Total Aerial Count of Elephants and other Wildlife Species in Sambisa Game Reserve in Borno State, Nigeria

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Monitoring the illegal killing of elephants

JULY 2006

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Cover Photo: Cessna 172 used during thee 2006 Sambisa Count

"*This document has been produced with the financial assistance of the European Union through CITES MIKE Programme. The views expressed herein are those of the Authors and can therefore in no way be taken to reflect the official opinion of the European Community'"*.

Executive Summary

A total aerial count of elephants in Sambisa Game Reserve was carried out between **10th and 11th July 2006**. Total counts of elephants, elephant carcasses and other wildlife species was done while cattle, shoats and other domestic animals were estimated. Logging sites, settlements, fires, charcoal burning sites and farmlands were also recorded.

No elephant and only an old elephant carcass was counted during the census. A total of 21,400 heads of cattle; 11,195 shoats (sheep & goats); 158 farmlands and 203 settlements were estimated. Only 3 Roan antelopes; 3 Red-footed Gazelles; 3 Oribi; 3 Waterbucks and 8 Warthogs wild animal species were counted during the census.

Extensive clearing of the reserve for farmland and charcoal burning was witnessed within the area during the census period.

Introduction

According to the literature, it is believed that Borno state was having two elephant herds, one found around the Lake Chad shores and the other in its Southern parts including use of the Sambisa Game Reserve during the dry season. Mamza J. U. 1987 estimated the latter herd to be around 350-500 individuals. Earlier estimates had put the population at 150-200 (P. Hall 1976). This elephant population is believed to be engaged in extensive seasonal migration within the six Borno State Local Government areas of Askira/Uba, Damboa, Chibok, Gwoza, Konduga and sometimes-even crossing into Adamawa State to the south and Yobe State to the west (see Fig 1). Apart from the Sambisa Game Reserve, which is the only Gazetted Game Reserve in Borno State and a few other forest reserves, the entire range is heavily farmed during the wet season and extensively grazed during the dry season. It was therefore very unclear on what the survey would reveal.

From the GIS reports in the Abuja Federal Ministry of Environment, it appeared that Marguba Forest Reserve was also being referred to as Sambisa Game Reserve. A decision was therefore taken to include this forest reserve in the survey (Block 1 Fig 2).

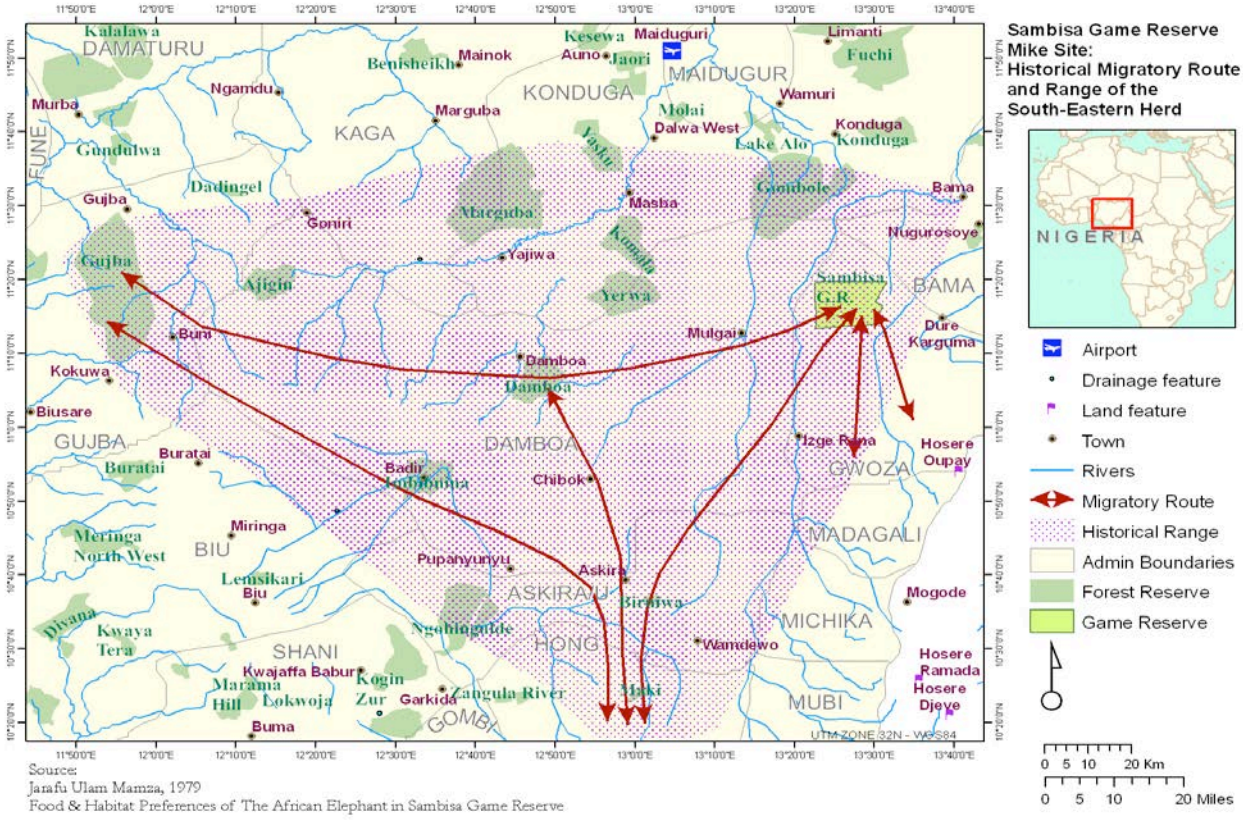

Figure 1: Historical Range of the South-Eastern Herd

Objectives of the Survey

No systematic surveys have hitherto been done in Sambisa to establish the actual status of this migratory elephant population. Therefore, as part of the CITES MIKE Programmes' attempt to establish baseline data in designated MIKE sites, this survey was planned with the following objectives:

- To establish the current elephant population size and distribution
- To determine the number and distribution of elephant carcasses.
- To map the incidences of human activities that may be threatening elephants through protected area encroachment e.g. logging, livestock grazing; farmland and charcoal burning.
- To document the distribution and numbers of other species in the ecosystem

Study Area

The Sambisa Game Reserve (SGR) located in the Southern part of Borno State lies between latitudes 11^0 15'- 11^0 30 ' N and longitude 13^0 12 ' – 13^0 37 ' E and occupies an area of 518 square kilometers (Fig 2). The reserve lies beween Gwoza and Bama Local Government Areas and was gazetted as a National Reserve in 1977 (MFR, 1977).

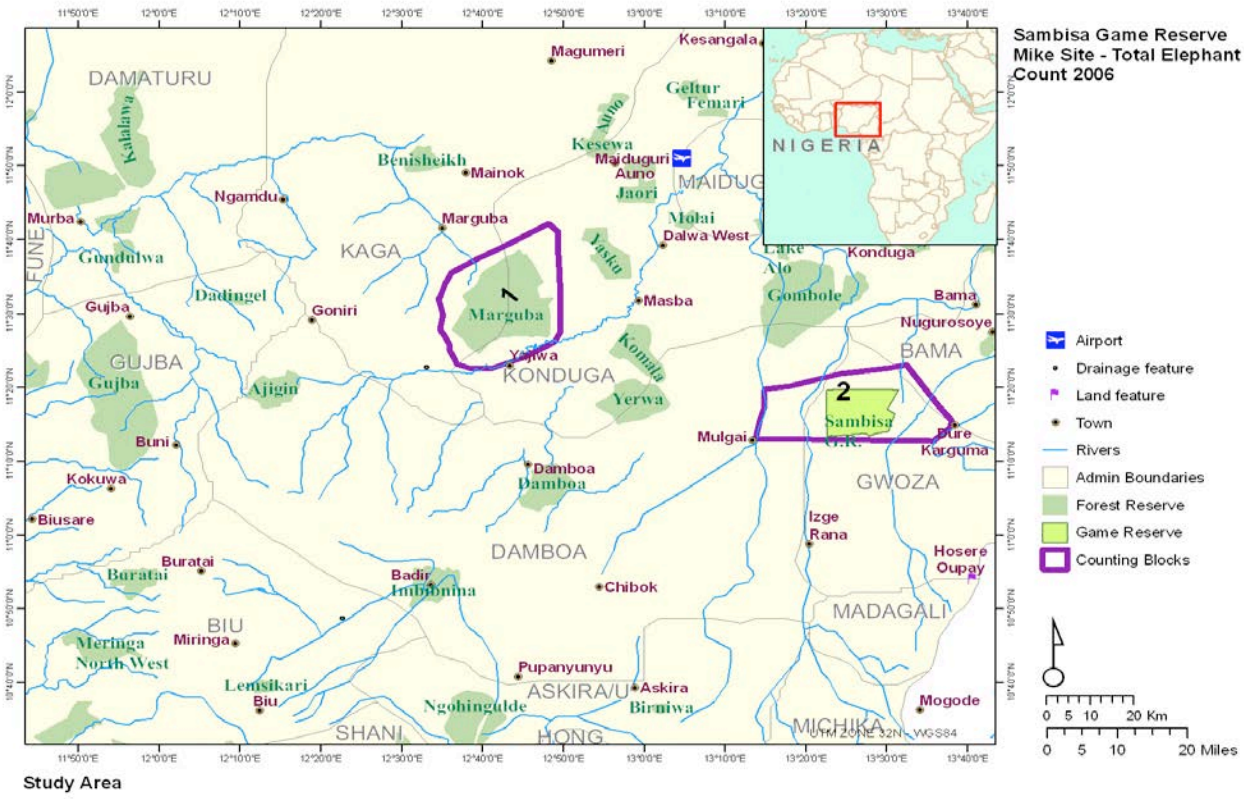

Figure 2: Study Area of Sambisa Game Reserve and surrounding buffer zone

Climate

The reserve experiences distinct wet and dry seasons. The wet season lasts from May to October while the Dry Season runs from November/December to April. The Ngadda and Yedzeram rivers are the main river systems in the area. The two seasonal rivers are fed by separate channels. Both the rivers have diffused flow in the reserve

(Bawden, 1972) and provide shallow ground water for floodplains that are important source of grass for grazing animals especially in the dry season. Four principal streams, which are tributaries of the two rivers which drain the reserve, completely dry out by the mid dry season.

Soil

The pavement material is of both recent and older alluvium deposits. They are leached halomorphic sandy loam and clay with distinct structured horizon around streams. The soils of the rest of the reserve are non-leached halomorphic, cracking clay or black cotton soil, and are of high salinity (Carol & Kinkkenberg, 1972). The reserve has poor drainage system and thus has low agricultural potential.

Flora & Fauna

The reserve lies in the Sudan zone (thorn tree savanna) with the southern portion in Northern Guinea zone (broad leaved savanna). The Sudan zone is characterized by relatively few trees, and grass forms the principal part of the vegetation. Seasonal drought is also a normal feature of the zone and animals best fitted are those that can survive on grass without regular water to drink (Ayeni, Afolayan & Ajayi, 1982).
The trees in the reserve are characterized by Acacia species especially A. Senegal on the lighter soils inter mixed with A. polyacantha. Other common tree species include Combretum glutinosum, C. ghasalense whch constitute the Combretaceous woodland. The streamside trees are usually large with open canopy formation, principally along the Kwada and Sambisa streams plus some areas of the Yedzerem River.

The Adansonia digitata located in the center of the reserve is said to be around the former Sambisa settlement in the reserve. Dalbergia melanoxylon occurs with Commiphora africana around the southeastern portion of the reserve.

The animal species believed to range in Sambisa include Elephants, Roan Antelopes, Topis, Red-footed gazelles, Duikers, Warthogs, Baboons, Tantalus and Red Patas monkeys.

Methodology

Training of the Crew

A half-day's training was given to two Ministry of Environment staff from Borno State that joined the crew from Yankari, whose training is detailed in the attached briefing notes (Appendix 1). The survey then adopted a consistent method with that used in the Yankari Census (Omondi et al 2006). The count employed the Global Positioning System (GPS) technique with Pathfinder software used for plotting all observations made in the form of waypoints (Fig. 3).

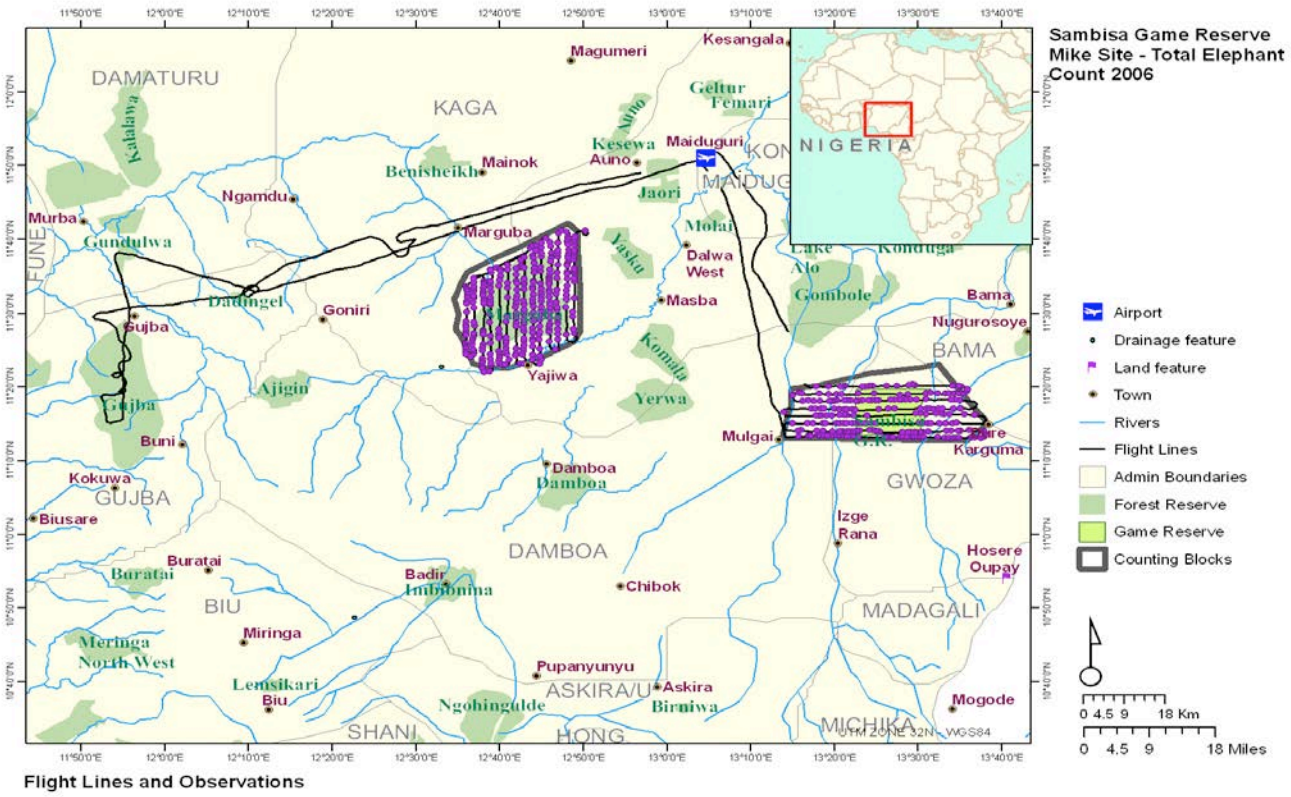

Figure 3: Survey Flight Paths and Observations

Census zone and counting blocks

The census area included the entire Game Reserve and surrounding buffer area and Marguba Forest Reserve and covered an area of 1,346 sq km (Fig 3). A reconnaissance flight was also done over Dadingel, Gundulwa and Gujba areas, outside of the counting blocks. The reconnaissance survey was based on previous

reports of sightings in these areas. The reconnaissance survey was agreed after the area covered by the Total survey produced no sighting of even one live elephant.

Each crew was provided with flight maps of the block for use by the pilot and Front Seat Observer (FSO). Flight paths to cover each block were then selected by the Pilot, FSO and GIS expert. In most cases these ran East-West, unless topography made a North-South or alternative pattern desirable. Given the very open visibility, transects were spaced at 2 km intervals (Fig. 3). The area of each block is shown in Table 1

Table 1

Block No.	Area in Km^2
Block 1	723
Block 2	623

Census Method

The survey adopted the total aerial survey standards for the MIKE programme as detailed in Craig G.C, 2004. The count therefore employed the Global Positioning System (GPS) technique with ArcView software used for plotting species distribution maps.

The Cessna 172 aircraft was used for navigating survey paths and recording waypoints. All observations made were saved in the GPS as waypoints with the geographical location referenced and were used in producing distribution maps.

The GPS was then down loaded onto a computer at the operation base each evening and the Front Seat Observers (FSO) did a summary table of each block. The exercise started every morning at 7.30am during the two days exercise and ended late in the evening. Breaks were taken during refueling of the aircraft and at lunch. Each survey crew consisted of 1 FSO and 2 Rear Seat Observers (RSO).

Results

The Sambisa total aerial count took 6 flying hours and 28 minutes, covering an area of 1,346 km2. The reconnaissance flight covered a distance of 382 km and took 2 flying hours and 23 minutes.

Table 2 provides the flight summary details of the flight logs.

Table 2: Flight summary ***(NB: Distance does not include ferrying distance to and from the blocks)***

Date	Take off time	Block	Start Count	End Count	Land time	FSO	RSOL	RSOR	Pilot	Dist. (kms)
10-Jul	08:04	1	08:30	11:09	11:21	PO	TU	SJM	JH	414
11-Jul	08:19	2	08:47	11:06	11:30	PO	UM	TDJ	JH	340
	Reccee Flight									
12-Jul	09:05	Reccee			11:28	PO	UM	SJM	JH	382

All Species Totals

No elephants were seen but 1 elephant carcass was counted (Table 3). A total of 21,400 cattle and 11,195 shoats goats and sheep were counted. 49% and 52.5% of the cattle and goats counted respectively were within Sambisa Game Reserve (Fig. 4).

Table 3:

Block	E	BF	C1	C2	C3	C4	CT	FL	ST	SH	DK	HS	RA	RFG	WB	WA
1	0	0	0	0	1	0	10,946	69	139	5,314	54	0	3	3	3	7
2	0	0	0	0	0	0	10,452	89	64	5,881	23	5	0	0	0	1
Totals	0	0	0	0	1	0	21,400	158	203	11,195	77	5	3	3	3	8

BF- Buffaloes; C1- Fresh Carcass; C2-Recent Carcass; C3- Old Carcass; C4-Very Old Carcass; CT-Cattle; E- Elephants; FL-Farmlands; DK- Donkey; OB- Oribi; RA- Roan Antelope; SH- Shoats; WB-Waterbuck; WA-Warthog and HS- Horses

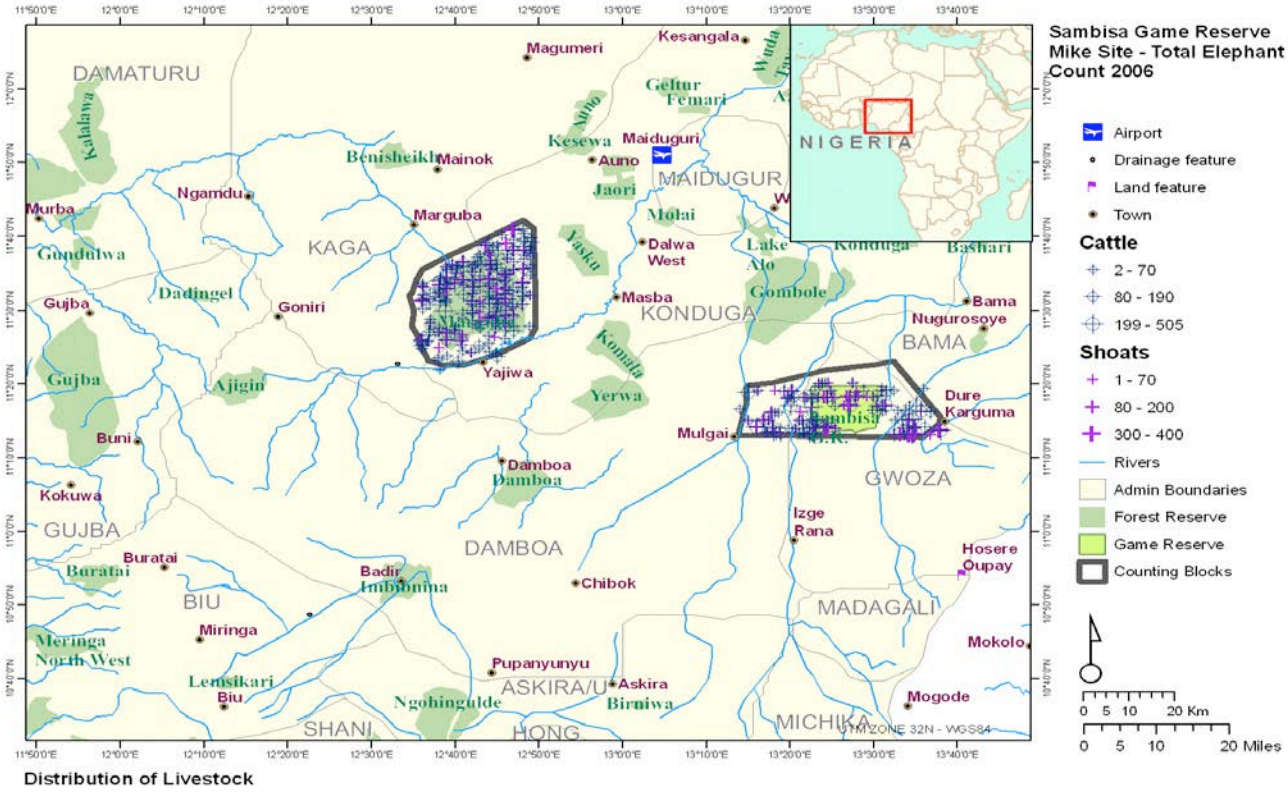

Figure 4: Livestock distribution Sambisa 2006 Count

Of the 361 farmlands and settlements recorded, 42% were within Sambisa Game Reserve (Fig 5). Also of the 17 wild animals of 4 different species counted, only one warthog was sighted in the Game Reserve.

From the reconnaissance survey, no elephant signs or sighting were recorded. Some of the forest reserves had less encroachment as compared to Sambisa Game Reserve suggesting more appropriate habitat for elephants.

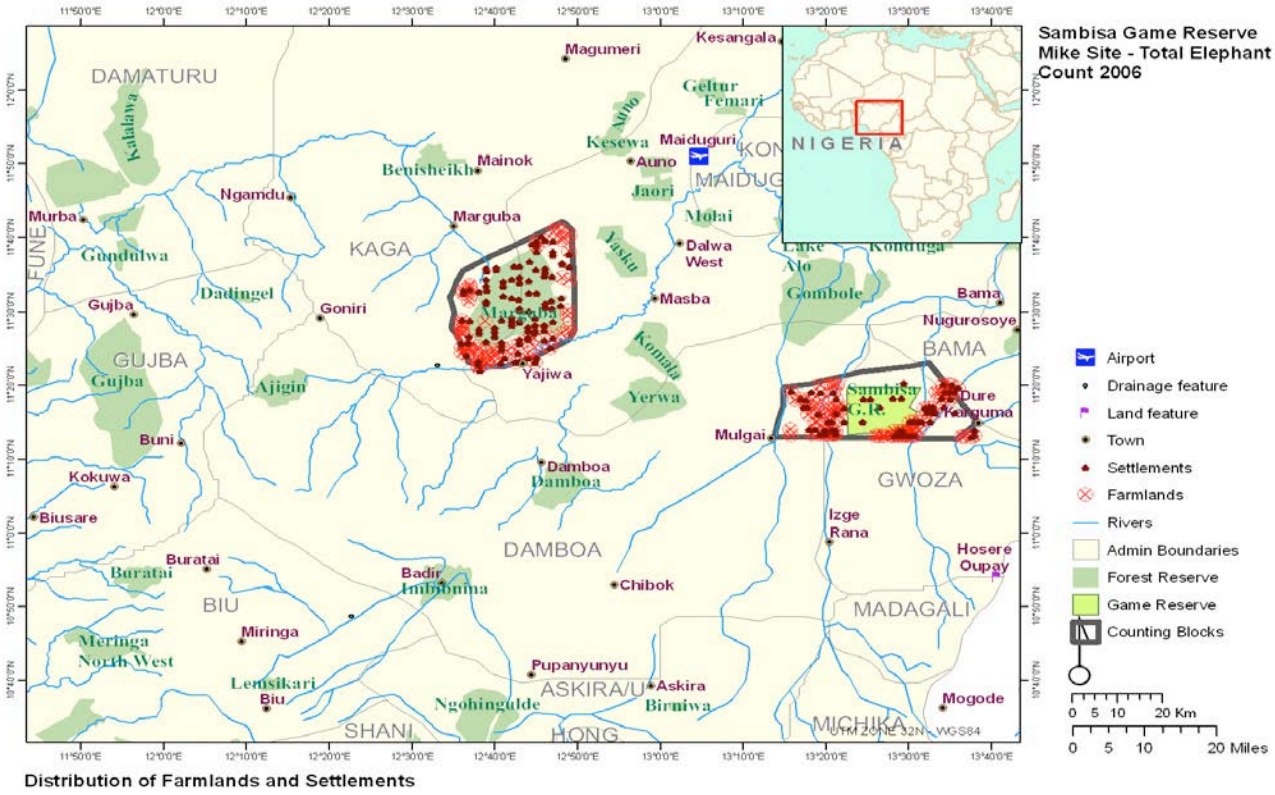

Figure 5: Farmland and Human Settlements Sambisa 2006 Count

Discussion and Recommendations

Sambisa Game Reserve is one of the two designated MIKE site in Nigeria and is a traditional dry season refuge for elephants ranging in Borno State. The reserve has extensively been settled and encroached by both livestock and humans. Fresh farm clearing, charcoal burning and livestock grazing and construction of new settlement were sited during the census. Unless a miracle happens, this range of elephants has seemingly been lost, sadly to the detriment of the elephants.

No elephant was sighted during the census and talking to staff of Borno State Federal Ministry of Environment, illegal killing of elephants has apparently been active within the past 3 years with an estimated 5 elephants killed a week (Solomon pers com)! Poachers were reportedly said to originate from the neighbouring states and neighbouring countries like Niger, Cameroon and Chad Republics. As no patrols had

been going on within the reserve because of lack of resources, reports on poachers were being left unattended by the staff because of lack of vehicles, firearms and financial support from the state. Staff could not dare approach poachers “because they were more sophisticated with state of the art firearms laments one of the staff”. From the foregoing, it is very likely that in the area covered by this census elephants no longer exist and even if any elephants could have migrated to one of the Forest Reserves, the numbers might not be viable to guarantee their survival.

However towards the end of the survey period, a report emerged of some 30 elephants living in the Uba/Askira area, some 100 kms south of the area covered by the survey. The information went on to suggest that this group was an all male one. If true, then their long term survival is even more precarious. Regrettably there was no time left in which to try an aerial reconnaissance search for this group.

During the survey it was also learnt that the Nigerian Government has licensed local elephant carcass dealers. Within Borno State there are 3 officially licensed carcass dealers and several other illegal dealers. Although the policy of the Government is to sell elephant carcass from problem animals killed in control, lack of proper monitoring system, poorly motivated staff, meant that staff would collude with the dealers, kill non problem elephants sell the carcass to the dealers and the ivory will then get to the illegal ivory market that thrive in Nigeria. According to ETIS 2000 report, Nigeria has one of the poorest records in the fight against illicit ivory trade, ranking high amongst originating countries and low on the law enforcement scale.

Recommendation:

It is difficult to make any specific recommendation on elephants given that the survey sighted no elephant nor even fresh elephant signs. However, given that it was not possible to follow up on the report of the possible elephant group south of the area surveyed, the following recommendations seem appropriate.

- The existence and movement of the possible group of 30 should be verified, starting with ground search based on local intelligence
- The survey result in the area covered does not rule out the possibility of a few elephants being present. The Borno State Ministry of Environment should therefore encourage the reporting of any sighting of any individuals, particularly to the south of Marguba, where settlement appears to be less dense.
- In the events that any sighting is reported, the Government of Nigeria should identify some of the National Forest Reserves within Borno state that have not been extensively destroyed (as has regrettably happened in Sambisa). These areas should be demarcated and given a special status to ensure their protection. These forests would then serve as refuge for any remaining elephants. Such areas could then be fenced and elephants enclosed within these fenced areas in order to reduce any human/ elephant conflict, assuming water availability in the forests is not a problem.
- Any licences for allowing the disposal of elephant meat should be withdrawn immediately

However in the event of no reported sightings of elephants it is recommended that this MIKE site be designated as a non MIKE site and MIKE should then re-focus its resources to Nigeria's Yankari National Reserve MIKE Site elephants.

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We appreciate the efforts and dedication shown by Captain Jim Hassan, Co-pilot Aniema Medekong and their team of engineers from Private Flyers International, Kaduna who adapted to the requirements of total count flying and flew tirelessly to ensure that all blocks were covered within schedule.

We would also like to thank the Rear Seat Observers comprising of Tata Umar, T.D. John, and Usman Moh'd Maaji for their endurance in the air and being good spotters. To the team drivers, Borno State Federal Ministry of Environment we applaud your dedication. Finally, to all those who participated in anyway and have not been mentioned, we thank you for your contribution to make the Sambisa count a success.

Appendix 1: Counting Methods

Total Aerial Count of Elephants: Sambisa Game Reserve MIKE Site. Briefing notes compiled by Patrick Omondi

July 2006

Counting Methods

The ecosystem has been divided up into discrete counting blocks, bordered by well-defined features such as roads, rivers, escarpment edges, mountains or the Park/Reserve boundary. Each crew will be allocated one or more blocks to be counted each day and will be provided with flight maps of the blocks.

Elephants, dead elephants, buffalo, roan antelope, western hartebeest, waterbuck, oribi will be counted. **Cattle, goats** and **sheep** (**shoats**) herds will be recorded as approximate estimates. The aim is to fly parallel lines across each block, to scan the entire surface and to record the accurate position and number of each group of animals.

An UTM grid has been super-imposed on each block map, so that transects can be flown on this grid with the help of GPS.

The GPS will also record the exact flight pattern for the later reconstruction of the exact position of each observation.

The GPS will be used to fly in parallel strips or 'flight lines', using the GPS to stay on track. In most cases East-West lines should be chosen, which has the advantage of equal light for the observers on both sides.

Pilots Role

The pilot should be familiar with using a GPS to fly a grid pattern before beginning the count.

The pilot and Front Seat Observer (FSO) must pre-plan each flight, decide on whether they will fly East-West or North-South transects. It is a good idea also to decide on the standard strip width separation to be used (this should be discussed with co-ordinators). Adjacent strips should be no further apart than the distance at which the observers can spot the animals in question. Suggested intervals are **1 km** or less for the riverine or dense areas, spreading out to **1.5** to **2 km** in the more open areas, or in the larger blocks.

When herds on the far side of a strip need to be counted or photographed the basic flying pattern may be interrupted temporarily. Normally, the aircraft and crew will circle around a group of elephants.

Great care must be taken, however, to resume the original strip at the spit at which is was broken off (refer to ground features before leaving the strip and use the GPS to reorient yourself when rejoining to check that you are on line).

The type of aircraft used largely determines speed; **130kph/80mph** is the most suitable speed for total aerial counts.

Height should be adapted to prevailing conditions (visibility, vegetation type etc.). A suitable mean height is **200-400 feet**. Flying higher increases the tendency to do wider strips, which should be avoided. Changes in ground level altitude should be observed and taken into account.

The pilot is also responsible for guaranteeing that he or she flies a **2-3km overlap** into the adjacent block on each block boundary. The pilot should participate in the counting only in so far as he can comfortably do so. In many cases, the pilot's vantage point can prove particularly useful in drawing the observer's attention to the animals coming in the plane's flight path.

Sharing responsibilities

The pilot and FSO must also decide on their start point and programme this into the GPS. The start point should be about 2km outside the block on the first flight line, so that the pilot has some time to line up on his correct line. The first transect should be at least 1 km outside the block in order to give a margin of overlap, and when turning at the end of each transect a similar overlap should be left into the next block.

Observers Role

The FSO will be responsible for the actual recording of data. The FSO will, in consultation with the Rear Seat Observers and the pilot, adjust the strip widths as necessary. The flight lines should be recorded onto the FSO's flight map including any deviations. This will be compared later with the computer printout, but is needed in case of any computer failure. The FSO must be certain that the pilot is flying a satisfactory overlap into adjacent blocks. The FSO will have primary responsibility for the recording and mapping of all data as described below.

The RSOs are responsible for observing on his or her side of the plane and for helping out when other observers are estimating large herds. When an animal is spotted they will call out clearly and loudly to the pilot and FSO indicating the species, side of aircraft, and the number of individuals counted (for example: 'Elephant, right, twelve). Very often if there is any doubt as to the exact number the pilot will need to circle the group until a consistent figure is agreed upon.

RSOs must alert the pilot when it will be necessary to photograph a herd that is too large to simply count (all herds over 25). See below for instructions on photography. The RSOs are responsible for calling out herd estimates on all herds that are photographed.

RSOs should make every effort not to call out their data at the same time as their fellow RSO is calling out his/hers. They must commit their information to memory and call it out to the FSO at the earliest possible opportunity or when requested by the FSO.

Recording animal numbers, species and photographic data in the plane:

The animals recorded will be elephants (**E**) both live and dead, buffalo (**B**), roan antelopes (**RA**); Western Hartebeest **(WH)**; Waterbuck **(WB)**; Hippos **(HI)** and cattle (**C**), sheep and goats (**SH**) distribution. Dead elephants will be recorded in the following categories:

5 **Carcass 1 (C1):** for **fresh** carcass (less than 1 month old), still has flesh giving the body a rounded appearance. Vultures probably present and ground still moist from body fluids.

6 **Carcass 2 (C2):** for **recent** carcass (more than 1 month old but less than one year old), the rot patch and skin still present. Skeleton not scattered.

7 **Carcass 3 (C3):** for an **old** carcass (more than a year old), where only a skeleton is present with white bones visible. Vegetation re-grown in rot patch.

8 **Carcass 4 (C4)** for a **very old** carcass (up to ten years old), where the bones are grey and cracked and widely scattered so the carcass does not stand out as a distinct entity. Difficult to spot from the air.

Each FSO will be equipped with a data entry sheet and a flight map. The FSO will be responsible for the entry of all data onto these sheets. During the flight the FSO will record, serially as a GPS way-point (or time reading), each individual group of each species on the data sheet along with the herd count or estimate and any photographs taken.

Recording the way-points (or time readings)

The pilot will record the actual way-point (or time point) on the GPS for later computer downloading. A briefing and demonstration of GPS handling will be made.

Correspondingly, the FSO will plot each group (according to its GPS way-point number (or time reading) on the data sheet) on the flight map. The FSO will not record the number of individuals per group onto the flight map. This will be done on clean maps later.

Group sizes are important for later analysis. Therefore, the FSO will plot each discrete group including single animals (NO LUMPING) in its approximate location. The pilot can assist the FSO to determine the plane's exact location at any given time. Make sure adjacent groups do not get mixed up by encircling more than one group on the flight map. Where groups are concentrated, they may be most clearly recorded on the flight map outside the actual block boundaries with an arrow to show the approximate location. When numerous herds are gathered in close proximity it may be easiest for the pilot to fly high and together with the FSO and RSOs work out a plan for the order of counting the different herds before coming low again to count each herd in the order agreed upon. If a waypoint has more than one observation the FSO must make sure the same waypoint number is written down for each observation.

Photographs

When herds of buffalo or elephant number more than 25 they are to be photographed. The FSO must coordinate closely with the pilot to assure the best possible alignment and order before they begin to count or photograph the herd(s). The FSO will then record the group number onto the flight map and the **group number, species, film number** and **number of frames taken** and an **estimate of herd size** onto the data sheet.

It is imperative that an estimate be made in the unlikely event that the films are destroyed of the camera is malfunctioning. A blank should be shot into the lens cap or the photographers hand in between different herds of between different series of shots of one herd to allow for accurate herd separation in the final photographic analysis. Make sure that all your films are properly labelled. Films will be numbered in advance. The individual film number will be scratched into the emulsion on the film leader – check to make sure this has been done.

Generally, the best angle for photography is slightly oblique, but not too oblique as larger animals may obscure young ones. Buffalo herds are particularly difficult to photograph properly. When bunched up or lying down, buffalo must be 'buzzed' to get them up and moving before the photograph is taken. Do not take pictures for too high up as it defeats the purpose when the animals are too small to count on the pictures.

Photographs should not be taken at anything under 1/500 sec or they will be blurred. Also make sure your film speed is set at 400 ASA. Make certain your focus is at infinity. It is often a good idea to tape it fast for the duration of the count. You may use a 50 or 55mm lens but a 105 or 135mm lens is preferable.

Finalising Data

Clear and legible recording is not always possible while flying. Therefore, after each day's flying the **FSO should set aside an hour or so for finalizing the day's data collection**. The original data sheets and flight maps must be tidied up so that they are legible by anyone attempting to read them. After cleaning up the original flight data, the FSO must then clean up the map.

The ground crew at the end of the day's flying will download the GPS, and a map of the flight path together with the waypoints will be printed out. The FSO must then check this map, and write down the actual number of each species recorded as well as dead elephants at each waypoint (using species code and number or estimated number of individuals). At this stage any **double counts of herds should be removed** through discussion with the pilot, RSOs and co-ordinators. This cleaned and checked map will be used for preliminary analysis by the co-ordinators.

A display table will be filled in at the end of each day by the ground crew showing the total number of each species counted in each block, together with start and stop flight times.

Key for species codes to be used:

B	**Buffalo**
BN	**Baboon**
C	**Cattle**
CM	**Camel**
GD	**Grims Duiker**
E	**Elephant**
C1	**Fresh Carcass**
C2	**Recent Carcass**
C3	**Old Carcass**
C4	**Very old Carcass**
LN	**Lion**
RA	**Roan Antelope**
SH	**Shoats (Goats & Sheep)**
WB	**Waterbuck**
WH	**Warthog**
WT	**Western Hartebeest**
OR	**Oribi**
IL	**Illegal Activity**
FL	**Farmland**
ST	**Settlement**
BB	**Bushbuck**

Carcass 1 (C1): Fresh (≤ 1 Month) still has flesh giving the body a rounded appearance. Vultures probably present and ground still moist from body fluids.
Carcass 2 (C2): Recent (≤ 1 year). Rot patch and skin present. Skeleton not scattered.
Carcass 3 (C3): Old (≤ 1 year) clean bones, skin usually absent, vegetation re-grown in rot patch.
Carcass 4 (C4): (Up to 10 years) Bones scattered and turning grey.

Appendix 2: Data Sheet

SAMBISA GAME RESERVE
MIKE SITE

SHEET NO.

Pilot							**Block No.**	
Front Seat Observer								
Rear Seat Observer(left)							**Date**	
Rear Seat Observer(right)								
Take off		**Start count**			**Stop count**		**Land**	
Way Point	Dist.	L/R	Species	Estimate	Film# & Frames	End Frame	Photo-count	Comments (Transects,etc)

MIKE SITE TOTAL AERIAL COUNT OF ELEPHANTS 2006 - YANKARI AND SAMBISA GAME RESERVES
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Appendix 3: List and Addresses of Participants