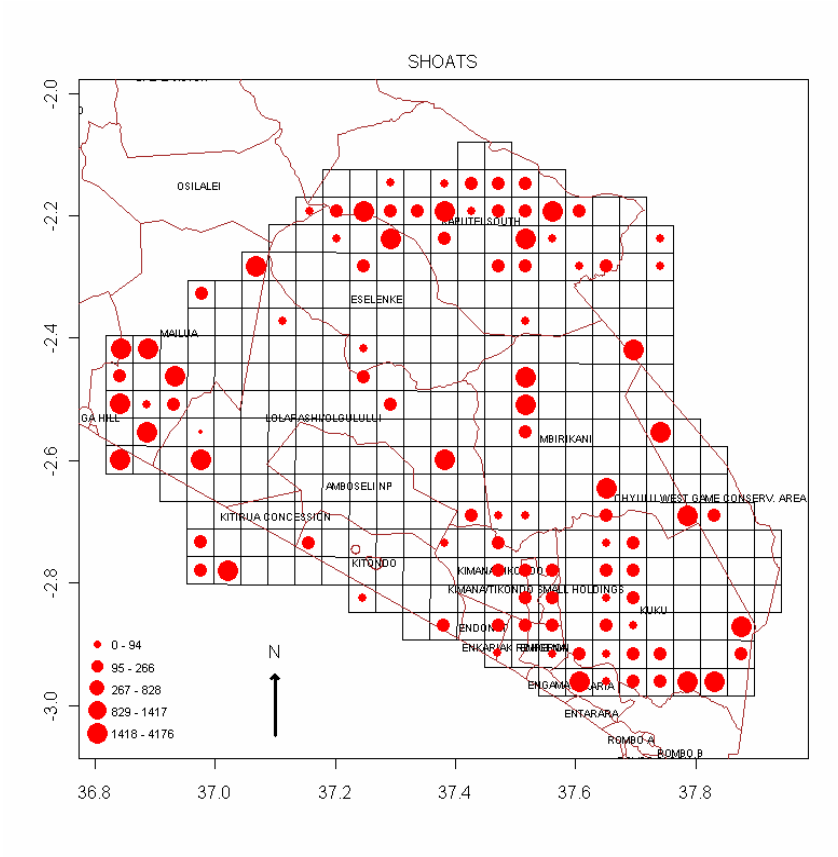
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KIMANA/TIKONDO
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ROMBO B
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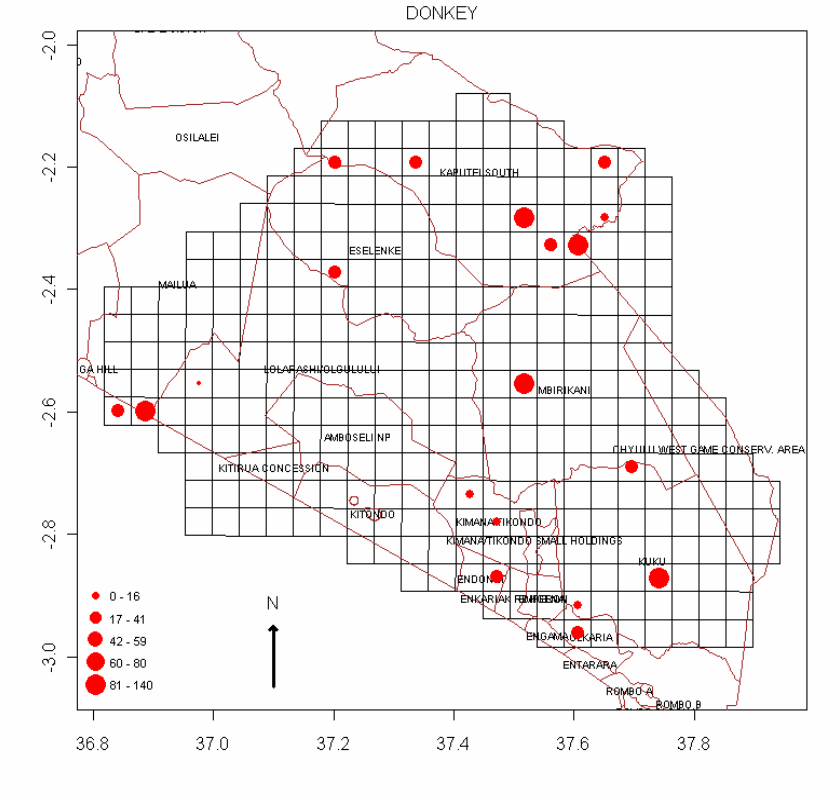
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37.8

MORTALITY ESTIMATES FOR 2010 DROUGHT

The last ACP aerial count of the eastern Kajiado prior to 2010 drought was flown in December 2008. A comparison of the two counts (Table 2) gives a measure of animal mortalities in the 2009 drought across the 8,300 square kilometer area

Species Name	Population Estimate (2008)	Population Estimate (2010)	t-statistic	Significant difference Level	Decline Since 2008 (%)
Zebra	22316	3034	9.543	***	86.40%
Wildebeest	10743	802	5.001	***	92.50%
Grant's Gazelle	8344	2815	4.865	***	66.30%
Cattle	146545	49129	7.492	***	66.50%
Shoats	201303	97397	4.332	***	51.60%
Donkey	3863	1196	4.399	***	69.00%

Table 2: The animal population estimates for eastern Kajiado before and after the 2009 drought. The significance of difference between counts is given by * (0.05), ** (0.01) and *** (0.001).

A comparison of pre- and post-drought aerial counts gives an estimated 92% loss of wildebeest, 86% loss of zebra, 66% loss of cattle, 52% loss of sheep and goats and 69% loss of donkeys. Other species did not show a significant change with the exception of Grant's gazelle, which showed a 66% loss. We believe this figure is greatly inflated, perhaps by some displacement of the populations during drought. A further count is needed to determine if this is the case.

The aerial estimates of the drop in wildebeest and zebra numbers corroborates the heavy losses recorded on ACP ground counts of the Amboseli basin between September 2009 and December 2009. Over this 3 month period, 93% of the wildebeest population and 65% of the zebra and 65% of the buffalo population succumbed, based on live and carcass counts.

KWS and supporting institutions conducted a total aerial count of all large herbivores in the Amboseli and surrounding ecosystems in March 2010, three weeks after the ACP count. Compared to a similar total count flown in 2007, KWS (2010) estimated drought losses in the Amboseli ecosystem wildebeest population at 83%, zebra at 71%, buffalo at 63%, cattle at 56% and sheep and goats at 62%. The drought losses estimated by KWS are in accord with those estimated by ACP on its ground and aerial counts. The higher losses recorded by ACP

for wildebeest reflect the higher losses in the Amboseli Basin population than in surrounding populations.

Despite fairly similar estimates in drought losses between the KWS and ACP counts, there are considerable differences in population estimates. The differences are largely explained by counting methodology, counting area, and timing. KWS conducted a total count with strip widths ranging up to 2km. ACP conducted a sample count with strip widths of 150m to 160ms. KWS counted a slightly larger (5.6%) area than ACP, and some areas (KE 10 and parts of KE 5) that ACP did not cover. Given the smaller and more controlled sampling strip of the ACP count, population estimates should be larger than those of KWS. Adjusting for the slight differences in area, this is the case. ACP counts are higher than KWS counts in 13 of 17 matched species, a statistically significant difference (sign statistic=13, p1-tailed=0.0245). For one species where the KWS had a higher count, the differences are not large (elephants 1,292 KWS v. 1,094 ACP). In the other case (Grant's gazelle 3,905 KWS v. 2,815 ACP), the larger KWS figure was increased by the sizeable population in KE 10, an area not counted by ACP.

The substantially higher numbers of wildebeest (3,905 KWS v. 805 ACP) and zebra (6,009 KWS v. 3,905 ACP) KWS counted are undoubtedly real and explained by timing. Wildebeest and zebra herds move into the wet season area of the Amboseli ecosystem with heavy rains from surrounding areas, including Kaputei and Tsavo West. At the time the ACP count was conducted in early February 2010, we found only small and scattered herds and wildebeest in the course of extensive reconnaissance surveys. There was no evidence of large numbers moving in from Tsavo or elsewhere. In contrast, KWS distribution maps for wildebeest and zebra during its March 2010 show herds stretching south from the Amboseli wet season dispersal area in the north east along the base of the Chyulus Hills to Tsavo. This suggests a continuing influx into the wet season dispersal area of the Amboseli ecosystem after the ACP count.

It is important to point out that the migratory populations of the wet season range do not predict how many wildebeest and zebra will move to the dry season concentration area of the Amboseli Basin. The size of the wildebeest and zebra populations across the ecosystem in the wet season runs two to three times that of the Amboseli dry season population in most years.

We therefore stress the need to monitor the Amboseli ecosystem populations closely in the coming months to determine how many do return to the Amboseli basin and National Park in the dry season. The actual numbers will dictate the vulnerability of herbivores and carnivores and the conflict between Maasai and predators. ACP will continue its regular ground counts in the Amboseli basin and conduct another aerial count of the ecosystem in the dry season. The count will be coordinated with KWS activities.

The losses of livestock are hard to capture in the case of cattle, given their extensive movements in and out of the Amboseli ecosystem, depending on the intensity of rains and the severity of drought. Extensive family surveys conducted by the African Conservation Centre at the end of the drought suggest losses in the range of 75% to 80%. The loss of 66% estimated by comparing the 2008 and 2010 ACP aerial counts is therefore likely to underestimate the true losses incurred by pastoralists in the Amboseli ecosystem. Sheep and goat losses estimated by aerial counts and questionnaire surveys correspond more closely,

due to their smaller seasonal movements and drought displacement. The aerial count losses of 52% are, consequently, not so different from the questionnaire estimates of 65% loss.

The findings of the post-drought aerial counts by both ACP and KWS highlight the severity of the 2009 drought, the need to monitor the impact on Amboseli in the coming months and the importance of a coordinated assessment of the conservation implications among researchers, management, community and the tourism industry.

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Jolly, G. M. 1969. Sampling methods for aerial censuses of wildlife populations. East African Agricultural Forestry Journal, 34:46-49.

Norton –Griffiths,M. 1978. Counting animals. Handbook no. 1. Techniques in African wildlife ecology. African Wildlife Foundation, Nairobi, Kenya.

Western, D. 1976. An Aerial Method of Monitoring Large Mammals and their Environment. UNDP/FAO Project Working Document No. 9, Nairobi, Kenya. 38pp.

Kenya Wildlife Survey, 2010. Aerial Total Count - Amboseli- West Kilimanjaro and Magadi – Natron Cross Border Landscape, Wet Season, March 2010, Aerial Count Report.