

**Aerial Survey of Elephants and other Large Herbivores  
in the Sebungwe (Zimbabwe): 2014**

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**April 2015, revised October 2015**





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**April 2015, revised October 2015**

**Great Elephant Census  
Vulcan Inc., 505 Fifth Ave S, Suite 900,  
Seattle, WA 98104, USA**

This survey was conducted in partnership with the Zimbabwe Parks and Wild Life  
Management Authority

The opinions expressed in this report are those of the authors and do not necessarily  
represent those of the Zimbabwe Parks and Wild Life Management Authority, The Great  
Elephant Census, or Paul G. Allen



An earlier version of this report, dated April 2015, was produced by the Parks and Wild Life Management Authority, Zimbabwe. Since production of that report, the survey sponsor – the Great Elephant Census – has completed a review of the survey. Following this, a new appendix (Appendix 9) and one footnote are included in this revised version of the report.

The April 2015 report and this revised report are identical except for the addition of Appendix 9 and the footnote, and a few minor editorial changes.

## Summary

Elephants and other large herbivores, wild and domestic, were surveyed from the air in the national parks, safari areas, forest land and communal lands of the Sebungwe region of north-west Zimbabwe during July-September 2014. Fixed-wing aircraft were used to conduct a sample survey, flying transects over most of the area and block counts in the hilly remainder. The area surveyed totalled 15527 km<sup>2</sup> and included Chizarira and Matusadona National Parks, Chete and Chirisa Safari Areas, Sijarira Forest Area and the communal lands of Binga, North Gokwe and Kariba. The area was divided into 26 strata and by design sampling intensity in the transect strata varied between strata, ranging from 4 to 20 %, with greater intensity in strata expected (on the basis of previous survey results) to contain greater densities of elephants. The overall sampling intensity was 12.8 % (10.4 % in the strata sampled with transects). The principal objective of the survey was to provide a relatively precise estimate of the number of elephants in the region. Secondary objectives included determining the spatial distribution of elephants, estimating the number and distribution of elephant carcasses, and estimating the numbers and distribution of other large herbivores. The methods were both repeatable and technically robust, and were similar to those used during the 2001 survey of elephants in this same region.

Some large herbivores are not easily seen from the air and their numbers were undoubtedly underestimated. Nonetheless, population estimates are given for these species, because the estimates provide useful indices of abundance with measures of precision and can be used to determine spatial distribution, as well as temporal trends in population number. No corrections have been applied to any of the estimates to compensate for any undercounting or missed animals.

The estimated population numbers of the principal large herbivores were: elephant 3407 (upper and lower 95% confidence limits  $\pm$  35.6 %); buffalo 3765 ( $\pm$  51 %); zebra 504 ( $\pm$  54.1 %); waterbuck 550 ( $\pm$  77.2 %); sable 160 ( $\pm$  129 %); impala 3142 ( $\pm$  42.1 %); cattle 72639 ( $\pm$  26 %); sheep and goat 79772 ( $\pm$  17 %); and donkey 4754 ( $\pm$  29.4 %).

There were estimated to be 2894 elephants ( $\pm$  39.7 %) in the Parks & Wild Life Estate, at a mean crude density of 0.46 elephants per square kilometre. No elephants were seen in eight strata in the communal lands.

The estimated total number of all elephant carcasses (1475) represented 30.2 % of the estimated total number of live and dead elephants. This carcass 'ratio' compared with estimates of 5.8 and 15.4 % during similar surveys in the same region during 2001 and 2006 respectively. The 1+2 carcass ratio (i.e. the ratio based on only fresh or recent carcasses) was 2.17 %, which compared with 0.79 % during 2001 and 1.69 % during 2006.

There have been significant declines since 2001 in the population estimates for elephant (-76 %), elephant bulls (-71 %), elephant cows (-77 %), buffalo (-73 %), sable (-80 %), zebra (-80 %), waterbuck(-58 %), kudu (-93 %) and impala (-62 %). Only for cattle and sheep/goats was there no decline in number since 2001. For elephant bulls, buffalo, kudu, impala and waterbuck, the declines started before 2001.

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## **Introduction**

Elephant and other large herbivores, both wild and domestic, were censused in the Sebungwe region of north-western Zimbabwe (Map 1). The survey was part of a national survey of the African elephant in Zimbabwe, the first since 2001 (Dunham & Mackie 2002), and was part of a continuing study to monitor the numbers of elephants and other wildlife in the Parks & Wild Life Estate of Zimbabwe. Wildlife in the Sebungwe was last surveyed during 2006 (Dunham *et al.* 2006).

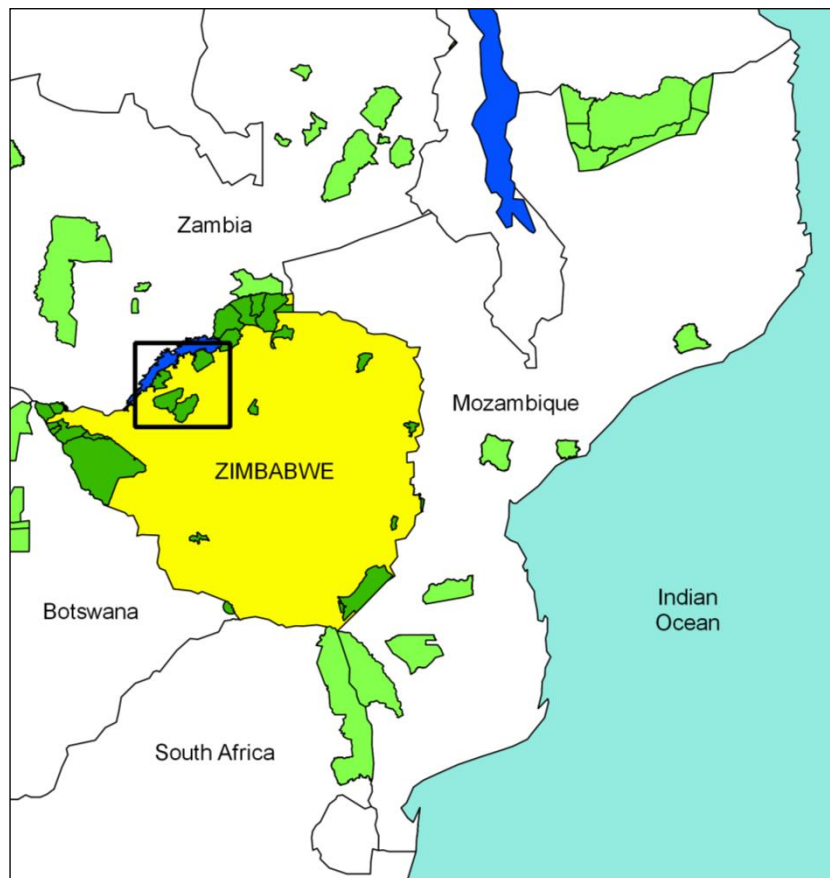
The Sebungwe region is a mosaic of Parks and Wild Life Estate and communal lands. There are no physical barriers to restrict elephant movements within this region. However, movement in and out of the region has been restricted since the 1960s, initially by game fences erected as part of tsetse fly control programmes and the shooting of elephants that broke these fences (Cumming 1981). More recently, there has been intense human settlement and the clearance of natural vegetation for agriculture both on the periphery of the survey area and in some communal lands within the survey area. The elephants in the Sebungwe region probably form a closed population, with little immigration or emigration.

The methods used during this survey were similar to those used during the 2001 and 2006 surveys of the wildlife populations of the Sebungwe. The principal objective of the survey was to provide relatively precise and accurate estimates of the number of elephants and other large herbivores in the survey area as a whole, using a technique that could be executed within a reasonable time and at a reasonable cost. The use of methods that gave results entirely comparable with the 2001 and 2006 surveys was a top priority. Secondary objectives included determination of the spatial distributions of elephants and other large herbivores; and estimation of the number and spatial distribution of elephant carcasses. The methods used were suitable for meeting the survey objectives, and are repeatable and technically robust.

## Survey Area

The survey area, located immediately south of Lake Kariba, covered 15527 km<sup>2</sup> and was divided into 26 strata (Map 4 and Table 4). The overall survey area was the same as that covered in previous surveys of this region (Dunham 1999, Dunham *et al.* 2006, Mackie 1998, 1999, 2002).

The survey area included the Parks and Wild Life lands of Chizarira and Matusadona National Parks, Chirisa and Chete Safari Areas; as well as Sijarira Forest Area and communal lands of Binga, North Gokwe and Nyaminyami (Kariba) Rural District Councils.



**Map 1.** Location of the Sebungwe survey area in north-western Zimbabwe

National Parks and Safari Areas in Zimbabwe are shown in dark green and selected protected areas in neighbouring countries are shown in light green. The box highlights the survey area, which is shown in more detail in the following maps.

## **Methods**

### ***Survey Design***

The procedures used followed those well established for aerial surveys of African large herbivores (Norton-Griffiths 1978) and utilised during earlier surveys of large herbivores in Zimbabwe. Survey procedures followed the revised standards set by the CITES MIKE programme (Craig 2012). This ensured that the data collected during the survey would be comparable with that from earlier surveys, particularly the 2001 survey. Changes to the survey design, or methods, during 2014 could have created problems, or prompted criticisms, or both, that could have compromised the analysis of the temporal variations in animal numbers.

The survey area was divided into 26 strata, 24 of which were sampled with transects, while the remaining two – in hilly terrain – were sampled with blocks.

### **Transect surveys**

The boundaries of the strata in the Sebungwe follow those used during the 2001 and 2006 surveys, but the geographic co-ordinates defining these boundaries were sometimes not a good fit to the features (e.g. roads, rivers) that defined the boundaries. (An error of say 100 m, while acceptable when digitising from a 1:250 000 scale paper map nearly 20 years ago, is less acceptable in today's world of ubiquitous GPS receivers.) Hence, a GIS file of the strata boundaries was prepared using on-screen digitising of these same features displayed on images in Google Earth. Consequently, there have been small changes to the calculated areas of the strata and the survey area, which now has a calculated area of 15527 km<sup>2</sup>, compared with 15622 km<sup>2</sup> during 2001 for the same piece of land.

Systematic, parallel transects were positioned across each stratum, with the position of the first transect in a stratum determined randomly. Transects were arranged at right angles to the principal environmental feature within a stratum (see Map 5 and Table 4 for transect orientations). In order to maximise the precision of the estimate of the total number of elephants in the survey area as a whole, the sampling intensity varied between strata. Hence, the distance between adjacent transects varied between strata, according to the planned sampling intensity in each stratum. Overall sampling intensity was planned to be 10 %, with a transect width (i.e. combined width of the two search strips) of 300 m. The planned sampling intensity in each stratum was determined by using the mean of the elephant densities in each stratum during 2001 and 2006 (Mackie 2002, Dunham et al. 2006) as the predicted elephant densities in equation 1 of Gibson (1989a). As a consequence, those strata expected to contain high densities of elephants were sampled more intensively than strata expected to contain few elephants. In practice, the transect spacing varied from 1.5 km in strata expected to contain numerous elephants, to 7.5 km in strata expected to contain few or no elephants (Table 4).

The survey was designed using the WWF-SARPO's custom software (AIRDESW, version dated 29/05/97). Given a stratum boundary in the form of an ATLAS GIS bna format file, and the transect orientation and spacing, this software generates flight lines (the transects), with the first flight line offset from the end of the stratum by an entered random number. The start and end points for each transect (Appendix 3) were transferred as waypoints to a Global Positioning System (GPS) receiver in the plane prior to flying each stratum.

### **Block counts**

For two strata in very hilly country (Matusadona Highlands and Kanyati Escarpment), sample units (blocks) were defined during planning for the 2001 survey on maps of scale 1:50000 using linear features (e.g. streamlines, watersheds, vehicle tracks) which were navigable

from the air. The size of the blocks was usually in the range of 5-25 km<sup>2</sup>. Block boundaries were unchanged for this 2014 survey. Blocks to be searched were selected by using computer-generated pseudo-random numbers as map co-ordinates. Consequently, the probability of a block being selected for survey was proportional to its area (Caughley 1977). Blocks to be searched were selected with replacement (Caughley & Sinclair 1994). In other words, a block could be selected more than once (and included more than once in the analysis), although it was searched just once.

## ***Flight Procedures***

### **Transect surveys**

All transect strata were surveyed during the period 11 to 28 September 2014 (Table 4).

The aircraft used for the survey was a Cessna 206. A laser rangefinder (with specifications similar to the AgLaser laser height measuring device) was mounted with a custom bracket, pointing downwards, on the right wing strut, just below the wing. The height above ground level (in feet) was displayed at 1 second intervals on a digital display mounted in the cockpit and sometimes also on a tablet computer (which used custom software that smoothed the reported temporal fluctuations in height).

The aircraft was equipped with a Garmin GPSMAP 295 GPS receiver (on September 11, 12 and the morning of September 13) and for the remainder of the survey with a Garmin Aera 500 GPS receiver. This was simply a case of replacing an old model GPS receiver with a new model as soon as the new one was available to the survey team. During the survey, the aircraft was flown at approximately 170 km per hour at about 300 feet above ground level. Waypoints denoting the start and end points of transects were entered into the GPS receiver and used to form routes. Navigation along the transects was undertaken by the pilot, with reference to the HIS display of the GPS receiver, with the course deviation scale set to 0.25 nautical miles. The track of the aircraft was recorded using the track log facility of a Garmin GPSMAP 64 GPS receiver, set to note the aircraft's location at 1 second intervals.

The aircraft crew included a pilot (Charles Mackie), a recorder (Kevin Dunham) who sat next to the pilot, and two observers who sat behind the pilot and recorder. All four crew members could talk to one another through an intercom system. The two observers were Colum Zhuwau and Greg Nyaguse. Both had prior experience as survey observers. While Greg had been an observer for the Zambezi Valley survey during August 2014, Colum had no recent experience as an observer. The observers were tested to ensure that they were not colour-blind (using the Ishihara test for colour blindness) and to check their visual acuity (using a Snellen eye chart, specifically their ability to read capital letters printed 7 mm high from a distance of 4.5 m).

All animals seen by the observers within the search strips (see section *Strip Width and Calibration* below) were called to the recorder, who wrote down the species, the number of individuals of the group that were within the strip, and the GPS location against the time (to the nearest 30 seconds) after the start of the transect. Locations were recorded as waypoints by the recorder using a Garmin III GPS receiver. During the survey, the actual height of the plane above ground level (agl) was recorded by the recorder, from the laser rangefinder, every 30 seconds (of time) while flying along the transects. Later the mean height above ground level for each transect was calculated. The recorder used a stopwatch to record the time (to the nearest second) taken to fly each transect. The GPS tracklog provided an additional record of times.

The Garmin III GPS receiver (also loaded with routes defining the transects) displayed a moving map, as well as the ground speed of the aircraft, the cross-track error (the distance between the intended route and the actual flight path), and the distance and time to the next transect waypoint. Thus, throughout the flight, the recorder could monitor adherence to the intended route, ground speed, and height about ground level.

## **Block counts**

The two block count strata were surveyed during the period 12 to 14 July 2014 (Table 4). The two-month gap between the block counts and the transect surveys was less than ideal, but was a consequence of the difficulty of safely flying light aircraft at low level over the escarpment hills during the late dry season, when wind speeds are generally greater. There was a similar gap between the block counts and transect surveys during 2001.

Key points on the boundary of a block to be searched were entered as waypoints in a Garmin GPSMAP 295 and a route connecting these waypoints. The pilot (Martin Henriksen) and one observer (Greg Nyaguse) in a Piper Super Cub aircraft searched the block until they believed that all animals within it had been seen and recorded. The Super Cub can safely fly slower than the plane used for the strip counts. The location of each group seen was recorded as a waypoint in a Garmin GPSMAP 62sc GPS receiver and the tracklog facility of this receiver was used to record the flight path of the aircraft. The time taken to search each block was recorded. Prior to the surveys, the pilot and observer were advised to search each block for a period equivalent to approximately one minute per square kilometre.

## ***Strip Width and Calibration***

Two fishing rods were attached with custom brackets to each wing strut of the aircraft, so that the rods pointed backwards and parallel to the ground during level flight. The distance between the rods on each strut was arranged so that, when the aircraft was flying at 300 feet agl, this distance represented a strip about 150 m wide on the ground. Each outer rod was marked with a small piece of tape to provide the observers with a “decision point” (it was at this point that the observer decided whether an animal was inside his search strip). When deciding if animals were inside or outside the strip, the observer moved his eye so as to align the tape on the outer rod with a small piece of tape on his window, thereby ensuring that all his decisions were made at the same viewing angle.

Prior to and during the survey, the strip widths were calibrated by flying the aircraft at right angles across an airstrip that had two sets of large-sized numbers (from 0 to 35) arranged at 10-metre intervals along the side of the airstrip. The numbers were arranged as 35 34 33...2 1 0 1 2.....33 34 35, with 0 near the centre of the airstrip. Each observer noted the largest and smallest number within his strip and the recorder noted the aircraft’s height above ground level, as recorded by the laser rangefinder. For each flight passing over the calibration numbers, the combined strip width (in metres) was adjusted to 300 feet above ground level as follows:

$$\text{Combined strip width at 300 feet} = \frac{\text{Actual combined strip width} \times 300}{\text{Actual flying height}}$$

The combined strip widths, after adjustment to 300 feet above ground level, were then averaged to give the nominal (calibrated) combined strip width at 300 feet. This was 307 m for strata flown during 11-20 September 2014 and 284 m for strata flown during 25-28 September 2014 (Appendix 1).

Readings from the laser rangefinder were compared with those from the plane’s barometric altimeters (Appendix 8).

## ***Observations***

As during previous surveys of this region, the observers were instructed to search for elephants but to count also other wild large herbivores and domestic livestock (cattle, goats,

sheep and donkeys). Sheep and goats are not readily distinguished during aerial surveys and so both were recorded as 'shoats'. If any animal group was too large for all the individuals within it to be counted, group size was estimated by the observer. The observers were tested on their ability to estimate group size (Appendix 7).

Groups of elephant bulls were differentiated from elephant cow herds (i.e. herds containing calves), although the latter may have included some bulls. The observers were instructed to note any carcasses seen. All elephant carcasses noted were classified using four age categories as follows:

<b>Carcass category</b>	<b>Definition</b>
<b>1</b>	<b>Fresh</b> Carcass still had flesh, giving the body a rounded appearance. Vultures were probably present and the ground was still moist from body fluids.
<b>2</b>	<b>Recent</b> Rot patch and skin still present. Skeleton not scattered.
<b>3</b>	<b>Old</b> Clean bones; skin usually absent; vegetation regrown in rot patch.
<b>4</b>	<b>Very Old</b> Bones scattered and turning grey.

These new carcass categories differ from those used the 2001 survey of this region, when only three categories were used (Mackie 2002). The new categories are those used by Douglas-Hamilton & Hillman (1981) and now recommended by MIKE for elephant surveys (Craig 2012). MIKE (Monitoring the Illegal Killing of Elephants) is a CITES programme that uses aerial and ground surveys of elephant populations, and data collected by law-enforcement patrols, to monitor the illegal killing of elephants at representative sites across Africa and Asia. For most practical purposes, the new categories 1 and 2 are the same as the former categories 1 and 2 respectively. The new categories 3 and 4 include all carcasses that previously were placed in the former category 3.

Carcasses that could not be identified as elephant carcasses were recorded as 'unidentified carcasses'. Poachers' camps were also counted – they were identified by the presence of a fire used to dry meat or fish, and drying racks. Ground hornbills are large and conspicuous birds and any seen were counted.

### ***Data Analysis***

#### **Transect surveys**

Population estimates and 95 % confidence limits for individual strata were calculated using Jolly's (1969) method 2 for unequal-sized sample units. Given the mean combined strip width when the plane was flying at 300 feet (i.e. the calibrated strip width), and the mean flying height for each transect, the actual combined strip width for each transect was determined. The actual combined strip width was the product of the nominal strip width at 300 ft and the mean height for the transect, divided by 300. The area of each transect was calculated as the product of the actual combined strip width and the transect length. Transect lengths were provided by the survey design software (Appendix 3).

Transects near a stratum boundary were sometimes broken into two or more sections. This was often the case when a winding river formed the stratum boundary. Land between the transect sections was in the neighbouring stratum. For analysis, data for all sections of a transect were combined (instead of treating each section as a separate transect, as the design software does). Calculation of the variance of a population estimate required the calculation of N, an integer that is the total number of transects that could have been used in

the survey of a stratum. The value of N for a stratum was found by dividing the baseline length by the overall mean actual strip width for that stratum.

Thus, for each stratum, N was calculated as:

$$N = \frac{\text{Baseline length} \times 1000 \times 300}{\text{Nominal strip width} \times \text{Average flying height}}$$

where:

Baseline length = length (in km) of a straight line aligned at right angles to the orientation of the transects, and running from one end of the stratum to the far end;

Nominal strip width = calibrated combined strip width (in m) when flying at 300 feet agl; and

Average flying height = Mean of the mean flying heights (in feet) for all transects in the stratum.

The calculated value of N was rounded to the nearest integer. The value of Student's *t* used to calculate the 95 % confidence limits of a population estimate was  $t_{n-1}$  for  $P = 0.05$  (Rohlf & Sokal 1981), where *n* = number of surveyed transects in stratum. The 95 % confidence *interval* is the difference between the mean population estimate and the upper (or lower) 95 % confidence *limit*. The lower 95 % confidence limit is zero if the calculated value is negative.

### **Block counts**

For block count strata, population estimates and confidence intervals for individual strata were calculated using Jolly's (1969) method 3 for unequal-sized sample units selected randomly with a probability proportional to their area.

For all block count strata, *n* = number of blocks sampled in stratum. Block selection was with replacement and so when one or more blocks were selected more than once, these blocks were included more than once in the analysis, although they were searched just once (Jolly 1969). In these circumstances, *n* = number of blocks sampled, which was greater than the number searched.

### **Entire survey area and land units within it**

Population estimates for the entire survey area and for various land units within it were calculated as the sum of the estimates for the individual strata within the survey area or land unit. The upper and lower 95% confidence limits for population estimates for the entire survey area or land unit were calculated as:

$$\text{Population estimate} \pm [t_v \times \text{Square root of (Sum of Variances for individual strata)}]$$

where:

*v* = the degrees of freedom estimated by Satterthwaite's rule (Snedecor & Cochran 1980, Gasaway *et al.* 1986).

*v* was an integer, calculated using the formula:

$$v = \frac{(\text{Sum of Variances for individual strata})^2}{\text{Sum of } [(\text{Variance for individual stratum})^2 / (n-1)]}$$

with the outcome of this formula rounded down to the nearest integer.  $t_v$  was calculated using the EXCEL function TINV(0.05, *v*).

## **Elephant carcasses**

The elephant all-carcass “ratio” *sensu* Douglas-Hamilton & Burrill (1991) - although it is a proportion or percentage, not a ratio - was calculated as the estimated number of all elephant carcasses (i.e. age categories 1, 2, 3 and 4 summed) as a percentage of the estimated number of all elephants (i.e. live + dead). Because this carcass ratio is based on all elephant carcasses, regardless of age category, the elephant all-carcass ratios and densities given here are directly comparable with the ratios and densities from the 2001 survey of this region.

Carcasses recorded by the observers as ‘unidentified’ were invariably the carcasses of large mammals. A few, if they were in the vicinity of permanent water bodies (e.g. near the shoreline of Lake Kariba) may have been hippopotamus carcasses, but most were likely elephant carcasses. Hence, the elephant all-carcass ratio was calculated a second time by assuming that all unidentified carcasses were elephant carcasses. Both all-carcass ratios are included in this report.

When interpreting the results of this survey, it is reasonable to assume that category 1 or 2 carcasses represent elephants that died during 2014. However, this is not the same as saying that the carcasses of all elephants that died during 2014 were still in age category 1 or 2 during the survey. This is likely not the case - some elephants that died during 2014 were probably reduced to skeletons or scattered bones by the time of the survey. Studies of the elephant population in northern Mozambique suggest that c.70% of the elephants that died there during a survey year were reduced by the time of the late-dry-season survey to just skeletons, or scattered bones; i.e. carcasses that were in age category 3 or 4 (Booth & Dunham 2015).

The 1+2 carcass ratio provides an index of elephant mortality (both natural and anthropogenic) during the survey year. It was calculated as the estimated number of elephant carcasses in age category 1 or 2 as a percentage of the sum of the estimated number of live elephants and the estimated number of carcasses in category 1 or 2.

## **Search Effort**

The greater the time spent searching each square kilometre of a transect, the greater the probability that the observer saw all the animals that were there. Search effort (in minutes per square kilometre) for a stratum was defined as the total time spent flying all transects or blocks within that stratum, divided by the total area of those same transects or blocks. For transect surveys, the search effort is influenced by the speed of the aircraft and its height above ground level. The average ground speed of the aircraft for each transect was calculated as the transect length divided by the time taken to fly that transect. The weighted mean ground speed was calculated for each stratum as the total length of the transects in that stratum divided by the total time to fly those transects. The recordings of the aircraft height from the laser rangefinder were used to determine the mean flying height and the distribution of flying heights for the survey as a whole.

Even the largest herbivores are not easily seen from the air and the numbers of all species were probably underestimated, with the degree of underestimation greater for small or cryptic species than for large species. However, population estimates are given for all species, because the estimates provide useful indices of abundance (with measures of precision) that can be used to determine spatial distribution, as well as temporal trends in population number (Dunham 2012). No corrections have been applied to any of the estimates to compensate for any undercounting or missed animals.



## Results

### Search Effort

Search effort averaged 1.13 minutes km<sup>-2</sup> for the entire survey area (Table 4). For the transect surveys, the mean ground speed was 171 km per hour (Table 4) and for >92 % of transects, the mean speed was <190 km per hour<sup>1</sup>. For the transect surveys, the mean flying height was 305 feet above ground level (Appendix 6).

### Animal Numbers

The estimated numbers of elephants, elephant bulls in bull groups, elephants in cow herds, elephant carcasses (age categories 1, 2, 3 and 4), unidentified carcasses, buffalo, zebra, sable, waterbuck, kudu, eland, impala, hippopotamus, warthog, large crocodile, cattle, sheep and goats, donkey and ground hornbill are given in Tables 5 to 26 respectively. Estimates are given for each stratum, for various land units within the survey area (Chizarira NP, Matusadona NP, Chirisa SA, Chete SA and the communal lands) and for the entire survey area, i.e. the Sebungwe. In addition, a separate summary table is provided for the Sebungwe (Table 1).

The columns in these tables give (from left to right):

- the name of the **stratum**;
- the **estimate** of the number of animals of that species (or of carcasses, camps, etc.) in that stratum, in other words the population estimate;
- the number of individuals of that species seen (**No. seen**) *inside the search strips or blocks* during the survey of that stratum;
- the **variance** of the estimated number of animals in that stratum;
- the 95 % confidence interval of the population estimate for that species in the stratum, as a percentage of the population estimate for that stratum (**% CI**);
- the lower 95 % confidence limit of the population estimate (**Lower CL**); and
- the upper 95 % confidence limit of the population estimate (**Upper CL**).

The last row of each table gives the same measures for the entire survey area and additional rows give subtotals for various land units within the survey area. There may appear to be small arithmetical errors in some tables, but these are simply rounding errors: all numbers in the tables were calculated to three decimal places before they were rounded to the required number of decimal places. If the number of individuals seen (**No. seen**) is greater than the calculated lower confidence limit (**Lower CL**), then it is biologically meaningful to replace the calculated lower confidence limit with the number seen.

For practical purposes, it can be assumed that the number of a given species in a given land unit lies between the lower and upper confidence limits, with the 'estimate' providing the best estimate of the number there. For example, from Table 5, one can say that there were between 2193 and 4622 elephants in the Sebungwe, with 3407 being the best estimate of the number of elephants in the region. For practical purposes, one might say that there were between 2200 and 4600 elephants in the Sebungwe during the 2014 dry season, with 3400 being the best estimate of the number of elephants there.

Small numbers of baboon, bushbuck, bushpig, grey duiker and steenbok were seen during the survey, but no attempt has been made to estimate the numbers of these species. No tsessebe, roan antelope, or rhinoceros were seen during the survey.

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<sup>1</sup> Of the 22 transects (8 %) with a ground speed exceeding 190 km per hour, four were in Negande stratum and three were in Siabuwa East stratum (no elephants were seen in either of these strata) and the remaining 15 transects were in 11 different strata.

**Table 1. Summary of population estimates and statistics for major wildlife species, domestic livestock and elephant carcasses in the Sebungwe during September 2014**

<b>Species</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>-2</sup>)</b>
Elephant	3407	583	372110	35.6	2193	4622	0.22
Elephant bull	776	115	30700	45.4	424	1129	0.05
Elephant cow	2633	468	341410	44.3	1468	3799	0.17
Carcass elephant 1	12	2	69	141.1	2	29	0.001
Carcass elephant 2	64	11	459	69.2	20	107	0.004
Carcass elephant 3	259	41	2130	35.7	166	351	0.02
Carcass elephant 4	1141	165	12811	19.7	916	1366	0.07
Carcass elephant all	1475	219	15469	16.7	1229	1722	0.10
Unidentified carcass	697	94	6297	22.6	539	854	0.04
Buffalo	3765	620	897818	51.0	1847	5683	0.24
Cattle	72639	3402	81703249	26.0	53720	91558	4.68
Crocodile	1200	222	106991	57.5	510	1890	0.08
Donkey	4754	302	450571	29.4	3358	6150	0.31
Eland	26	5	312	142.9	5	64	0.002
Ground hornbill	261	36	6643	62.7	97	425	0.02
Hippopotamus	665	102	38935	60.2	265	1066	0.04
Impala	3142	518	431809	42.1	1820	4464	0.20
Kudu	188	26	3965	67.1	62	314	0.01
Sable	160	20	10030	129.0	20	365	0.01
Sheep / Goats	79772	4662	43125388	17.0	66247	93297	5.14
Warthog	330	51	9848	60.4	131	530	0.02
Waterbuck	550	88	40853	77.2	125	974	0.04
Zebra	504	83	18741	54.1	232	777	0.03

### **Animal Distributions**

The spatial distribution of the principal wild herbivores is shown in Maps 6 to 8 and 11 to 16. The distribution is shown in two ways. First, each stratum is shaded to represent the average density of the given species in that stratum. Secondly, the locations of sightings of groups of the given species are shown, together with an indication of the size of the group. The strata were sampled with systematically-arranged transects and so maps of the locations of animal sightings provide information on the spatial distribution of the animal groups. However, it must be remembered that the recorded number of groups of any species was determined by both group density and the sampling intensity – which, by design, varied between strata (Table 4).

The spatial distributions of elephant carcasses and unidentified carcasses are shown in Maps 9 and 10.

### **Human Activities**

The spatial distributions of domestic livestock are shown in Maps 17 to 19.

The estimated number of poachers' camps in the Sebungwe was small (15, with 95% confidence limits 2 and 36). Just two camps were seen in the transects, one in Chete West stratum and one in Chirisa Gadzi stratum.

Although no cattle were seen in the Chizarira East stratum, there were four sightings of a total of seven (empty) cattle kraals (pens) within the transects in that stratum. The presence of these kraals and of numerous cattle trails orientated approximately west-east suggested that the movement of cattle – probably during the wet season - into Chizarira NP from the Simchembo area was common. During the survey, cattle were seen in the Chizarira West stratum.

### **Comparison of Observers**

The right observer saw significantly more warthog groups than the left observer, but those groups seen by the right observer were significantly smaller than those seen by the left observer (Appendix 5). For other major species, there were no significant differences between the observers in either the number of groups seen, or in the size of the groups.

### **Elephant Carcasses**

The 1+2 carcass ratio represents the number of elephant carcasses in age category 1 or 2 as a percentage of the sum of the number of live elephants and the number of such carcasses. In other words, it provides an index of the *mortality rate* of elephants during the year of the survey. The 1+2 carcass ratio for the Sebungwe was 2.17 % during 2014 (Table 13). There was a high incidence of fresh or recent elephant carcasses in the stratum SWRA, which is the former Sengwa Wildlife Research Area (Map 9).

The estimated number of all elephant carcasses regardless of age category was 1475 (CI 247) during 2014 and the all-carcass ratio was 30.2 %. If it is assumed that all 'unidentified' carcasses were elephant carcasses (and in 2014 the majority were), then the all-carcass ratio increases to 38.9 %.

## **Temporal Variation in Animal Numbers in the Sebungwe**

Dunham (2008) reviewed the aerial surveys of wildlife in the Sebungwe and used data from twelve surveys to examine trends in elephant number in the Sebungwe (Cumming & Taylor 1997, Cumming *et al.* 1997, Dunham 1999, Dunham *et al.* 2006, Gibson 1989b, Mackie 1994, Mackie 1995, Mackie 1997, Mackie 1998, Mackie 2002, Taylor & Mackie 1993, Taylor *et al.* 1992). The 2014 survey adds a thirteenth point to the dataset. Cumming & Lyman (1997) examined trends in the numbers of several large herbivores, wild and domestic, in the Sebungwe prior to 1997. Here, we extend both analyses to examine the temporal variation in estimated numbers for all the major herbivores, including domestic livestock.

The 1980 survey reported on only elephant, buffalo and black rhinoceros, but in later years the range of species surveyed was widened: by 1996, all medium-sized and large herbivores (i.e. impala upwards) were included. From 1997, elephants were distinguished as elephants in bull groups, or elephants in cow or breeding herds. For elephant, the temporal variation in numbers are shown separately for the entire Sebungwe survey area, for the Parks & Wild Life Estate of the Sebungwe, and for the Sebungwe communal lands.

The statistical significance of changes in estimated number since 2001 (the year of the last nationwide elephant survey in Zimbabwe) and since 2006 (the year of the last Sebungwe survey) was determined using a two-tailed *t* test (Gasaway *et al* 1986) (Tables 2 and 3).

The analyses reveal large declines since 2001 in the population estimates for elephant, elephant bulls, elephant cows, buffalo, sable, zebra, waterbuck, kudu, impala and donkey. Only for cattle and sheep/goats was there no decline in number since 2001 (and for eland, but this is probably a consequence of the small sample for this species).

For sable and zebra, the declines appear to have happened after 2001. For eland, the pre-2000 estimates are noticeably greater than the post-2000 estimates. But for other species, the declines appear to have started earlier. The estimated number of elephant bulls has decreased since 1997, especially in the Parks & Wild Life Estate. The decline in buffalo number started at the time of the 1992 drought (Cumming & Lyman 1997). Both kudu and impala have declined since recording for these species commenced during 1996. For waterbuck, the decrease dates from c.1997.

The vast majority of cattle, sheep/goats and donkeys in the Sebungwe are in the communal lands. While the number of donkeys increased throughout the 1980s and 1990s, it declined after 1999. The numbers of cattle and sheep/goats also increased during the 1980s and 1990s, but their numbers have remained approximately stable since 2001.

**Table 2. Statistical significance of changes in the estimated numbers of large herbivores in the Sebungwe since the 2001 survey**

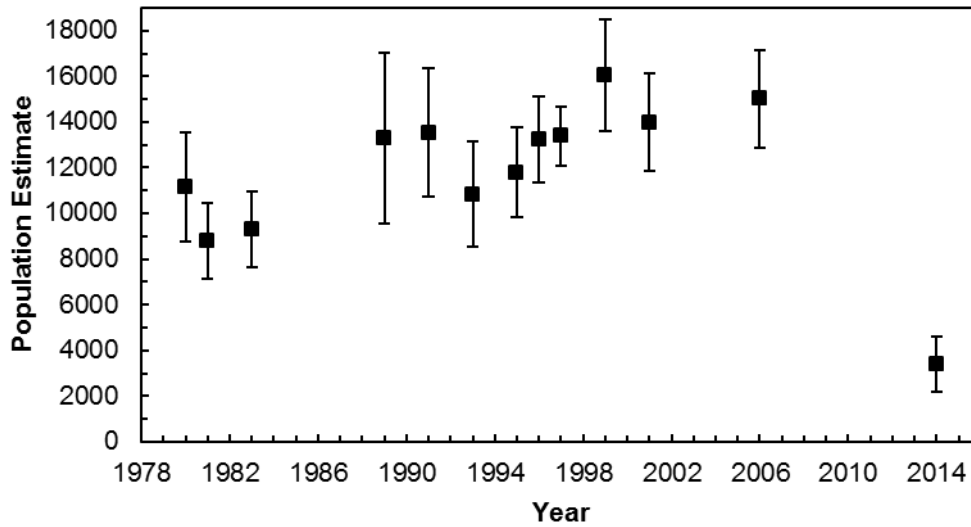
The percentage change in estimated number is given only if the change is statistically significant (i.e.  $P < 0.05$ ).

Species / observation	2001		2014		Difference		Change (%)
	Estimate	% CI	Estimate	% CI	t'	P	
Elephant	13989	15.2	3407	35.6	8.588	<0.001	-76
Elephant bull	2661	19.0	776	45.4	6.130	<0.001	-71
Elephant cow	11329	18.1	2633	44.3	7.310	<0.001	-77
Elephant carcass 1	12	187.8	12	141.1	0.015	0.988	
Elephant carcass 2	99	61.2	64	69.2	0.959	0.340	
Elephant carcass 3	756	20.5	259	35.7	5.477	<0.001	-66
Elephant carcass 4			1141	19.7			
Elephant carcass all	867	19.3	1475	16.7	4.047	<0.001	70
Unidentified carcass	1269	16.7	697	22.6	4.291	<0.001	-45
Buffalo	13787	35.9	3765	51.0	3.747	<0.001	-73
Cattle	76735	13.6	72639	26.0	0.393	0.697	
Donkey	9989	21.0	4754	29.4	4.235	<0.001	-52
Eland	54	160.8	26	142.9	0.626	0.539	
Impala	8211	22.3	3142	42.1	4.497	<0.001	-62
Kudu	2549	20.8	188	67.1	8.572	<0.001	-93
Sable	783	54.6	160	129.0	2.626	0.010	-80
Sheep / Goats	66616	15.7	79772	17.0	1.574	0.121	
Waterbuck	1311	43.6	550	77.2	2.179	0.033	-58
Zebra	2492	31.0	504	54.1	4.854	<0.001	-80

**Table 3. Statistical significance of changes in the estimated numbers of large herbivores in the Sebungwe since the 2006 survey**

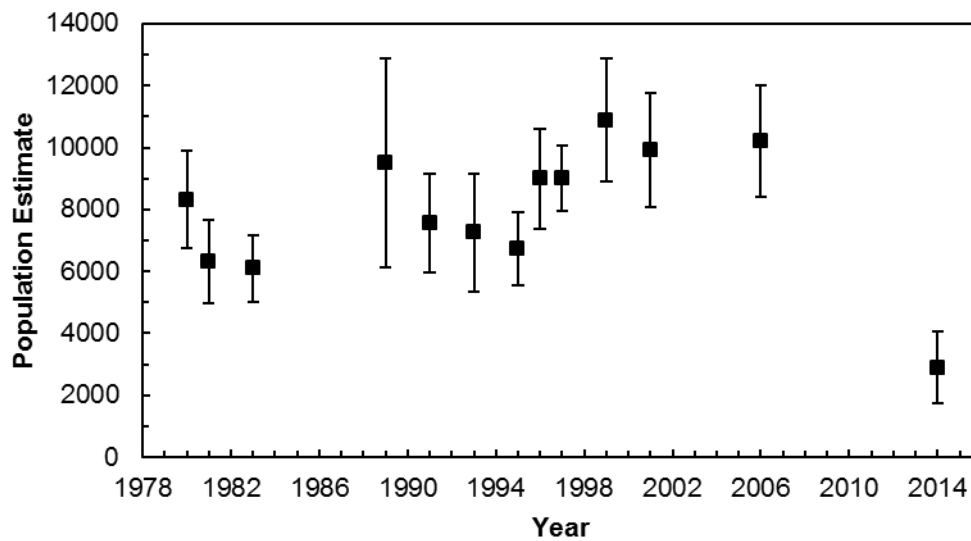
The percentage change in estimated number is given only if the change is statistically significant (i.e.  $P < 0.05$ ).

Species / observation	2006		2014		Difference		Change (%)
	Estimate	% CI	Estimate	% CI	t'	P	
Elephant	15024	14.2	3407	35.6	9.372	<0.001	-77
Elephant bulls	2663	20.1	776	45.4	5.894	<0.001	-71
Elephant cows	12361	16.7	2633	44.3	8.123	<0.001	-79
Elephant carcass 1	25	80.1	12	141.1	0.981	0.330	
Elephant carcass 2	234	29.3	64	69.2	4.192	<0.001	-73
Elephant carcass 3	830	19.3	259	35.7	6.154	<0.001	-69
Elephant carcass 4	1640	14.2	1141	19.7	10.299	0.003	-30
Elephant carcass all	2729	10.7	1475	16.7	6.502	<0.001	-46
Unidentified carcass	1233	14.9	697	22.6	4.380	<0.001	-44
Buffalo	10395	37.6	3765	51.0	3.038	0.003	-64
Sable	596	70.4	160	129.0	1.880	0.064	
Zebra	1155	37.8	504	54.1	2.520	0.013	-56
Waterbuck	885	54.9	550	77.2	1.085	0.285	
Kudu	1163	27.1	188	67.1	5.682	<0.001	-84
Eland	65	152.0	26	142.9	0.772	0.450	
Impala	8047	29.5	3142	42.1	3.634	0.001	-61
Cattle	76316	16.4	72639	26.0	0.341	0.735	
Sheep / Goats	75811	12.6	79772	17.0	0.487	0.628	
Donkey	7765	16.0	4754	29.4	3.334	0.002	-39



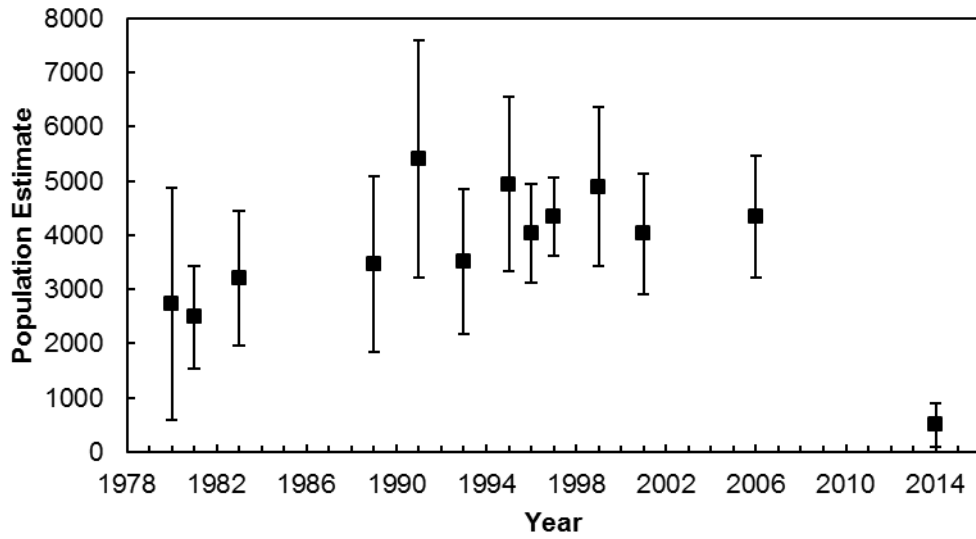
**Fig. 1. Number of elephant estimated to be in the Sebungwe since 1980**

Mean population estimates and 95% confidence intervals shown.

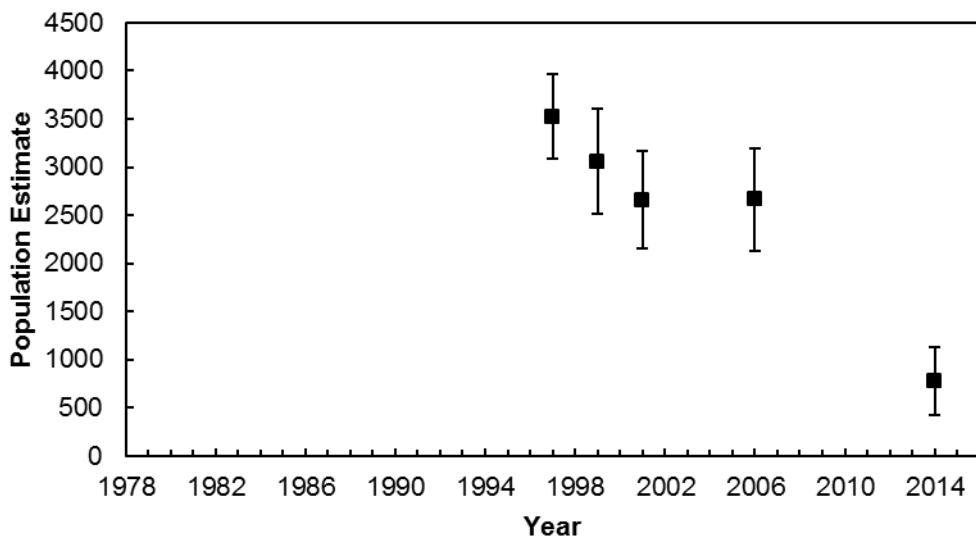


**Fig. 2. Number of elephant estimated to be in the Parks and Wild Life Estate of the Sebungwe since 1980**

The Parks and Wild Life Estate in the Sebungwe comprises Matusadona National Park, Chizarira NP, Chirisa Safari Area and Chete SA.

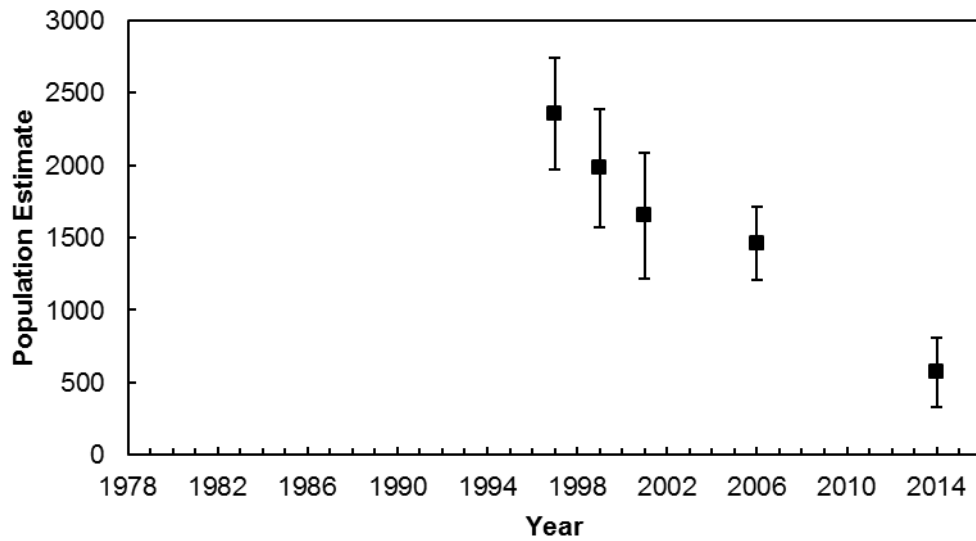


**Fig. 3. Number of elephant estimated to be in the communal lands of the Sebungwe since 1980**

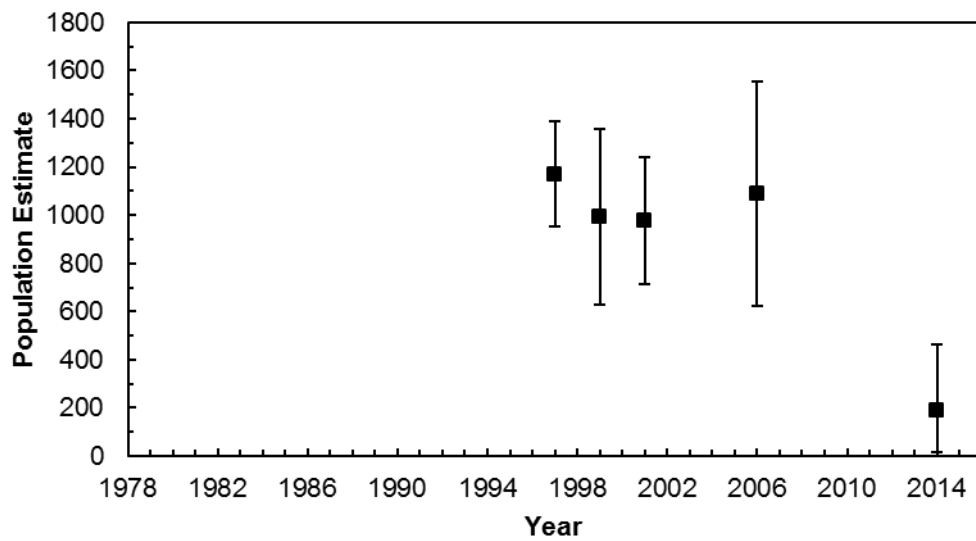


**Fig. 4. Number of elephant bulls estimated to be in the Sebungwe since 1997**





**Fig. 5. Number of elephant bulls estimated to be in the Parks and Wild Life Estate of the Sebungwe since 1997**



**Fig. 6. Number of elephant bulls estimated to be in the communal lands of the Sebungwe since 1997**

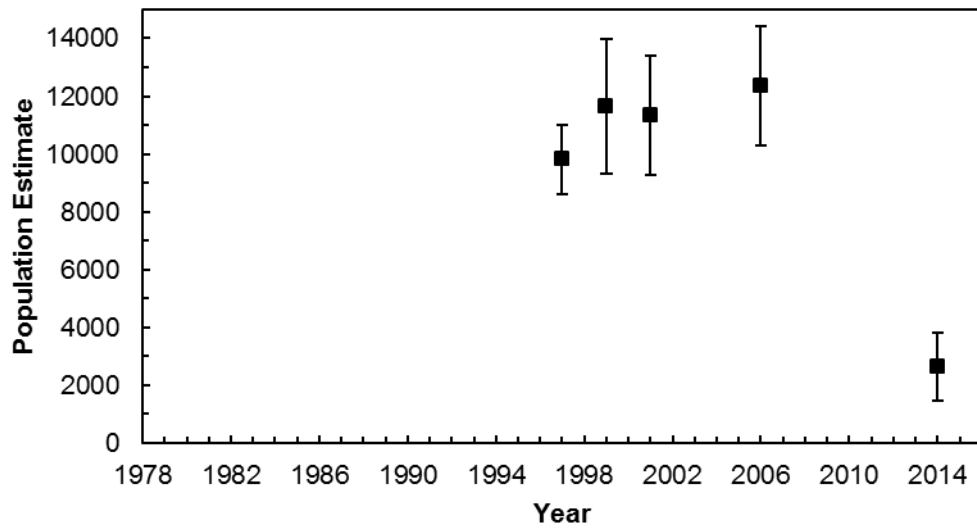


Fig. 7. Number of elephants in cow herds estimated to be in the Sebungwe since 1997

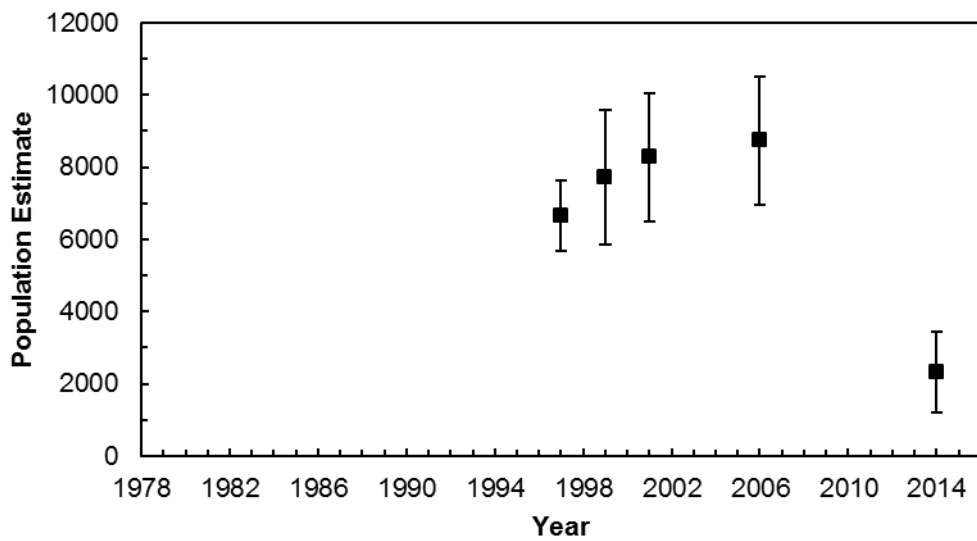
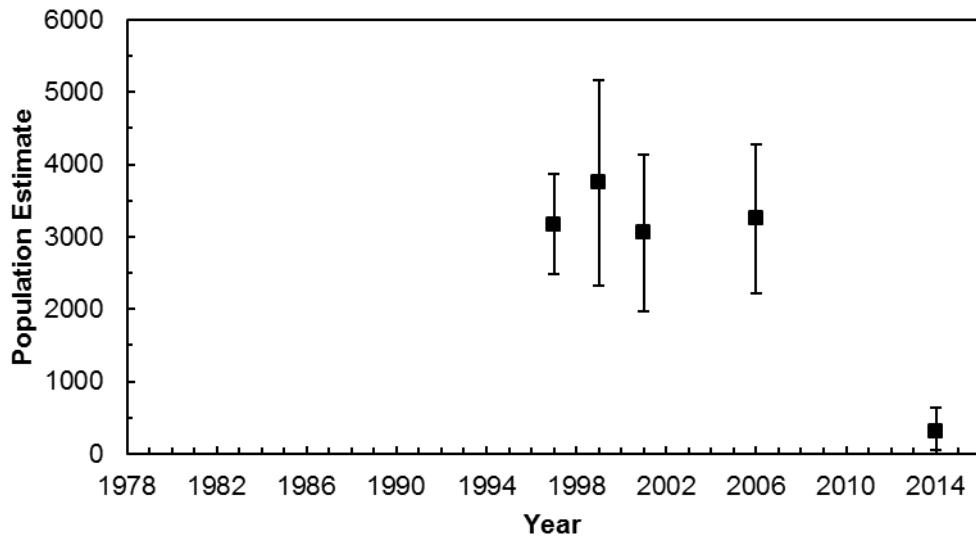
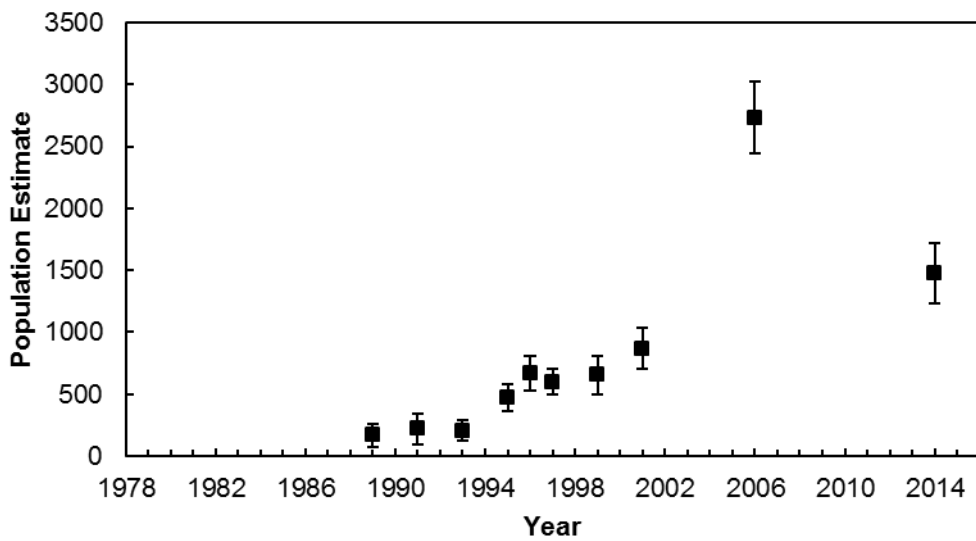


Fig. 8. Number of elephants in cow herds estimated to be in the Parks and Wild Life Estate of the Sebungwe since 1997

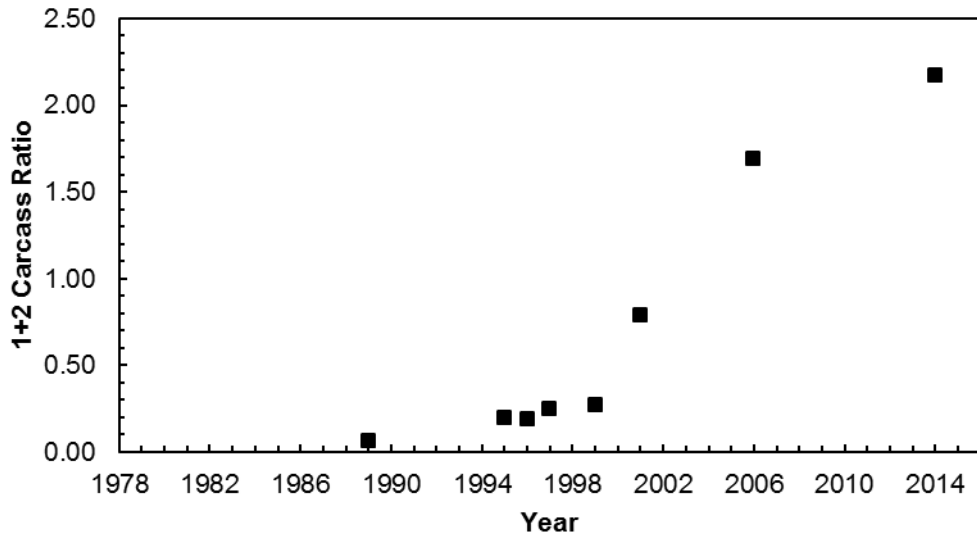


**Fig. 9. Number of elephants in cow herds estimated to be in the communal lands of the Sebungwe since 1997**



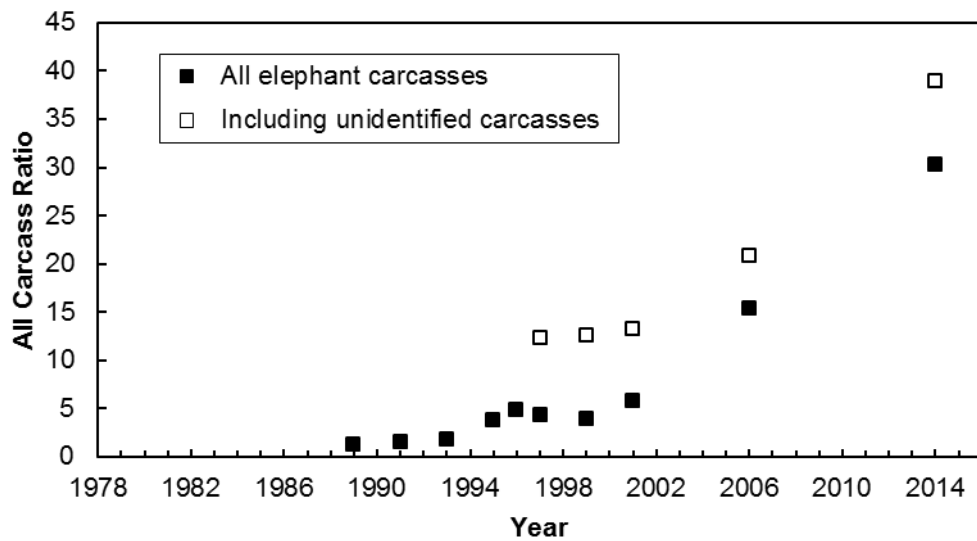
**Fig. 10. Number of elephant carcasses estimated to be in the Sebungwe since 1989**

Estimates based on elephant carcasses in all age categories.



**Fig. 11. The 1+2 carcass ratio for elephants in the Sebungwe since 1989**

The 1+2 carcass ratio provides an index of the mortality rate of elephants during the year of the survey.



**Fig. 12. The all-carcass ratio for elephants in the Sebungwe since 1989**

The all-carcass ratio is calculated for all elephant carcasses, regardless of the age of the carcass. If it is assumed that all 'unidentified' carcasses were in fact elephant carcasses, then the all-carcass ratio would be increased as shown.

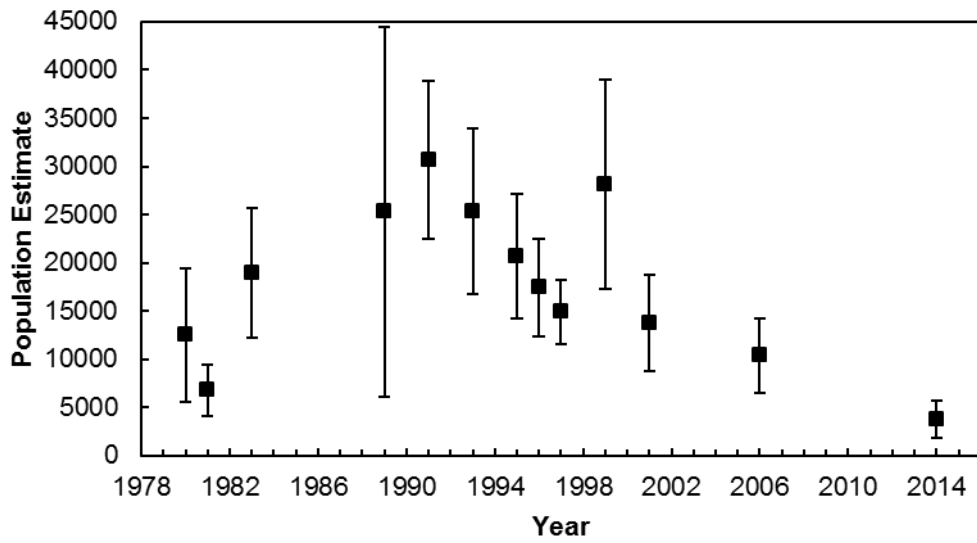


Fig. 13. Number of buffalo estimated to be in the Sebungwe since 1980

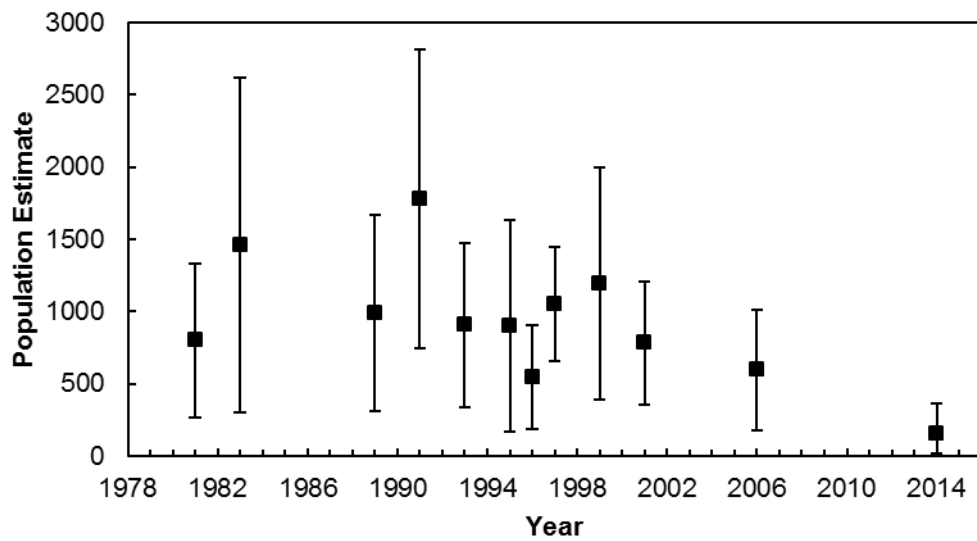


Fig. 14. Number of sable estimated to be in the Sebungwe since 1981

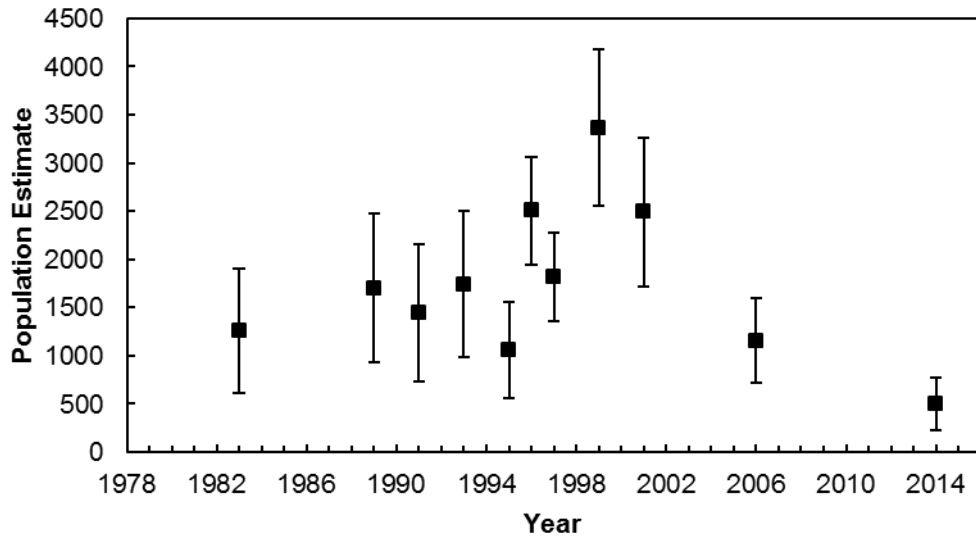


Fig. 15. Number of zebra estimated to be in the Sebungwe since 1983

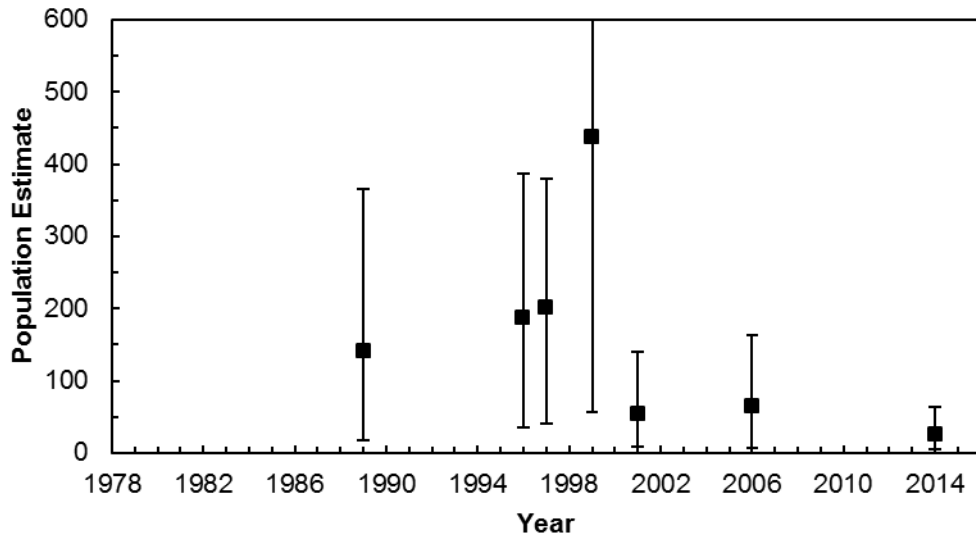


Fig. 16. Number of eland estimated to be in the Sebungwe since 1989

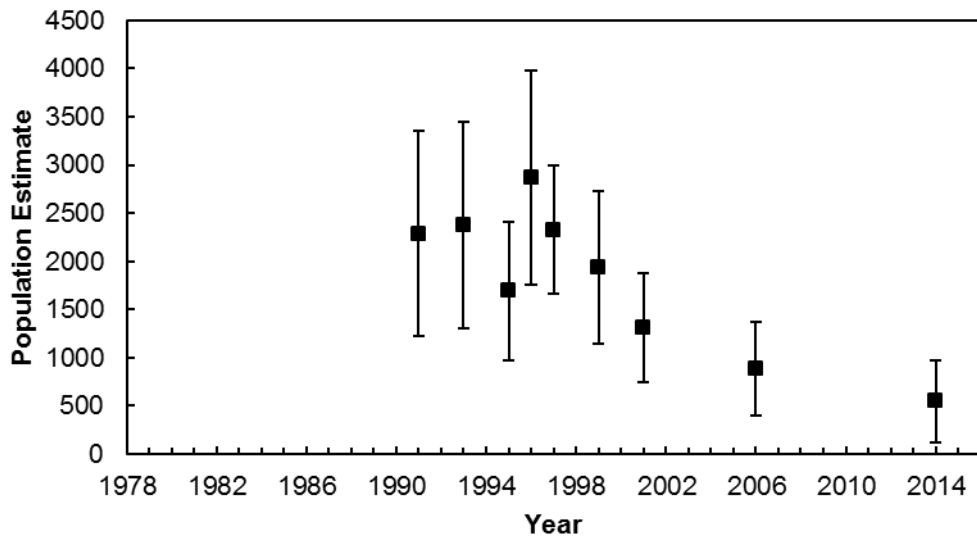


Fig. 17. Number of waterbuck estimated to be in the Sebungwe since 1991

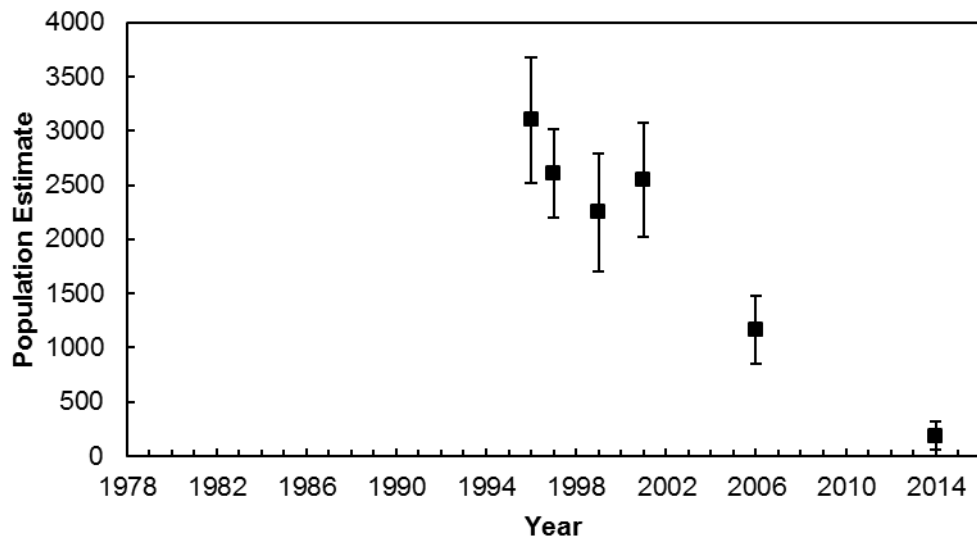


Fig. 18. Number of kudu estimated to be in the Sebungwe since 1996

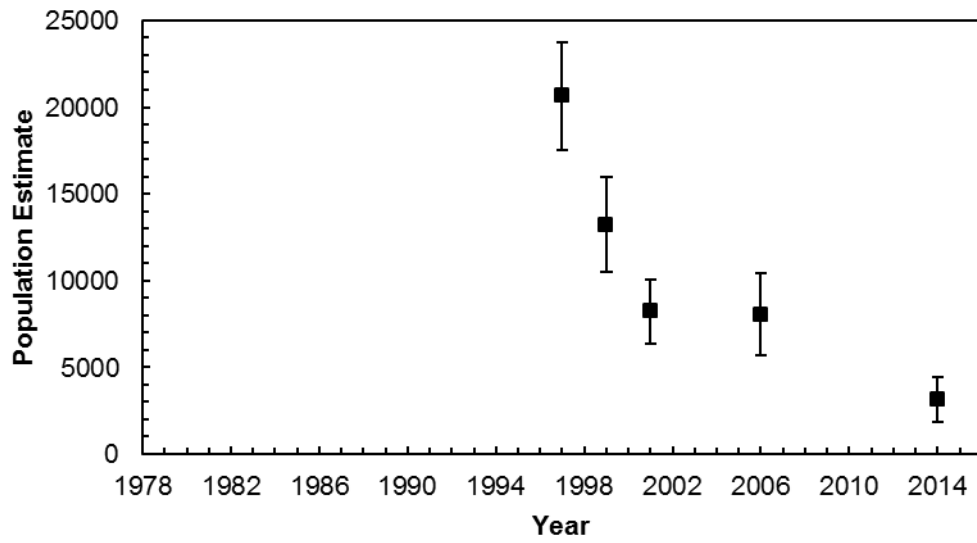


Fig. 19. Number of impala estimated to be in the Sebungwe since 1996

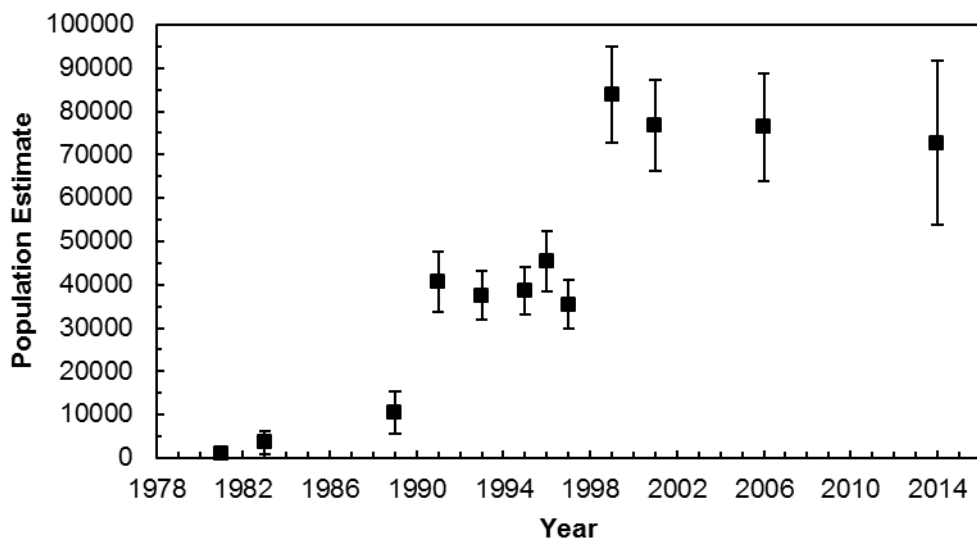


Fig. 20. Number of cattle estimated to be in the Sebungwe since 1981



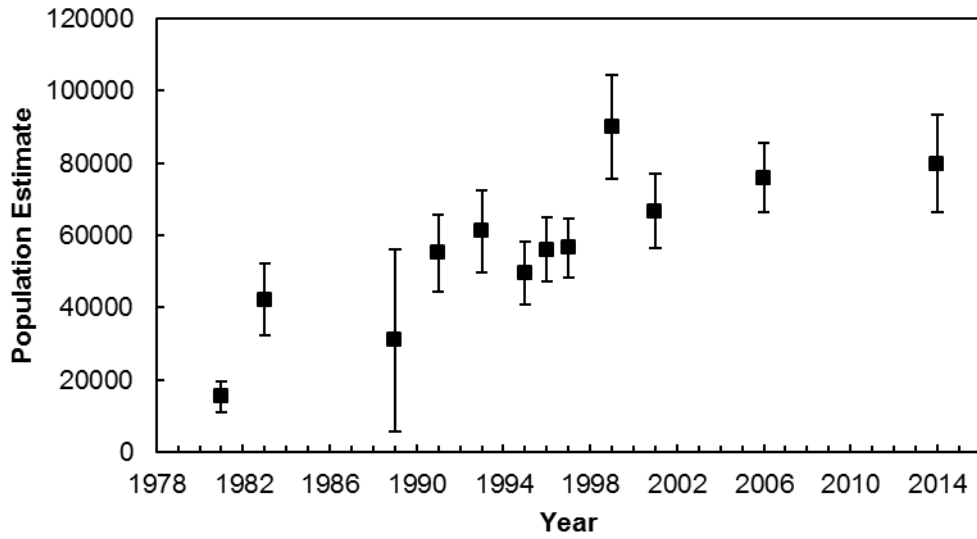


Fig. 21. Number of sheep and goats estimated to be in the Sebungwe since 1981

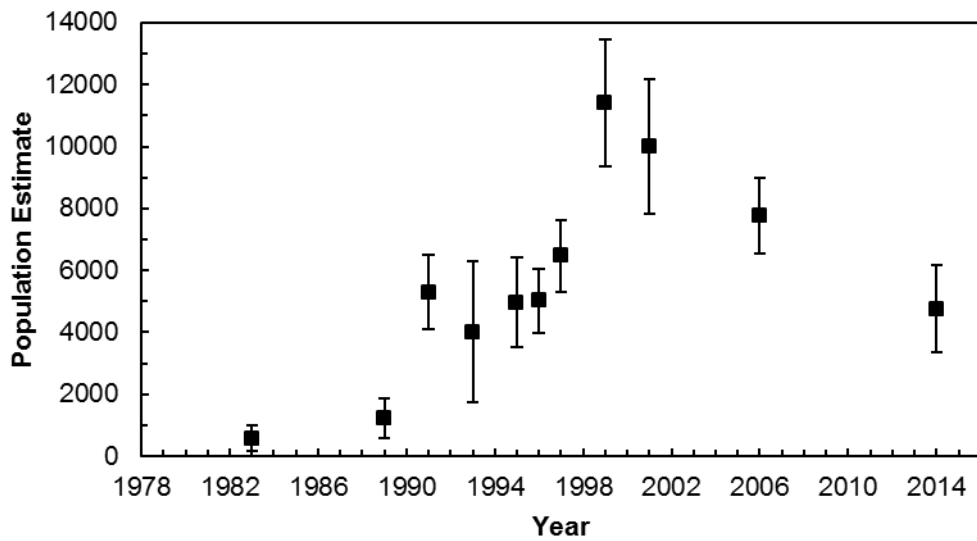


Fig. 22. Number of donkeys estimated to be in the Sebungwe since 1983

## **Discussion**

### ***Elephants***

There were estimated to be 3407 (+/- 1214) elephants in the Sebungwe during 2014. This represents a decline of 77 % during the eight years between the 2006 and 2014 surveys.

### ***Elephant Carcasses***

The 1+2 carcass ratio of 2.17 % during 2014 was greater than any previously-recorded 1+2 carcass ratio for elephants in the Sebungwe (Fig. 11). The ratio was 0.79 % during 2001 and 1.69 % during 2006. The high values for this index of the elephant mortality rate during 2006 and 2014 are consistent with the observed decrease in the number of live elephants.

The estimated number of all elephant carcasses regardless of age category (1475) represented a decline of 46 % since the 2006 survey, but the all-carcass ratio was 30.2 % during 2014, which was double that observed during 2006 (15.4 %) and nearly five-fold the 2001 value (5.8 %).

If it is assumed that all 'unidentified' carcasses were elephant carcasses, then the all-carcass ratio increases to 38.9 % during 2014, compared to 20.9 % during 2006 and 13.2 % during 2001.

The estimated number of poachers' camps was small (15) during 2014, which represents a major decline since 2006 (estimate 939). But this decrease may represent a change in the way that poachers operate, rather than a decline in poaching.

### ***Other Large Herbivores***

Study of the temporal variation in the estimated numbers of large herbivores in the Sebungwe revealed that most large herbivores, not only elephant, have declined in number in the Sebungwe since 2001. For several species (e.g. buffalo, waterbuck, kudu, impala) the decline started before 2001. Only for the two major domestic species of large herbivore (cattle and sheep/goats) has there been no decline in number since 2001.

### ***Ground Hornbill***

Since 1997, ground hornbills seen during the Sebungwe surveys have been counted. Ground hornbills are large birds that become conspicuous when they take flight as the plane goes overhead. Hence they can be counted – and temporal trends in their population determined – at no additional expense. It is noted that the population density in the Parks and Wild Life Estate is an order of magnitude greater than the density in the communal areas (Table 27).

### ***Encroachment on the Parks and Wild Life Estate***

The observation of cattle kraals and trails in the north-east of Chizarira NP suggests that the encroachment noted during the 2006 survey is continuing.

## Acknowledgements

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**Table 4. Sampling statistics for the 2014 aerial survey of elephants and other large herbivores in the Sebungwe**

Stratum	Stratum area (km <sup>2</sup> )	Transect spacing (km)	Transect orientation (°)	Number of transects/ blocks [= n]	Percent of stratum sampled	Time and date sampled	Flying time (hours) <sup>a</sup>			Mean ground speed (km hour <sup>-1</sup> )	Mean search effort (minutes km <sup>-2</sup> )
							Transect / Block	Stratum	Total		
Busi	445	1.6	- 45 (135)	16	19.3	am 19/09/2014	1.65	2.20	3.35	168	1.15
Chizarira West	683	2.0	90	15	14.5	am 18/09/2014	1.99	2.40	3.72	168	1.21
Chizarira East	968	2.5	90	11	12.3	am 17/09/2014	2.22	2.68	3.73	173	1.12
Matusadona East	245	1.8	0	17	18.2	am & pm 11/09/2014	0.89	1.45	1.82	163	1.20
Matusadona West	116	1.6	0	12	19.7	am 11/09/2014	0.43	0.92	1.92	167	1.12
Chirisa Gadzi	743	2.0	90	19	13.6	am 26/09/2014	2.11	2.70	3.68	177	1.25
Chirisa Sengwa	414	1.9	45	16	16.5	am 20/09/2014	1.29	1.83	3.12	166	1.14
SWRA	373	1.5	0	15	18.9	am 27/09/2014	1.46	1.88	3.35	171	1.24
Chete East	501	3.1	90	9	10.2	pm 13/09/2014	0.94	1.45	2.30	174	1.10
Chete West	741	2.5	0	17	12.6	am 16/09/2014	1.79	2.40	3.40	164	1.15
Sijarira	261	2.5	0	7	12.2	pm 17/09/2014	0.62	0.87	2.02	165	1.16
Chireya South	1383	7.5	90	6	4.0	pm 25/09/2014	1.03	1.35	1.85	181	1.12
Chireya North	430	7.5	45	4	4.2	pm 25/09/2014	0.34	0.58	1.23	174	1.13
Simchembo	788	7.5	0	6	3.8	pm 26/09/2014	0.57	0.90	1.93	183	1.14
Nenyunga	495	2.5	90	11	12.9	pm 16/09/2014	1.16	1.58	2.28	170	1.09
Siabuwa West	481	7.5	0	6	3.9	am 28/09/2014	0.36	0.68	1.32	173	1.14
Siabuwa East	1295	5.3	90	9	5.5	pm 27/09/2014	1.32	1.75	2.52	185	1.11
Lusulu	537	7.5	90	6	3.9	am 28/09/2014	0.38	0.73	1.57	180	1.09
Mwenda	425	3.0	90	9	10.4	pm 12/09/2014	0.91	1.30	1.88	159	1.23
Sampakaruma	990	2.6	0	20	12.1	am 13/09/2014	2.29	3.15	3.62	167	1.14

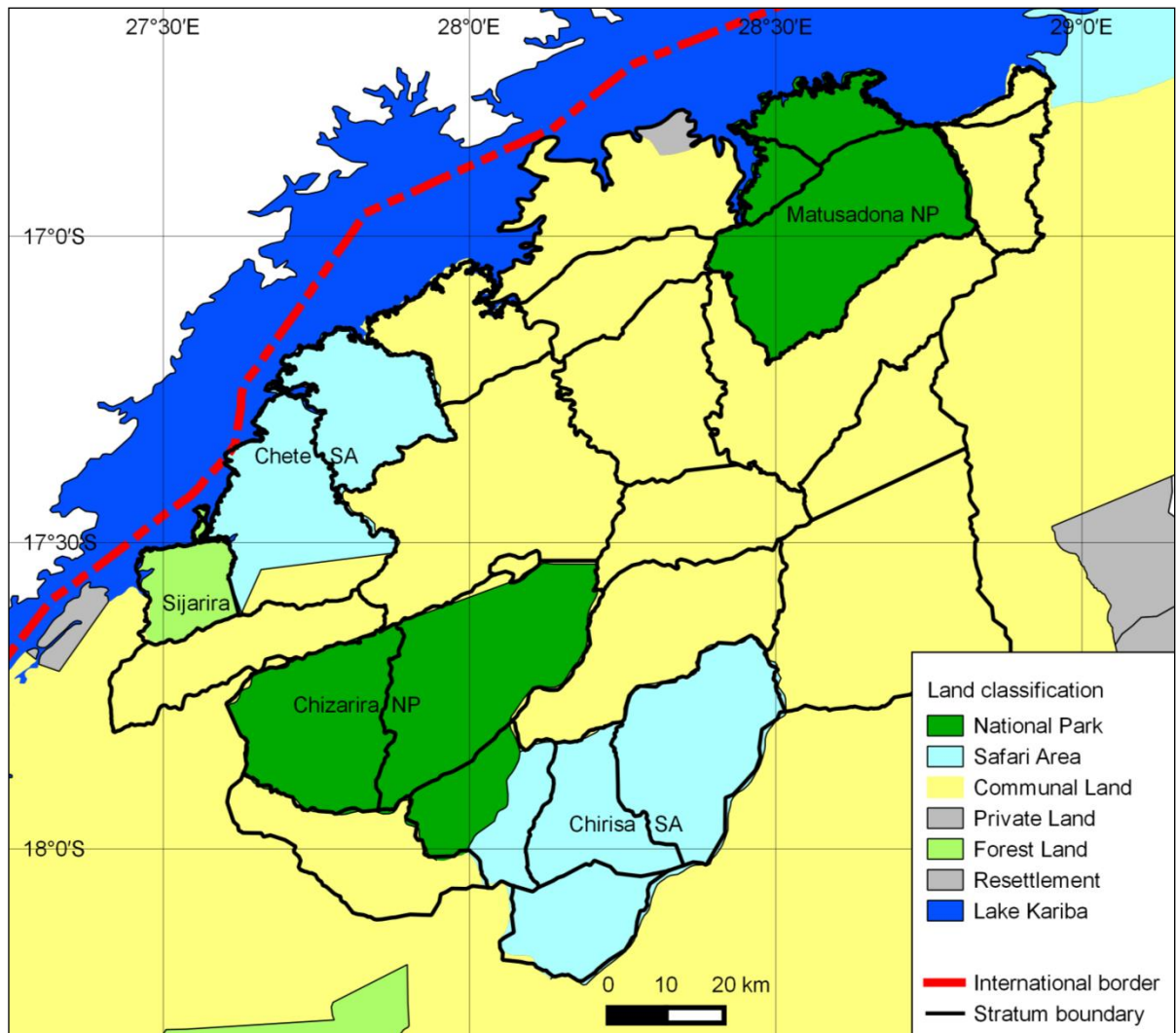
*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Stratum	Stratum area (km <sup>2</sup> )	Transect spacing (km)	Transect orientation (°)	Number of transects/blocks [= n]	Percent of stratum sampled	Time and date sampled	Flying time (hours) <sup>a</sup>			Mean ground speed (km hour <sup>-1</sup> )	Mean search effort (minutes km <sup>-2</sup> )
							Transect / Block	Stratum	Total		
Negande	713	2.3	0	16	13.4	am & pm 14/09/2014	1.79	2.32	3.18	168	1.12
Sibilobilo	737	3.2	0	13	9.5	am 12/09/2014	1.44	2.05	2.50	161	1.23
Mapongolas	377	1.9	90	13	17.6	am 14/09/2014	1.13	1.55	1.88	173	1.02
Gatche Gatche	73	2.1	0	8	16.5	pm 11/09/2014	0.22	0.47	0.82	171	1.10
<b>Subtotal / Mean</b>	<b>14 214</b>				<b>10.4<sup>b</sup></b>		<b>28.3</b>	<b>39.2</b>	<b>59.0</b>	<b>171</b>	<b>1.15</b>
Matusadona Hills	1005			11 (8) <sup>c</sup>	37.2	am & pm 12, am 13, am 14 July 2014	4.60	5.07	9.80		1.01
Kanyati Highlands	308			6 (4) <sup>c</sup>	47.8	am 12 July 2014	1.42	1.67	3.02		0.89
<b>Subtotal / Mean</b>	<b>1313</b>				<b>39.7<sup>b</sup></b>		<b>6.0</b>	<b>6.7</b>	<b>12.8</b>		<b>0.95</b>
<b>Total / Mean</b>	<b>15 527</b>				<b>12.8<sup>b</sup></b>		<b>34.3</b>	<b>45.9</b>	<b>71.8</b>		<b>1.13</b>

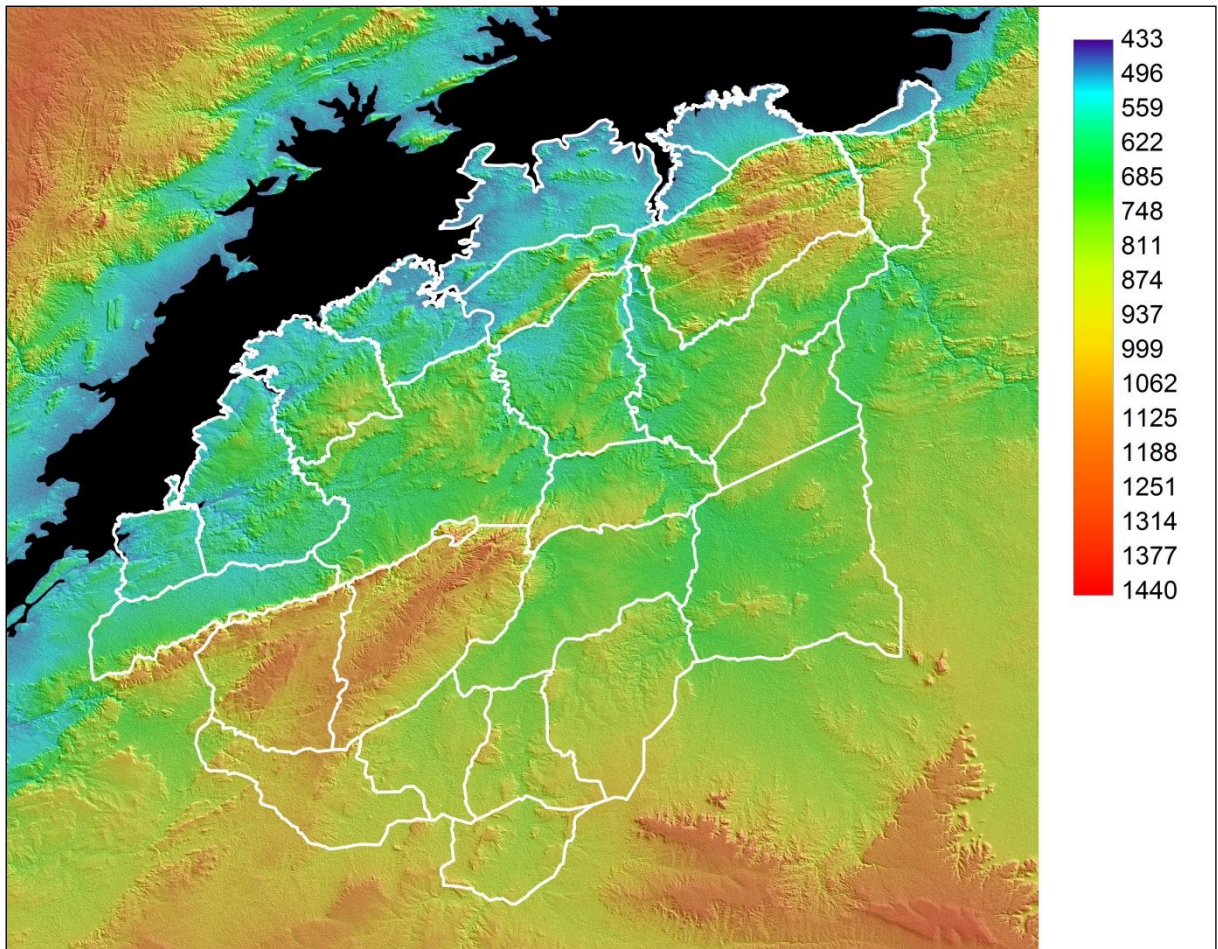
<sup>a</sup> Transect /block time is the time spent searching the transects or blocks; stratum time is the transect/block time, plus the time spent travelling between transects/blocks in the same stratum; and total time is the stratum time, plus the time spent travelling between the stratum and the airstrip

<sup>b</sup> Weighted mean, with stratum area as a proportion of the total area as weight

<sup>c</sup> Sampling was with replacement – number in parentheses is the number of blocks searched



Map 2. Land designation in and around the 2014 Sebungwe survey area

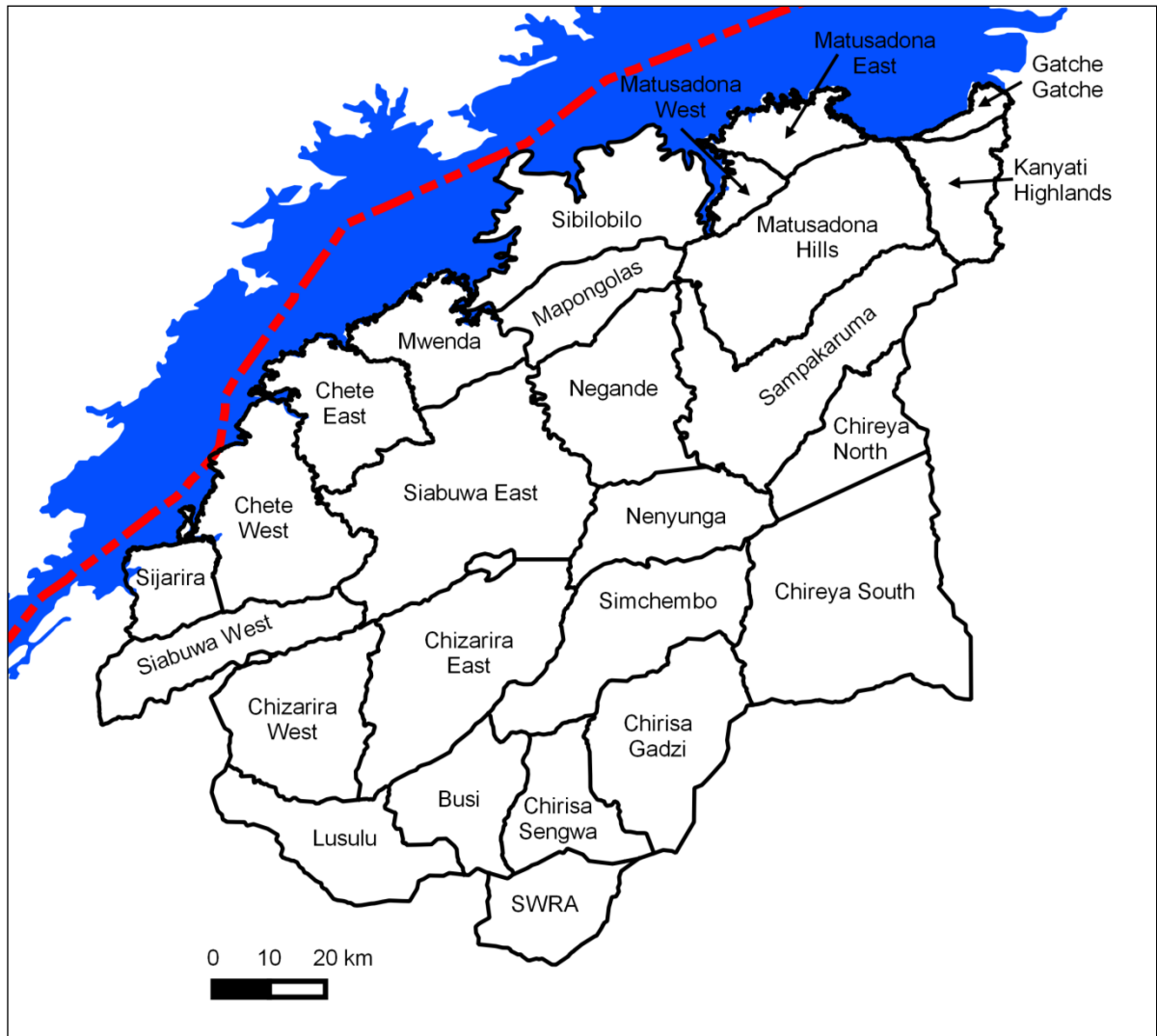


**Map 3.** Altitude in and around the Sebungwe survey area

Altitude is in metres. Bold white lines indicate stratum boundaries. Lake Kariba is shown in black.

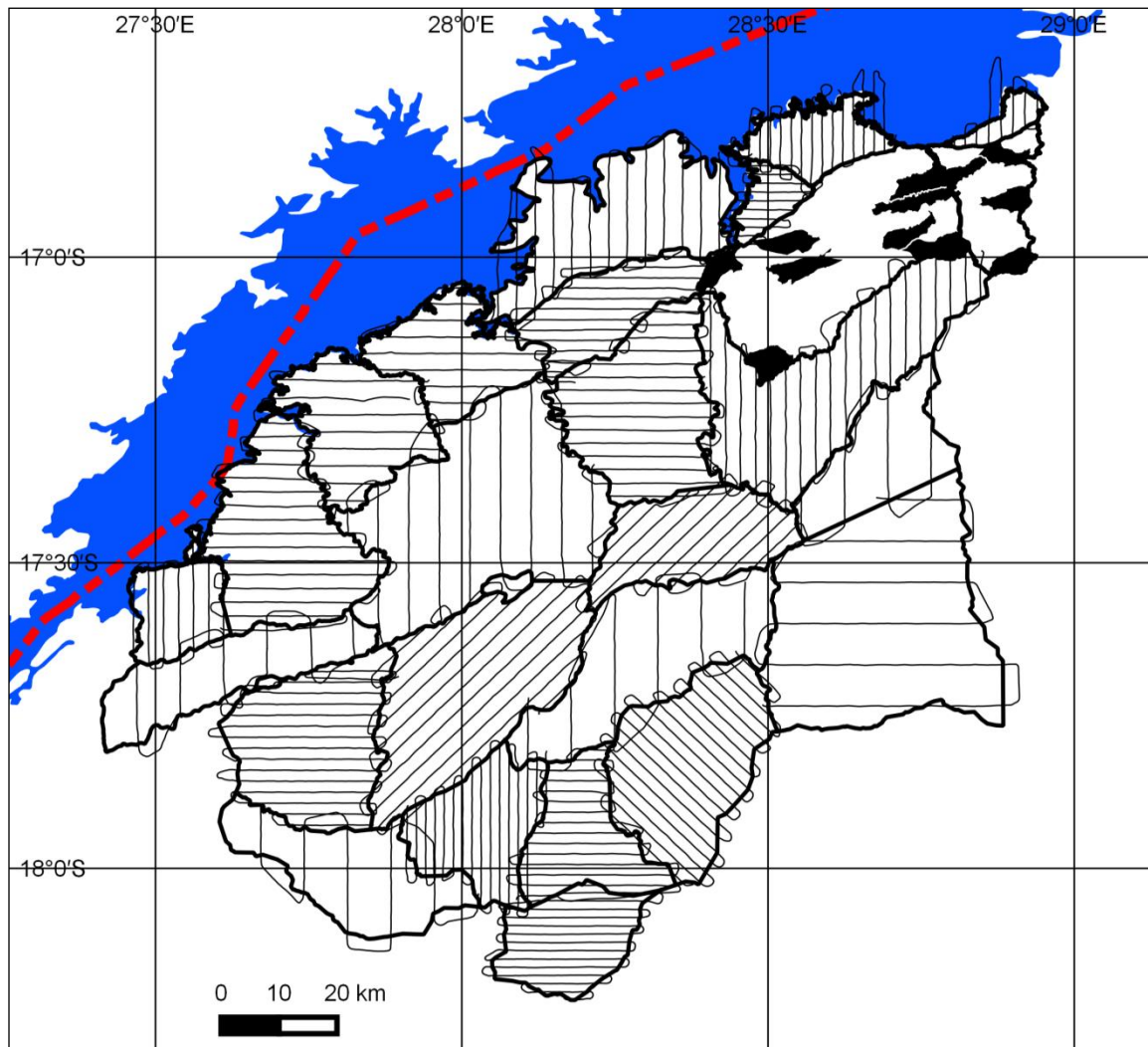
ASTER GDEM is a product of METI and NASA.



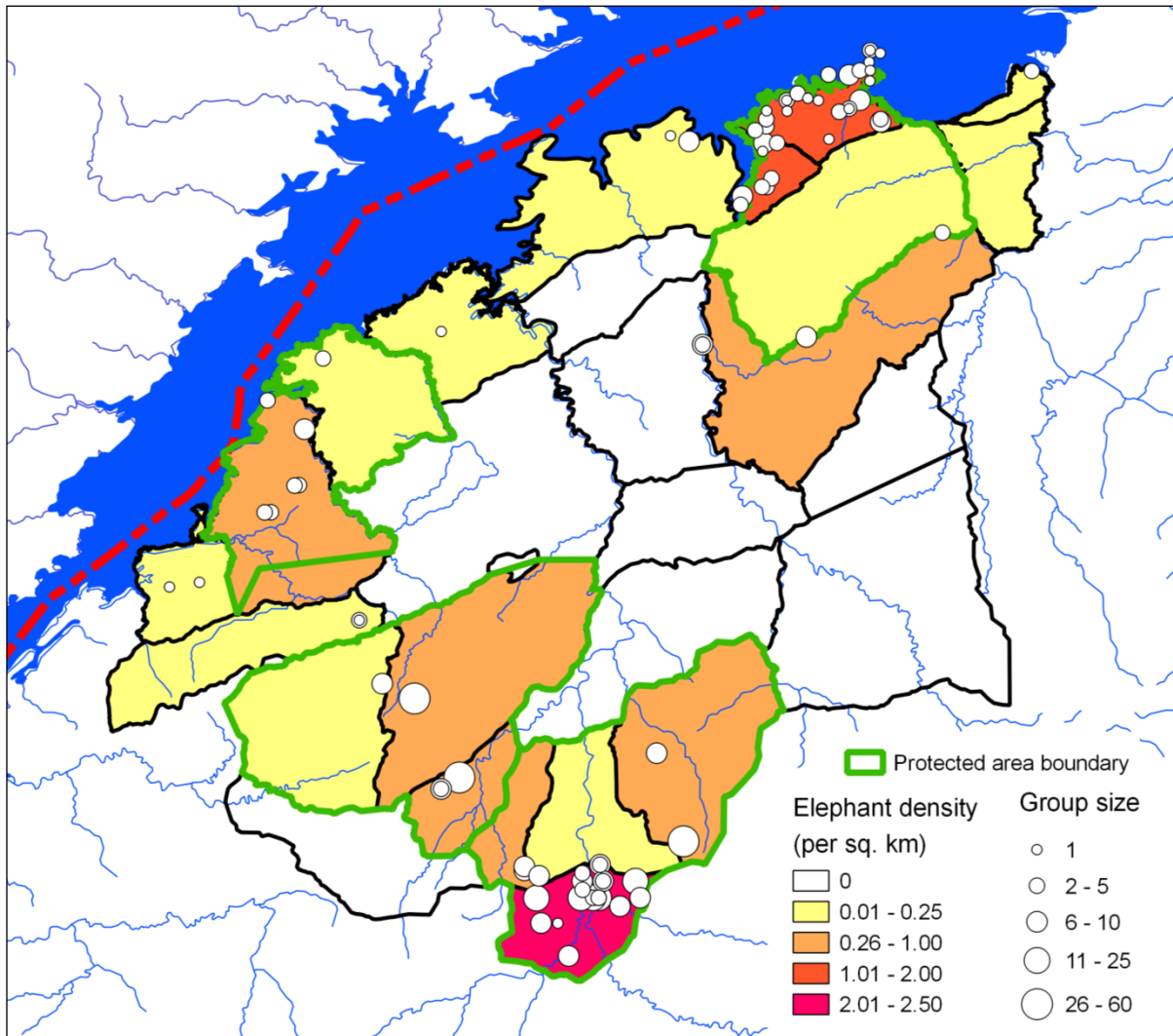


**Map 4.** Strata used during the Sebungwe aerial survey

Bold lines indicate stratum boundaries and labels give stratum names. Lake Kariba is shown in blue and the red dashed line indicates the international border with Zambia.



**Map 5.** Tracklogs (flight lines) indicating the transects flown during the Sebungwe aerial survey  
Bold lines indicate stratum boundaries. Thin parallel lines indicate flight lines along the transects.  
Areas shown in black in the Matusadona Hills and Kanyati Highlands indicate blocks searched during  
Block Counts of these strata.



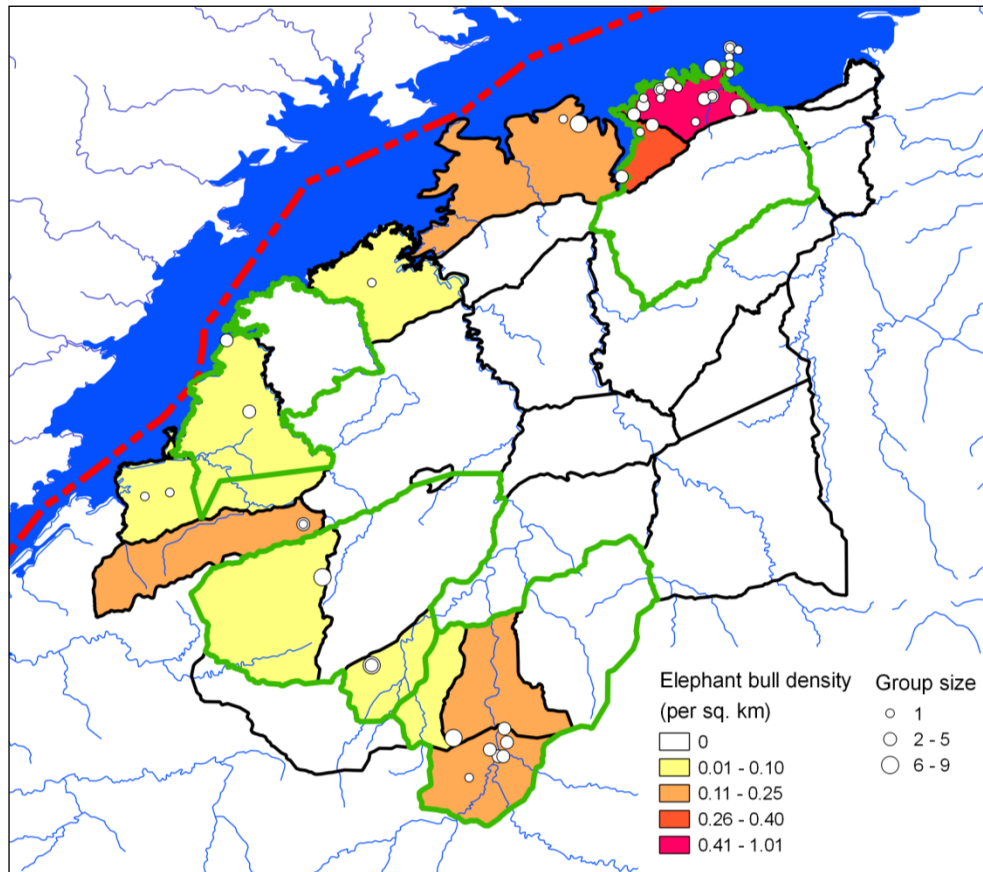
**Map 6.** Distribution of elephant in the Sebungwe during 2014

Colouring indicates the mean density of elephants within each stratum. The dots indicate the locations of elephants seen *within the search strips during transect surveys*, together with an indication of the size of each group. Small dots overlaying large dots indicate two or more groups of elephants in close proximity. Variation in dot density between strata reflects differences between strata in *both* the density of elephant groups *and* the sampling intensity (given in Table 4). The green lines indicates the boundaries of the protected areas. The red dashed line indicate the international border.

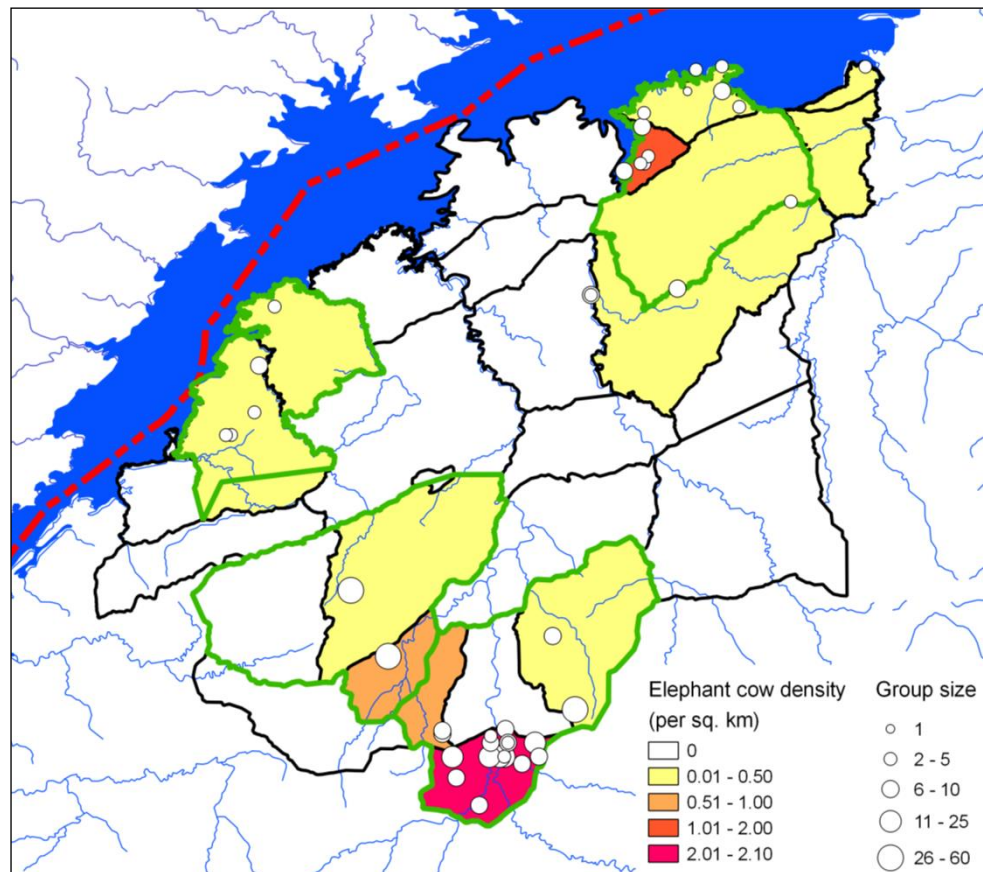
Sighting locations are not shown for the two strata sampled with block counts (Matusadona Hills and Kanyati Escarpment), because the spatial pattern of sampling in these strata was not systematic.

**Table 5. Population estimates and statistics for Elephant in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	424	82	85939	147.3	82	1049	0.95
Chizarira West	55	8	3151	218.9	8	175	0.08
Chizarira East	268	33	63913	210.2	33	831	0.28
<b>Subtotals</b>	<b>747</b>	<b>123</b>	<b>153003</b>	<b>107.8</b>	<b>123</b>	<b>1553</b>	<b>0.36</b>
<b>Matusadona NP</b>							
Matusadona East	369	67	8956	54.4	168	570	1.51
Matusadona West	162	32	2146	62.9	60	264	1.40
Matusadona Hills	138	53	5284	117.7	53	300	0.14
<b>Subtotals</b>	<b>669</b>	<b>152</b>	<b>16387</b>	<b>39.0</b>	<b>408</b>	<b>929</b>	<b>0.49</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	293	40	50280	160.8	40	764	0.39
Chirisa Sengwa	49	8	2020	195.5	8	145	0.12
SWRA	858	162	96032	77.5	193	1523	2.3
<b>Subtotals</b>	<b>1200</b>	<b>210</b>	<b>148332</b>	<b>65.9</b>	<b>410</b>	<b>1990</b>	<b>0.78</b>
<b>Chete SA</b>							
Chete East	49	5	2239	222.7	5	158	0.10
Chete West	229	29	10645	95.5	29	448	0.31
<b>Subtotals</b>	<b>278</b>	<b>34</b>	<b>12884</b>	<b>84.9</b>	<b>42</b>	<b>514</b>	<b>0.22</b>
<b>P&amp;W Estate</b>	<b>2894</b>	<b>519</b>	<b>330605</b>	<b>39.7</b>	<b>1745</b>	<b>4043</b>	<b>0.46</b>
<b>Sijarira FA</b>	<b>16</b>	<b>2</b>	<b>75</b>	<b>132.2</b>	<b>2</b>	<b>37</b>	<b>0.06</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	76	3	6806	279.1	3	288	0.16
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	10	1	66	186.7	1	29	0.02
<b>Subtotals</b>	<b>86</b>	<b>4</b>	<b>6872</b>	<b>247.8</b>	<b>4</b>	<b>299</b>	<b>0.03</b>
<b>Kariba CL</b>							
Sampakaruma	255	31	23158	124.9	31	574	0.26
Negande	0	0	0	0.0	0	0	0
Sibilobilo	105	10	9682	204.2	10	319	0.14
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	12	2	159	248.5	2	42	0.16
Kanyati Highlands	39	15	1559	257.1	15	141	0.13
<b>Subtotals</b>	<b>411</b>	<b>58</b>	<b>34558</b>	<b>92.0</b>	<b>58</b>	<b>790</b>	<b>0.13</b>
<b>All Communal Lands</b>	<b>497</b>	<b>62</b>	<b>41430</b>	<b>82.9</b>	<b>85</b>	<b>910</b>	<b>0.06</b>
<b>Totals</b>	<b>3407</b>	<b>583</b>	<b>372110</b>	<b>35.6</b>	<b>2193</b>	<b>4622</b>	<b>0.22</b>



Map 7. Distribution of elephant bulls in the Sebungwe during 2014



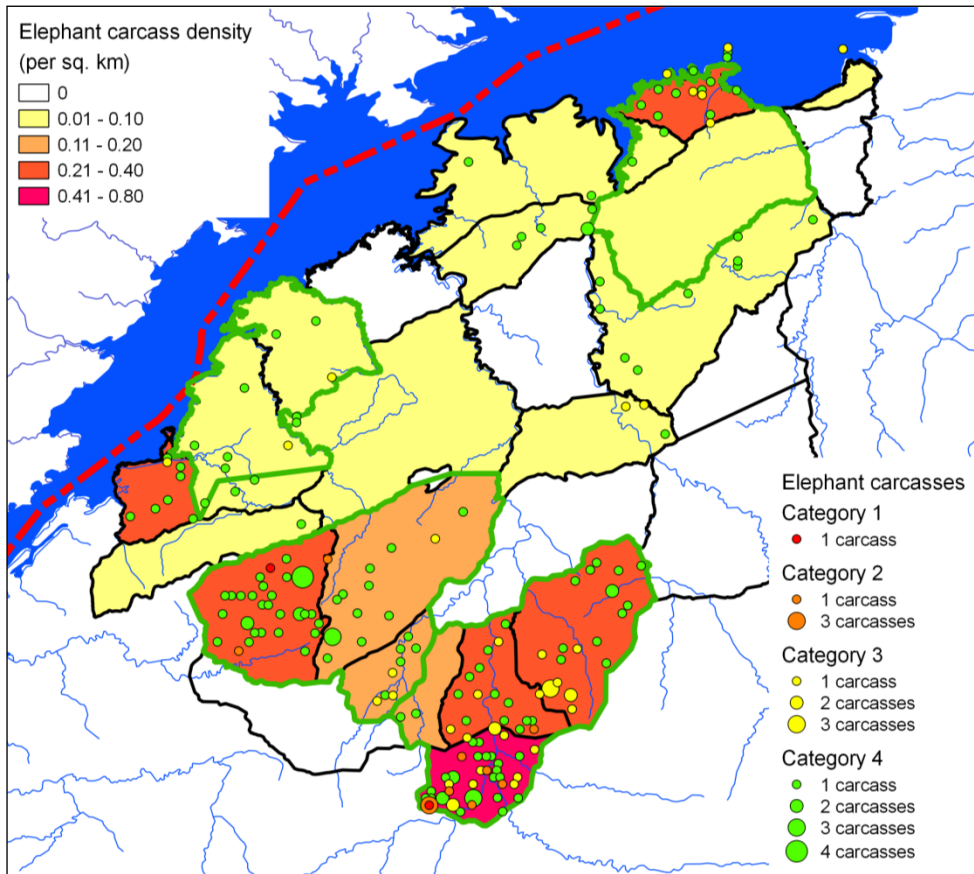
Map 8. Distribution of elephant cows in the Sebungwe during 2014

**Table 6. Population estimates and statistics for Elephant Bulls in the Sebungwe**

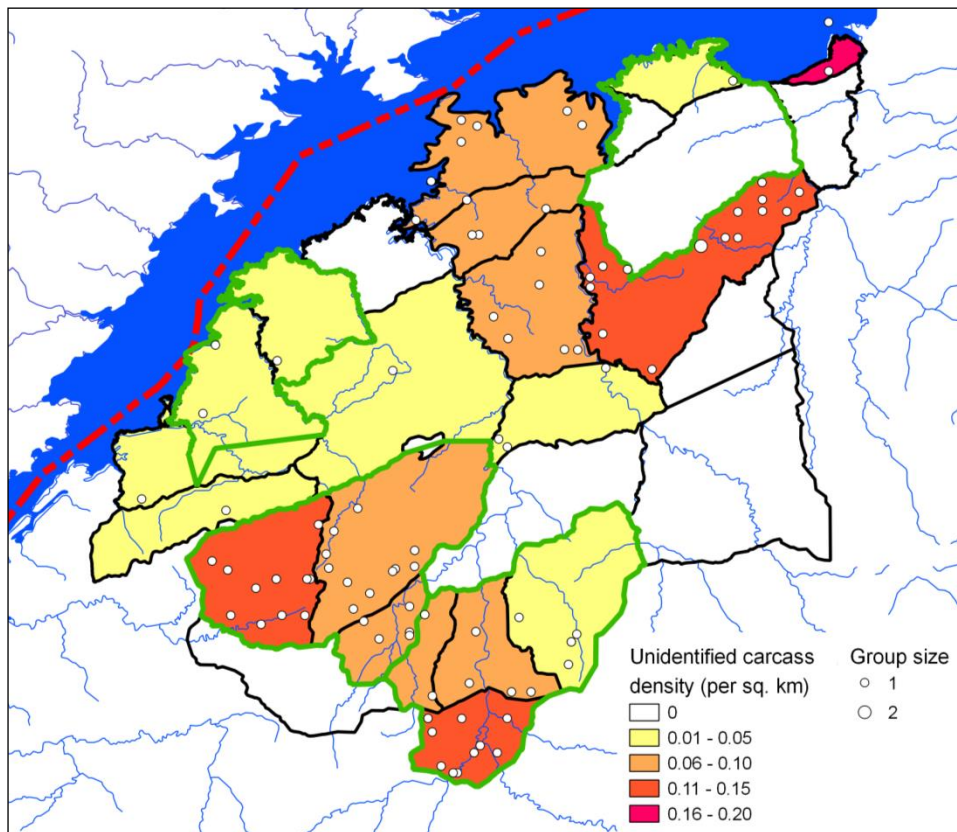
<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	41	8	1477	197.7	8	123	0.09
Chizarira West	55	8	3151	218.0	8	176	0.08
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>97</b>	<b>16</b>	<b>4628</b>	<b>144.9</b>	<b>16</b>	<b>237</b>	<b>0.05</b>
<b>Matusadona NP</b>							
Matusadona East	248	45	4622	58.2	104	392	1.01
Matusadona West	30	6	229	109.8	6	64	0.26
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>278</b>	<b>51</b>	<b>4851</b>	<b>52.8</b>	<b>131</b>	<b>425</b>	<b>0.20</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	49	8	2020	197.1	8	144	0.12
SWRA	90	17	1165	81.3	17	163	0.24
<b>Subtotals</b>	<b>139</b>	<b>25</b>	<b>3186</b>	<b>83.5</b>	<b>25</b>	<b>255</b>	<b>0.09</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	55	7	1407	143.3	7	135	0.07
<b>Subtotals</b>	<b>55</b>	<b>7</b>	<b>1407</b>	<b>143.3</b>	<b>7</b>	<b>135</b>	<b>0.04</b>
<b>P&amp;W Estate</b>	<b>569</b>	<b>99</b>	<b>14072</b>	<b>41.6</b>	<b>333</b>	<b>805</b>	<b>0.09</b>
<b>Sijarira FA</b>	<b>16</b>	<b>2</b>	<b>75</b>	<b>128.8</b>	<b>2</b>	<b>38</b>	<b>0.06</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	76	3	6806	278.4	3	288	0.16
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	10	1	66	193.6	1	28	0.02
<b>Subtotals</b>	<b>86</b>	<b>4</b>	<b>6872</b>	<b>248.2</b>	<b>4</b>	<b>299</b>	<b>0.03</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	105	10	9682	203.8	10	320	0.14
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>105</b>	<b>10</b>	<b>9682</b>	<b>203.8</b>	<b>10</b>	<b>320</b>	<b>0.03</b>
<b>All Communal Lands</b>	<b>191</b>	<b>14</b>	<b>16553</b>	<b>142.8</b>	<b>14</b>	<b>464</b>	<b>0.02</b>
<b>Totals</b>	<b>776</b>	<b>115</b>	<b>30700</b>	<b>45.4</b>	<b>424</b>	<b>1129</b>	<b>0.05</b>

**Table 7. Population estimates and statistics for Elephant Cows in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	383	74	84462	161.6	74	1003	0.86
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	268	33	63913	210.0	33	831	0.28
<b>Subtotals</b>	<b>651</b>	<b>107</b>	<b>148374</b>	<b>122.0</b>	<b>107</b>	<b>1446</b>	<b>0.31</b>
<b>Matusadona NP</b>							
Matusadona East	121	22	4334	115.2	22	261	0.49
Matusadona West	132	26	1917	73.3	35	228	1.13
Matusadona Hills	138	53	5284	117.7	53	300	0.14
<b>Subtotals</b>	<b>390</b>	<b>101</b>	<b>11536</b>	<b>56.2</b>	<b>171</b>	<b>610</b>	<b>0.29</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	293	40	50280	160.7	40	764	0.39
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	768	145	94866	86.0	145	1429	2.06
<b>Subtotals</b>	<b>1062</b>	<b>185</b>	<b>145146</b>	<b>73.8</b>	<b>278</b>	<b>1845</b>	<b>0.69</b>
<b>Chete SA</b>							
Chete East	49	5	2239	222.9	5	158	0.10
Chete West	174	22	9238	116.8	22	378	0.24
<b>Subtotals</b>	<b>223</b>	<b>27</b>	<b>11477</b>	<b>99.5</b>	<b>27</b>	<b>446</b>	<b>0.18</b>
<b>P&amp;W Estate</b>	<b>2327</b>	<b>420</b>	<b>316533</b>	<b>48.4</b>	<b>1201</b>	<b>3452</b>	<b>0.37</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	255	31	23158	124.8	31	574	0.26
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	12	2	159	245.5	2	42	0.17
Kanyati Highlands	39	15	1559	257.1	15	141	0.13
<b>Subtotals</b>	<b>307</b>	<b>48</b>	<b>24877</b>	<b>106.9</b>	<b>48</b>	<b>635</b>	<b>0.10</b>
<b>All Communal Lands</b>	<b>307</b>	<b>48</b>	<b>24877</b>	<b>106.9</b>	<b>48</b>	<b>635</b>	<b>0.03</b>
<b>Totals</b>	<b>2633</b>	<b>468</b>	<b>341410</b>	<b>44.3</b>	<b>1468</b>	<b>3799</b>	<b>0.17</b>



**Map 9.** Distribution of elephant carcasses in the Sebungwe during 2014



**Map 10.** Distribution of unidentified carcasses in the Sebungwe during 2014



**Table 8. Population estimates and statistics for Elephant Carcass 1 in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	7	1	49	217.4	1	22	0.01
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>7</b>	<b>1</b>	<b>49</b>	<b>217.4</b>	<b>1</b>	<b>22</b>	<b>0.003</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	5	1	20	182.2	1	15	0.01
<b>Subtotals</b>	<b>5</b>	<b>1</b>	<b>20</b>	<b>182.2</b>	<b>1</b>	<b>15</b>	<b>0.003</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>P&amp;W Estate</b>	<b>12</b>	<b>2</b>	<b>69</b>	<b>141.1</b>	<b>2</b>	<b>29</b>	<b>0.002</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>All Communal Lands</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Totals</b>	<b>12</b>	<b>2</b>	<b>69</b>	<b>141.1</b>	<b>2</b>	<b>29</b>	<b>0.001</b>

**Table 9. Population estimates and statistics for Elephant Carcass 2 in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	7	1	50	220.3	1	22	0.01
Chizarira East	8	1	66	223.1	1	26	0.01
<b>Subtotals</b>	<b>15</b>	<b>2</b>	<b>117</b>	<b>149.3</b>	<b>2</b>	<b>37</b>	<b>0.01</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	6	1	27	183.5	1	17	0.01
SWRA	42	8	315	89.8	8	80	0.11
<b>Subtotals</b>	<b>48</b>	<b>9</b>	<b>342</b>	<b>80.9</b>	<b>9</b>	<b>88</b>	<b>0.03</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>P&amp;W Estate</b>	<b>64</b>	<b>11</b>	<b>459</b>	<b>69.2</b>	<b>20</b>	<b>107</b>	<b>0.01</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>All Communal Lands</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Totals</b>	<b>64</b>	<b>11</b>	<b>459</b>	<b>69.2</b>	<b>20</b>	<b>107</b>	<b>0.004</b>

**Table 10. Population estimates and statistics for Elephant Carcass 3 in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	16	3	111	144.4	3	38	0.03
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	8	1	54	202.2	1	25	0.01
<b>Subtotals</b>	<b>24</b>	<b>4</b>	<b>165</b>	<b>112.1</b>	<b>4</b>	<b>50</b>	<b>0.01</b>
<b>Matusadona NP</b>							
Matusadona East	28	5	83	70.2	8	47	0.11
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>28</b>	<b>5</b>	<b>83</b>	<b>70.1</b>	<b>8</b>	<b>47</b>	<b>0.02</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	66	9	1088	105.1	9	135	0.09
Chirisa Sengwa	30	5	163	89.7	5	58	0.07
SWRA	64	12	303	58.7	26	101	0.17
<b>Subtotals</b>	<b>160</b>	<b>26</b>	<b>1554</b>	<b>50.2</b>	<b>80</b>	<b>240</b>	<b>0.10</b>
<b>Chete SA</b>							
Chete East	10	1	104	240.0	1	33	0.02
Chete West	8	1	51	191.7	1	23	0.01
<b>Subtotals</b>	<b>18</b>	<b>2</b>	<b>155</b>	<b>149.9</b>	<b>2</b>	<b>44</b>	<b>0.01</b>
<b>P&amp;W Estate</b>	<b>229</b>	<b>37</b>	<b>1958</b>	<b>38.9</b>	<b>140</b>	<b>318</b>	<b>0.04</b>
<b>Sijarira FA</b>	<b>8</b>	<b>1</b>	<b>50</b>	<b>209.9</b>	<b>1</b>	<b>25</b>	<b>0.03</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	16	2	85	132.2	2	36	0.03
<b>Subtotals</b>	<b>16</b>	<b>2</b>	<b>85</b>	<b>132.2</b>	<b>2</b>	<b>36</b>	<b>0.01</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	6	1	38	238.7	1	21	0.08
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>6</b>	<b>1</b>	<b>38</b>	<b>238.6</b>	<b>1</b>	<b>21</b>	<b>0.002</b>
<b>All Communal Lands</b>	<b>22</b>	<b>3</b>	<b>123</b>	<b>108.6</b>	<b>3</b>	<b>45</b>	<b>0.002</b>
<b>Totals</b>	<b>259</b>	<b>41</b>	<b>2130</b>	<b>35.7</b>	<b>166</b>	<b>351</b>	<b>0.02</b>

**Table 11. Population estimates and statistics for Elephant Carcass 4 in the Sebungwe**

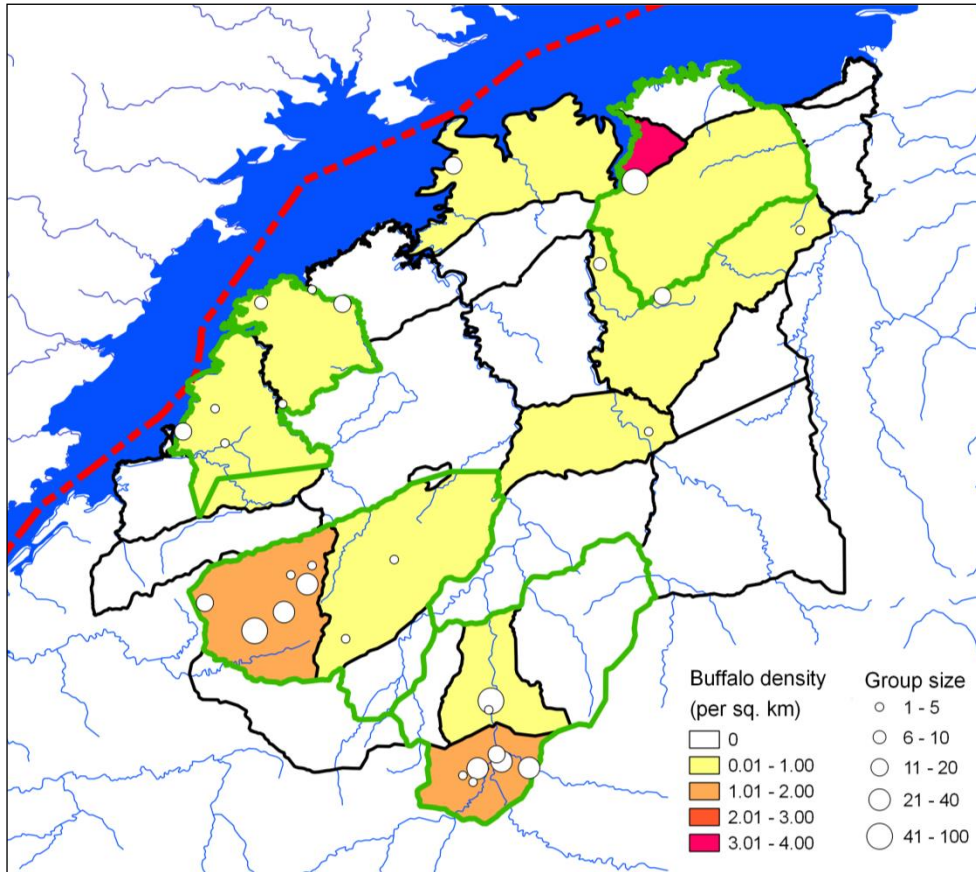
<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	36	7	262	95.1	7	71	0.08
Chizarira West	214	31	2977	54.7	97	331	0.31
Chizarira East	122	15	2200	85.7	17	226	0.13
<b>Subtotals</b>	<b>372</b>	<b>53</b>	<b>5440</b>	<b>40.7</b>	<b>221</b>	<b>524</b>	<b>0.18</b>
<b>Matusadona NP</b>							
Matusadona East	66	12	327	58.0	28	104	0.27
Matusadona West	10	2	27	112.6	2	22	0.09
Matusadona Hills	11	3	37	128.6	3	24	0.01
<b>Subtotals</b>	<b>87</b>	<b>17</b>	<b>390</b>	<b>47.2</b>	<b>46</b>	<b>128</b>	<b>0.06</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	103	14	909	61.8	39	166	0.14
Chirisa Sengwa	79	13	388	53.1	37	121	0.19
SWRA	154	29	1526	54.5	70	237	0.41
<b>Subtotals</b>	<b>335</b>	<b>56</b>	<b>2823</b>	<b>32.2</b>	<b>227</b>	<b>443</b>	<b>0.22</b>
<b>Chete SA</b>							
Chete East	20	2	147	142.9	2	48	0.04
Chete West	55	7	148	46.5	30	81	0.07
<b>Subtotals</b>	<b>75</b>	<b>9</b>	<b>295</b>	<b>47.6</b>	<b>39</b>	<b>111</b>	<b>0.06</b>
<b>P&amp;W Estate</b>	<b>869</b>	<b>135</b>	<b>8948</b>	<b>21.8</b>	<b>680</b>	<b>1059</b>	<b>0.14</b>
<b>Sijarira FA</b>	<b>57</b>	<b>7</b>	<b>209</b>	<b>61.5</b>	<b>22</b>	<b>93</b>	<b>0.22</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	23	3	127	107.4	3	48	0.05
<b>Subtotals</b>	<b>23</b>	<b>3</b>	<b>127</b>	<b>107.4</b>	<b>3</b>	<b>48</b>	<b>0.01</b>
<b>Binga CL</b>							
Siabuwa West	25	1	756	278.4	1	96	0.05
Siabuwa East	36	2	1580	252.9	2	128	0.03
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>62</b>	<b>3</b>	<b>2336</b>	<b>170.8</b>	<b>3</b>	<b>167</b>	<b>0.02</b>
<b>Kariba CL</b>							
Sampakaruma	74	9	783	79.1	16	133	0.07
Negande	0	0	0	0.0	0	0	0
Sibilobilo	21	2	216	152.3	2	53	0.03
Mapongolas	34	6	191	88.0	6	64	0.09
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>129</b>	<b>17</b>	<b>1190</b>	<b>54.1</b>	<b>59</b>	<b>199</b>	<b>0.04</b>
<b>All Communal Lands</b>	<b>214</b>	<b>23</b>	<b>3653</b>	<b>57.8</b>	<b>90</b>	<b>338</b>	<b>0.02</b>
<b>Totals</b>	<b>1141</b>	<b>165</b>	<b>12811</b>	<b>19.7</b>	<b>916</b>	<b>1366</b>	<b>0.07</b>

**Table 12. Population estimates and statistics for Unidentified Carcasses in the Sebungwe**

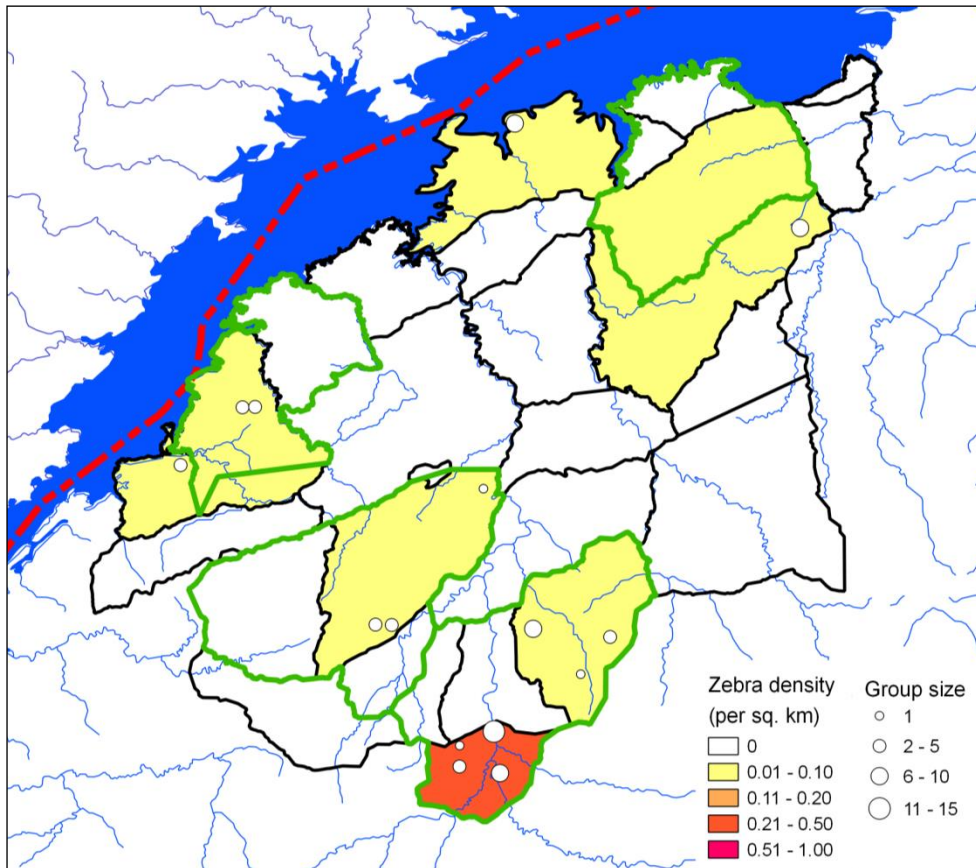
<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>-2</sup>)</b>
<b>Chizarira NP</b>							
Busi	36	7	200	83.2	7	66	0.08
Chizarira West	83	12	1072	84.8	13	153	0.12
Chizarira East	89	11	1171	85.3	13	166	0.09
<b>Subtotals</b>	<b>209</b>	<b>30</b>	<b>2443</b>	<b>48.7</b>	<b>107</b>	<b>310</b>	<b>0.10</b>
<b>Matusadona NP</b>							
Matusadona East	6	1	30	212.6	1	17	0.02
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>6</b>	<b>1</b>	<b>30</b>	<b>212.6</b>	<b>1</b>	<b>17</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	37	5	359	108.6	5	76	0.05
Chirisa Sengwa	24	4	136	102.2	4	49	0.06
SWRA	53	10	255	64.7	19	87	0.14
<b>Subtotals</b>	<b>114</b>	<b>19</b>	<b>750</b>	<b>48.5</b>	<b>59</b>	<b>169</b>	<b>0.07</b>
<b>Chete SA</b>							
Chete East	10	1	114	251.0	1	34	0.02
Chete West	16	2	101	134.7	2	37	0.02
<b>Subtotals</b>	<b>26</b>	<b>3</b>	<b>215</b>	<b>119.3</b>	<b>3</b>	<b>56</b>	<b>0.02</b>
<b>P&amp;W Estate</b>	<b>354</b>	<b>53</b>	<b>3439</b>	<b>33.3</b>	<b>236</b>	<b>471</b>	<b>0.06</b>
<b>Sijarira FA</b>	<b>8</b>	<b>1</b>	<b>53</b>	<b>217.1</b>	<b>1</b>	<b>26</b>	<b>0.03</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	23	3	93	92.0	3	45	0.05
<b>Subtotals</b>	<b>23</b>	<b>3</b>	<b>93</b>	<b>92.1</b>	<b>3</b>	<b>45</b>	<b>0.01</b>
<b>Binga CL</b>							
Siabuwa East	18	1	311	224.3	1	59	0.01
Lusulu	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>18</b>	<b>1</b>	<b>311</b>	<b>224.3</b>	<b>1</b>	<b>59</b>	<b>0.01</b>
<b>Kariba CL</b>							
Sampakaruma	140	17	1058	48.6	72	208	0.14
Negande	45	6	283	80.1	9	81	0.06
Sibilobilo	74	7	811	84.3	12	136	0.1
Mapongolas	23	4	100	95.5	4	45	0.06
Gatche Gatche	12	2	150	238.7	2	41	0.17
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>293</b>	<b>36</b>	<b>2402</b>	<b>33.6</b>	<b>195</b>	<b>392</b>	<b>0.09</b>
<b>All Communal Lands</b>	<b>335</b>	<b>40</b>	<b>2805</b>	<b>31.7</b>	<b>229</b>	<b>441</b>	<b>0.04</b>
<b>Totals</b>	<b>697</b>	<b>94</b>	<b>6297</b>	<b>22.6</b>	<b>539</b>	<b>854</b>	<b>0.04</b>

**Table 13. Elephant carcass ratios in the Sebungwe**

<b>Stratum</b>	<b>1+2 carcass ratio (elephant carcasses in age category 1 or 2)</b>	<b>All-carcass ratio (all elephant carcasses)</b>	<b>All-carcass ratio (all elephant carcasses and unidentified carcasses)</b>
<b>Chizarira NP</b>			
Busi	0.00	10.9	17.2
Chizarira West	20.07	80.6	85.0
Chizarira East	2.94	34.0	45.9
<b>Entire NP</b>	<b>2.85</b>	<b>35.9</b>	<b>45.6</b>
<b>Matusadona NP</b>			
Matusadona East	0.00	20.2	21.2
Matusadona West	0.00	5.9	5.9
Matusadona Hills	0.00	7.1	7.1
<b>Entire NP</b>	<b>0.00</b>	<b>14.6</b>	<b>15.2</b>
<b>Chirisa SA</b>			
Chirisa Gadzi	0.00	36.5	41.2
Chirisa Sengwa	11.03	70.2	74.0
SWRA	5.27	23.6	27.0
<b>Entire SA</b>	<b>4.29</b>	<b>31.4</b>	<b>35.6</b>
<b>Chete SA</b>			
Chete East	0.00	37.5	44.4
Chete West	0.00	21.7	25.7
<b>Entire SA</b>	<b>0.00</b>	<b>25.0</b>	<b>29.9</b>
<b>P&amp;W Estate</b>	<b>2.55</b>	<b>28.9</b>	<b>34.5</b>
<b>Sijarira FA</b>	<b>0.00</b>	<b>80.4</b>	<b>82.2</b>
<b>North Gokwe CL</b>			
Chireya South	-	-	-
Chireya North	-	-	-
Simchembo	-	-	-
Nenyunga	-	100.0	100.0
<b>All North Gokwe CL</b>	<b>-</b>	<b>100.0</b>	<b>100.0</b>
<b>Binga CL</b>			
Siabuwa West	0.00	25.0	36.4
Siabuwa East	-	100.0	100.0
Lusulu	-	-	-
Mwenda	0.00	0.0	0.0
<b>All Binga CL</b>	<b>0.00</b>	<b>41.8</b>	<b>48.1</b>
<b>Kariba CL</b>			
Sampakaruma	0.00	22.5	45.6
Negande	-	-	100.0
Sibilobilo	0.00	16.7	47.4
Mapongolas	-	100.0	100.0
Gatche Gatche	0.00	33.6	60.3
Kanyati Highlands	0.00	0.0	0.0
<b>All Kariba CL</b>	<b>0.00</b>	<b>24.8</b>	<b>51.0</b>
<b>All Communal Lands</b>	<b>0.00</b>	<b>32.2</b>	<b>53.4</b>
<b>Sebungwe</b>	<b>2.17</b>	<b>30.2</b>	<b>38.9</b>



Map 11. Distribution of buffalo in the Sebungwe during 2014



Map 12. Distribution of zebra in the Sebungwe during 2014

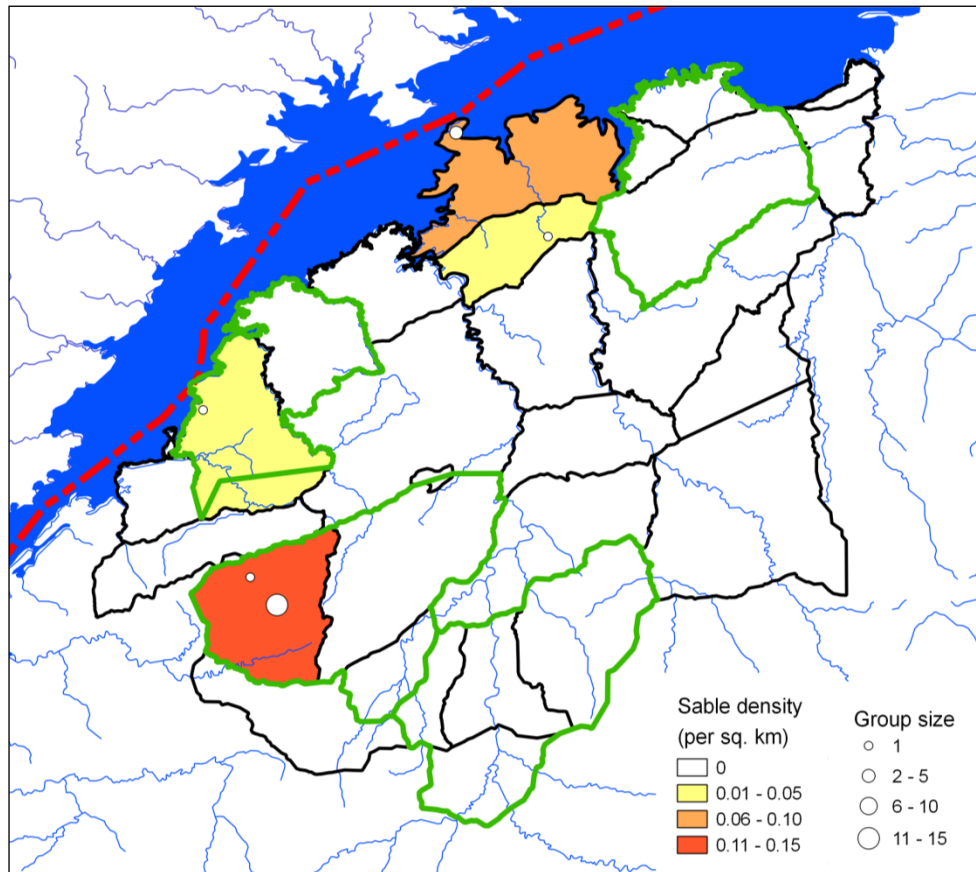
**Table 14. Population estimates and statistics for Buffalo in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	1257	182	505163	121.3	182	2781	1.84
Chizarira East	41	5	889	163.5	5	107	0.04
<b>Subtotals</b>	<b>1297</b>	<b>187</b>	<b>506052</b>	<b>117.6</b>	<b>187</b>	<b>2823</b>	<b>0.62</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	430	85	134028	187.3	85	1236	3.71
Matusadona Hills	322	96	22308	103.3	96	655	0.32
<b>Subtotals</b>	<b>752</b>	<b>181</b>	<b>156335</b>	<b>112.7</b>	<b>181</b>	<b>1600</b>	<b>0.55</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	328	54	65646	166.4	54	874	0.79
SWRA	572	108	67233	97.2	108	1129	1.53
<b>Subtotals</b>	<b>900</b>	<b>162</b>	<b>132878</b>	<b>82.9</b>	<b>162</b>	<b>1647</b>	<b>0.59</b>
<b>Chete SA</b>							
Chete East	284	29	47561	177.1	29	787	0.57
Chete West	111	14	7598	166.5	14	296	0.15
<b>Subtotals</b>	<b>395</b>	<b>43</b>	<b>55159</b>	<b>132.5</b>	<b>43</b>	<b>918</b>	<b>0.32</b>
<b>P&amp;W Estate</b>	<b>3345</b>	<b>573</b>	<b>850424</b>	<b>56.0</b>	<b>1471</b>	<b>5219</b>	<b>0.54</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	23	3	480	209.0	3	72	0.05
<b>Subtotals</b>	<b>23</b>	<b>3</b>	<b>480</b>	<b>209.0</b>	<b>3</b>	<b>72</b>	<b>0.01</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	239	29	21751	129.3	29	547	0.24
Negande	0	0	0	0.0	0	0	0
Sibilobilo	158	15	25163	219.1	15	503	0.21
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>396</b>	<b>44</b>	<b>46914</b>	<b>111.9</b>	<b>44</b>	<b>840</b>	<b>0.12</b>
<b>All Communal Lands</b>	<b>420</b>	<b>47</b>	<b>47393</b>	<b>106.2</b>	<b>47</b>	<b>866</b>	<b>0.05</b>
<b>Totals</b>	<b>3765</b>	<b>620</b>	<b>897818</b>	<b>51.0</b>	<b>1847</b>	<b>5683</b>	<b>0.24</b>

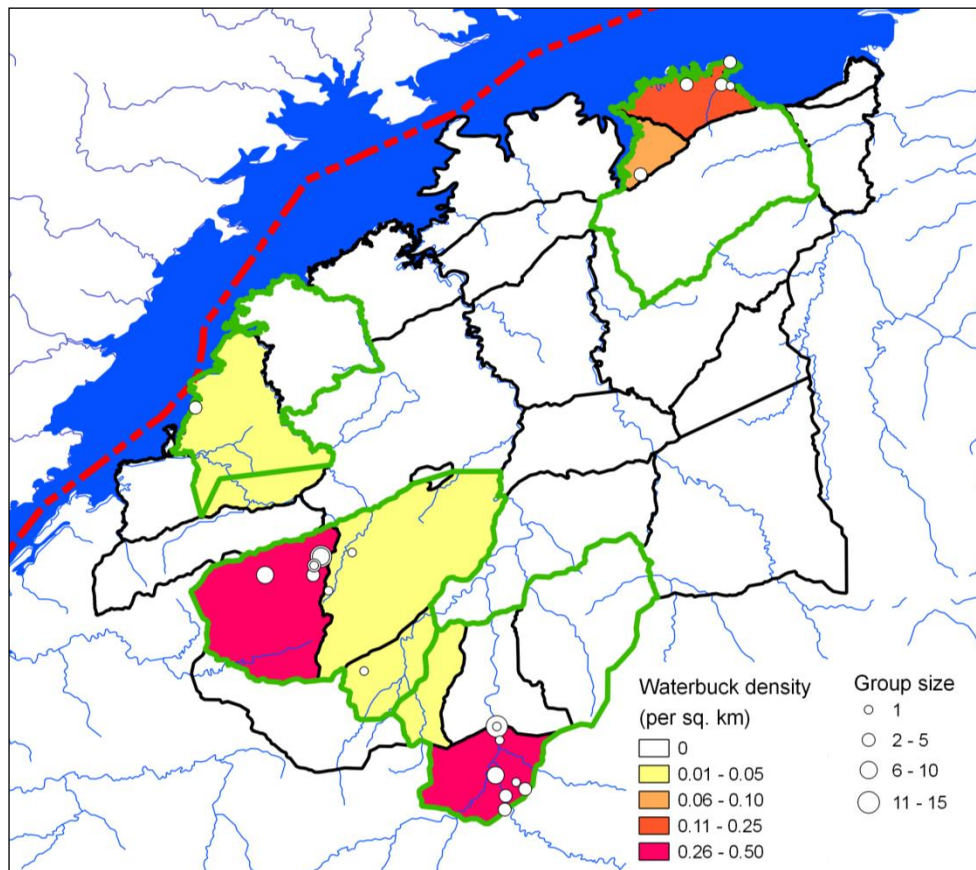


**Table 15. Population estimates and statistics for Zebra in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	57	7	926	119.2	7	125	0.06
<b>Subtotals</b>	<b>57</b>	<b>7</b>	<b>926</b>	<b>119.2</b>	<b>7</b>	<b>125</b>	<b>0.03</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	59	20	1106	126.5	20	133	0.06
<b>Subtotals</b>	<b>59</b>	<b>20</b>	<b>1106</b>	<b>126.5</b>	<b>20</b>	<b>133</b>	<b>0.04</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	66	9	2364	154.9	9	168	0.09
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	138	26	5156	111.8	26	292	0.37
<b>Subtotals</b>	<b>204</b>	<b>35</b>	<b>7519</b>	<b>87.7</b>	<b>35</b>	<b>382</b>	<b>0.13</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	40	5	1387	199.2	5	119	0.05
<b>Subtotals</b>	<b>40</b>	<b>5</b>	<b>1387</b>	<b>199.1</b>	<b>5</b>	<b>119</b>	<b>0.03</b>
<b>P&amp;W Estate</b>	<b>359</b>	<b>67</b>	<b>10938</b>	<b>58.6</b>	<b>148</b>	<b>569</b>	<b>0.06</b>
<b>Sijarira FA</b>	<b>25</b>	<b>3</b>	<b>509</b>	<b>224.1</b>	<b>3</b>	<b>80</b>	<b>0.09</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	58	7	2979	198.3	7	172	0.06
Negande	0	0	0	0.0	0	0	0
Sibilobilo	63	6	4315	226.8	6	206	0.09
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>121</b>	<b>13</b>	<b>7293</b>	<b>145.4</b>	<b>13</b>	<b>296</b>	<b>0.04</b>
<b>All Communal Lands</b>	<b>121</b>	<b>13</b>	<b>7293</b>	<b>145.4</b>	<b>13</b>	<b>296</b>	<b>0.01</b>
<b>Totals</b>	<b>504</b>	<b>83</b>	<b>18741</b>	<b>54.1</b>	<b>232</b>	<b>777</b>	<b>0.03</b>



**Map 13.** Distribution of sable in the Sebungwe during 2014



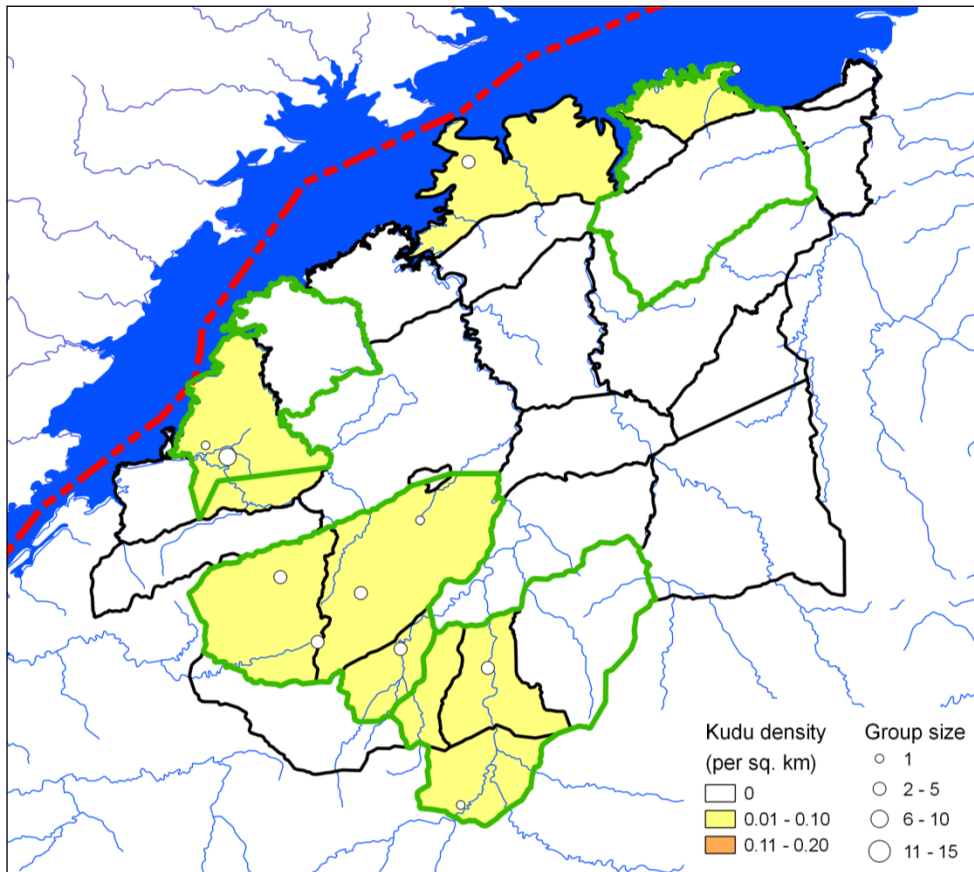
**Map 14.** Distribution of waterbuck in the Sebungwe during 2014

**Table 16. Population estimates and statistics for Sable in the Sebungwe**

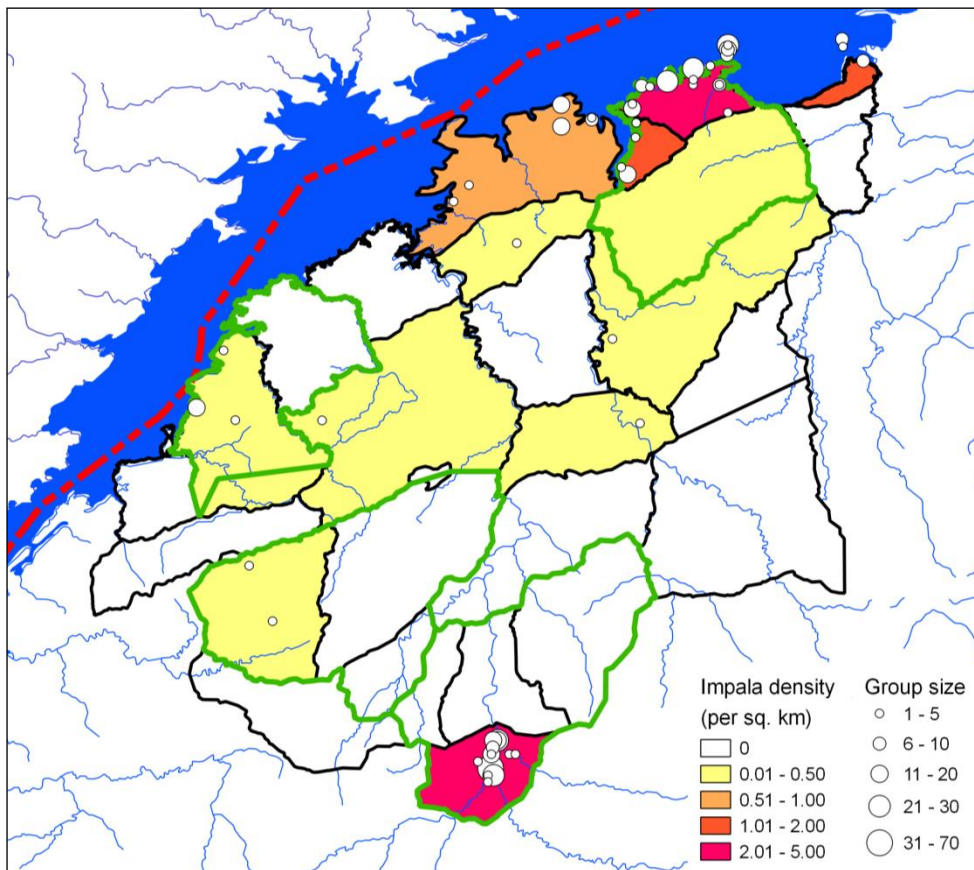
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	83	12	5927	199.3	12	248	0.12
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>83</b>	<b>12</b>	<b>5927</b>	<b>199.3</b>	<b>12</b>	<b>248</b>	<b>0.04</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	8	1	55	199.2	1	24	0.01
<b>Subtotals</b>	<b>8</b>	<b>1</b>	<b>55</b>	<b>199.1</b>	<b>1</b>	<b>24</b>	<b>0.01</b>
<b>P&amp;W Estate</b>	<b>91</b>	<b>13</b>	<b>5982</b>	<b>182.7</b>	<b>13</b>	<b>257</b>	<b>0.01</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	63	6	4026	219.1	6	201	0.09
Mapongolas	6	1	22	177.4	1	16	0.02
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>69</b>	<b>7</b>	<b>4048</b>	<b>201.4</b>	<b>7</b>	<b>207</b>	<b>0.02</b>
<b>All Communal Lands</b>	<b>69</b>	<b>7</b>	<b>4048</b>	<b>201.4</b>	<b>7</b>	<b>207</b>	<b>0.01</b>
<b>Totals</b>	<b>160</b>	<b>20</b>	<b>10030</b>	<b>129.0</b>	<b>20</b>	<b>365</b>	<b>0.01</b>

**Table 17 Population estimates and statistics for Waterbuck in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	5	1	23	198.8	1	15	0.01
Chizarira West	283	41	34823	141.4	41	683	0.41
Chizarira East	16	2	116	147.3	2	40	0.02
<b>Subtotals</b>	<b>305</b>	<b>44</b>	<b>34962</b>	<b>131.7</b>	<b>44</b>	<b>706</b>	<b>0.15</b>
<b>Matusadona NP</b>							
Matusadona East	55	10	719	103.2	10	112	0.22
Matusadona West	10	2	67	178.0	2	28	0.09
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>65</b>	<b>12</b>	<b>786</b>	<b>90.3</b>	<b>12</b>	<b>124</b>	<b>0.05</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	148	28	4218	93.9	28	288	0.40
<b>Subtotals</b>	<b>148</b>	<b>28</b>	<b>4218</b>	<b>93.9</b>	<b>28</b>	<b>288</b>	<b>0.10</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	32	4	887	199.2	4	95	0.04
<b>Subtotals</b>	<b>32</b>	<b>4</b>	<b>887</b>	<b>199.1</b>	<b>4</b>	<b>95</b>	<b>0.03</b>
<b>P&amp;W Estate</b>	<b>550</b>	<b>88</b>	<b>40853</b>	<b>77.2</b>	<b>125</b>	<b>974</b>	<b>0.09</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>All Communal Lands</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Totals</b>	<b>550</b>	<b>88</b>	<b>40853</b>	<b>77.2</b>	<b>125</b>	<b>974</b>	<b>0.04</b>



**Map 15.** Distribution of kudu in the Sebungwe during 2014



**Map 16.** Distribution of impala in the Sebungwe during 2014

**Table 18. Population estimates and statistics for Kudu in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	16	3	201	194.4	3	46	0.03
Chizarira West	35	5	593	151.2	5	87	0.05
Chizarira East	33	4	538	158.9	4	84	0.03
<b>Subtotals</b>	<b>83</b>	<b>12</b>	<b>1331</b>	<b>90.1</b>	<b>12</b>	<b>157</b>	<b>0.04</b>
<b>Matusadona NP</b>							
Matusadona East	6	1	30	209.3	1	17	0.02
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>6</b>	<b>1</b>	<b>30</b>	<b>209.3</b>	<b>1</b>	<b>17</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	18	3	267	191.2	3	53	0.04
SWRA	5	1	20	182.2	1	15	0.01
<b>Subtotals</b>	<b>24</b>	<b>4</b>	<b>288</b>	<b>152.1</b>	<b>4</b>	<b>59</b>	<b>0.02</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	55	7	1842	164.0	7	146	0.07
<b>Subtotals</b>	<b>55</b>	<b>7</b>	<b>1842</b>	<b>163.9</b>	<b>7</b>	<b>146</b>	<b>0.04</b>
<b>P&amp;W Estate</b>	<b>167</b>	<b>24</b>	<b>3490</b>	<b>71.3</b>	<b>48</b>	<b>286</b>	<b>0.03</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	21	2	475	225.8	2	69	0.03
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>21</b>	<b>2</b>	<b>475</b>	<b>225.8</b>	<b>2</b>	<b>69</b>	<b>0.01</b>
<b>All Communal Lands</b>	<b>21</b>	<b>2</b>	<b>475</b>	<b>225.8</b>	<b>2</b>	<b>69</b>	<b>0.002</b>
<b>Totals</b>	<b>188</b>	<b>26</b>	<b>3965</b>	<b>67.1</b>	<b>62</b>	<b>314</b>	<b>0.01</b>

**Table 19. Population estimates and statistics for Eland in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	26	5	312	142.9	5	64	0.07
<b>Subtotals</b>	<b>26</b>	<b>5</b>	<b>312</b>	<b>142.9</b>	<b>5</b>	<b>64</b>	<b>0.02</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>P&amp;W Estate</b>	<b>26</b>	<b>5</b>	<b>312</b>	<b>142.9</b>	<b>5</b>	<b>64</b>	<b>0.00</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>All Communal Lands</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Totals</b>	<b>26</b>	<b>5</b>	<b>312</b>	<b>142.9</b>	<b>5</b>	<b>64</b>	<b>0.002</b>

**Table 20. Population estimates and statistics for Impala in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	28	4	362	147.9	4	68	0.04
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>28</b>	<b>4</b>	<b>362</b>	<b>147.8</b>	<b>4</b>	<b>68</b>	<b>0.01</b>
<b>Matusadona NP</b>							
Matusadona East	1008	183	143011	79.6	206	1809	4.11
Matusadona West	127	25	4413	115.6	25	273	1.09
Matusadona Hills	6	2	30	222.8	2	18	0.005
<b>Subtotals</b>	<b>1140</b>	<b>210</b>	<b>147455</b>	<b>71.4</b>	<b>326</b>	<b>1954</b>	<b>0.83</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	1113	210	157434	76.5	262	1964	2.98
<b>Subtotals</b>	<b>1113</b>	<b>210</b>	<b>157434</b>	<b>76.5</b>	<b>262</b>	<b>1964</b>	<b>0.73</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	151	19	12582	157.9	19	388	0.2
<b>Subtotals</b>	<b>151</b>	<b>19</b>	<b>12582</b>	<b>157.9</b>	<b>19</b>	<b>388</b>	<b>0.12</b>
<b>P&amp;W Estate</b>	<b>2431</b>	<b>443</b>	<b>317834</b>	<b>47.2</b>	<b>1284</b>	<b>3578</b>	<b>0.39</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	8	1	51	205.2	1	24	0.02
<b>Subtotals</b>	<b>8</b>	<b>1</b>	<b>51</b>	<b>205.2</b>	<b>1</b>	<b>24</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	73	4	5533	236.6	4	244	0.06
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>73</b>	<b>4</b>	<b>5533</b>	<b>236.6</b>	<b>4</b>	<b>244</b>	<b>0.03</b>
<b>Kariba CL</b>							
Sampakaruma	8	1	54	187.2	1	24	0.01
Negande	0	0	0	0.0	0	0	0
Sibilobilo	484	46	100926	143.1	46	1176	0.66
Mapongolas	6	1	23	182.8	1	16	0.02
Gatche Gatche	134	22	7388	152.2	22	337	1.83
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>631</b>	<b>70</b>	<b>108391</b>	<b>112.6</b>	<b>70</b>	<b>1343</b>	<b>0.20</b>
<b>All Communal Lands</b>	<b>712</b>	<b>75</b>	<b>113975</b>	<b>101.1</b>	<b>75</b>	<b>1431</b>	<b>0.08</b>
<b>Totals</b>	<b>3142</b>	<b>518</b>	<b>431809</b>	<b>42.1</b>	<b>1820</b>	<b>4464</b>	<b>0.20</b>



**Table 21. Population estimates and statistics for Hippopotamus in the Sebungwe**

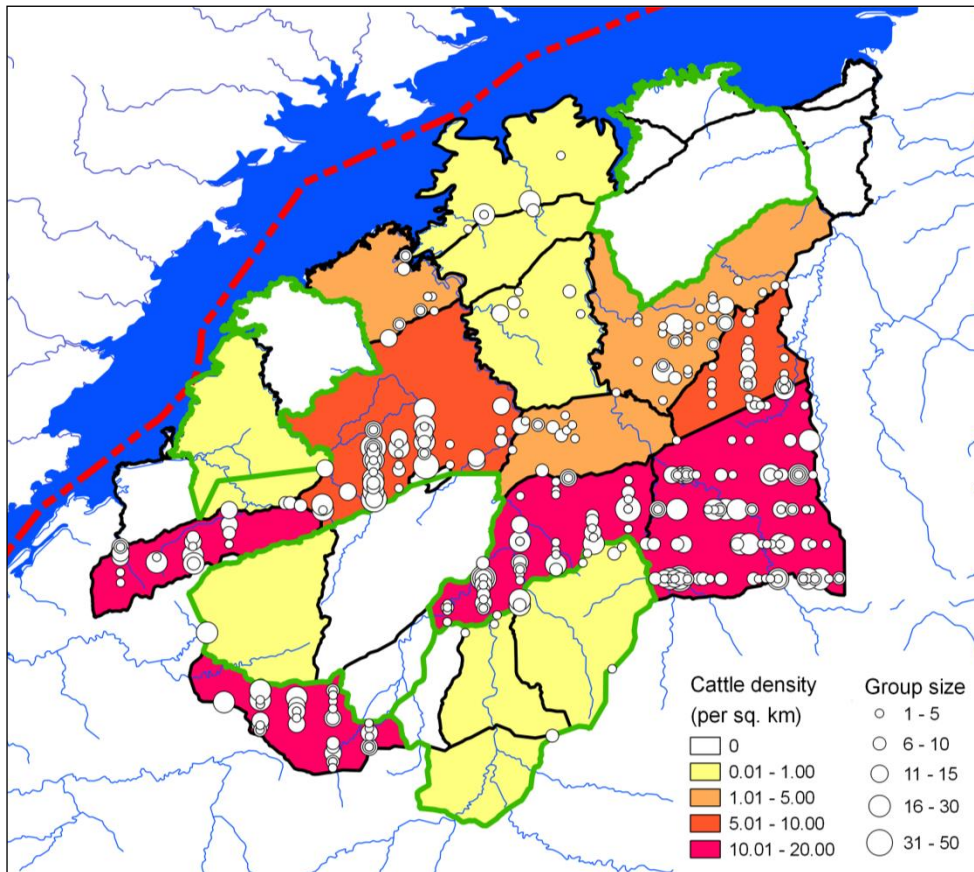
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Matusadona NP</b>							
Matusadona East	303	55	21902	103.6	55	617	1.24
Matusadona West	101	20	1858	93.7	20	196	0.87
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>404</b>	<b>75</b>	<b>23760</b>	<b>80.2</b>	<b>80</b>	<b>728</b>	<b>0.30</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>P&amp;W Estate</b>	<b>404</b>	<b>75</b>	<b>23760</b>	<b>80.2</b>	<b>80</b>	<b>728</b>	<b>0.06</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	106	11	8774	203.6	11	322	0.25
<b>Subtotals</b>	<b>106</b>	<b>11</b>	<b>8774</b>	<b>203.6</b>	<b>11</b>	<b>322</b>	<b>0.04</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	137	13	6063	124.1	13	306	0.19
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	18	3	338	238.7	3	62	0.25
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>155</b>	<b>16</b>	<b>6401</b>	<b>111.5</b>	<b>16</b>	<b>328</b>	<b>0.05</b>
<b>All Communal Lands</b>	<b>261</b>	<b>27</b>	<b>15175</b>	<b>99.1</b>	<b>27</b>	<b>520</b>	<b>0.03</b>
<b>Totals</b>	<b>665</b>	<b>102</b>	<b>38935</b>	<b>60.2</b>	<b>265</b>	<b>1066</b>	<b>0.04</b>

**Table 22. Population estimates and statistics for Warthog in the Sebungwe**

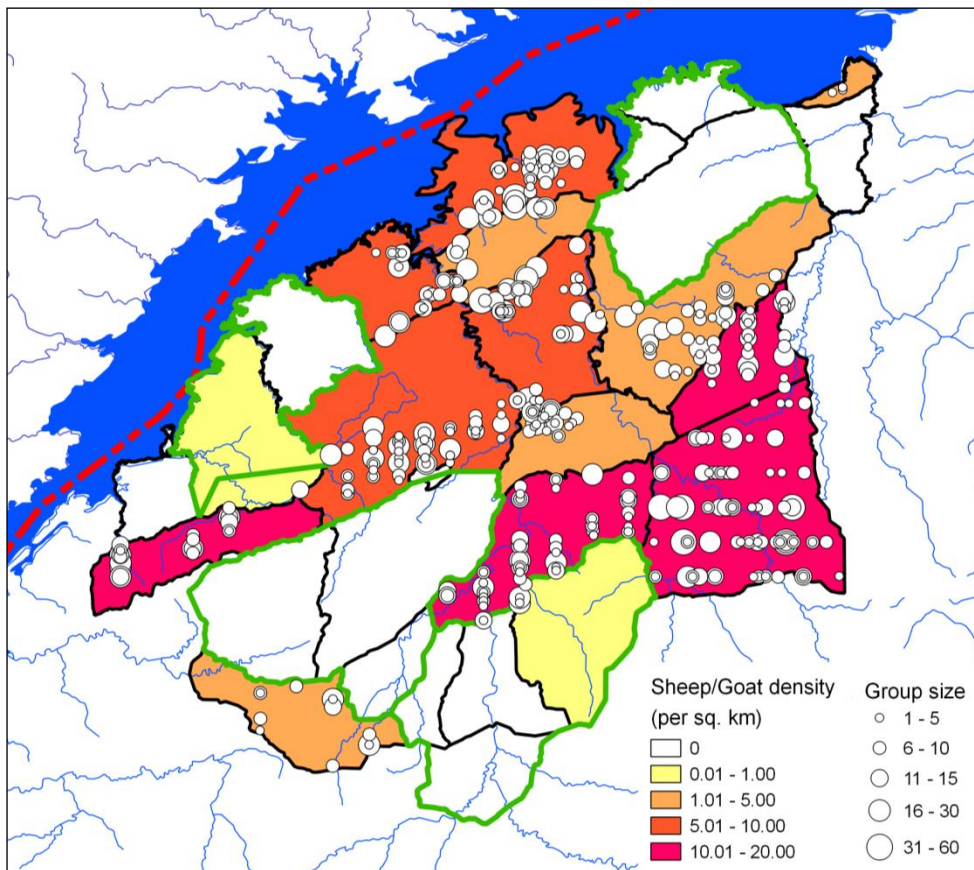
Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	48	7	922	134.8	7	113	0.07
Chizarira East	41	5	1589	218.6	5	129	0.04
<b>Subtotals</b>	<b>89</b>	<b>12</b>	<b>2512</b>	<b>117.5</b>	<b>12</b>	<b>194</b>	<b>0.04</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	29	9	268	124.3	9	66	0.03
<b>Subtotals</b>	<b>29</b>	<b>9</b>	<b>268</b>	<b>124.3</b>	<b>9</b>	<b>66</b>	<b>0.02</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	74	14	1283	103.6	14	151	0.20
<b>Subtotals</b>	<b>74</b>	<b>14</b>	<b>1283</b>	<b>103.5</b>	<b>14</b>	<b>151</b>	<b>0.05</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	32	4	931	203.9	4	96	0.04
<b>Subtotals</b>	<b>32</b>	<b>4</b>	<b>931</b>	<b>203.9</b>	<b>4</b>	<b>96</b>	<b>0.03</b>
<b>P&amp;W Estate</b>	<b>224</b>	<b>39</b>	<b>4994</b>	<b>63.3</b>	<b>82</b>	<b>366</b>	<b>0.04</b>
<b>Sijarira FA</b>	<b>25</b>	<b>3</b>	<b>471</b>	<b>215.5</b>	<b>3</b>	<b>78</b>	<b>0.09</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	63	6	4146	222.3	6	203	0.09
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	18	3	238	200.1	3	55	0.25
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>81</b>	<b>9</b>	<b>4384</b>	<b>175.9</b>	<b>9</b>	<b>224</b>	<b>0.03</b>
<b>All Communal Lands</b>	<b>81</b>	<b>9</b>	<b>4384</b>	<b>175.9</b>	<b>9</b>	<b>224</b>	<b>0.01</b>
<b>Totals</b>	<b>330</b>	<b>51</b>	<b>9848</b>	<b>60.4</b>	<b>131</b>	<b>530</b>	<b>0.02</b>

**Table 23. Population estimates and statistics for Crocodile in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	14	2	200	219.4	2	44	0.02
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>14</b>	<b>2</b>	<b>200</b>	<b>219.4</b>	<b>2</b>	<b>44</b>	<b>0.01</b>
<b>Matusadona NP</b>							
Matusadona East	121	22	3721	106.8	22	250	0.49
Matusadona West	132	26	5021	118.6	26	288	1.13
Matusadona Hills	281	100	79028	222.8	100	907	0.28
<b>Subtotals</b>	<b>534</b>	<b>148</b>	<b>87770</b>	<b>120.9</b>	<b>148</b>	<b>1179</b>	<b>0.39</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	11	2	80	180.8	2	30	0.03
<b>Subtotals</b>	<b>11</b>	<b>2</b>	<b>80</b>	<b>180.8</b>	<b>2</b>	<b>30</b>	<b>0.01</b>
<b>Chete SA</b>							
Chete East	117	12	3828	121.4	12	260	0.23
Chete West	103	13	3601	123.4	13	230	0.14
<b>Subtotals</b>	<b>221</b>	<b>25</b>	<b>7428</b>	<b>81.5</b>	<b>41</b>	<b>400</b>	<b>0.18</b>
<b>P&amp;W Estate</b>	<b>779</b>	<b>177</b>	<b>95478</b>	<b>85.1</b>	<b>177</b>	<b>1441</b>	<b>0.12</b>
<b>Sijarira FA</b>	<b>41</b>	<b>5</b>	<b>858</b>	<b>174.6</b>	<b>5</b>	<b>113</b>	<b>0.16</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	29	3	436	166.5	3	77	0.07
<b>Subtotals</b>	<b>29</b>	<b>3</b>	<b>436</b>	<b>166.5</b>	<b>3</b>	<b>77</b>	<b>0.011</b>
<b>Kariba CL</b>							
Sampakaruma	8	1	58	192.9	1	24	0.01
Negande	0	0	0	0.0	0	0	0
Sibilobilo	295	28	9341	71.5	84	505	0.40
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	43	7	813	158.6	7	110	0.58
Kanyati Highlands	6	1	8	115.0	1	13	0.02
<b>Subtotals</b>	<b>351</b>	<b>37</b>	<b>10219</b>	<b>61.7</b>	<b>135</b>	<b>568</b>	<b>0.11</b>
<b>All Communal Lands</b>	<b>380</b>	<b>40</b>	<b>10655</b>	<b>57.8</b>	<b>160</b>	<b>600</b>	<b>0.04</b>
<b>Totals</b>	<b>1200</b>	<b>222</b>	<b>106991</b>	<b>57.5</b>	<b>510</b>	<b>1890</b>	<b>0.08</b>



Map 17. Distribution of cattle in the Sebungwe during 2014



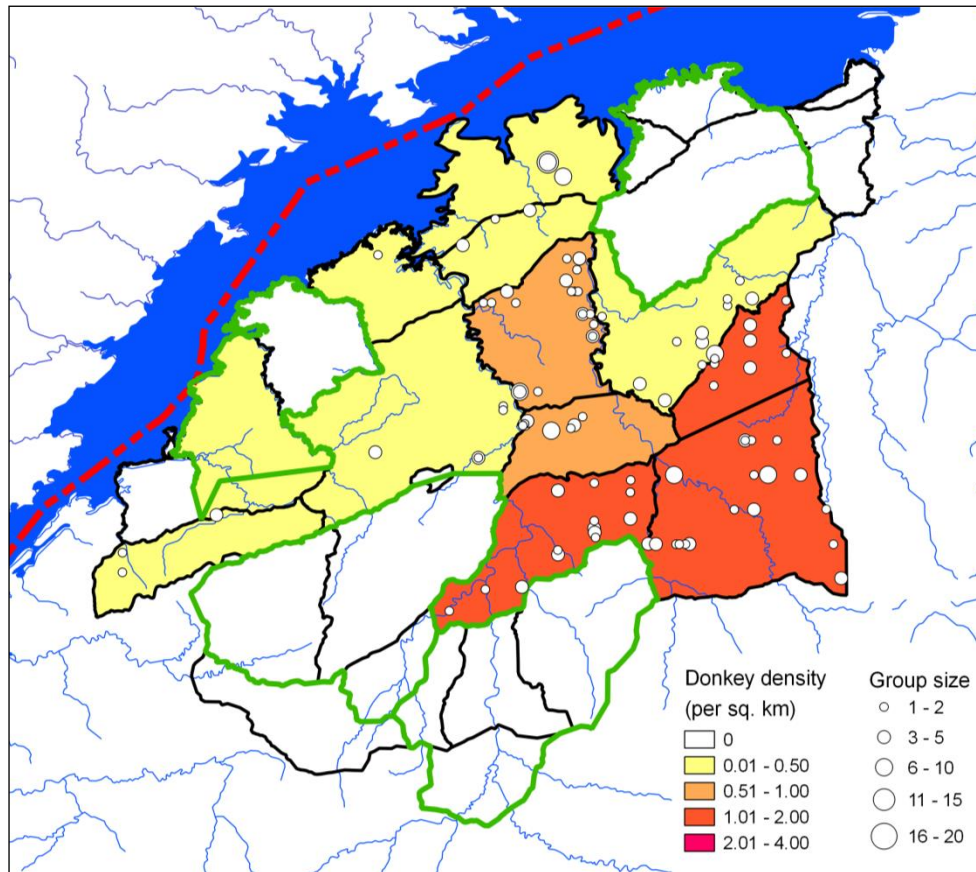
Map 18. Distribution of sheep and goats in the Sebungwe during 2014

**Table 24. Population estimates and statistics for Cattle in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	124	18	16023	218.5	18	396	0.18
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>124</b>	<b>18</b>	<b>16023</b>	<b>218.4</b>	<b>18</b>	<b>396</b>	<b>0.06</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	139	19	6024	117.1	19	302	0.19
Chirisa Sengwa	49	8	775	122.1	8	108	0.12
SWRA	42	8	1411	190.0	8	123	0.11
<b>Subtotals</b>	<b>230</b>	<b>35</b>	<b>8210</b>	<b>80.4</b>	<b>45</b>	<b>415</b>	<b>0.15</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	230	29	20469	131.9	29	533	0.31
<b>Subtotals</b>	<b>230</b>	<b>29</b>	<b>20469</b>	<b>131.9</b>	<b>29</b>	<b>533</b>	<b>0.19</b>
<b>P&amp;W Estate</b>	<b>584</b>	<b>82</b>	<b>44702</b>	<b>73.0</b>	<b>158</b>	<b>1011</b>	<b>0.09</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	23152	929	30934470	61.8	8853	37452	16.74
Chireya North	3990	168	851931	73.6	1053	6927	9.28
Simchembo	14326	542	12528836	63.5	5225	23426	18.18
Nenyunga	747	96	54991	69.9	224	1269	1.51
<b>Subtotals</b>	<b>42214</b>	<b>1735</b>	<b>44370228</b>	<b>36.4</b>	<b>26854</b>	<b>57575</b>	<b>13.64</b>
<b>Binga CL</b>							
Siabuwa West	5181	204	2166317	73.0	1397	8965	10.77
Siabuwa East	11909	657	30000141	106.1	657	24539	9.2
Lusulu	9817	384	4814765	57.5	4175	15458	18.28
Mwenda	588	61	33731	72.0	165	1012	1.38
<b>Subtotals</b>	<b>27495</b>	<b>1306</b>	<b>37014954</b>	<b>48.7</b>	<b>14104</b>	<b>40886</b>	<b>10.04</b>
<b>Kariba CL</b>							
Sampakaruma	1490	181	171938	58.3	622	2358	1.50
Negande	358	48	27355	98.5	48	710	0.50
Sibilobilo	463	44	73202	127.4	44	1052	0.63
Mapongolas	34	6	871	188.1	6	98	0.09
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>2345</b>	<b>279</b>	<b>273366</b>	<b>45.2</b>	<b>1284</b>	<b>3405</b>	<b>0.73</b>
<b>All Communal Lands</b>	<b>72054</b>	<b>3320</b>	<b>81658547</b>	<b>26.2</b>	<b>53141</b>	<b>90968</b>	<b>7.98</b>
<b>Totals</b>	<b>72639</b>	<b>3402</b>	<b>81703249</b>	<b>26.0</b>	<b>53720</b>	<b>91558</b>	<b>4.68</b>

**Table 25. Population estimates and statistics for Sheep and Goats in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	59	8	2989	195.9	8	173	0.08
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>59</b>	<b>8</b>	<b>2989</b>	<b>195.9</b>	<b>8</b>	<b>173</b>	<b>0.04</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	254	32	25702	134.0	32	594	0.34
<b>Subtotals</b>	<b>254</b>	<b>32</b>	<b>25702</b>	<b>134.0</b>	<b>32</b>	<b>594</b>	<b>0.20</b>
<b>P&amp;W Estate</b>	<b>312</b>	<b>40</b>	<b>28691</b>	<b>113.5</b>	<b>40</b>	<b>667</b>	<b>0.05</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	21931	880	14327100	44.4	12200	31663	15.86
Chireya North	6008	253	3390080	97.5	253	11867	13.97
Simchembo	14881	563	6068241	42.6	8547	21214	18.88
Nenyunga	1509	194	593986	113.8	194	3227	3.05
<b>Subtotals</b>	<b>44329</b>	<b>1890</b>	<b>24379407</b>	<b>24.5</b>	<b>33462</b>	<b>55197</b>	<b>14.32</b>
<b>Binga CL</b>							
Siabuwa West	7721	304	9183231	100.9	304	15512	16.05
Siabuwa East	9335	515	3662641	47.3	4922	13748	7.21
Lusulu	2608	102	880920	92.5	195	5021	4.86
Mwenda	2199	228	134111	38.4	1355	3044	5.17
<b>Subtotals</b>	<b>21863</b>	<b>1149</b>	<b>13860903</b>	<b>37.9</b>	<b>13567</b>	<b>30158</b>	<b>7.98</b>
<b>Kariba CL</b>							
Sampakaruma	2889	351	594669	55.9	1275	4503	2.92
Negande	4041	542	1144339	56.4	1761	6320	5.67
Sibilobilo	5239	498	2991606	71.9	1470	9007	7.11
Mapongolas	1014	178	120551	74.6	258	1771	2.69
Gatche Gatche	85	14	5221	201.0	14	256	1.16
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>13268</b>	<b>1583</b>	<b>4856387</b>	<b>34.1</b>	<b>8746</b>	<b>17789</b>	<b>4.15</b>
<b>All Communal Lands</b>	<b>79460</b>	<b>4622</b>	<b>43096697</b>	<b>17.0</b>	<b>65939</b>	<b>92980</b>	<b>8.80</b>
<b>Totals</b>	<b>79772</b>	<b>4662</b>	<b>43125388</b>	<b>17.0</b>	<b>66247</b>	<b>93297</b>	<b>5.14</b>



**Map 19.** Distribution of donkeys in the Sebungwe during 2014

**Table 26. Population estimates and statistics for Donkey in the Sebungwe**

Stratum	Estimate	No. Seen	Variance	% CI	Lower CL	Upper CL	Density (km <sup>2</sup> )
<b>Chizarira NP</b>							
Busi	0	0	0	0.0	0	0	0
Chizarira West	0	0	0	0.0	0	0	0
Chizarira East	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Matusadona NP</b>							
Matusadona East	0	0	0	0.0	0	0	0
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	0	0	0	0.0	0	0	0
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Chete SA</b>							
Chete East	0	0	0	0.0	0	0	0
Chete West	24	3	553	209.7	3	74	0.03
<b>Subtotals</b>	<b>24</b>	<b>3</b>	<b>553</b>	<b>209.7</b>	<b>3</b>	<b>74</b>	<b>0.02</b>
<b>P&amp;W Estate</b>	<b>24</b>	<b>3</b>	<b>553</b>	<b>209.7</b>	<b>3</b>	<b>74</b>	<b>0.004</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	1520	61	173462	70.4	449	2591	1.10
Chireya North	499	21	47654	139.3	21	1193	1.16
Simchembo	1084	41	110191	78.8	230	1937	1.38
Nenyunga	288	37	32123	138.7	37	687	0.58
<b>Subtotals</b>	<b>3390</b>	<b>160</b>	<b>363430</b>	<b>38.1</b>	<b>2097</b>	<b>4683</b>	<b>1.10</b>
<b>Binga CL</b>							
Siabuwa West	102	4	8748	236.7	4	342	0.21
Siabuwa East	236	13	13787	114.9	13	506	0.18
Lusulu	0	0	0	0.0	0	0	0
Mwenda	19	2	348	222.9	2	62	0.05
<b>Subtotals</b>	<b>357</b>	<b>19</b>	<b>22882</b>	<b>91.7</b>	<b>30</b>	<b>683</b>	<b>0.13</b>
<b>Kariba CL</b>							
Sampakaruma	296	36	8845	66.4	99	493	0.3
Negande	373	50	11711	61.9	142	603	0.52
Sibilobilo	263	25	42603	171.0	25	713	0.36
Mapongolas	51	9	546	99.3	9	102	0.14
Gatche Gatche	0	0	0	0.0	0	0	0
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>983</b>	<b>120</b>	<b>63705</b>	<b>53.0</b>	<b>462</b>	<b>1504</b>	<b>0.31</b>
<b>All Communal Lands</b>	<b>4730</b>	<b>299</b>	<b>450017</b>	<b>29.5</b>	<b>3335</b>	<b>6125</b>	<b>0.52</b>
<b>Totals</b>	<b>4754</b>	<b>302</b>	<b>450571</b>	<b>29.4</b>	<b>3358</b>	<b>6150</b>	<b>0.31</b>



**Table 27. Population estimates and statistics for Ground Hornbill in the Sebungwe**

<b>Stratum</b>	<b>Estimate</b>	<b>No. Seen</b>	<b>Variance</b>	<b>% CI</b>	<b>Lower CL</b>	<b>Upper CL</b>	<b>Density (km<sup>2</sup>)</b>
<b>Chizarira NP</b>							
Busi	21	4	335	188.4	4	60	0.05
Chizarira West	48	7	2420	218.3	7	154	0.07
Chizarira East	98	12	2083	104.3	12	199	0.1
<b>Subtotals</b>	<b>167</b>	<b>23</b>	<b>4839</b>	<b>85.7</b>	<b>24</b>	<b>309</b>	<b>0.08</b>
<b>Matusadona NP</b>							
Matusadona East	6	1	30	212.6	1	17	0.02
Matusadona West	0	0	0	0.0	0	0	0
Matusadona Hills	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>6</b>	<b>1</b>	<b>30</b>	<b>212.6</b>	<b>1</b>	<b>17</b>	<b>0.00</b>
<b>Chirisa SA</b>							
Chirisa Gadzi	22	3	428	197.7	3	65	0.03
Chirisa Sengwa	0	0	0	0.0	0	0	0
SWRA	11	2	80	180.8	2	30	0.03
<b>Subtotals</b>	<b>33</b>	<b>5</b>	<b>508</b>	<b>142.7</b>	<b>5</b>	<b>79</b>	<b>0.02</b>
<b>Chete SA</b>							
Chete East	20	2	394	233.8	2	65	0.04
Chete West	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>20</b>	<b>2</b>	<b>394</b>	<b>233.8</b>	<b>2</b>	<b>65</b>	<b>0.02</b>
<b>P&amp;W Estate</b>	<b>224</b>	<b>31</b>	<b>5771</b>	<b>68.6</b>	<b>70</b>	<b>378</b>	<b>0.04</b>
<b>Sijarira FA</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>North Gokwe CL</b>							
Chireya South	0	0	0	0.0	0	0	0
Chireya North	0	0	0	0.0	0	0	0
Simchembo	0	0	0	0.0	0	0	0
Nenyunga	31	4	822	205.2	4	95	0.06
<b>Subtotals</b>	<b>31</b>	<b>4</b>	<b>822</b>	<b>205.2</b>	<b>4</b>	<b>95</b>	<b>0.01</b>
<b>Binga CL</b>							
Siabuwa West	0	0	0	0.0	0	0	0
Siabuwa East	0	0	0	0.0	0	0	0
Lusulu	0	0	0	0.0	0	0	0
Mwenda	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0.00</b>
<b>Kariba CL</b>							
Sampakaruma	0	0	0	0.0	0	0	0
Negande	0	0	0	0.0	0	0	0
Sibilobilo	0	0	0	0.0	0	0	0
Mapongolas	0	0	0	0.0	0	0	0
Gatche Gatche	6	1	50	275.6	1	23	0.08
Kanyati Highlands	0	0	0	0.0	0	0	0
<b>Subtotals</b>	<b>6</b>	<b>1</b>	<b>50</b>	<b>275.5</b>	<b>1</b>	<b>23</b>	<b>0.002</b>
<b>All Communal Lands</b>	<b>37</b>	<b>5</b>	<b>872</b>	<b>174.7</b>	<b>5</b>	<b>102</b>	<b>0.004</b>
<b>Totals</b>	<b>261</b>	<b>36</b>	<b>6643</b>	<b>62.7</b>	<b>97</b>	<b>425</b>	<b>0.02</b>

### Appendix 1. Calibration of strip width

For each run (i.e. flight over the calibration numbers):

- Strip width (in metres) for one observer = 10 x (1 + Difference between outer and inner);
  - Combined strip width (in metres) at flying height = Left strip width + right strip width; *and*
  - Combined strip width at 300 ft agl<sup>1</sup> = Actual combined strip width x 300 / (Flying height)
- <sup>1</sup> agl: above ground level

For surveys flown on September 11-20:

Calibration flights were flown at Kiplings on 11 September 2014 (runs 1-20), 12 September (runs 21-23), 14 September (runs 24-25) and 17 September (runs 26-27).

Run no.	Left observer: Colum Zhuwau			Right observer: Greg Nyaguse			Combined strip width (m) at flying height	Flying height agl (ft)	Combined strip width (m) when flying at 300 ft
	Outer marker	Inner marker	Strip width (m)	Outer marker	Inner marker	Strip width (m)			
1				21	7	150	-	291	-
2	17	4	140	25	8	180	320	304	316
3	19	5	150	24	8	170	320	307	313
4	21	7	150	19	4	160	310	292	318
5	18	2	170	23	10	140	310	294	316
6	20	6	150	23	7	170	320	295	325
7	17	4	140	20	7	140	280	270	311
8	22	11	120	20	4	170	290	348	250
9	24	8	170	24	7	180	350	336	313
10	22	6	170	24	7	180	350	339	310
11	22	7	160	25	9	170	330	338	293
12	27	12	160	20	3	180	340	336	304
13	24	9	160	21	6	160	320	326	294
14	25	9	170	21	4	180	350	332	316
15	16	3	140	19	7	130	270	207	391
16	18	8	110	15	2	140	250	233	322
17	14	2	130	19	8	120	250	237	316
18	16	7	100	16	4	130	230	224	308
19	14	3	120	19	7	130	250	224	335
20	18	6	130	15	3	130	260	228	342
21	19	5	150	20	7	140	290	295	295
22	23	9	150	27	8	200	350	365	288
23	19	6	140	16	5	120	260	254	307
24	23	9	150	25	5	210	360	344	314
25	17	5	130	21	5	170	300	290	310
26	21	7	150	24	9	160	310	363	256
27	17	8	100	15	6	100	200	261	230
<b>Mean combined strip width (in metres) when flying at 300 feet agl =</b>									<b>307</b>
<b>Standard error of mean combined strip width as a percentage of the mean</b>									<b>1.9</b>

For surveys flown on September 25-28:

Calibration flights were flown at Kiplings on 25 September 2014 (runs 1-10), 26 September (runs 11-18) and 28 September (runs 19-24).

Run no.	Left observer: Colum Zhuwau			Right observer: Greg Nyaguse			Combined strip width (m) at flying height	Flying height agl (ft)	Combined strip width (m) when flying at 300 ft
	Outer marker	Inner marker	Strip width (m)	Outer marker	Inner marker	Strip width (m)			
1	25	11	150	16	2	150	300	296	304
2	21	7	150	23	7	170	320	315	305
3	23	10	140	23	6	180	320	321	299
4	17	6	120	15	5	110	230	244	283
5	19	6	140	22	8	150	290	285	305
6	16	6	110	16	6	110	220	245	269
7	25	9	170	22	7	160	330	352	281
8	22	10	130	25	8	180	310	350	266
9	22	8	150	26	9	180	330	349	284
10	24	8	170	25	9	170	340	358	285
11	24	12	130	22	6	170	300	324	278
12	20	10	110	23	8	160	270	313	259
13	18	9	100	26	8	190	290	298	292
14	20	8	130	21	7	150	280	291	289
15	11	2	100	21	9	130	230	249	277
16	16	7	100	18	5	140	240	249	289
17	22	8	150	23	8	160	310	350	266
18	25	11	150	26	8	190	340	345	296
19	18	7	120	24	9	160	280	320	263
20	21	8	140	22	6	170	310	303	307
21	23	9	150	25	8	180	330	353	280
22	27	12	160	20	5	160	320	358	268
23	17	6	120	16	6	110	230	246	280
24	16	5	120	18	7	120	240	252	286
<b>Mean combined strip width (in metres) when flying at 300 feet agl =</b>									<b>284</b>
<b>Standard error of mean combined strip width as a percentage of the mean</b>									<b>1.0</b>

**Appendix 2. Flight summary for Sebungwe survey**

<b>Date</b>	<b>Time take off</b>	<b>Time land</b>	<b>Flight time (hours)</b>	<b>Duty</b>
11-Jul-14	15:04	16:05	1.02	Supercub positioning, Pedza to Kariba
12-Jul-14	7:37	10:38	3.02	Stratum Kanyati Highlands and Stratum Matusadona High block 35
12-Jul-14	14:47	16:28	1.68	Stratum Matusadona High blocks 31, 30E
13-Jul-14	7:34	10:35	3.02	Stratum Matusadona High blocks 8, 1, 13
14-Jul-14	7:24	9:29	2.08	Stratum Matusadona High blocks 12, 34
14-Jul-14			2.00	Supercub positioning, Kariba to Harare
09-Sep-14			0.90	Cessna 206 positioning, Harare to Kariba
09-Sep-14			0.30	Cessna 206 positioning, Kariba to Kiplings
10-Sep-14	14:53	16:19	1.43	Calibration
11-Sep-14	7:15	10:25	3.17	Calibration, Stratum Matusadona West, Stratum Matusadona East transects 1-11
11-Sep-14	15:11	16:44	1.55	Stratum Matusadona East transects 12-17; Gatche Gatche
12-Sep-14	7:06	9:36	2.50	Stratum Sibilobilo
12-Sep-14	14:53	16:46	1.88	Stratum Mwenda
13-Sep-14	7:11	10:21	3.17	Stratum Sampakaruma
13-Sep-14	14:42	17:00	2.30	Stratum Chete East
14-Sep-14	6:52	9:44	2.87	Stratum Mapongolas; stratum Negande transects 1-7
14-Sep-14	14:48	17:00	2.20	Stratum Negande transects 8-17
16-Sep-14	6:53	10:17	3.40	Stratum Chete West
16-Sep-14	14:42	16:59	2.28	Stratum Nenyunga
17-Sep-14	6:56	10:40	3.73	Stratum Chizarira East
17-Sep-14	14:38	16:39	2.02	Stratum Sijarira
18-Sep-14	6:54	10:37	3.72	Stratum Chizarira West
19-Sep-14	6:50	10:11	3.35	Stratum Busi
20-Sep-14	6:52	9:59	3.12	Stratum Chirisa Sengwa
20-Sep-14	10:09	10:21	0.20	Calibration
20-Sep-14	11:23	12:47	1.4	Positioning, Kiplings to Harare
25-Sep-14	9:35	10:53	1.3	Positioning, Harare to Kiplings
25-Sep-14	14:27	17:32	3.08	Strata Chireya North & Chireya South
26-Sep-14	6:52	10:33	3.68	Stratum Chirisa Gadzi
26-Sep-14	14:49	16:45	1.93	Stratum Simchembo
27-Sep-14	6:50	10:11	3.35	Stratum SWRA
27-Sep-14	14:35	17:06	2.52	Stratum Siabuwa East
28-Sep-14	7:03	9:56	2.88	Strata Siabuwa West & Lusulu
28-Sep-14			0.30	Cessna 206 positioning, Kiplings to Kariba
28-Sep-14			1.20	Cessna 206 positioning, Kariba to Harare
<b>Total</b>			<b>78.55</b>	

### **Appendix 3. Transect start and end points, and lengths**

Degrees and decimal minutes; datum WGS84

#### **Chirisa Gadzi**

Number of transects : 19

Transect Bearing : -45.00 Degrees

Transect Spacing : 2.00 km

Transect # : 1

Start Lat : S 17 : 39.237 Start Lon : E 28 : 27.278  
Finish Lat : S 17 : 40.794 Finish Lon : E 28 : 28.912  
Length : 4.08 km

Transect # : 2

Start Lat : S 17 : 43.174 Start Lon : E 28 : 29.806  
Finish Lat : S 17 : 39.786 Finish Lon : E 28 : 26.251  
Length : 8.87 km

Transect # : 3

Start Lat : S 17 : 39.829 Start Lon : E 28 : 24.694  
Finish Lat : S 17 : 45.269 Finish Lon : E 28 : 30.402  
Length : 14.25 km

Transect # : 4

Start Lat : S 17 : 46.740 Start Lon : E 28 : 30.343  
Finish Lat : S 17 : 40.354 Finish Lon : E 28 : 23.642  
Length : 16.72 km

Transect # : 5

Start Lat : S 17 : 40.840 Start Lon : E 28 : 22.550  
Finish Lat : S 17 : 47.609 Finish Lon : E 28 : 29.652  
Length : 17.73 km

Transect # : 6

Start Lat : S 17 : 48.246 Start Lon : E 28 : 28.717  
Finish Lat : S 17 : 42.244 Finish Lon : E 28 : 22.420  
Length : 15.72 km

Transect # : 7

Start Lat : S 17 : 42.982 Start Lon : E 28 : 21.592  
Finish Lat : S 17 : 49.526 Finish Lon : E 28 : 28.458  
Length : 17.14 km

Transect # : 8

Start Lat : S 17 : 51.058 Start Lon : E 28 : 28.463  
Finish Lat : S 17 : 43.307 Finish Lon : E 28 : 20.330  
Length : 20.30 km

Transect # : 9

Start Lat : S 17 : 43.688 Start Lon : E 28 : 19.127  
Finish Lat : S 17 : 52.191 Finish Lon : E 28 : 28.049  
Length : 22.27 km

Transect # : 10

Start Lat : S 17 : 53.040 Start Lon : E 28 : 27.338  
Finish Lat : S 17 : 44.117 Finish Lon : E 28 : 17.975  
Length : 23.37 km

Transect # : 11

Start Lat : S 17 : 44.136 Start Lon : E 28 : 16.392  
Finish Lat : S 17 : 53.857 Finish Lon : E 28 : 26.592  
Length : 25.46 km

Transect # : 12

Start Lat : S 17 : 54.661 Start Lon : E 28 : 25.833  
Finish Lat : S 17 : 44.961 Finish Lon : E 28 : 15.656  
Length : 25.40 km

Transect # : 13

Start Lat : S 17 : 46.140 Start Lon : E 28 : 15.290  
Finish Lat : S 17 : 55.447 Finish Lon : E 28 : 25.055  
Length : 24.37 km

Transect # : 14

Start Lat : S 17 : 56.956 Start Lon : E 28 : 25.035  
Finish Lat : S 17 : 47.433 Finish Lon : E 28 : 15.044  
Length : 24.94 km

Transect # : 15

Start Lat : S 17 : 48.321 Start Lon : E 28 : 14.374  
Finish Lat : S 17 : 58.458 Finish Lon : E 28 : 25.009  
Length : 26.55 km

Transect # : 16

Start Lat : S 17 : 59.437 Start Lon : E 28 : 24.434  
Finish Lat : S 17 : 49.463 Finish Lon : E 28 : 13.969  
Length : 26.12 km

Transect # : 17

Start Lat : S 17 : 51.471 Start Lon : E 28 : 14.474  
Finish Lat : S 18 : 0.417 Finish Lon : E 28 : 23.860  
Length : 23.43 km

Transect # : 18

Start Lat : S 18 : 1.396 Start Lon : E 28 : 23.285  
Finish Lat : S 17 : 53.030 Finish Lon : E 28 : 14.507  
Length : 21.91 km

Transect # : 19A

Start Lat : S 17 : 54.589 Start Lon : E 28 : 14.540  
Finish Lat : S 17 : 56.684 Finish Lon : E 28 : 16.738  
Length : 5.49 km

Transect # : 19B

Start Lat : S 17 : 57.423 Start Lon : E 28 : 17.514  
Finish Lat : S 17 : 59.563 Finish Lon : E 28 : 19.759  
Length : 5.60 km

Transect # : 19C

Start Lat : S 18 : 0.212 Start Lon : E 28 : 20.440  
Finish Lat : S 18 : 1.376 Finish Lon : E 28 : 21.661  
Length : 3.05 km

**Chirisa Sengwa**

Number of transects : 16  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 1.90 km

Transect # : 1  
Start Lat : S 17 : 48.321 Start Lon : E 28 : 14.374  
Finish Lat : S 17 : 48.321 Finish Lon : E 28 : 12.195  
Length : 3.84 km

Transect # : 2  
Start Lat : S 17 : 49.347 Start Lon : E 28 : 10.950  
Finish Lat : S 17 : 49.347 Finish Lon : E 28 : 14.023  
Length : 5.42 km

Transect # : 3  
Start Lat : S 17 : 50.373 Start Lon : E 28 : 14.120  
Finish Lat : S 17 : 50.373 Finish Lon : E 28 : 8.398  
Length : 10.09 km

Transect # : 4  
Start Lat : S 17 : 51.399 Start Lon : E 28 : 8.146  
Finish Lat : S 17 : 51.399 Finish Lon : E 28 : 14.472  
Length : 11.16 km

Transect # : 5  
Start Lat : S 17 : 52.425 Start Lon : E 28 : 14.494  
Finish Lat : S 17 : 52.425 Finish Lon : E 28 : 7.731  
Length : 11.93 km

Transect # : 6  
Start Lat : S 17 : 53.451 Start Lon : E 28 : 8.237  
Finish Lat : S 17 : 53.451 Finish Lon : E 28 : 14.516  
Length : 11.07 km

Transect # : 7  
Start Lat : S 17 : 54.477 Start Lon : E 28 : 14.537  
Finish Lat : S 17 : 54.477 Finish Lon : E 28 : 8.099  
Length : 11.35 km

Transect # : 8  
Start Lat : S 17 : 55.503 Start Lon : E 28 : 7.605  
Finish Lat : S 17 : 55.503 Finish Lon : E 28 : 14.764  
Length : 12.63 km

Transect # : 9A  
Start Lat : S 17 : 56.529 Start Lon : E 28 : 17.306  
Finish Lat : S 17 : 56.529 Finish Lon : E 28 : 16.847  
Length : 0.81 km

Transect # : 9B  
Start Lat : S 17 : 56.529 Start Lon : E 28 : 16.008  
Finish Lat : S 17 : 56.529 Finish Lon : E 28 : 6.833  
Length : 16.18 km

Transect # : 10  
Start Lat : S 17 : 57.555 Start Lon : E 28 : 6.326  
Finish Lat : S 17 : 57.555 Finish Lon : E 28 : 17.430  
Length : 19.58 km

Transect # : 11  
Start Lat : S 17 : 58.581 Start Lon : E 28 : 17.638  
Finish Lat : S 17 : 58.581 Finish Lon : E 28 : 5.931  
Length : 20.65 km

Transect # : 12  
Start Lat : S 17 : 59.607 Start Lon : E 28 : 5.608  
Finish Lat : S 17 : 59.607 Finish Lon : E 28 : 20.212  
Length : 25.75 km

Transect # : 13  
Start Lat : S 18 : 0.633 Start Lon : E 28 : 20.598  
Finish Lat : S 18 : 0.633 Finish Lon : E 28 : 5.579  
Length : 26.48 km

Transect # : 14A  
Start Lat : S 18 : 1.659 Start Lon : E 28 : 5.684  
Finish Lat : S 18 : 1.659 Finish Lon : E 28 : 11.055  
Length : 9.47 km

Transect # : 14B  
Start Lat : S 18 : 1.659 Start Lon : E 28 : 13.572  
Finish Lat : S 18 : 1.659 Finish Lon : E 28 : 20.845  
Length : 12.83 km

Transect # : 15  
Start Lat : S 18 : 2.685 Start Lon : E 28 : 9.068  
Finish Lat : S 18 : 2.685 Finish Lon : E 28 : 5.976  
Length : 5.45 km

Transect # : 16  
Start Lat : S 18 : 3.711 Start Lon : E 28 : 6.773  
Finish Lat : S 18 : 3.711 Finish Lon : E 28 : 6.861  
Length : 0.15 km

**SWRA**

Number of transects : 15  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 1.50 km

Transect # : 1A  
Start Lat : S 18 : 1.576 Start Lon : E 28 : 13.361  
Finish Lat : S 18 : 1.576 Finish Lon : E 28 : 11.846  
Length : 2.67 km

Transect # : 1B  
Start Lat : S 18 : 1.576 Start Lon : E 28 : 11.728  
Finish Lat : S 18 : 1.576 Finish Lon : E 28 : 11.210  
Length : 0.91 km

Transect # : 2A  
Start Lat : S 18 : 2.386 Start Lon : E 28 : 9.683  
Finish Lat : S 18 : 2.386 Finish Lon : E 28 : 14.383  
Length : 8.28 km

Transect # : 2B  
Start Lat : S 18 : 2.386 Start Lon : E 28 : 18.250  
Finish Lat : S 18 : 2.386 Finish Lon : E 28 : 19.114  
Length : 1.52 km

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Transect # : 3  
Start Lat : S 18 : 3.196 Start Lon : E 28 : 17.997  
Finish Lat : S 18 : 3.196 Finish Lon : E 28 : 8.012  
Length : 17.59 km

Transect # : 4A  
Start Lat : S 18 : 4.006 Start Lon : E 28 : 4.252  
Finish Lat : S 18 : 4.006 Finish Lon : E 28 : 5.602  
Length : 2.38 km

Transect # : 4B  
Start Lat : S 18 : 4.006 Start Lon : E 28 : 6.420  
Finish Lat : S 18 : 4.006 Finish Lon : E 28 : 17.450  
Length : 19.43 km

Transect # : 5  
Start Lat : S 18 : 4.816 Start Lon : E 28 : 17.450  
Finish Lat : S 18 : 4.816 Finish Lon : E 28 : 4.092  
Length : 23.53 km

Transect # : 6  
Start Lat : S 18 : 5.626 Start Lon : E 28 : 4.279  
Finish Lat : S 18 : 5.626 Finish Lon : E 28 : 17.358  
Length : 23.04 km

Transect # : 7  
Start Lat : S 18 : 6.437 Start Lon : E 28 : 16.602  
Finish Lat : S 18 : 6.437 Finish Lon : E 28 : 4.139  
Length : 21.96 km

Transect # : 8  
Start Lat : S 18 : 7.246 Start Lon : E 28 : 4.220  
Finish Lat : S 18 : 7.246 Finish Lon : E 28 : 16.392  
Length : 21.44 km

Transect # : 9  
Start Lat : S 18 : 8.056 Start Lon : E 28 : 16.297  
Finish Lat : S 18 : 8.056 Finish Lon : E 28 : 4.328  
Length : 21.08 km

Transect # : 10  
Start Lat : S 18 : 8.866 Start Lon : E 28 : 3.176  
Finish Lat : S 18 : 8.866 Finish Lon : E 28 : 15.855  
Length : 22.34 km

Transect # : 11  
Start Lat : S 18 : 9.676 Start Lon : E 28 : 15.369  
Finish Lat : S 18 : 9.676 Finish Lon : E 28 : 2.986  
Length : 21.81 km

Transect # : 12  
Start Lat : S 18 : 10.486 Start Lon : E 28 : 3.238  
Finish Lat : S 18 : 10.486 Finish Lon : E 28 : 14.294  
Length : 19.48 km

Transect # : 13  
Start Lat : S 18 : 11.296 Start Lon : E 28 : 13.148  
Finish Lat : S 18 : 11.296 Finish Lon : E 28 : 6.328  
Length : 12.01 km

Transect # : 14  
Start Lat : S 18 : 12.106 Start Lon : E 28 : 7.707  
Finish Lat : S 18 : 12.106 Finish Lon : E 28 : 12.271  
Length : 8.04 km

Transect # : 15  
Start Lat : S 18 : 12.916 Start Lon : E 28 : 11.086  
Finish Lat : S 18 : 12.916 Finish Lon : E 28 : 10.632  
Length : 0.80 km

**Busi**

Number of transects : 16  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 1.60 km

Transect # : 1A  
Start Lat : S 17 : 49.531 Start Lon : E 28 : 8.249  
Finish Lat : S 17 : 51.117 Finish Lon : E 28 : 8.249  
Length : 2.94 km

Transect # : 1B  
Start Lat : S 17 : 53.610 Start Lon : E 28 : 8.249  
Finish Lat : S 17 : 53.619 Finish Lon : E 28 : 8.249  
Length : 0.02 km

Transect # : 2  
Start Lat : S 17 : 55.662 Start Lon : E 28 : 7.341  
Finish Lat : S 17 : 49.299 Finish Lon : E 28 : 7.341  
Length : 11.78 km

Transect # : 3A  
Start Lat : S 17 : 49.469 Start Lon : E 28 : 6.434  
Finish Lat : S 17 : 57.092 Finish Lon : E 28 : 6.434  
Length : 14.12 km

Transect # : 3B  
Start Lat : S 18 : 3.209 Start Lon : E 28 : 6.434  
Finish Lat : S 18 : 3.997 Finish Lon : E 28 : 6.434  
Length : 1.46 km

Transect # : 4A  
Start Lat : S 18 : 3.985 Start Lon : E 28 : 5.527  
Finish Lat : S 18 : 0.394 Finish Lon : E 28 : 5.527  
Length : 6.65 km

Transect # : 4B  
Start Lat : S 17 : 59.832 Start Lon : E 28 : 5.527  
Finish Lat : S 17 : 50.310 Finish Lon : E 28 : 5.527  
Length : 17.63 km

Transect # : 5  
Start Lat : S 17 : 48.549 Start Lon : E 28 : 4.620  
Finish Lat : S 18 : 3.723 Finish Lon : E 28 : 4.620  
Length : 28.10 km

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Transect # : 6  
Start Lat : S 18 : 3.412 Start Lon : E 28 : 3.712  
Finish Lat : S 17 : 47.910 Finish Lon : E 28 : 3.712  
Length : 28.71 km

Transect # : 7  
Start Lat : S 17 : 48.669 Start Lon : E 28 : 2.805  
Finish Lat : S 18 : 3.387 Finish Lon : E 28 : 2.805  
Length : 27.25 km

Transect # : 8  
Start Lat : S 18 : 3.803 Start Lon : E 28 : 1.898  
Finish Lat : S 17 : 49.629 Finish Lon : E 28 : 1.898  
Length : 26.25 km

Transect # : 9  
Start Lat : S 17 : 50.368 Start Lon : E 28 : 0.990  
Finish Lat : S 18 : 1.138 Finish Lon : E 28 : 0.990  
Length : 19.94 km

Transect # : 10  
Start Lat : S 18 : 0.235 Start Lon : E 28 : 0.083  
Finish Lat : S 17 : 51.471 Finish Lon : E 28 : 0.083  
Length : 16.23 km

Transect # : 11  
Start Lat : S 17 : 51.971 Start Lon : E 27 : 59.176  
Finish Lat : S 18 : 0.160 Finish Lon : E 27 : 59.176  
Length : 15.16 km

Transect # : 12  
Start Lat : S 18 : 0.716 Start Lon : E 27 : 58.269  
Finish Lat : S 17 : 52.463 Finish Lon : E 27 : 58.269  
Length : 15.28 km

Transect # : 13  
Start Lat : S 17 : 52.757 Start Lon : E 27 : 57.361  
Finish Lat : S 18 : 0.739 Finish Lon : E 27 : 57.361  
Length : 14.78 km

Transect # : 14  
Start Lat : S 18 : 0.762 Start Lon : E 27 : 56.454  
Finish Lat : S 17 : 53.321 Finish Lon : E 27 : 56.454  
Length : 13.78 km

Transect # : 15A  
Start Lat : S 17 : 53.772 Start Lon : E 27 : 55.547  
Finish Lat : S 17 : 59.931 Finish Lon : E 27 : 55.547  
Length : 11.40 km

Transect # : 15B  
Start Lat : S 18 : 0.490 Start Lon : E 27 : 55.547  
Finish Lat : S 18 : 0.520 Finish Lon : E 27 : 55.547  
Length : 0.05 km

Transect # : 16  
Start Lat : S 17 : 57.449 Start Lon : E 27 : 54.639  
Finish Lat : S 17 : 54.279 Finish Lon : E 27 : 54.639  
Length : 5.87 km

**Lusulu**

Number of transects : 6  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 7.50 km

Transect # : 1  
Start Lat : S 17 : 53.772 Start Lon : E 27 : 40.312  
Finish Lat : S 17 : 58.705 Finish Lon : E 27 : 40.312  
Length : 9.13 km

Transect # : 2  
Start Lat : S 18 : 2.373 Start Lon : E 27 : 44.565  
Finish Lat : S 17 : 55.989 Finish Lon : E 27 : 44.565  
Length : 11.82 km

Transect # : 3  
Start Lat : S 17 : 56.017 Start Lon : E 27 : 48.817  
Finish Lat : S 18 : 6.331 Finish Lon : E 27 : 48.817  
Length : 19.10 km

Transect # : 4  
Start Lat : S 18 : 6.637 Start Lon : E 27 : 53.069  
Finish Lat : S 17 : 55.394 Finish Lon : E 27 : 53.069  
Length : 20.82 km

Transect # : 5  
Start Lat : S 18 : 0.740 Start Lon : E 27 : 57.322  
Finish Lat : S 18 : 4.378 Finish Lon : E 27 : 57.322  
Length : 6.74 km

Transect # : 6  
Start Lat : S 18 : 3.767 Start Lon : E 28 : 1.574  
Finish Lat : S 18 : 2.989 Finish Lon : E 28 : 1.574  
Length : 1.44 km

**Chizarira West**

Number of transects : 17  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 2.00 km

Transect # : 1 - Not flown.  
Start Lat : S 17 : 38.469 Start Lon : E 27 : 51.668  
Finish Lat : S 17 : 38.469 Finish Lon : E 27 : 53.241  
Length : 2.78 km

Transect # : 2 – Not flown.  
Start Lat : S 17 : 39.549 Start Lon : E 27 : 53.458  
Finish Lat : S 17 : 39.549 Finish Lon : E 27 : 49.188  
Length : 7.54 km



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Transect # : 3  
Start Lat : S 17 : 40.629 Start Lon : E 27 : 45.317  
Finish Lat : S 17 : 40.629 Finish Lon : E 27 : 53.045  
Length : 13.64 km

Transect # : 4  
Start Lat : S 17 : 41.709 Start Lon : E 27 : 52.127  
Finish Lat : S 17 : 41.709 Finish Lon : E 27 : 42.164  
Length : 17.59 km

Transect # : 5  
Start Lat : S 17 : 42.789 Start Lon : E 27 : 39.108  
Finish Lat : S 17 : 42.789 Finish Lon : E 27 : 52.228  
Length : 23.16 km

Transect # : 6  
Start Lat : S 17 : 43.869 Start Lon : E 27 : 52.249  
Finish Lat : S 17 : 43.869 Finish Lon : E 27 : 37.842  
Length : 25.43 km

Transect # : 7  
Start Lat : S 17 : 44.949 Start Lon : E 27 : 37.128  
Finish Lat : S 17 : 44.949 Finish Lon : E 27 : 51.987  
Length : 26.23 km

Transect # : 8  
Start Lat : S 17 : 46.029 Start Lon : E 27 : 51.787  
Finish Lat : S 17 : 46.029 Finish Lon : E 27 : 36.273  
Length : 27.38 km

Transect # : 9  
Start Lat : S 17 : 47.109 Start Lon : E 27 : 36.755  
Finish Lat : S 17 : 47.109 Finish Lon : E 27 : 51.292  
Length : 25.66 km

Transect # : 10  
Start Lat : S 17 : 48.189 Start Lon : E 27 : 51.680  
Finish Lat : S 17 : 48.189 Finish Lon : E 27 : 37.238  
Length : 25.49 km

Transect # : 11  
Start Lat : S 17 : 49.269 Start Lon : E 27 : 38.107  
Finish Lat : S 17 : 49.269 Finish Lon : E 27 : 52.611  
Length : 25.60 km

Transect # : 12  
Start Lat : S 17 : 50.349 Start Lon : E 27 : 51.751  
Finish Lat : S 17 : 50.349 Finish Lon : E 27 : 38.114  
Length : 24.07 km

Transect # : 13  
Start Lat : S 17 : 51.429 Start Lon : E 27 : 38.103  
Finish Lat : S 17 : 51.429 Finish Lon : E 27 : 51.657  
Length : 23.92 km

Transect # : 14  
Start Lat : S 17 : 52.509 Start Lon : E 27 : 51.217  
Finish Lat : S 17 : 52.509 Finish Lon : E 27 : 37.885  
Length : 23.53 km

Transect # : 15  
Start Lat : S 17 : 53.589 Start Lon : E 27 : 39.257  
Finish Lat : S 17 : 53.589 Finish Lon : E 27 : 50.840  
Length : 20.45 km

Transect # : 16  
Start Lat : S 17 : 54.669 Start Lon : E 27 : 51.293  
Finish Lat : S 17 : 54.669 Finish Lon : E 27 : 41.913  
Length : 16.56 km

Transect # : 17  
Start Lat : S 17 : 55.749 Start Lon : E 27 : 43.015  
Finish Lat : S 17 : 55.749 Finish Lon : E 27 : 51.115  
Length : 14.30 km

### **Chizarira East**

Number of transects : 11  
Transect Bearing : 45.00 Degrees  
Transect Spacing : 2.50 km

Transect # : 1  
Start Lat : S 17 : 36.306 Start Lon : E 27 : 56.253  
Finish Lat : S 17 : 38.936 Finish Lon : E 27 : 53.495  
Length : 6.89 km

Transect # : 2  
Start Lat : S 17 : 42.025 Start Lon : E 27 : 52.258  
Finish Lat : S 17 : 34.962 Finish Lon : E 27 : 59.663  
Length : 18.50 km

Transect # : 3  
Start Lat : S 17 : 32.921 Start Lon : E 28 : 3.805  
Finish Lat : S 17 : 44.095 Finish Lon : E 27 : 52.089  
Length : 29.26 km

Transect # : 4A  
Start Lat : S 17 : 46.630 Start Lon : E 27 : 51.433  
Finish Lat : S 17 : 33.520 Finish Lon : E 28 : 5.179  
Length : 34.33 km

Transect # : 4B  
Start Lat : S 17 : 33.125 Start Lon : E 28 : 5.594  
Finish Lat : S 17 : 33.002 Finish Lon : E 28 : 5.722  
Length : 0.32 km

Transect # : 4C  
Start Lat : S 17 : 31.895 Start Lon : E 28 : 6.883  
Finish Lat : S 17 : 31.770 Finish Lon : E 28 : 7.014  
Length : 0.33 km

Transect # : 5  
Start Lat : S 17 : 31.768 Start Lon : E 28 : 9.017  
Finish Lat : S 17 : 48.306 Finish Lon : E 27 : 51.678  
Length : 43.31 km

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Transect # : 6A  
Start Lat : S 17 : 49.847 Start Lon : E 27 : 52.064  
Finish Lat : S 17 : 49.813 Finish Lon : E 27 : 52.099  
Length : 0.09 km

Transect # : 6B  
Start Lat : S 17 : 49.344 Start Lon : E 27 : 52.591  
Finish Lat : S 17 : 31.767 Finish Lon : E 28 : 11.021  
Length : 46.03 km

Transect # : 7  
Start Lat : S 17 : 32.291 Start Lon : E 28 : 12.472  
Finish Lat : S 17 : 52.588 Finish Lon : E 27 : 51.192  
Length : 53.15 km

Transect # : 8  
Start Lat : S 17 : 54.487 Start Lon : E 27 : 51.202  
Finish Lat : S 17 : 34.330 Finish Lon : E 28 : 12.337  
Length : 52.79 km

Transect # : 9  
Start Lat : S 17 : 35.931 Start Lon : E 28 : 12.660  
Finish Lat : S 17 : 56.123 Finish Lon : E 27 : 51.489  
Length : 52.88 km

Transect # : 10  
Start Lat : S 17 : 53.336 Start Lon : E 27 : 56.413  
Finish Lat : S 17 : 38.797 Finish Lon : E 28 : 11.657  
Length : 38.08 km

Transect # : 11  
Start Lat : S 17 : 41.187 Start Lon : E 28 : 11.153  
Finish Lat : S 17 : 44.448 Finish Lon : E 28 : 7.734  
Length : 8.54 km

### **Simchembo**

Number of transects : 6  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 7.50 km

Transect # : 1  
Start Lat : S 17 : 30.699 Start Lon : E 28 : 27.694  
Finish Lat : S 17 : 39.139 Finish Lon : E 28 : 27.694  
Length : 15.63 km

Transect # : 2  
Start Lat : S 17 : 40.432 Start Lon : E 28 : 23.450  
Finish Lat : S 17 : 31.757 Finish Lon : E 28 : 23.450  
Length : 16.07 km

Transect # : 3  
Start Lat : S 17 : 32.235 Start Lon : E 28 : 19.205  
Finish Lat : S 17 : 43.680 Finish Lon : E 28 : 19.205  
Length : 21.19 km

Transect # : 4  
Start Lat : S 17 : 47.519 Start Lon : E 28 : 14.961  
Finish Lat : S 17 : 32.804 Finish Lon : E 28 : 14.961  
Length : 27.25 km

Transect # : 5  
Start Lat : S 17 : 41.948 Start Lon : E 28 : 10.717  
Finish Lat : S 17 : 49.384 Finish Lon : E 28 : 10.717  
Length : 13.77 km

Transect # : 6  
Start Lat : S 17 : 49.415 Start Lon : E 28 : 6.472  
Finish Lat : S 17 : 44.232 Finish Lon : E 28 : 6.472  
Length : 9.60 km

### **Chireya South**

Number of transects : 6  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 7.50 km

Transect # : 1  
Start Lat : S 17 : 23.817 Start Lon : E 28 : 42.076  
Finish Lat : S 17 : 23.817 Finish Lon : E 28 : 49.023  
Length : 12.28 km

Transect # : 2  
Start Lat : S 17 : 27.867 Start Lon : E 28 : 49.065  
Finish Lat : S 17 : 27.867 Finish Lon : E 28 : 33.455  
Length : 27.60 km

Transect # : 3  
Start Lat : S 17 : 31.917 Start Lon : E 28 : 30.695  
Finish Lat : S 17 : 31.917 Finish Lon : E 28 : 49.583  
Length : 33.39 km

Transect # : 4  
Start Lat : S 17 : 35.967 Start Lon : E 28 : 50.889  
Finish Lat : S 17 : 35.967 Finish Lon : E 28 : 30.778  
Length : 35.56 km

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Transect # : 5  
Start Lat : S 17 : 40.017 Start Lon : E 28 : 29.620  
Finish Lat : S 17 : 40.017 Finish Lon : E 28 : 52.994  
Length : 41.32 km

Transect # : 6B  
Start Lat : S 17 : 44.067 Start Lon : E 28 : 45.357  
Finish Lat : S 17 : 44.067 Finish Lon : E 28 : 29.988  
Length : 27.17 km

Transect # : 6A  
Start Lat : S 17 : 44.067 Start Lon : E 28 : 53.019  
Finish Lat : S 17 : 44.067 Finish Lon : E 28 : 47.579  
Length : 9.62 km

### **Chireya North**

Number of transects : 4  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 7.50 km

Transect # : 1A  
Start Lat : S 17 : 9.518 Start Lon : E 28 : 45.959  
Finish Lat : S 17 : 12.903 Finish Lon : E 28 : 45.959  
Length : 6.27 km

Transect # : 3  
Start Lat : S 17 : 18.728 Start Lon : E 28 : 37.483  
Finish Lat : S 17 : 25.964 Finish Lon : E 28 : 37.483  
Length : 13.40 km

Transect # : 1B  
Start Lat : S 17 : 15.735 Start Lon : E 28 : 45.959  
Finish Lat : S 17 : 22.002 Finish Lon : E 28 : 45.959  
Length : 11.60 km

Transect # : 4  
Start Lat : S 17 : 27.360 Start Lon : E 28 : 33.245  
Finish Lat : S 17 : 23.301 Finish Lon : E 28 : 33.245  
Length : 7.52 km

Transect # : 2  
Start Lat : S 17 : 23.983 Start Lon : E 28 : 41.721  
Finish Lat : S 17 : 12.836 Finish Lon : E 28 : 41.721  
Length : 20.64 km

### **Sampakaruma**

Number of transects : 20  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 2.60 km

Transect # : 1  
Start Lat : S 17 : 0.927 Start Lon : E 28 : 50.803  
Finish Lat : S 17 : 4.109 Finish Lon : E 28 : 50.803  
Length : 5.89 km

Transect # : 6  
Start Lat : S 17 : 11.619 Start Lon : E 28 : 43.466  
Finish Lat : S 17 : 1.050 Finish Lon : E 28 : 43.466  
Length : 19.57 km

Transect # : 2  
Start Lat : S 17 : 4.984 Start Lon : E 28 : 49.336  
Finish Lat : S 16 : 59.418 Finish Lon : E 28 : 49.336  
Length : 10.31 km

Transect # : 7A  
Start Lat : S 17 : 2.238 Start Lon : E 28 : 41.998  
Finish Lat : S 17 : 2.444 Finish Lon : E 28 : 41.998  
Length : 0.38 km

Transect # : 3  
Start Lat : S 17 : 0.171 Start Lon : E 28 : 47.868  
Finish Lat : S 17 : 5.953 Finish Lon : E 28 : 47.868  
Length : 10.71 km

Transect # : 7B  
Start Lat : S 17 : 2.515 Start Lon : E 28 : 41.998  
Finish Lat : S 17 : 12.940 Finish Lon : E 28 : 41.998  
Length : 19.31 km

Transect # : 4  
Start Lat : S 17 : 8.483 Start Lon : E 28 : 46.401  
Finish Lat : S 16 : 59.841 Finish Lon : E 28 : 46.401  
Length : 16.00 km

Transect # : 8  
Start Lat : S 17 : 12.230 Start Lon : E 28 : 40.531  
Finish Lat : S 17 : 3.500 Finish Lon : E 28 : 40.531  
Length : 16.17 km

Transect # : 5  
Start Lat : S 17 : 0.228 Start Lon : E 28 : 44.933  
Finish Lat : S 17 : 10.261 Finish Lon : E 28 : 44.933  
Length : 18.58 km

Transect # : 9  
Start Lat : S 17 : 4.519 Start Lon : E 28 : 39.063  
Finish Lat : S 17 : 15.091 Finish Lon : E 28 : 39.063  
Length : 19.58 km

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Transect # : 10  
Start Lat : S 17 : 18.638 Start Lon : E 28 : 37.596  
Finish Lat : S 17 : 5.946 Finish Lon : E 28 : 37.596  
Length : 23.50 km

Transect # : 11  
Start Lat : S 17 : 8.935 Start Lon : E 28 : 36.128  
Finish Lat : S 17 : 19.808 Finish Lon : E 28 : 36.128  
Length : 20.14 km

Transect # : 12  
Start Lat : S 17 : 21.525 Start Lon : E 28 : 34.661  
Finish Lat : S 17 : 9.285 Finish Lon : E 28 : 34.661  
Length : 22.67 km

Transect # : 13  
Start Lat : S 17 : 9.575 Start Lon : E 28 : 33.193  
Finish Lat : S 17 : 23.373 Finish Lon : E 28 : 33.193  
Length : 25.55 km

Transect # : 14  
Start Lat : S 17 : 24.825 Start Lon : E 28 : 31.726  
Finish Lat : S 17 : 10.869 Finish Lon : E 28 : 31.726  
Length : 25.84 km

Transect # : 15A  
Start Lat : S 17 : 11.911 Start Lon : E 28 : 30.258  
Finish Lat : S 17 : 23.748 Finish Lon : E 28 : 30.258  
Length : 21.92 km

Transect # : 15B  
Start Lat : S 17 : 23.906 Start Lon : E 28 : 30.258  
Finish Lat : S 17 : 23.992 Finish Lon : E 28 : 30.258  
Length : 0.16 km

Transect # : 16  
Start Lat : S 17 : 23.128 Start Lon : E 28 : 28.790  
Finish Lat : S 17 : 10.706 Finish Lon : E 28 : 28.790  
Length : 23.00 km

Transect # : 17A  
Start Lat : S 17 : 9.118 Start Lon : E 28 : 27.323  
Finish Lat : S 17 : 22.331 Finish Lon : E 28 : 27.323  
Length : 24.47 km

Transect # : 17B  
Start Lat : S 17 : 22.350 Start Lon : E 28 : 27.323  
Finish Lat : S 17 : 22.724 Finish Lon : E 28 : 27.323  
Length : 0.69 km

Transect # : 18A  
Start Lat : S 17 : 22.194 Start Lon : E 28 : 25.855  
Finish Lat : S 17 : 6.689 Finish Lon : E 28 : 25.855  
Length : 28.71 km

Transect # : 18B  
Start Lat : S 17 : 6.464 Start Lon : E 28 : 25.855  
Finish Lat : S 17 : 5.879 Finish Lon : E 28 : 25.855  
Length : 1.08 km

Transect # : 19A  
Start Lat : S 17 : 3.461 Start Lon : E 28 : 24.388  
Finish Lat : S 17 : 14.204 Finish Lon : E 28 : 24.388  
Length : 19.89 km

Transect # : 19B  
Start Lat : S 17 : 16.004 Start Lon : E 28 : 24.388  
Finish Lat : S 17 : 16.379 Finish Lon : E 28 : 24.388  
Length : 0.69 km

Transect # : 19C  
Start Lat : S 17 : 17.578 Start Lon : E 28 : 24.388  
Finish Lat : S 17 : 21.349 Finish Lon : E 28 : 24.388  
Length : 6.98 km

Transect # : 20A  
Start Lat : S 17 : 11.056 Start Lon : E 28 : 22.920  
Finish Lat : S 17 : 10.855 Finish Lon : E 28 : 22.920  
Length : 0.37 km

Transect # : 20B  
Start Lat : S 17 : 6.996 Start Lon : E 28 : 22.920  
Finish Lat : S 17 : 6.720 Finish Lon : E 28 : 22.920  
Length : 0.51 km

## **Negande**

Number of transects : 16  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 2.40 km

Transect # : 1  
Start Lat : S 17 : 4.017 Start Lon : E 28 : 22.406  
Finish Lat : S 17 : 4.017 Finish Lon : E 28 : 23.354  
Length : 1.68 km

Transect # : 2  
Start Lat : S 17 : 5.313 Start Lon : E 28 : 23.448  
Finish Lat : S 17 : 5.313 Finish Lon : E 28 : 18.538  
Length : 8.69 km

Transect # : 3  
Start Lat : S 17 : 6.609 Start Lon : E 28 : 17.138  
Finish Lat : S 17 : 6.609 Finish Lon : E 28 : 23.502  
Length : 11.27 km

Transect # : 4  
Start Lat : S 17 : 7.905 Start Lon : E 28 : 23.007  
Finish Lat : S 17 : 7.905 Finish Lon : E 28 : 16.106  
Length : 12.22 km

Transect # : 5  
Start Lat : S 17 : 9.201 Start Lon : E 28 : 14.997  
Finish Lat : S 17 : 9.201 Finish Lon : E 28 : 23.578  
Length : 15.19 km

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Transect # : 6  
Start Lat : S 17 : 10.497 Start Lon : E 28 : 23.211  
Finish Lat : S 17 : 10.497 Finish Lon : E 28 : 11.360  
Length : 20.98 km

Transect # : 7  
Start Lat : S 17 : 11.793 Start Lon : E 28 : 9.277  
Finish Lat : S 17 : 11.793 Finish Lon : E 28 : 23.398  
Length : 25.00 km

Transect # : 8  
Start Lat : S 17 : 13.089 Start Lon : E 28 : 23.461  
Finish Lat : S 17 : 13.089 Finish Lon : E 28 : 9.150  
Length : 25.34 km

Transect # : 9  
Start Lat : S 17 : 14.385 Start Lon : E 28 : 8.719  
Finish Lat : S 17 : 14.385 Finish Lon : E 28 : 25.082  
Length : 28.97 km

Transect # : 10  
Start Lat : S 17 : 15.681 Start Lon : E 28 : 24.570  
Finish Lat : S 17 : 15.681 Finish Lon : E 28 : 8.575  
Length : 28.32 km

Transect # : 11  
Start Lat : S 17 : 16.977 Start Lon : E 28 : 10.071  
Finish Lat : S 17 : 16.977 Finish Lon : E 28 : 24.631  
Length : 25.78 km

Transect # : 12  
Start Lat : S 17 : 18.273 Start Lon : E 28 : 23.169  
Finish Lat : S 17 : 18.273 Finish Lon : E 28 : 9.858  
Length : 23.57 km

Transect # : 13  
Start Lat : S 17 : 19.569 Start Lon : E 28 : 11.498  
Finish Lat : S 17 : 19.569 Finish Lon : E 28 : 23.679  
Length : 21.57 km

Transect # : 14  
Start Lat : S 17 : 20.865 Start Lon : E 28 : 24.175  
Finish Lat : S 17 : 20.865 Finish Lon : E 28 : 12.413  
Length : 20.83 km

Transect # : 15  
Start Lat : S 17 : 22.161 Start Lon : E 28 : 14.516  
Finish Lat : S 17 : 22.161 Finish Lon : E 28 : 25.633  
Length : 19.68 km

Transect # : 16  
Start Lat : S 17 : 23.457 Start Lon : E 28 : 20.665  
Finish Lat : S 17 : 23.457 Finish Lon : E 28 : 14.348  
Length : 11.19 km

### **Nenyunga**

Number of transects : 11  
Transect Bearing : 45.00 Degrees  
Transect Spacing : 2.50 km

Transect # : 1  
Start Lat : S 17 : 24.082 Start Lon : E 28 : 17.224  
Finish Lat : S 17 : 26.271 Finish Lon : E 28 : 14.932  
Length : 5.73 km

Transect # : 2  
Start Lat : S 17 : 29.094 Start Lon : E 28 : 13.975  
Finish Lat : S 17 : 24.015 Finish Lon : E 28 : 19.293  
Length : 13.30 km

Transect # : 3  
Start Lat : S 17 : 22.798 Start Lon : E 28 : 22.567  
Finish Lat : S 17 : 32.386 Finish Lon : E 28 : 12.526  
Length : 25.11 km

Transect # : 4  
Start Lat : S 17 : 34.682 Start Lon : E 28 : 12.122  
Finish Lat : S 17 : 22.530 Finish Lon : E 28 : 24.847  
Length : 31.82 km

Transect # : 5  
Start Lat : S 17 : 22.566 Start Lon : E 28 : 26.808  
Finish Lat : S 17 : 31.894 Finish Lon : E 28 : 17.040  
Length : 24.43 km

Transect # : 6  
Start Lat : S 17 : 32.154 Start Lon : E 28 : 18.768  
Finish Lat : S 17 : 22.829 Finish Lon : E 28 : 28.533  
Length : 24.42 km

Transect # : 7A  
Start Lat : S 17 : 23.326 Start Lon : E 28 : 30.012  
Finish Lat : S 17 : 31.749 Finish Lon : E 28 : 21.191  
Length : 22.06 km

Transect # : 7B  
Start Lat : S 17 : 32.479 Start Lon : E 28 : 20.426  
Finish Lat : S 17 : 32.562 Finish Lon : E 28 : 20.339  
Length : 0.22 km

Transect # : 8  
Start Lat : S 17 : 31.769 Start Lon : E 28 : 23.169  
Finish Lat : S 17 : 24.373 Finish Lon : E 28 : 30.914  
Length : 19.37 km

Transect # : 9  
Start Lat : S 17 : 24.981 Start Lon : E 28 : 32.276  
Finish Lat : S 17 : 31.613 Finish Lon : E 28 : 25.332  
Length : 17.37 km

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Transect # : 10  
Start Lat : S 17 : 30.527 Start Lon : E 28 : 28.468  
Finish Lat : S 17 : 26.364 Finish Lon : E 28 : 32.828  
Length : 10.90 km

Transect # : 11  
Start Lat : S 17 : 27.688 Start Lon : E 28 : 33.441  
Finish Lat : S 17 : 28.360 Finish Lon : E 28 : 32.737  
Length : 1.76 km

**Matusadona East**

Number of transects : 17  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 1.80 km

Transect # : 1  
Start Lat : S 16 : 49.485 Start Lon : E 28 : 26.169  
Finish Lat : S 16 : 49.197 Finish Lon : E 28 : 26.169  
Length : 0.53 km

Transect # : 9A  
Start Lat : S 16 : 53.022 Start Lon : E 28 : 34.285  
Finish Lat : S 16 : 45.402 Finish Lon : E 28 : 34.285  
Length : 14.11 km

Transect # : 2  
Start Lat : S 16 : 49.021 Start Lon : E 28 : 27.184  
Finish Lat : S 16 : 50.034 Finish Lon : E 28 : 27.184  
Length : 1.88 km

Transect # : 9B  
Start Lat : S 16 : 45.084 Start Lon : E 28 : 34.285  
Finish Lat : S 16 : 44.909 Finish Lon : E 28 : 34.285  
Length : 0.32 km

Transect # : 3  
Start Lat : S 16 : 50.389 Start Lon : E 28 : 28.198  
Finish Lat : S 16 : 47.751 Finish Lon : E 28 : 28.198  
Length : 4.89 km

Transect # : 10A  
Start Lat : S 16 : 44.255 Start Lon : E 28 : 35.299  
Finish Lat : S 16 : 44.919 Finish Lon : E 28 : 35.299  
Length : 1.23 km

Transect # : 4A  
Start Lat : S 16 : 46.034 Start Lon : E 28 : 29.213  
Finish Lat : S 16 : 46.381 Finish Lon : E 28 : 29.213  
Length : 0.64 km

Transect # : 10B  
Start Lat : S 16 : 45.766 Start Lon : E 28 : 35.299  
Finish Lat : S 16 : 52.100 Finish Lon : E 28 : 35.299  
Length : 11.73 km

Transect # : 4B  
Start Lat : S 16 : 46.387 Start Lon : E 28 : 29.213  
Finish Lat : S 16 : 46.905 Finish Lon : E 28 : 29.213  
Length : 0.96 km

Transect # : 11  
Start Lat : S 16 : 51.451 Start Lon : E 28 : 36.313  
Finish Lat : S 16 : 45.332 Finish Lon : E 28 : 36.313  
Length : 11.33 km

Transect # : 4C  
Start Lat : S 16 : 47.098 Start Lon : E 28 : 29.213  
Finish Lat : S 16 : 50.737 Finish Lon : E 28 : 29.213  
Length : 6.74 km

Transect # : 12  
Start Lat : S 16 : 44.286 Start Lon : E 28 : 37.328  
Finish Lat : S 16 : 50.872 Finish Lon : E 28 : 37.328  
Length : 12.20 km

Transect # : 5  
Start Lat : S 16 : 50.914 Start Lon : E 28 : 30.227  
Finish Lat : S 16 : 46.493 Finish Lon : E 28 : 30.227  
Length : 8.19 km

Transect # : 13  
Start Lat : S 16 : 50.518 Start Lon : E 28 : 38.342  
Finish Lat : S 16 : 44.019 Finish Lon : E 28 : 38.342  
Length : 12.04 km

Transect # : 6  
Start Lat : S 16 : 46.138 Start Lon : E 28 : 31.241  
Finish Lat : S 16 : 51.245 Finish Lon : E 28 : 31.241  
Length : 9.46 km

Transect # : 14A  
Start Lat : S 16 : 41.839 Start Lon : E 28 : 39.357  
Finish Lat : S 16 : 44.999 Finish Lon : E 28 : 39.357  
Length : 5.85 km

Transect # : 7A  
Start Lat : S 16 : 51.537 Start Lon : E 28 : 32.256  
Finish Lat : S 16 : 46.109 Finish Lon : E 28 : 32.256  
Length : 10.05 km

Transect # : 14B  
Start Lat : S 16 : 46.671 Start Lon : E 28 : 39.357  
Finish Lat : S 16 : 50.161 Finish Lon : E 28 : 39.357  
Length : 6.46 km

Transect # : 7B  
Start Lat : S 16 : 45.161 Start Lon : E 28 : 32.256  
Finish Lat : S 16 : 45.081 Finish Lon : E 28 : 32.256  
Length : 0.15 km

Transect # : 15A  
Start Lat : S 16 : 49.841 Start Lon : E 28 : 40.371  
Finish Lat : S 16 : 47.172 Finish Lon : E 28 : 40.371  
Length : 4.94 km

Transect # : 8  
Start Lat : S 16 : 45.573 Start Lon : E 28 : 33.270  
Finish Lat : S 16 : 52.368 Finish Lon : E 28 : 33.270  
Length : 12.58 km

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Transect # : 15B  
Start Lat : S 16 : 47.086 Start Lon : E 28 : 40.371  
Finish Lat : S 16 : 46.756 Finish Lon : E 28 : 40.371  
Length : 0.61 km

Transect # : 15C  
Start Lat : S 16 : 44.607 Start Lon : E 28 : 40.371  
Finish Lat : S 16 : 43.660 Finish Lon : E 28 : 40.371  
Length : 1.75 km

Transect # : 15D  
Start Lat : S 16 : 42.451 Start Lon : E 28 : 40.371  
Finish Lat : S 16 : 42.318 Finish Lon : E 28 : 40.371  
Length : 0.25 km

Transect # : 16A  
Start Lat : S 16 : 43.214 Start Lon : E 28 : 41.385  
Finish Lat : S 16 : 44.221 Finish Lon : E 28 : 41.385  
Length : 1.86 km

Transect # : 16B  
Start Lat : S 16 : 47.844 Start Lon : E 28 : 41.385  
Finish Lat : S 16 : 49.708 Finish Lon : E 28 : 41.385  
Length : 3.45 km

Transect # : 17  
Start Lat : S 16 : 49.317 Start Lon : E 28 : 42.400  
Finish Lat : S 16 : 48.727 Finish Lon : E 28 : 42.400  
Length : 1.09 km

**Matusadona West**

Number of transects : 12  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 1.60 km

Transect # : 1A  
Start Lat : S 16 : 58.799 Start Lon : E 28 : 26.908  
Finish Lat : S 16 : 58.799 Finish Lon : E 28 : 26.993  
Length : 0.15 km

Transect # : 1B  
Start Lat : S 16 : 58.799 Start Lon : E 28 : 27.410  
Finish Lat : S 16 : 58.799 Finish Lon : E 28 : 27.799  
Length : 0.69 km

Transect # : 2  
Start Lat : S 16 : 57.935 Start Lon : E 28 : 28.895  
Finish Lat : S 16 : 57.935 Finish Lon : E 28 : 26.859  
Length : 3.61 km

Transect # : 3A  
Start Lat : S 16 : 57.071 Start Lon : E 28 : 26.572  
Finish Lat : S 16 : 57.071 Finish Lon : E 28 : 27.060  
Length : 0.87 km

Transect # : 3B  
Start Lat : S 16 : 57.071 Start Lon : E 28 : 27.451  
Finish Lat : S 16 : 57.071 Finish Lon : E 28 : 30.140  
Length : 4.77 km

Transect # : 4A  
Start Lat : S 16 : 56.207 Start Lon : E 28 : 31.207  
Finish Lat : S 16 : 56.207 Finish Lon : E 28 : 26.538  
Length : 8.28 km

Transect # : 4B  
Start Lat : S 16 : 56.207 Start Lon : E 28 : 26.423  
Finish Lat : S 16 : 56.207 Finish Lon : E 28 : 26.323  
Length : 0.18 km

Transect # : 5  
Start Lat : S 16 : 55.343 Start Lon : E 28 : 27.291  
Finish Lat : S 16 : 55.343 Finish Lon : E 28 : 32.681  
Length : 9.55 km

Transect # : 6  
Start Lat : S 16 : 54.479 Start Lon : E 28 : 33.375  
Finish Lat : S 16 : 54.479 Finish Lon : E 28 : 27.966  
Length : 9.59 km

Transect # : 7  
Start Lat : S 16 : 53.615 Start Lon : E 28 : 27.997  
Finish Lat : S 16 : 53.615 Finish Lon : E 28 : 34.381  
Length : 11.32 km

Transect # : 8  
Start Lat : S 16 : 52.751 Start Lon : E 28 : 33.745  
Finish Lat : S 16 : 52.751 Finish Lon : E 28 : 28.507  
Length : 9.28 km

Transect # : 9  
Start Lat : S 16 : 51.887 Start Lon : E 28 : 28.358  
Finish Lat : S 16 : 51.887 Finish Lon : E 28 : 32.633  
Length : 7.58 km

Transect # : 10  
Start Lat : S 16 : 51.023 Start Lon : E 28 : 30.359  
Finish Lat : S 16 : 51.023 Finish Lon : E 28 : 28.126  
Length : 3.96 km

Transect # : 11  
Start Lat : S 16 : 50.159 Start Lon : E 28 : 26.749  
Finish Lat : S 16 : 50.159 Finish Lon : E 28 : 27.249  
Length : 0.89 km

Transect # : 12  
Start Lat : S 16 : 49.295 Start Lon : E 28 : 25.639  
Finish Lat : S 16 : 49.295 Finish Lon : E 28 : 25.355  
Length : 0.50 km

**Sibilobilo**

Number of transects : 13  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 3.20 km

Transect # : 1  
Start Lat : S 16 : 50.566 Start Lon : E 28 : 25.220  
Finish Lat : S 16 : 59.390 Finish Lon : E 28 : 25.220  
Length : 16.34 km

Transect # : 2  
Start Lat : S 17 : 0.201 Start Lon : E 28 : 23.416  
Finish Lat : S 16 : 50.339 Finish Lon : E 28 : 23.416  
Length : 18.26 km

Transect # : 3A  
Start Lat : S 16 : 48.724 Start Lon : E 28 : 21.612  
Finish Lat : S 16 : 49.803 Finish Lon : E 28 : 21.612  
Length : 2.00 km

Transect # : 3B  
Start Lat : S 16 : 50.163 Start Lon : E 28 : 21.612  
Finish Lat : S 16 : 59.103 Finish Lon : E 28 : 21.612  
Length : 16.56 km

Transect # : 4  
Start Lat : S 16 : 59.339 Start Lon : E 28 : 19.807  
Finish Lat : S 16 : 48.093 Finish Lon : E 28 : 19.807  
Length : 20.83 km

Transect # : 5  
Start Lat : S 16 : 49.222 Start Lon : E 28 : 18.003  
Finish Lat : S 17 : 0.274 Finish Lon : E 28 : 18.003  
Length : 20.47 km

Transect # : 6  
Start Lat : S 17 : 0.309 Start Lon : E 28 : 16.199  
Finish Lat : S 16 : 50.508 Finish Lon : E 28 : 16.199  
Length : 18.15 km

Transect # : 7  
Start Lat : S 16 : 49.982 Start Lon : E 28 : 14.395  
Finish Lat : S 17 : 1.159 Finish Lon : E 28 : 14.395  
Length : 20.70 km

Transect # : 8  
Start Lat : S 17 : 1.636 Start Lon : E 28 : 12.591  
Finish Lat : S 16 : 53.931 Finish Lon : E 28 : 12.591  
Length : 14.27 km

Transect # : 9  
Start Lat : S 16 : 52.509 Start Lon : E 28 : 10.787  
Finish Lat : S 17 : 1.981 Finish Lon : E 28 : 10.787  
Length : 17.54 km

Transect # : 10  
Start Lat : S 17 : 3.672 Start Lon : E 28 : 8.982  
Finish Lat : S 16 : 52.597 Finish Lon : E 28 : 8.982  
Length : 20.51 km

Transect # : 11A  
Start Lat : S 16 : 50.483 Start Lon : E 28 : 7.178  
Finish Lat : S 16 : 54.195 Finish Lon : E 28 : 7.178  
Length : 6.87 km

Transect # : 11B  
Start Lat : S 16 : 54.510 Start Lon : E 28 : 7.178  
Finish Lat : S 16 : 58.070 Finish Lon : E 28 : 7.178  
Length : 6.59 km

Transect # : 11C  
Start Lat : S 16 : 58.600 Start Lon : E 28 : 7.178  
Finish Lat : S 17 : 5.086 Finish Lon : E 28 : 7.178  
Length : 12.01 km

Transect # : 12A  
Start Lat : S 17 : 6.462 Start Lon : E 28 : 5.374  
Finish Lat : S 17 : 2.585 Finish Lon : E 28 : 5.374  
Length : 7.18 km

Transect # : 12B  
Start Lat : S 17 : 1.933 Start Lon : E 28 : 5.374  
Finish Lat : S 17 : 1.890 Finish Lon : E 28 : 5.374  
Length : 0.08 km

Transect # : 12C  
Start Lat : S 17 : 1.149 Start Lon : E 28 : 5.374  
Finish Lat : S 17 : 0.714 Finish Lon : E 28 : 5.374  
Length : 0.81 km

Transect # : 12D  
Start Lat : S 16 : 59.176 Start Lon : E 28 : 5.374  
Finish Lat : S 16 : 56.394 Finish Lon : E 28 : 5.374  
Length : 5.15 km

Transect # : 12E  
Start Lat : S 16 : 53.418 Start Lon : E 28 : 5.374  
Finish Lat : S 16 : 52.763 Finish Lon : E 28 : 5.374  
Length : 1.21 km

Transect # : 13A  
Start Lat : S 16 : 58.652 Start Lon : E 28 : 3.570  
Finish Lat : S 16 : 59.437 Finish Lon : E 28 : 3.570  
Length : 1.45 km

Transect # : 13B  
Start Lat : S 17 : 3.357 Start Lon : E 28 : 3.570  
Finish Lat : S 17 : 6.042 Finish Lon : E 28 : 3.570  
Length : 4.97 km



**Mwenda**

Number of transects : 9  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 3.00 km

Transect # : 1A  
Start Lat : S 17 : 2.991 Start Lon : E 28 : 1.808  
Finish Lat : S 17 : 2.991 Finish Lon : E 28 : 1.692  
Length : 0.20 km

Transect # : 1B  
Start Lat : S 17 : 2.991 Start Lon : E 28 : 0.497  
Finish Lat : S 17 : 2.991 Finish Lon : E 27 : 59.043  
Length : 2.58 km

Transect # : 1C  
Start Lat : S 17 : 2.991 Start Lon : E 27 : 58.415  
Finish Lat : S 17 : 2.991 Finish Lon : E 27 : 58.362  
Length : 0.09 km

Transect # : 2  
Start Lat : S 17 : 4.610 Start Lon : E 27 : 56.773  
Finish Lat : S 17 : 4.610 Finish Lon : E 28 : 2.391  
Length : 9.95 km

Transect # : 3A  
Start Lat : S 17 : 6.231 Start Lon : E 28 : 1.787  
Finish Lat : S 17 : 6.231 Finish Lon : E 28 : 1.045  
Length : 1.31 km

Transect # : 3B  
Start Lat : S 17 : 6.231 Start Lon : E 28 : 0.835  
Finish Lat : S 17 : 6.231 Finish Lon : E 27 : 54.310  
Length : 11.56 km

Transect # : 3C  
Start Lat : S 17 : 6.231 Start Lon : E 27 : 53.977  
Finish Lat : S 17 : 6.231 Finish Lon : E 27 : 53.801  
Length : 0.31 km

Transect # : 4A  
Start Lat : S 17 : 7.851 Start Lon : E 27 : 50.704  
Finish Lat : S 17 : 7.851 Finish Lon : E 27 : 52.090  
Length : 2.45 km

Transect # : 4B  
Start Lat : S 17 : 7.851 Start Lon : E 27 : 52.124  
Finish Lat : S 17 : 7.851 Finish Lon : E 28 : 1.321  
Length : 16.29 km

Transect # : 4C  
Start Lat : S 17 : 7.851 Start Lon : E 28 : 1.321  
Finish Lat : S 17 : 7.851 Finish Lon : E 28 : 2.470  
Length : 2.03 km

Transect # : 4D  
Start Lat : S 17 : 7.851 Start Lon : E 28 : 2.784  
Finish Lat : S 17 : 7.851 Finish Lon : E 28 : 2.959  
Length : 0.31 km

Transect # : 4E  
Start Lat : S 17 : 7.851 Start Lon : E 28 : 3.104  
Finish Lat : S 17 : 7.851 Finish Lon : E 28 : 5.369  
Length : 4.01 km

Transect # : 5  
Start Lat : S 17 : 9.471 Start Lon : E 28 : 8.554  
Finish Lat : S 17 : 9.471 Finish Lon : E 27 : 50.206  
Length : 32.50 km

Transect # : 6  
Start Lat : S 17 : 11.091 Start Lon : E 27 : 51.665  
Finish Lat : S 17 : 11.091 Finish Lon : E 28 : 8.129  
Length : 29.16 km

Transect # : 7  
Start Lat : S 17 : 12.710 Start Lon : E 28 : 5.545  
Finish Lat : S 17 : 12.710 Finish Lon : E 27 : 56.183  
Length : 16.58 km

Transect # : 8A  
Start Lat : S 17 : 14.331 Start Lon : E 27 : 56.341  
Finish Lat : S 17 : 14.331 Finish Lon : E 27 : 56.530  
Length : 0.34 km

Transect # : 8B  
Start Lat : S 17 : 14.331 Start Lon : E 27 : 56.678  
Finish Lat : S 17 : 14.331 Finish Lon : E 28 : 1.437  
Length : 8.43 km

Transect # : 9  
Start Lat : S 17 : 15.951 Start Lon : E 27 : 59.949  
Finish Lat : S 17 : 15.951 Finish Lon : E 27 : 56.828  
Length : 5.53 km

**Chete East**

Number of transects : 9  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 3.10 km

Transect # : 1A  
Start Lat : S 17 : 10.490 Start Lon : E 27 : 51.002  
Finish Lat : S 17 : 10.490 Finish Lon : E 27 : 50.393  
Length : 1.08 km

Transect # : 1B  
Start Lat : S 17 : 10.490 Start Lon : E 27 : 50.366  
Finish Lat : S 17 : 10.490 Finish Lon : E 27 : 50.016  
Length : 0.62 km

Transect # : 1C  
Start Lat : S 17 : 10.490 Start Lon : E 27 : 49.926  
Finish Lat : S 17 : 10.490 Finish Lon : E 27 : 45.280  
Length : 8.22 km

Transect # : 2  
Start Lat : S 17 : 12.164 Start Lon : E 27 : 41.594  
Finish Lat : S 17 : 12.164 Finish Lon : E 27 : 56.131  
Length : 25.73 km

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Transect # : 3  
Start Lat : S 17 : 13.838 Start Lon : E 27 : 56.119  
Finish Lat : S 17 : 13.838 Finish Lon : E 27 : 41.300  
Length : 26.23 km

Transect # : 4  
Start Lat : S 17 : 15.512 Start Lon : E 27 : 44.278  
Finish Lat : S 17 : 15.512 Finish Lon : E 27 : 56.807  
Length : 22.17 km

Transect # : 5  
Start Lat : S 17 : 17.186 Start Lon : E 27 : 57.389  
Finish Lat : S 17 : 17.186 Finish Lon : E 27 : 45.855  
Length : 20.41 km

Transect # : 6  
Start Lat : S 17 : 18.860 Start Lon : E 27 : 44.718  
Finish Lat : S 17 : 18.860 Finish Lon : E 27 : 58.015  
Length : 23.53 km

Transect # : 7  
Start Lat : S 17 : 20.534 Start Lon : E 27 : 54.278  
Finish Lat : S 17 : 20.534 Finish Lon : E 27 : 44.899  
Length : 16.60 km

Transect # : 8A  
Start Lat : S 17 : 22.208 Start Lon : E 27 : 46.087  
Finish Lat : S 17 : 22.208 Finish Lon : E 27 : 51.698  
Length : 9.93 km

Transect # : 8B  
Start Lat : S 17 : 22.208 Start Lon : E 27 : 51.910  
Finish Lat : S 17 : 22.208 Finish Lon : E 27 : 52.543  
Length : 1.12 km

Transect # : 9  
Start Lat : S 17 : 23.882 Start Lon : E 27 : 50.699  
Finish Lat : S 17 : 23.882 Finish Lon : E 27 : 46.590  
Length : 7.27 km

**Chete West**

Number of transects : 17  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 2.50 km

Transect # : 1A  
Start Lat : S 17 : 14.971 Start Lon : E 27 : 41.770  
Finish Lat : S 17 : 14.971 Finish Lon : E 27 : 41.222  
Length : 0.97 km

Transect # : 1B  
Start Lat : S 17 : 14.971 Start Lon : E 27 : 40.461  
Finish Lat : S 17 : 14.971 Finish Lon : E 27 : 40.049  
Length : 0.73 km

Transect # : 2  
Start Lat : S 17 : 16.321 Start Lon : E 27 : 40.079  
Finish Lat : S 17 : 16.321 Finish Lon : E 27 : 44.103  
Length : 7.12 km

Transect # : 3  
Start Lat : S 17 : 17.671 Start Lon : E 27 : 45.417  
Finish Lat : S 17 : 17.671 Finish Lon : E 27 : 39.186  
Length : 11.02 km

Transect # : 4A  
Start Lat : S 17 : 19.021 Start Lon : E 27 : 39.315  
Finish Lat : S 17 : 19.021 Finish Lon : E 27 : 39.595  
Length : 0.50 km

Transect # : 4B  
Start Lat : S 17 : 19.021 Start Lon : E 27 : 39.919  
Finish Lat : S 17 : 19.021 Finish Lon : E 27 : 44.744  
Length : 8.54 km

Transect # : 5  
Start Lat : S 17 : 20.371 Start Lon : E 27 : 44.952  
Finish Lat : S 17 : 20.371 Finish Lon : E 27 : 37.653  
Length : 12.91 km

Transect # : 6  
Start Lat : S 17 : 21.721 Start Lon : E 27 : 36.115  
Finish Lat : S 17 : 21.721 Finish Lon : E 27 : 45.644  
Length : 16.86 km

Transect # : 7  
Start Lat : S 17 : 23.071 Start Lon : E 27 : 46.664  
Finish Lat : S 17 : 23.071 Finish Lon : E 27 : 37.144  
Length : 16.84 km

Transect # : 8A  
Start Lat : S 17 : 24.421 Start Lon : E 27 : 36.441  
Finish Lat : S 17 : 24.421 Finish Lon : E 27 : 36.577  
Length : 0.24 km

Transect # : 8B  
Start Lat : S 17 : 24.421 Start Lon : E 27 : 36.659  
Finish Lat : S 17 : 24.421 Finish Lon : E 27 : 46.494  
Length : 17.40 km

Transect # : 9  
Start Lat : S 17 : 25.771 Start Lon : E 27 : 47.109  
Finish Lat : S 17 : 25.771 Finish Lon : E 27 : 35.528  
Length : 20.49 km

Transect # : 10A  
Start Lat : S 17 : 27.121 Start Lon : E 27 : 35.023  
Finish Lat : S 17 : 27.121 Finish Lon : E 27 : 35.287  
Length : 0.47 km

Transect # : 10B  
Start Lat : S 17 : 27.121 Start Lon : E 27 : 35.359  
Finish Lat : S 17 : 27.121 Finish Lon : E 27 : 48.312  
Length : 22.91 km

Transect # : 11  
Start Lat : S 17 : 28.471 Start Lon : E 27 : 50.197  
Finish Lat : S 17 : 28.471 Finish Lon : E 27 : 34.656  
Length : 27.49 km

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Transect # : 12  
Start Lat : S 17 : 29.821 Start Lon : E 27 : 36.433  
Finish Lat : S 17 : 29.821 Finish Lon : E 27 : 52.842  
Length : 29.03 km

Transect # : 13  
Start Lat : S 17 : 31.171 Start Lon : E 27 : 52.418  
Finish Lat : S 17 : 31.171 Finish Lon : E 27 : 36.913  
Length : 27.43 km

Transect # : 14  
Start Lat : S 17 : 32.521 Start Lon : E 27 : 36.638  
Finish Lat : S 17 : 32.521 Finish Lon : E 27 : 51.504  
Length : 26.30 km

Transect # : 15  
Start Lat : S 17 : 33.871 Start Lon : E 27 : 49.580  
Finish Lat : S 17 : 33.871 Finish Lon : E 27 : 36.552  
Length : 23.05 km

Transect # : 16  
Start Lat : S 17 : 35.221 Start Lon : E 27 : 36.910  
Finish Lat : S 17 : 35.221 Finish Lon : E 27 : 48.372  
Length : 20.28 km

Transect # : 17  
Start Lat : S 17 : 36.571 Start Lon : E 27 : 39.328  
Finish Lat : S 17 : 36.571 Finish Lon : E 27 : 37.268  
Length : 3.64 km

**Sijarira**

Number of transects : 7  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 2.60 km

Transect # : 1A  
Start Lat : S 17 : 30.824 Start Lon : E 27 : 36.668  
Finish Lat : S 17 : 32.122 Finish Lon : E 27 : 36.668  
Length : 2.40 km

Transect # : 1B  
Start Lat : S 17 : 32.201 Start Lon : E 27 : 36.668  
Finish Lat : S 17 : 32.494 Finish Lon : E 27 : 36.668  
Length : 0.54 km

Transect # : 1C  
Start Lat : S 17 : 34.308 Start Lon : E 27 : 36.668  
Finish Lat : S 17 : 37.312 Finish Lon : E 27 : 36.668  
Length : 5.56 km

Transect # : 2  
Start Lat : S 17 : 37.823 Start Lon : E 27 : 35.197  
Finish Lat : S 17 : 29.791 Finish Lon : E 27 : 35.197  
Length : 14.87 km

Transect # : 3A  
Start Lat : S 17 : 26.606 Start Lon : E 27 : 33.725  
Finish Lat : S 17 : 27.480 Finish Lon : E 27 : 33.725  
Length : 1.62 km

Transect # : 3B  
Start Lat : S 17 : 27.832 Start Lon : E 27 : 33.725  
Finish Lat : S 17 : 29.309 Finish Lon : E 27 : 33.725  
Length : 2.73 km

Transect # : 3C  
Start Lat : S 17 : 29.645 Start Lon : E 27 : 33.725  
Finish Lat : S 17 : 29.935 Finish Lon : E 27 : 33.725  
Length : 0.54 km

Transect # : 3D  
Start Lat : S 17 : 29.990 Start Lon : E 27 : 33.725  
Finish Lat : S 17 : 38.567 Finish Lon : E 27 : 33.725  
Length : 15.88 km

Transect # : 4  
Start Lat : S 17 : 39.362 Start Lon : E 27 : 32.254  
Finish Lat : S 17 : 30.336 Finish Lon : E 27 : 32.254  
Length : 16.72 km

Transect # : 5  
Start Lat : S 17 : 30.449 Start Lon : E 27 : 30.782  
Finish Lat : S 17 : 39.556 Finish Lon : E 27 : 30.782  
Length : 16.86 km

Transect # : 6A  
Start Lat : S 17 : 39.997 Start Lon : E 27 : 29.311  
Finish Lat : S 17 : 30.616 Finish Lon : E 27 : 29.311  
Length : 17.37 km

Transect # : 6B  
Start Lat : S 17 : 30.610 Start Lon : E 27 : 29.311  
Finish Lat : S 17 : 30.546 Finish Lon : E 27 : 29.311  
Length : 0.12 km

Transect # : 7A  
Start Lat : S 17 : 30.899 Start Lon : E 27 : 27.839  
Finish Lat : S 17 : 31.181 Finish Lon : E 27 : 27.839  
Length : 0.52 km

Transect # : 7B  
Start Lat : S 17 : 31.793 Start Lon : E 27 : 27.839  
Finish Lat : S 17 : 34.574 Finish Lon : E 27 : 27.839  
Length : 5.15 km

Transect # : 7C  
Start Lat : S 17 : 38.712 Start Lon : E 27 : 27.839  
Finish Lat : S 17 : 39.149 Finish Lon : E 27 : 27.839  
Length : 0.81 km

### **Siabuwa West**

Number of transects : 6  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 7.50 km

Transect # : 1  
Start Lat : S 17 : 39.943 Start Lon : E 27 : 28.175  
Finish Lat : S 17 : 47.887 Finish Lon : E 27 : 28.175  
Length : 14.71 km

Transect # : 2  
Start Lat : S 17 : 44.936 Start Lon : E 27 : 32.420  
Finish Lat : S 17 : 39.176 Finish Lon : E 27 : 32.420  
Length : 10.67 km

Transect # : 3  
Start Lat : S 17 : 37.313 Start Lon : E 27 : 36.665  
Finish Lat : S 17 : 43.272 Finish Lon : E 27 : 36.665  
Length : 11.04 km

Transect # : 4  
Start Lat : S 17 : 41.204 Start Lon : E 27 : 40.910  
Finish Lat : S 17 : 35.953 Finish Lon : E 27 : 40.910  
Length : 9.73 km

Transect # : 5  
Start Lat : S 17 : 36.002 Start Lon : E 27 : 45.154  
Finish Lat : S 17 : 40.718 Finish Lon : E 27 : 45.154  
Length : 8.73 km

Transect # : 6  
Start Lat : S 17 : 39.300 Start Lon : E 27 : 49.399  
Finish Lat : S 17 : 35.258 Finish Lon : E 27 : 49.399  
Length : 7.49 km

### **Siabuwa East**

Number of transects : 9  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 5.30 km

Transect # : 1  
Start Lat : S 17 : 21.081 Start Lon : E 28 : 12.782  
Finish Lat : S 17 : 31.361 Finish Lon : E 28 : 12.782  
Length : 19.04 km

Transect # : 2A  
Start Lat : S 17 : 31.768 Start Lon : E 28 : 9.787  
Finish Lat : S 17 : 16.063 Finish Lon : E 28 : 9.787  
Length : 29.08 km

Transect # : 2B  
Start Lat : S 17 : 15.466 Start Lon : E 28 : 9.787  
Finish Lat : S 17 : 15.041 Finish Lon : E 28 : 9.787  
Length : 0.79 km

Transect # : 3  
Start Lat : S 17 : 12.238 Start Lon : E 28 : 6.792  
Finish Lat : S 17 : 30.964 Finish Lon : E 28 : 6.792  
Length : 34.68 km

Transect # : 4  
Start Lat : S 17 : 31.211 Start Lon : E 28 : 3.797  
Finish Lat : S 17 : 13.279 Finish Lon : E 28 : 3.797  
Length : 33.21 km

Transect # : 5  
Start Lat : S 17 : 15.402 Start Lon : E 28 : 0.802  
Finish Lat : S 17 : 34.161 Finish Lon : E 28 : 0.802  
Length : 34.74 km

Transect # : 6A  
Start Lat : S 17 : 35.864 Start Lon : E 27 : 57.807  
Finish Lat : S 17 : 20.047 Finish Lon : E 27 : 57.807  
Length : 29.29 km

Transect # : 6B  
Start Lat : S 17 : 18.418 Start Lon : E 27 : 57.807  
Finish Lat : S 17 : 18.111 Finish Lon : E 27 : 57.807  
Length : 0.57 km

Transect # : 6C  
Start Lat : S 17 : 18.001 Start Lon : E 27 : 57.807  
Finish Lat : S 17 : 16.375 Finish Lon : E 27 : 57.807  
Length : 3.01 km

Transect # : 7  
Start Lat : S 17 : 20.190 Start Lon : E 27 : 54.812  
Finish Lat : S 17 : 37.069 Finish Lon : E 27 : 54.812  
Length : 31.26 km

Transect # : 8A  
Start Lat : S 17 : 38.392 Start Lon : E 27 : 51.817  
Finish Lat : S 17 : 36.917 Finish Lon : E 27 : 51.817  
Length : 2.73 km

Transect # : 8B  
Start Lat : S 17 : 36.511 Start Lon : E 27 : 51.817  
Finish Lat : S 17 : 32.067 Finish Lon : E 27 : 51.817  
Length : 8.23 km

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Transect # : 8C  
Start Lat : S 17 : 31.872 Start Lon : E 27 : 51.817  
Finish Lat : S 17 : 31.644 Finish Lon : E 27 : 51.817  
Length : 0.42 km

Transect # : 9  
Start Lat : S 17 : 24.834 Start Lon : E 27 : 48.822  
Finish Lat : S 17 : 27.166 Finish Lon : E 27 : 48.822  
Length : 4.32 km

Transect # : 8D  
Start Lat : S 17 : 28.757 Start Lon : E 27 : 51.817  
Finish Lat : S 17 : 22.183 Finish Lon : E 27 : 51.817  
Length : 12.17 km

### **Mapongolas**

Number of transects : 13  
Transect Bearing : 90.00 Degrees  
Transect Spacing : 1.90 km

Transect # : 1  
Start Lat : S 16 : 59.966 Start Lon : E 28 : 19.299  
Finish Lat : S 16 : 59.966 Finish Lon : E 28 : 22.394  
Length : 5.48 km

Transect # : 8  
Start Lat : S 17 : 7.148 Start Lon : E 28 : 16.681  
Finish Lat : S 17 : 7.148 Finish Lon : E 28 : 5.116  
Length : 20.49 km

Transect # : 2  
Start Lat : S 17 : 0.992 Start Lon : E 28 : 24.041  
Finish Lat : S 17 : 0.992 Finish Lon : E 28 : 15.187  
Length : 15.69 km

Transect # : 9  
Start Lat : S 17 : 8.174 Start Lon : E 28 : 5.384  
Finish Lat : S 17 : 8.174 Finish Lon : E 28 : 15.839  
Length : 18.52 km

Transect # : 3  
Start Lat : S 17 : 2.018 Start Lon : E 28 : 10.701  
Finish Lat : S 17 : 2.018 Finish Lon : E 28 : 23.634  
Length : 22.92 km

Transect # : 10  
Start Lat : S 17 : 9.200 Start Lon : E 28 : 14.997  
Finish Lat : S 17 : 9.200 Finish Lon : E 28 : 8.602  
Length : 11.33 km

Transect # : 4  
Start Lat : S 17 : 3.044 Start Lon : E 28 : 23.080  
Finish Lat : S 17 : 3.044 Finish Lon : E 28 : 9.475  
Length : 24.11 km

Transect # : 11  
Start Lat : S 17 : 10.226 Start Lon : E 28 : 7.910  
Finish Lat : S 17 : 10.226 Finish Lon : E 28 : 12.113  
Length : 7.45 km

Transect # : 5  
Start Lat : S 17 : 4.070 Start Lon : E 28 : 8.562  
Finish Lat : S 17 : 4.070 Finish Lon : E 28 : 22.370  
Length : 24.47 km

Transect # : 12  
Start Lat : S 17 : 11.252 Start Lon : E 28 : 10.122  
Finish Lat : S 17 : 11.252 Finish Lon : E 28 : 8.130  
Length : 3.53 km

Transect # : 6  
Start Lat : S 17 : 5.096 Start Lon : E 28 : 18.746  
Finish Lat : S 17 : 5.096 Finish Lon : E 28 : 7.166  
Length : 20.52 km

Transect # : 13  
Start Lat : S 17 : 12.278 Start Lon : E 28 : 8.621  
Finish Lat : S 17 : 12.278 Finish Lon : E 28 : 8.986  
Length : 0.65 km

Transect # : 7  
Start Lat : S 17 : 6.122 Start Lon : E 28 : 5.897  
Finish Lat : S 17 : 6.122 Finish Lon : E 28 : 17.572  
Length : 20.69 km

### **Gatche Gatche**

Number of transects : 8  
Transect Bearing : 0.00 Degrees  
Transect Spacing : 2.10 km

Transect # : 1  
Start Lat : S 16 : 48.515 Start Lon : E 28 : 48.069  
Finish Lat : S 16 : 49.113 Finish Lon : E 28 : 48.069  
Length : 1.11 km

Transect # : 2  
Start Lat : S 16 : 49.164 Start Lon : E 28 : 49.253  
Finish Lat : S 16 : 48.103 Finish Lon : E 28 : 49.253  
Length : 1.96 km

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Transect # : 3  
Start Lat : S 16 : 47.314 Start Lon : E 28 : 50.436  
Finish Lat : S 16 : 49.091 Finish Lon : E 28 : 50.436  
Length : 3.29 km

Transect # : 4  
Start Lat : S 16 : 48.963 Start Lon : E 28 : 51.620  
Finish Lat : S 16 : 46.695 Finish Lon : E 28 : 51.620  
Length : 4.20 km

Transect # : 5A  
Start Lat : S 16 : 40.891 Start Lon : E 28 : 52.803  
Finish Lat : S 16 : 42.726 Finish Lon : E 28 : 52.803  
Length : 3.40 km

Transect # : 5B  
Start Lat : S 16 : 46.329 Start Lon : E 28 : 52.803  
Finish Lat : S 16 : 48.490 Finish Lon : E 28 : 52.803  
Length : 4.00 km

Transect # : 6A  
Start Lat : S 16 : 48.040 Start Lon : E 28 : 53.987  
Finish Lat : S 16 : 43.832 Finish Lon : E 28 : 53.987  
Length : 7.79 km

Transect # : 6B  
Start Lat : S 16 : 43.781 Start Lon : E 28 : 53.987  
Finish Lat : S 16 : 43.756 Finish Lon : E 28 : 53.987  
Length : 0.05 km

Transect # : 6C  
Start Lat : S 16 : 43.189 Start Lon : E 28 : 53.987  
Finish Lat : S 16 : 42.838 Finish Lon : E 28 : 53.987  
Length : 0.65 km

Transect # : 7  
Start Lat : S 16 : 43.566 Start Lon : E 28 : 55.171  
Finish Lat : S 16 : 47.315 Finish Lon : E 28 : 55.171  
Length : 6.94 km

Transect # : 8  
Start Lat : S 16 : 46.632 Start Lon : E 28 : 56.354  
Finish Lat : S 16 : 44.230 Finish Lon : E 28 : 56.354  
Length : 4.45 km

## Appendix 4. Transect summaries of sightings

### Species codes:

Code	Species
Bab	Baboon
Bbk	Bushbuck
Bpig	Bushpig
Buff	Buffalo
Catt	Cattle
Croc	Crocodile
Dkr	Common or Bush Duiker
Donk	Donkey
EIC1	Elephant carcass, age category 1
EIC2	Elephant carcass, age category 2
EIC3	Elephant carcass, age category 3
EIC4	Elephant carcass, age category 4
Eld	Eland
EleF	Elephant cow
EleM	Elephant bull
Ghb	Ground hornbill
Hipo	Hippopotamus
Imp	Impala
Kral	Kraal (Cattle pen)
Kudu	Kudu
PC	Poachers' camp
Sab	Sable antelope
Sbk	Steenbok
Shoa	Sheep and/or goats
UnCa	Unidentified carcass
Wbk	Waterbuck
Whog	Warthog
Zeb	Zebra

### Other abbreviations

Abbreviation	Meaning
n	number of transects sampled
N	possible number of transects in stratum
t	Student's <i>t</i> value, $P = 0.05$
T #	transect number
-	that no animals were seen in search the strips

The following tables list, for each stratum, the number of individuals of each species that were seen inside the search strips on each transect.

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 19/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 445 sq km  
 N : 84                      n : 16  
 Pilot : Charles Mackie

Stratum Name : Busi  
 Base Line Length : 26 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.131  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EleF	EIC3	EIC4	UnCa	Wbk	Kudu	Ghb	Bab	Bbk	Dkr
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	14	0	0	1	0	0	0	0	0	0
5	0	0	0	0	1	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	1
7	0	0	0	2	3	0	0	4	0	0	0
8	0	0	0	1	0	0	0	0	0	0	0
9	0	0	0	3	0	0	3	0	4	0	0
10	0	0	2	0	0	0	0	0	0	0	0
11	0	60	0	1	1	0	0	0	0	0	0
12	0	0	1	0	0	0	0	0	0	1	0
13	8	0	0	0	1	0	0	0	0	0	0
14	0	0	0	0	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleM	EleF	EIC3	EIC4	UnCa	Wbk	Kudu	Ghb	Bab	Bbk	Dkr
	8	74	3	7	7	1	3	4	4	1	1

Date of Survey : 13/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 501 sq km  
 N : 95                      n : 9  
 Pilot : Charles Mackie

Stratum Name : Chete East  
 Base Line Length : 29.8 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.306  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleF	EIC3	EIC4	UnCa	Buff	Ghb	Croc
1	0	0	0	0	1	0	5
2	5	0	0	0	23	0	0
3	0	0	1	0	0	0	1
4	0	0	1	0	0	2	0
5	0	0	0	0	0	0	3
6	0	0	0	0	0	0	1
7	0	1	0	0	0	0	0
8	0	0	0	1	0	0	0
9	0	0	0	0	5	0	2

Sighting Totals

	EleF	EIC3	EIC4	UnCa	Buff	Ghb	Croc
	5	1	2	1	29	2	12



*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 25/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 430 sq km  
 N : 96                      n : 4  
 Pilot : Charles Mackie

Stratum Name : Chireya North  
 Base Line Length : 29.1 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 3.182  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	Cat	Shoa	Donk
1	63	100	3
2	80	132	14
3	25	21	4
4	0	0	0

Sighting Totals

	Cat	Shoa	Donk
	168	253	21

Date of Survey : 11/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 245 sq km  
 N : 100                      n : 17  
 Pilot : Charles Mackie

Stratum Name : Matusadona East  
 Base Line Length : 30.7 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.12  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EleF	EIC3	EIC4	UnCa	Wbk	Imp	Whog	Kudu	Ghb	Hipo	Croc
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	2
3	4	0	0	0	0	0	21	0	0	0	4	1
4	4	5	0	1	0	0	10	0	0	0	0	0
5	0	0	0	0	0	0	5	0	0	0	0	0
6	4	0	0	2	0	0	0	0	0	0	1	2
7	2	0	1	0	0	0	25	0	0	0	0	0
8	1	0	0	1	0	0	0	0	0	0	0	0
9	0	1	0	0	0	4	0	0	0	0	6	0
10	1	2	1	1	0	0	37	0	0	0	0	0
11	5	0	1	1	0	0	0	0	0	0	0	0
12	11	0	1	2	0	0	3	0	0	0	0	0
13	0	12	0	0	0	3	15	0	0	0	0	2
14	6	0	1	3	0	3	67	0	0	0	20	0
15	7	2	0	1	0	0	0	0	1	0	21	6
16	0	0	0	0	1	0	0	0	0	1	3	9
17	0	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleM	EleF	EIC3	EIC4	UnCa	Wbk	Imp	Whog	Kudu	Ghb	Hipo	Croc
	45	22	5	12	1	10	183	0	1	1	55	22

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 26/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 743 sq km  
 N : 142                      n : 19  
 Pilot : Charles Mackie

Stratum Name : Chirisa Gadzi  
 Base Line Length : 38.4 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.101  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleF	EleM	EIC3	EIC4	Zeb	Cat	Shoa	Ghb	Dkr	Sbk	PC
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	1	0	0	2	0	0	1	0	0
3	0	0	0	0	0	10	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	0	0
5	0	0	1	0	0	1	0	0	0	0	0
6	0	0	4	0	0	4	0	0	0	0	0
7	0	0	1	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	1	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	2	0	0	0	0	2	0
11	0	0	1	0	0	0	0	0	0	0	0
12	0	0	1	0	0	2	8	0	1	0	0
13	0	1	0	0	0	0	0	3	0	0	0
14	8	0	1	1	0	0	0	0	0	0	0
15	0	0	1	2	7	0	0	0	0	0	0
16	0	1	0	0	0	0	0	0	0	0	0
17	0	3	0	2	0	0	0	0	0	0	0
18	32	4	1	0	0	0	0	0	0	0	1
19	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleF	EleM	EIC3	EIC4	Zeb	Cat	Shoa	Ghb	Dkr	Sbk	PC
	40	9	14	5	9	19	8	3	3	2	1

Date of Survey : 25/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 1383 sq km  
 N : 159                      n : 6  
 Pilot : Charles Mackie

Stratum Name : Chireya South  
 Base Line Length : 47.3 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.571  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	Cat	Shoa	Donk
1	32	21	0
2	28	89	10
3	182	95	18
4	192	264	8
5	158	260	21
6	337	151	4

Sighting Totals

	Cat	Shoa	Donk
	929	880	61

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 20/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 414 sq km  
 N : 94                      n : 16  
 Pilot : Charles Mackie

Stratum Name : Chirisa Sengwa  
 Base Line Length : 29.7 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.131  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EIC2	EIC3	EIC4	UnCa	Buff	Kudu	Cat	Bab	Sbk	Bbk
1	0	0	0	0	0	0	0	4	0	0	0
2	0	0	0	1	0	0	0	2	0	0	0
3	0	0	0	0	0	0	0	2	0	0	0
4	0	0	1	0	0	0	0	0	0	0	0
5	0	0	0	1	0	0	0	0	3	1	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	1	1	0	3	0	0	2	0
8	0	0	0	1	0	0	0	0	0	2	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	2	2	0	0	0	0	0	0	0
11	0	0	0	1	0	50	0	0	0	0	1
12	0	0	0	0	0	4	0	0	0	0	0
13	0	0	0	4	1	0	0	0	2	0	0
14	0	1	1	2	2	0	0	0	0	0	0
15	8	0	1	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleM	EIC2	EIC3	EIC4	UnCa	Buff	Kudu	Cat	Bab	Sbk	Bbk
	8	1	5	13	4	54	3	8	5	5	1

Date of Survey : 11/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 73 sq km  
 N : 57                      n : 8  
 Pilot : Charles Mackie

Stratum Name : Gatche Gatche  
 Base Line Length : 17.9 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.365  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleF	EIC3	UnCa	Imp	Whog	Kudu	Cat	Shoa	Ghb	Hipo	Croc
1	0	0	0	0	1	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	1	0	0
4	0	0	0	0	0	0	0	2	0	0	0
5	0	1	2	14	0	0	0	12	0	3	5
6	0	0	0	0	0	0	0	0	0	0	0
7	2	0	0	8	0	0	0	0	0	0	1
8	0	0	0	0	2	0	0	0	0	0	1

Sighting Totals

	EleF	EIC3	UnCa	Imp	Whog	Kudu	Cat	Shoa	Ghb	Hipo	Croc
	2	1	2	22	3	0	0	14	1	3	7

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 28/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 537 sq km  
 N : 152                      n : 6  
 Pilot : Charles Mackie

Stratum Name : Lusulu  
 Base Line Length : 45 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.571  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	Cat	Shoa	Dkr
1	21	0	1
2	129	23	0
3	67	6	0
4	114	44	0
5	53	29	0
6	0	0	0

Sighting Totals

	Cat	Shoa	Dkr
	384	102	1

Date of Survey : 14/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 377 sq km  
 N : 70                      n : 13  
 Pilot : Charles Mackie

Stratum Name : Mapongolas  
 Base Line Length : 24.3 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.179  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EIC4	UnCa	Sab	Imp	Cat	Shoa	Donk
1	0	0	0	0	0	0	0
2	1	0	0	0	6	60	4
3	0	0	0	0	0	46	2
4	3	1	0	0	0	0	0
5	1	1	1	0	0	0	0
6	1	0	0	1	0	15	3
7	0	0	0	0	0	39	0
8	0	2	0	0	0	0	0
9	0	0	0	0	0	18	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0

Sighting Totals

	EIC4	UnCa	Sab	Imp	Cat	Shoa	Donk
	6	4	1	1	6	178	9

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 11/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 116 sq km  
 N : 55                      n : 12  
 Pilot : Charles Mackie

Stratum Name : Matusadona West  
 Base Line Length : 18 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.201  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EleF	EIC4	Buff	Wbk	Imp	Hipo	Croc
1	0	0	0	0	0	0	0	0
2	0	0	0	85	0	0	0	0
3	2	0	0	0	2	16	0	18
4	0	6	0	0	0	5	0	0
5	0	7	1	0	0	0	0	2
6	0	5	0	0	0	0	11	2
7	0	0	0	0	0	0	0	2
8	0	0	0	0	0	1	2	0
9	1	0	1	0	0	0	5	1
10	3	8	0	0	0	3	2	0
11	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	0

Sighting Totals

	EleM	EleF	EIC4	Buff	Wbk	Imp	Hipo	Croc
	6	26	2	85	2	25	20	26

Date of Survey : 12/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 425 sq km  
 N : 85                      n : 9  
 Pilot : Charles Mackie

Stratum Name : Mwenda  
 Base Line Length : 26.3 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.306  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	Cat	Shoa	Donk	Hipo	Croc
1	0	0	0	0	0	0
2	0	0	0	0	1	1
3	0	9	35	2	10	2
4	0	10	23	0	0	0
5	1	0	44	0	0	0
6	0	8	42	0	0	0
7	0	13	23	0	0	0
8	0	8	31	0	0	0
9	0	13	30	0	0	0

Sighting Totals

	EleM	Cat	Shoa	Donk	Hipo	Croc
	1	61	228	2	11	3

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 14/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 713 sq km  
 N : 118                      n : 16  
 Pilot : Charles Mackie

Stratum Name : Negande  
 Base Line Length : 38.6 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.131  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	Cat	Shoa	Donk	Bab	Dkr
1	0	0	0	0	0
2	0	11	0	1	0
3	0	0	9	0	0
4	0	20	1	0	0
5	0	77	3	0	0
6	13	104	10	0	0
7	10	84	4	0	0
8	21	93	6	0	0
9	0	17	1	0	0
10	0	47	5	1	2
11	0	0	0	1	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	10	11	0	0
16	4	79	0	0	0

Sighting Totals

	Cat	Shoa	Donk	Bab	Dkr
	48	542	50	3	2

Date of Survey : 16/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 495 sq km  
 N : 85                      n : 11  
 Pilot : Charles Mackie

Stratum Name : Nenyunga  
 Base Line Length : 27.7 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.228  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EIC3	EIC4	UnCa	Buff	Imp	Cat	Shoa	Donk	Ghb	Dkr	Bbk
1	0	0	0	0	0	16	29	22	0	0	0
2	0	0	0	0	0	17	99	0	0	0	0
3	0	0	1	0	0	12	38	9	0	0	0
4	0	0	1	0	0	15	28	6	0	0	0
5	0	0	1	0	0	9	0	0	0	1	0
6	1	1	0	0	0	0	0	0	0	0	0
7	1	1	0	0	0	27	0	0	0	1	2
8	0	0	0	0	1	0	0	0	4	0	0
9	0	0	0	3	0	0	0	0	0	0	0
10	0	1	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EIC3	EIC4	UnCa	Buff	Imp	Cat	Shoa	Donk	Ghb	Dkr	Bbk
	2	3	3	3	1	96	194	37	4	2	2

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

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Date of Survey : 13/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 990 sq km  
 N : 162                      n : 20  
 Pilot : Charles Mackie

Stratum Name : Sampakaruma  
 Base Line Length : 51.4 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.093  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleF	EiC4	UnCa	Buff	Zeb	Imp	Cat	Shoa	Donk	Croc	Dkr
1	0	0	0	0	0	0	0	0	0	0	0
2	0	1	1	0	0	0	0	0	0	0	0
3	0	0	1	1	7	0	0	0	0	0	0
4	4	0	0	0	0	0	0	0	0	0	0
5	0	0	3	0	0	0	2	8	0	0	0
6	0	0	0	0	0	0	3	6	0	0	0
7	0	0	2	0	0	0	2	5	3	0	0
8	0	3	1	0	0	0	2	0	2	0	0
9	0	0	0	0	0	0	39	68	3	1	0
10	0	0	2	0	0	0	25	35	9	0	0
11	0	0	0	0	0	0	14	51	9	0	0
12	0	1	0	0	0	0	19	22	0	0	1
13	17	0	0	0	0	0	36	23	5	0	0
14	0	0	1	18	0	0	26	27	0	0	1
15	0	0	0	0	0	0	0	79	0	0	0
16	0	1	1	0	0	0	13	6	3	0	0
17	0	1	0	0	0	0	0	18	0	0	0
18	0	0	3	0	0	1	0	0	0	0	0
19	0	2	2	10	0	0	0	3	2	0	0
20	10	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleF	EiC4	UnCa	Buff	Zeb	Imp	Cat	Shoa	Donk	Croc	Dkr
	31	9	17	29	7	1	181	351	36	1	2

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 27/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 1295 sq km  
 N : 167                      n : 9  
 Pilot : Charles Mackie

Stratum Name : Siabuwa East  
 Base Line Length : 50.6 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.306  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EIC4	UnCa	Imp	Cat	Shoa	Donk	Bab
1	0	0	0	31	22	4	0
2	0	0	0	29	47	5	0
3	0	0	0	8	75	0	0
4	0	0	0	158	126	0	0
5	0	1	0	51	114	0	2
6	0	0	0	324	92	4	0
7	0	0	0	12	39	0	0
8	0	0	4	44	0	0	0
9	2	0	0	0	0	0	0

Sighting Totals

	EIC4	UnCa	Imp	Cat	Shoa	Donk	Bab
	2	1	4	657	515	13	2

Date of Survey : 28/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 481 sq km  
 N : 159                      n : 6  
 Pilot : Charles Mackie

Stratum Name : Siabuwa West  
 Base Line Length : 48 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.571  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EIC4	UnCa	Cat	Shoa	Donk
1	0	0	0	59	134	4
2	0	0	0	23	0	0
3	0	0	0	77	71	0
4	0	0	1	39	99	0
5	0	0	0	0	0	0
6	3	1	0	6	0	0

Sighting Totals

	EleM	EIC4	UnCa	Cat	Shoa	Donk
	3	1	1	204	304	4



*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 17/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 261 sq km  
 N : 56                      n : 7  
 Pilot : Charles Mackie

Stratum Name : Sijarira  
 Base Line Length : 17.8 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.447  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EIC3	EIC4	UnCa	Zeb	Whog	Croc
1	0	0	1	0	0	0	0
2	0	0	2	0	3	0	0
3	1	1	2	0	0	0	0
4	0	0	1	0	0	0	0
5	1	0	0	1	0	0	0
6	0	0	1	0	0	3	4
7	0	0	0	0	0	0	1

Sighting Totals

	EleM	EIC3	EIC4	UnCa	Zeb	Whog	Croc
	2	1	7	1	3	3	5

Date of Survey : 26/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 788 sq km  
 N : 166                      n : 6  
 Pilot : Charles Mackie

Stratum Name : Simchembo  
 Base Line Length : 47.8 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.571  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	Cat	Shoa	Donk
1	79	79	10
2	57	58	13
3	69	85	11
4	127	201	4
5	172	107	1
6	38	33	2

Sighting Totals

	Cat	Shoa	Donk
	542	563	41

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 12-14 July 2014

Stratum Name : Matusadona Hills

Stratum Locality : Sebungwe

Stratum Area : 1005 sq km

n (sampled) : 11                      n (searched) : 8

t : 2.228

Pilot : M. Henriksen

Recorder/Observer : G. Nyaguse

Block summary table :

	Number	Time (mins)	Area (sq km)	EleF	EIC4	Buff	Zeb	Imp	Whog	Croc
1	13	37	37.5	21	0	1	0	0	6	0
2	35	37	37.2	0	1	30	0	0	3	0
3	31	35	34.5	0	0	0	2	0	0	0
4	8	32	33.1	19	0	15	6	2	0	0
5	30E	31	34.6	0	0	0	0	0	0	0
6	12	39	34.9	13	0	50	12	0	0	0
7	1	35	32.5	0	2	0	0	0	0	100
8	34	30	28.8	0	0	0	0	0	0	0
9	35									
10	31									
11	34									

Sighting Totals:

				EleF	EIC4	Buff	Zeb	Imp	Whog	Croc
				53	3	96	20	2	9	100

Date of Survey : 12/07/14

Stratum Name : Kanyati Highlands

Stratum Locality : Sebungwe

Stratum Area : 308 sq km

n (sampled) : 6                      n (searched) : 4

t : 2.571

Pilot : M. Henriksen

Recorder/Observer : G. Nyaguse

Block summary table :

	Number	Time (mins)	Area (sq km)	EleF	Croc
1	13	25	24.9	0	1
2	13				
3	13				
4	4	20	19.5	15	0
5	2	23	25.1	0	0
6	8	17	28.0	0	0

Sighting Totals:

				EleF	Croc
				15	1

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 16/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 741 sq km  
 N : 135                      n : 17  
 Pilot : Charles Mackie

Stratum Name : Chete West  
 Base Line Length : 42.3 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.12  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EleF	EIC3	EIC4	UnCa	Buff	Zeb	Sab	Wbk	Imp	Whog	Kudu	Cat	Shoa	Donk	Eld	Bab	Croc	Dkr	Sbk	PC
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	1	0	0	0
4	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0
8	4	5	0	0	0	1	5	1	4	15	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0
10	0	7	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
12	0	0	0	1	0	0	0	0	0	0	0	6	0	20	0	0	0	8	0	1	1
13	0	0	0	1	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0
14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
15	0	0	0	1	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
16	0	0	0	1	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0

Sighting Totals

	EleM	EleF	EIC3	EIC4	UnCa	Buff	Zeb	Sab	Wbk	Imp	Whog	Kudu	Cat	Shoa	Donk	Eld	Bab	Croc	Dkr	Sbk	PC
	7	22	1	7	2	14	5	1	4	19	4	7	29	32	3	0	6	13	2	2	1

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

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Date of Survey : 17/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 968 sq km  
 N : 91                      n : 11  
 Pilot : Charles Mackie

Stratum Name : Chizarira East  
 Base Line Length : 28.5 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.228  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleF	EIC2	EIC3	EIC4	UnCa	Buff	Zeb	Wbk	Whog	Kudu	Ghb	Bab	Bbk	Sbk	Kral
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	4	4	0	0	0
3	0	0	0	0	2	0	0	1	5	0	0	0	0	1	0
4	0	0	0	0	1	0	0	1	0	0	0	0	2	0	0
5	33	0	0	5	1	0	0	0	0	1	0	0	0	0	0
6	0	0	0	1	0	1	0	0	0	3	0	0	0	0	0
7	0	0	1	6	1	0	1	0	0	0	1	0	0	0	0
8	0	0	0	1	0	4	0	0	0	0	3	0	0	0	2
9	0	0	0	2	5	0	4	0	0	0	0	0	0	0	1
10	0	0	0	0	1	0	2	0	0	0	4	0	0	0	4
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleF	EIC2	EIC3	EIC4	UnCa	Buff	Zeb	Wbk	Whog	Kudu	Ghb	Bab	Bbk	Sbk	Kral
	33	1	1	15	11	5	7	2	5	4	12	4	2	1	7

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

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Date of Survey : 18/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 683 sq km  
 N : 114                      n : 15  
 Pilot : Charles Mackie

Stratum Name : Chizarira West  
 Base Line Length : 34.2 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.145  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EIC1	EIC2	EIC4	UnCa	Buff	Sab	Wbk	Imp	Whog	Kudu	Cat	Ghb	Bab	Croc	Dkr	Bbk	Sbk
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	1	0	0	24	0	0	0	0	0	0	0	0	0	0
5	0	1	0	0	0	1	0	5	2	0	0	0	0	0	0	0	0	0
6	8	0	0	6	0	3	1	12	0	0	3	0	0	4	0	0	0	0
7	0	0	0	1	0	30	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	5	1	0	0	0	0	2	0	0	0	0	0	0	0	2
9	0	0	0	2	1	18	11	0	0	0	0	0	7	0	0	0	0	0
10	0	0	0	6	4	30	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	3	1	0	0	0	2	1	0	0	0	0	0	0	0	1
12	0	0	0	4	0	100	0	0	0	0	0	18	0	0	0	0	0	0
13	0	0	0	2	0	0	0	0	0	4	2	0	0	0	2	0	2	0
14	0	0	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleM	EIC1	EIC2	EIC4	UnCa	Buff	Sab	Wbk	Imp	Whog	Kudu	Cat	Ghb	Bab	Croc	Dkr	Bbk	Sbk
	8	1	1	31	12	182	12	41	4	7	5	18	7	4	2	1	2	3

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

Date of Survey : 12/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 737 sq km  
 N : 149                      n : 13  
 Pilot : Charles Mackie

Stratum Name : Sibilobilo  
 Base Line Length : 44.8 km  
 Calibrated Strip Width at 300 ft : 307 m  
 t : 2.179  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EIC4	UnCa	Buff	Zeb	Sab	Imp	Whog	Kudu	Cat	Shoa	Donk	Hipo	Croc	Sbk
1	0	0	0	0	0	0	0	0	0	0	0	0	6	4	0
2	0	1	1	0	0	0	11	0	0	0	0	0	0	0	0
3	9	0	1	0	0	0	0	0	0	0	25	0	4	0	0
4	1	0	0	0	0	0	29	0	0	5	31	6	0	1	1
5	0	0	0	0	0	0	0	6	0	0	107	19	0	0	0
6	0	0	0	0	0	0	0	0	0	19	86	0	0	0	0
7	0	0	0	0	6	0	0	0	0	0	139	0	0	6	0
8	0	0	0	0	0	0	0	0	0	0	45	0	0	1	1
9	0	0	1	0	0	0	0	0	0	18	35	0	0	0	1
10	0	1	2	0	0	0	4	0	2	2	30	0	0	5	0
11	0	0	0	15	0	6	2	0	0	0	0	0	3	3	0
12	0	0	1	0	0	0	0	0	0	0	0	0	0	5	2
13	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0

Sighting Totals

	EleM	EIC4	UnCa	Buff	Zeb	Sab	Imp	Whog	Kudu	Cat	Shoa	Donk	Hipo	Croc	Sbk
	10	2	7	15	6	6	46	6	2	44	498	25	13	28	5

*Aerial Survey of Elephants and other Large Herbivores in the Sebungwe (Zimbabwe): 2014*

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Date of Survey : 27/09/14  
 Stratum Locality : Sebungwe  
 Stratum Area : 373 sq km  
 N : 76                      n : 15  
 Pilot : Charles Mackie

Stratum Name : SWRA  
 Base Line Length : 21.8 km  
 Calibrated Strip Width at 300 ft : 284 m  
 t : 2.145  
 Observers : Colum Zhuwau, Greg Nyaguse

Transect summary table :

T #	EleM	EleF	EIC1	EIC2	EIC3	EIC4	UnCa	Buff	Zeb	Wbk	Imp	Whog	Kudu	Cat	Ghb	Eld	Bab	Croc	Sbk	Bpig
1	4	6	0	0	2	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
2	0	3	0	0	1	1	0	0	14	0	0	0	0	8	0	0	0	0	0	0
3	5	33	0	0	0	2	0	0	0	1	65	6	0	0	0	0	0	0	1	0
4	2	0	0	0	1	0	0	0	1	0	8	6	0	0	0	0	0	0	0	1
5	5	68	0	1	0	4	3	14	0	0	26	0	0	0	0	4	0	0	2	0
6	0	18	0	0	0	1	0	30	0	0	5	0	0	0	0	1	0	0	0	0
7	0	0	0	1	1	2	1	55	4	0	70	0	0	0	0	0	0	0	1	0
8	1	10	0	0	1	5	0	4	7	6	34	0	0	0	0	0	2	0	0	0
9	0	0	0	1	3	2	1	5	0	1	2	0	0	0	0	0	0	0	0	0
10	0	0	0	1	1	1	2	0	0	2	0	0	0	0	2	0	0	2	1	0
11	0	0	0	0	0	9	0	0	0	2	0	2	0	0	0	0	0	0	0	0
12	0	7	1	4	2	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0
13	0	0	0	0	0	2	2	0	0	4	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sighting Totals

	EleM	EleF	EIC1	EIC2	EIC3	EIC4	UnCa	Buff	Zeb	Wbk	Imp	Whog	Kudu	Cat	Ghb	Eld	Bab	Croc	Sbk	Bpig
	17	145	1	8	12	29	10	108	26	28	210	14	1	8	2	5	3	2	6	1

## **Appendix 5. Comparison of observers**

### **Introduction**

The numbers and sizes of groups seen by the two observers were compared to determine if the observers appeared to be similarly efficient.

### **Methods**

For each of the commoner species, the total numbers and the average sizes of the groups seen by each observer in all transects were determined. For each observer/species, the numbers of groups that an observer was expected to see (if the observers were equally efficient and animals similarly distributed on the two sides of the aircraft) were calculated as:

$$\text{Expected Number} = \frac{\text{Total Number} \times \text{Observer's Strip Width}}{\text{Total Strip Width for both Observers}}$$

where:

Expected Number = the number of groups of a given species that an observer was expected to count if the two observers saw similar numbers;

Total Number = the total number of groups of a given species actually counted by both observers;

Observer's Strip Width = the width (in metres) of the search strip of one observer when the aircraft was flying at 300 feet above ground level; and

Total Strip Width for both Observers = the combined calibrated strip width (in metres) for both observers when the aircraft was flying at 300 feet above ground level (Appendix 1).

The expected numbers were calculated separately for the two periods of the survey and, for each species/observer, the expected numbers for the two periods were summed to give the expected number for the entire survey.

For each species, the observed and expected numbers of groups were compared using a chi-square one-sample statistical test with 1 degree of freedom (Siegel 1956). No test was conducted for a species if either expected number was <5. For each species, the average sizes of the groups seen by the two observers were compared with a Mann-Whitney U two-tailed test.

### **Results**

Only for warthog was there a statistically-significant difference between the observers: the right observer saw more warthog groups than the left observer, but those groups seen by the right observer were smaller than those seen by the left observer (Table A5.1).

### **Conclusion**

The observers seem to have been similarly efficient at detecting and counting groups of animals.

### **Reference**

Siegel, S. 1956. *Nonparametric Statistics for the Behavioral Sciences*. McGraw-Hill Kogakusha Ltd, Tokyo. 312 pp.



**Table A5.1. Comparison of numbers and sizes of groups seen by the left and right observers**

Expected numbers of groups were proportional to the observers' strip widths (which varied between the first and second half of the survey - Appendix 1). No chi-square test was conducted if any expected number was <5.  $P_N$  indicates the probability of the observed numbers of groups if there was no difference in the efficiency of the two observers.  $P_s$  indicates the probability of the observed sizes of groups if there was no difference in the efficiency of the two observers. ns = not significant.

Species / observation	Observed number of groups		Expected number of groups		Mean size of groups		Chi-square	$P_N$	U	$P_s$
	Left	Right	Left	Right	Left	Right				
Buffalo	17	13	14	16	15.6	19.8	1.2	ns	97	ns
Carcass elephant 1	1	1	0	2	1.0	1.0				
Carcass elephant 2	5	4	4	5	1.4	1.0	0.5	ns	8	ns
Carcass elephant 3	19	17	17	19	1.2	1.1	0.4	ns	145	ns
Carcass elephant 4	82	67	71	78	1.1	1.0	3.3	ns	2592	ns
Carcass unidentified	53	41	45	49	1.0	1.0	2.7	ns		
Cattle	189	241	200	230	8.3	7.6	1.1	ns	21182	ns
Crocodile	29	47	36	40	1.4	1.7	2.6	ns	666	ns
Donkey	42	65	50	57	2.8	2.8	2.4	ns	1351	ns
Elephant bull	18	25	21	22	2.2	3.0	0.8	ns	186	ns
Elephant cow	19	25	20	24	7.0	10.7	0.1	ns	169	ns
Ground hornbill	5	8	6	7	2.0	3.3	0.3	ns	10	ns
Hippopotamus	12	16	13	15	4.1	3.3	0.1	ns	68	ns
Impala	26	28	25	29	11.8	7.4	0.1	ns	327	ns
Kudu	6	5	5	6	3.0	1.6	0.4	ns	7	ns
Sable	5	1	3	3	3.8	1.0			1	ns
Sheep/Goats	227	256	226	257	10.4	9.0	0.0	ns	27917	ns
Warthog	3	12	7	8	4.7	2.3	4.3	0.038	4	0.020
Waterbuck	12	11	11	12	4.3	3.4	0.2	ns	64	ns
Zebra	8	7	7	8	3.4	5.1	0.3	ns	23	ns

### Appendix 6. Maintenance of flying height

The intended height for flying the survey was 300 feet agl. The mean height flown was 305 feet agl (SD = 57.9 feet, SE = 1.2 feet, n = 2334 observations). Variation in the flying height is influenced by both the undulating nature of the terrain in the survey area, and by the pilot's ability to maintain the desired flying height.

The laser rangefinder worked only up to a maximum distance of 500 feet and hence some records that should have been >500 feet (usually in areas of relatively rugged terrain) were recorded as simply 500 feet. This explains the small peak on the extreme right of the figure. Only 2.6 % of records were 500 feet.

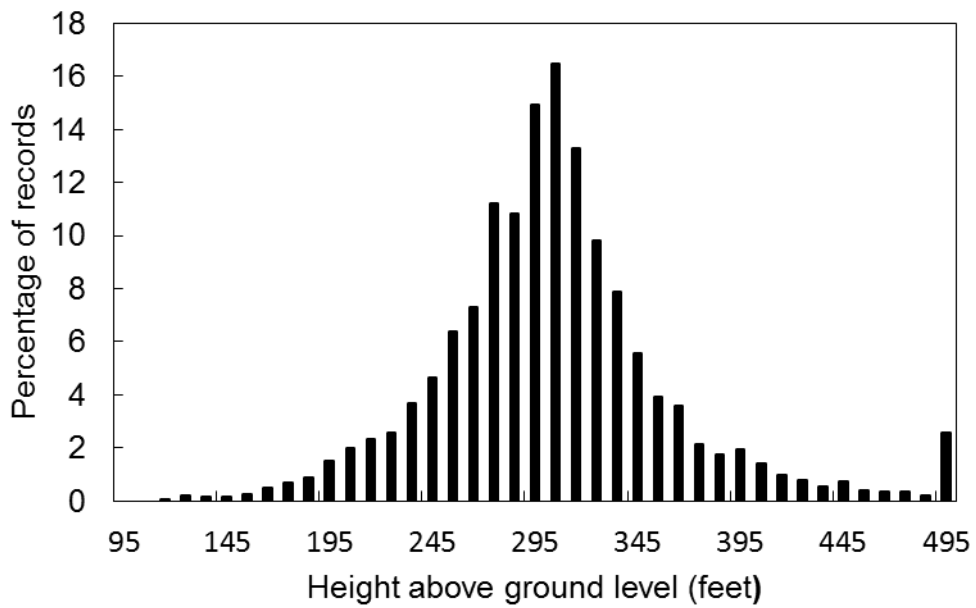


Fig. A6.1. Frequency distribution of flying height above ground level

## **Appendix 7. Ability of observers to estimate group sizes with acceptable accuracy**

Prior to the survey, the observers were given a slide presentation that was intended to allow them to test and, by repeated use, to improve their ability to estimate group sizes. In the absence of a large number of aerial photographs of elephant herds, the pictures in the presentation were of circles scattered around the screen. The number of circles varied from 5 to 40 which represented the range of elephant herd sizes expected in the survey. Usually each slide contained a different number of circles (two numbers were used twice) and so there were 38 slides. There were two sizes of solid blue circles and the circles were presented on a pale blue background. The arrangement of the circles on the slide varied between slides, even when circle numbers were similar. The order in which the slides were presented was determined randomly. Each slide was displayed for three seconds before the correct number of circles was displayed.

Before (in the case of the right observer) or after (in the case of the left observer) the survey, the observers were shown a second presentation. This test presentation was generally similar to the training presentation, but not identical. The two sizes of circles were grey and the background was pale green. The number of circles varied from 8 to 40. Each slide was displayed to the observers for three seconds and then they were given time to write down their estimate of the number of circles on the slide. The slides were labelled with different letters of the alphabet. Towards the end of the test – and without warning – the observers were shown five slides that were low-level aerial photographs of elephant herds, with the number of elephants varying from 14 to 46. The final slide was an aerial photograph of a herd of 89 elephants. Herds as large as this were not expected to be encountered during the survey and hence were outside the range of group sizes included in the training presentation.

After the test, the observers were shown a different version of the test presentation that included the numbers of circles/elephants on each slide.

For each observer, the estimated number was regressed against the actual number (excluding the last data point). If an observer could estimate group size without error, a linear regression should have a slope ( $b$ ) of 1 and an intercept ( $a$ ) of 0. In practice, for the left observer,  $b = 1.14$  (SE of  $b = 0.102$ ) and  $a = 0.42$  (SE of  $a = 2.67$ ). For the right observer,  $b = 1.04$  (SE of  $b = 0.061$ ) and  $a = 1.76$  (SE of  $a = 1.60$ ).

### **Conclusion**

The observers did not make wild guesses at group sizes for groups that they could not count, but were able to estimate group sizes with acceptable accuracy.

Ideally, future surveys should use photographs of herds of elephant (and other species) for training and testing. They should also use photographs of herds of >40 animals.

**Table A7.1. Comparison of actual and estimated group sizes**

Slide number	Actual number of dots (* elephants) on slide.	Estimated number of dots (* elephants)	
		Left observer	Right observer
1	23	20	22
2	31	30	30
3	33	30	40
4	21	20	18
5	27	25	28
6	34	50	40
7	13	18	16
8	35	50	43
9	29	30	28
10	12	18	15
11	19	20	22
12	9	10	11
13	38	60	42
14	17	15	22
15	20	20	18
16	10	10	12
17	18	20	18
18	40	35	40
19	14	20	16
20	32	40	32
21	24	25	30
22	15	18	18
23	39	50	48
24	16	20	18
25	11	12	13
26	26	30	22
27	8	10	8
28	25	40	26
29	22	25	30
30	28	30	32
31	36	40	42
32	30	40	38
33	37	45	46
34 *	19		22
35 *	46	40	42
36 *	14	15	22
37 *	20	25	26
38 *	89	50	62

## **Appendix 8. Calibration of laser rangefinder**

On three occasions, readings from the laser rangefinder (no. MP6314030) were compared with those from the plane's barometric altimeters. This was done by flying the plane immediately above and parallel to the airstrip, ideally six times – twice at 400 feet agl, twice at 300 ft and twice at 200 ft. To facilitate this, the pilot would arbitrarily zero his altimeter and so the readings from the pilot's altimeter are relative, not absolute. On the pilot's say, one of the observers would note the reading of the laser rangefinder and the recorder would note the reading of the co-pilot's altimeter. That the airstrip was not flat and level prevented more than one reading during each flight down the runway.

For each occasion, the reading from the laser rangefinder was regressed first against the reading from the altimeter and then against the reading from the co-pilot's altimeter. For each regression, the slope of the linear regression was determined.

For pilot's altimeter

11 Sept, slope (b) = 1.038, SE of b = 0.042;

20 Sept: b = 1.138, SE of b = 0.029;

27 Sept: b = 1.045, SE of b = 0.059.

Co-pilot's altimeter

11 Sept, b = 1.169, SE of b = 0.148;

20 Sept: b = 1.190, SE of b = 0.046;

27 Sept: b = 1.045, SE of b = 0.065.

**Table A8.1. Comparison of readings from laser rangefinder and barometric altimeters**

<b>Date</b>	<b>Pilot's barometric altimeter (ft)</b>	<b>Co-pilot's barometric altimeter (ft)</b>	<b>Laser rangefinder (ft)</b>
11 Sep 14	400	250	418
	400	300	416
	300	210	295
	300	220	313
	200	120	216
	200	110	199
	400	300	409
20 Sep 14	400	2310	380
	300	2220	266
	200	2110	142
	200	2120	156
	300	2200	266
	400	2300	373
27 Sep 14	400	2300	285
	400	2300	298
	300	-	199
	300	2200	210
	200	2100	82
	200	2100	83

## **Appendix 9. Great Elephant Census Review**

On behalf of the Great Elephant Census (GEC), technical advisors were requested to review three aspects of the survey:

1. The execution of the survey against plans and according to GEC survey standards;
2. The completion of post-flight and post-census validations; and
3. The scientific interpretation of the findings.

With reference to aspects 1 and 2, the advisors concluded that:

- the survey was excellent, with no problems of flight performance, design or calibration noted.

With reference to aspect 3, the advisors concluded that:

- this survey provides compelling evidence for a catastrophic decline in elephant numbers in the Sebungwe area between 2006 and 2014: and
- there is no evidence that this was caused by any factor other than human-induced mortality.