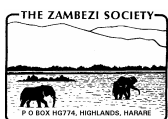


# ***ELEPHANT RESEARCH AND MANAGEMENT IN MUZARABANI DISTRICT AND THE MID - ZAMBEZI VALLEY***

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***OCTOBER 2000***



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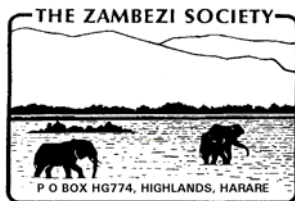
## THE MID ZAMBEZI ELEPHANT RESEARCH & MONITORING PROGRAMME COLLABORATING AGENCIES

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**THE MID ZAMBEZI ELEPHANT PROJECT** was established in 1997. Its major objective is to study the ecology of crop raiding elephants within the mid Zambezi Valley, with the goal of improving elephant management through the establishment of research and monitoring programmes. These include the radio tracking of collared elephants, the development of a district-wide crop damage assessment scheme, and experimentation with techniques to reduce conflict between elephants and humans. In addition the project has conducted elephant feeding studies and vegetation surveys within the Mavuradona Wilderness Area.

MZEP has produced a detailed mapping programme for the study area and is currently engaged in the analysis of elephant movement corridors within the Communal Lands. Funding has been provided through the U S Fish and Wildlife Service, the Wildlife Conservation Society and the National Geographic Society.



**THE ZAMBEZI SOCIETY** was established in 1982. Its major objectives are the maintenance of biological diversity and of wilderness values where appropriate, and the promotion of sustainable natural resource management, within the Zambezi basin.

The Society has been involved in Muzarabani district since 1988, initially through its support for the Mavuradonha Wilderness area but more recently through a range of biodiversity and natural resource conservation projects.

Within the MERMP collaboration the Society has been responsible for managing radiocollaring and decollaring exercises, for the aerial tracking of long-range elephant movements, and for the interpretation of the long-range movement research results. During the project the Society has undertaken 98 separate radiotracking flights across the Muzarabani and Guruve districts of Zimbabwe and Magoé district, Mozambique. Funding has been provided by the Royal Netherlands Government.

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# ***ELEPHANT RESEARCH AND MANAGEMENT IN MUZARABANI DISTRICT AND THE MID-ZAMBEZI VALLEY***

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View across the Mavuradonha Wilderness Area, Muzarabani district

## SUMMARY

In 1997 the Zambezi Society and the Mid Zambezi Elephant Project developed a collaborative project to examine the ecology of elephants in the communal lands of Muzarabani district in northern Zimbabwe. The project was later extended to include parts of Guruve district and of Magoe district, Mozambique. The goal of the project is to assist local authorities with the development of management strategies for their elephant resource.

This report deals mainly with the Muzarabani component of the project, but also notes the wider implications of the project findings to date. These findings show that there is a great deal of movement of bull elephants across the Zambezi Valley, and that the elephant populations are contiguous. A corridor of movement between Muzarabani and Guruve districts has been described, together with several key refuge habitats. Areas of high elephant-human conflict have also been identified. A range of recommendations for land planning and other elephant management activities has been submitted to Muzarabani Rural District Council.

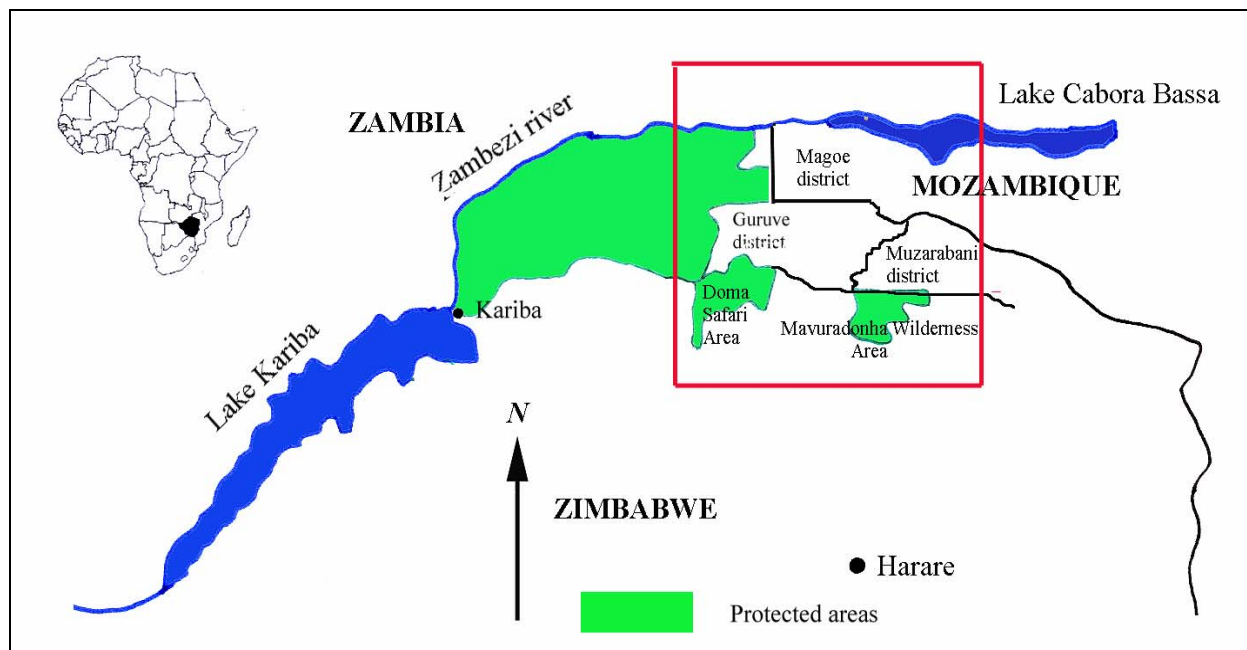


Figure 1: The project area



## **I**NTRODUCTION

Elephants do not only occur within protected areas such as National Parks, either in Zimbabwe or in neighbouring countries. Large populations exist within areas designated for human settlement, in unprotected habitats, often alongside small scale agriculture.

Wildlife management is delegated to local authorities in many districts with viable wildlife populations, and is implemented according to the philosophies embodied in the Communal Areas Management Programme For Indigenous



*Elephants in the Mavuradonha Wilderness Area, Muzarabani district*

Resources (CAMPFIRE). Substantial revenues can be generated through sport hunting and tourism ventures, and are invested in community projects.

In the last decade, elephant populations in CAMPFIRE districts of Zimbabwe have become important for several reasons. Elephants generate the greatest revenue of any natural resource, mainly through sport hunting, but also cause a great deal of damage to crops and property within the communal farming areas. There are also concerns over the long-term future of these populations. Elephants therefore represent both the most valuable and the most problematic management issue within CAMPFIRE districts, and a great deal of baseline information is required for their effective management.

## **B**ACKGROUND TO THE PROJECT

Conservation activities in Muzarabani rural district have largely focused on the Mavuradonha Wilderness Area, which in 1987 became the first wildlife area to be formally gazetted in Zimbabwean communal lands.

Wildlife-related land use in the Mavuradonha includes commercial hunting safaris, guided tourist safaris involving horse riding, basic facilities and walks for self-catering visitors, and some extraction of natural resources by local people. The district's small elephant population, thought to number around 120 animals, has a range which is centred on the Mavuradonha.

As is the case with other CAMPFIRE districts in Zimbabwe, elephants in Muzarabani represent both an important wildlife asset and a major problem species. In recognition of this, the District Council's wildlife sub-committee established an Elephant Technical Group in 1995. The group was tasked with producing a comprehensive strategy for the management of the district's elephant population, including sustainable consumptive and non-consumptive utilisation for the economic benefit of Muzarabani communities.

It quickly became clear that the formulation of an effective management strategy for elephants was seriously constrained by a lack of

knowledge of the characteristics of the district's elephant population. To address these issues, the Zambezi Society (ZAMSOC) and the Mid-Zambezi Elephant Project (MZEP) formed a collaboration in 1997 under the umbrella title of the Mid Zambezi Elephant Research and Monitoring Programme.

ZAMSOC undertook the long-range monitoring of the movements and behaviour of a number of elephants within the district, while MZEP formed the ground component of the collaboration, and established monitoring programmes for regular ground radio tracking of collared elephants, crop damage assessment, experimentation with problem animal control techniques and vegetation surveillance.

## **T**HE STUDY AREA

The study area was initially confined to the 2774km<sup>2</sup> Muzarabani district, in north eastern Zimbabwe, but was extended to include approximately 3000km<sup>2</sup> of Guruve district after long-range elephant movement was detected between the two districts. Subsequent cross-border movements resulted in a further geographical extension of monitoring activities into some

2500km<sup>2</sup> of elephant range in the Magoé district of Tete province, Mozambique. This brought the total project area to approximately 8300km<sup>2</sup> (Figure 1, page ii).

Muzarabani district is divided into three distinct geographical regions: the flat Zambezi Valley to the north (350-500metres amsl), a broken mountainous plateau to the south (800-1300metres amsl), and a ten kilometre wide band of escarpment mountains (900-1650metres amsl) that runs from east to west and separates the two (Cunliffe 1992).

The Mavuradonha Wilderness Area, which formed the initial focus of the project, was gazetted by the District Council in 1987 because of its potential for wildlife and wilderness tourism. It includes 650km<sup>2</sup> of the escarpment mountains, and is bordered to the south by commercial farms, to the east and west by communal farms in the mountains, and to the north by a near-continuous boundary of settled lands in the Zambezi Valley.

Rainfall in the Zambezi Valley is low at 650-850 mm per year, falling mainly between December and mid March. Rainfall is higher on the escarpments and plateau, averaging 1000mm per year, and falls during a longer wet season from November to mid March. There is a long dry season from April to October (Cunliffe, 1992).

Guruve District borders Muzarabani to the east, and has a similar topography to that of Muzarabani, with escarpment mountains in the south and an extensive area of Zambezi Valley floor. The portion of Magoé district within the project area lies entirely within the Zambezi Valley. It is bounded in the north by Lake Cabora Bassa and is virtually devoid of topographical relief.

Land use in Muzarabani and Guruve districts includes subsistence and small-scale commercial agriculture interspersed to varying degrees with wildlife habitats and utilisation schemes within the Zambezi Valley; large-scale commercial agriculture on the high ground south of the Zambezi escarpment; and ecotourism in the Mavuradonha Wilderness Area in the escarpment. The main land use in Magoé district is wildlife utilisation, interspersed with scattered subsistence agriculture.

## **P**ROJECT GOALS AND OBJECTIVES

The goal of the collaborative project is to assist the relevant local authorities to develop an elephant management strategy within the Mid-Zambezi Valley. Project objectives include:

- the identification and demarcation of elephant range in the settled areas of the Mid-Zambezi Valley;
- the identification of refuge habitats and movement routes within the settled areas;
- the identification of areas of high elephant-human conflict;
- the development of appropriate methods to reduce the impact of crop-raiding elephants on rural farmers; and
- contribution to an increased understanding of human-elephant coexistence in savanna ecosystems.



*View across the Mavuradonha Wilderness Area in Muzarabani district*

## **M**ONITORING MOVEMENTS

In any research project it is vitally important to ask - and answer - the right questions.

The movement monitoring component of the project was initially designed to answer several questions important to the formulation of an elephant management strategy for Muzarabani district.

### **The Research Questions**

- Do individual elephants make excursions out of the Mavuradonha Wilderness Area?



- Do elephants move between the Mavuradonha Wilderness Area and the Zambezi Valley floor? If so, during which season do they move and where do they go; and how much time do they spend in settled and unsettled areas?
- What are the sex and age differences in elephants which make these movements?
- What proportion of the elephant population is resident in the partially protected refuge offered by the Mavuradonha Wilderness Area?

### **Radiocollaring and tracking**

The most efficient way to monitor elephant movement is by fitting individual animals with radiocollars. A sample of animals representative of the population is selected, immobilised using suitable drugs, fitted with a radiocollar, and revived. Each radiocollar transmits on a unique frequency, and can therefore be tracked and located using a radio receiver tuned to the appropriate frequency, either on the ground or from an aircraft. The life of these transmitters is approximately three years.

A sample of 11 elephants in Muzarabani District was fitted with radiocollars during the first year of the project. Because the terrain made this procedure very difficult, five separate operations were carried out, from November 1997 to August 1998. Of the 11 sample elephants, nine were bulls and two were cows. Seven bulls and two cows were radiocollared in the Mavuradonha Wilderness Area, while two bulls were



*Radiocollaring an immobilised elephant*

radiocollared in the valley wards, one in Dambakurimwa ward and one in Gutsa ward. The latter were particularly interesting animals as they were located and collared very close to human

settlements during June and July, when elephants move around in small, dense patches of residual riverine vegetation, feeding on wild fruiting masau (*Ziziphus mauritiana*) trees.

In 1999, after an exceptionally heavy rainy season, four elephants were seen in farmland very close to the city of Harare. Two animals were destroyed by the Department of National Parks on the outskirts of Harare, but the remaining two subsequently moved to commercial farmlands in the Bindura area, where they were immobilised by a game capture operator. As it was presumed that they had strayed from the Mavuradonha Wilderness Area, over 100km to the north, they were transported back by road to the Mavuradonha, radiocollared, and released.

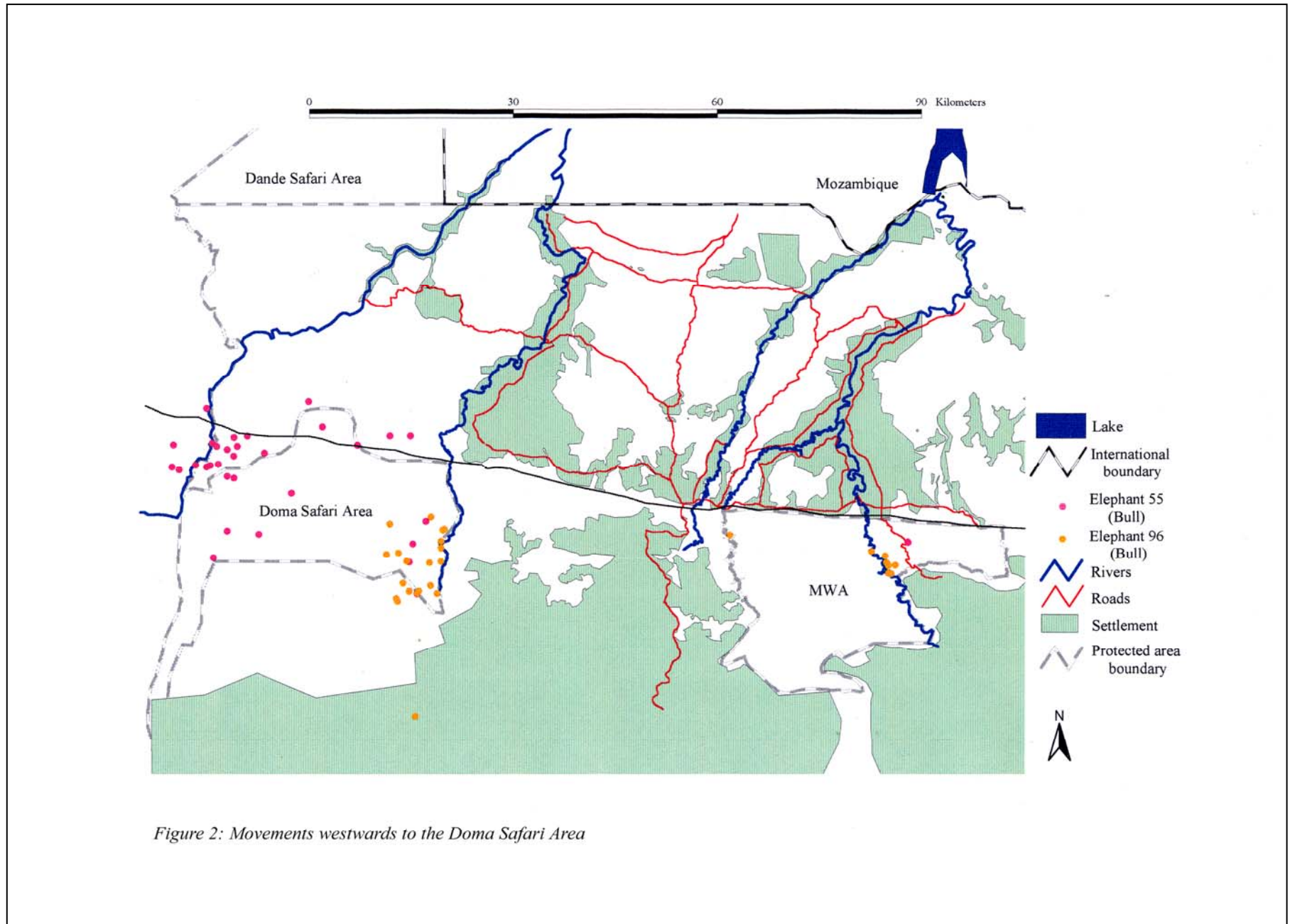
Researchers based at the Mavuradonha Wilderness Area radio tracked all the collared elephants on the ground, aiming to locate each animal twice weekly. Aerial tracking of long-range movements took place at an average frequency of three times monthly. Visual sightings, from the ground and the aircraft, provided information on group size, habitats and other data.

### **Movements made by radiocollared animals**

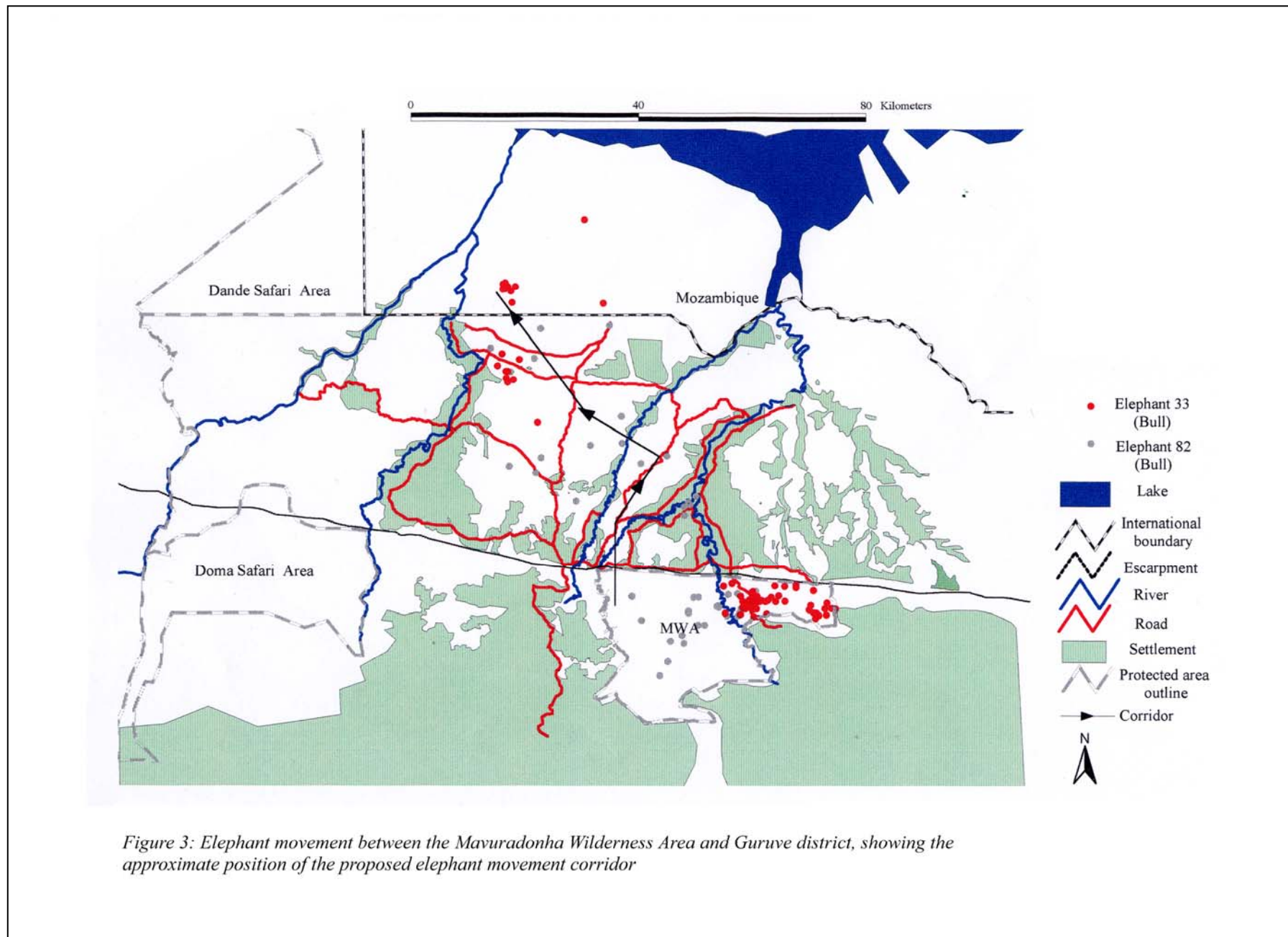
Elephants are referred to by their radiocollar numbers, abbreviated to two digits.

#### *Animals radiocollared within the Mavuradonha Wilderness Area*

Three bulls (55, 18 & 33) left the Mavuradonha Wilderness Area during the first wet season and, after extensive aerial tracking, were found on the Zambezi Valley floor in neighbouring Guruve district, to the northwest of Muzarabani. One (18) moved to the Dande Safari Area, while another (55) moved even further west, to the Chewore and Doma Safari Areas (Figure 2, page 4). Two of these three animals (18 & 33) returned to the Mavuradonha and then moved to the valley floor again in the following year. No. 33 subsequently moved into the Magoe district of Mozambique (Figure 3, page 5), but has since shed its radiocollar. The remaining animal (55) has never returned to the Mavuradonha and at the time of writing (October 2000) is still resident in the rugged escarpment country of the Angwa River basin and the Doma Safari Area, approximately 100km west of the Mavuradonha.







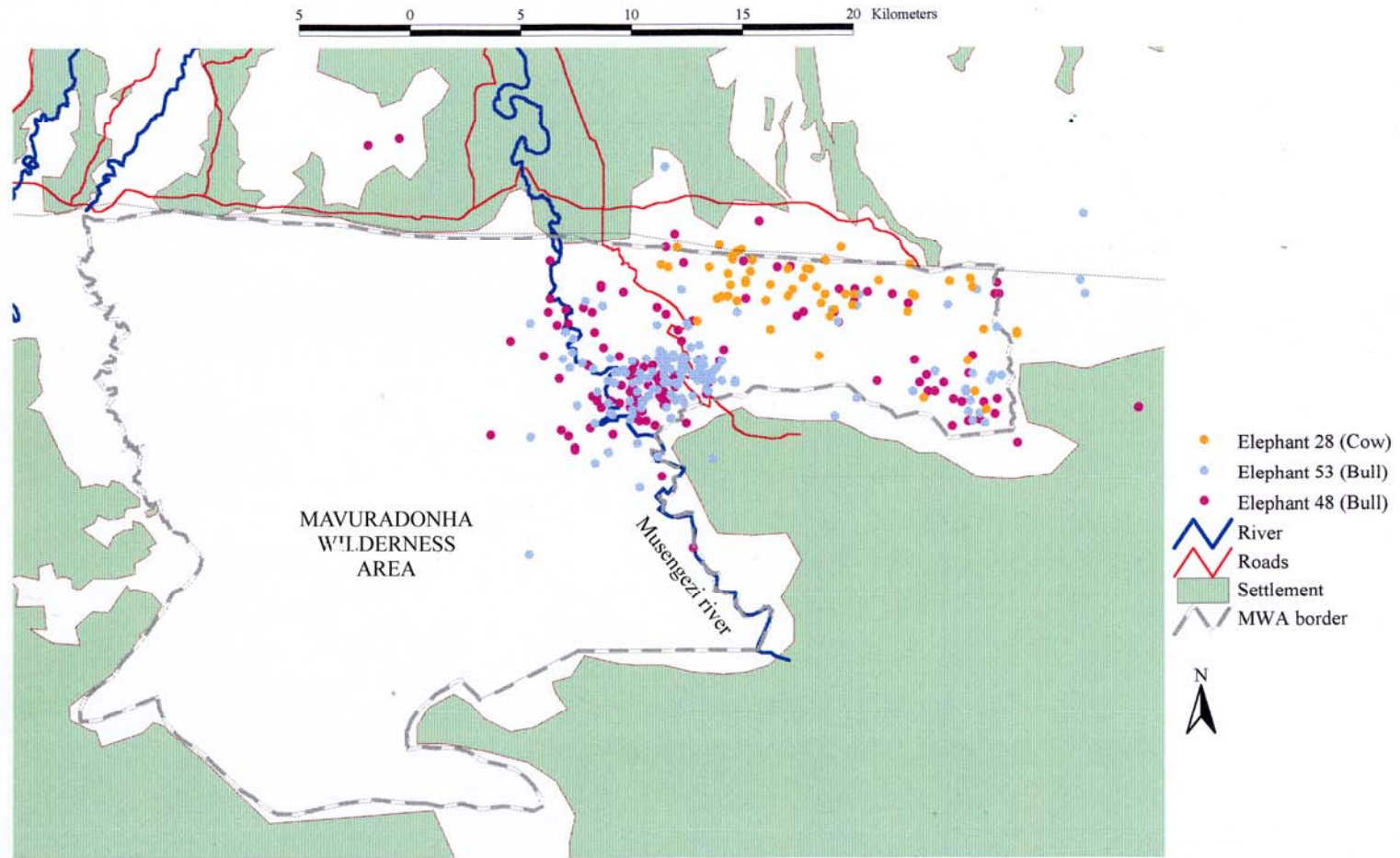


Figure 4: Elephants resident in the Mavuradonha Wilderness Area throughout the year

The two animals captured in Bindura and released in the Mavuradonha (08 & 96) subsequently separated. One (08) has remained in the Mavuradonha while, after extensive aerial tracking, the other (96) was found to have moved to the Doma Safari Area, where it has remained to date (Figure 2). The Doma consists of escarpment terrain similar to the Mavuradonha.

The Mavuradonha cow sample was very small because it was extremely difficult to find and immobilize cows in the mountainous escarpment terrain. The two collared cows (03 & 28) were relocated very frequently by researchers and remained resident in fairly small home ranges within the Mavuradonha (Figure 4, page 7). Some of the radiocollared bulls, both young and older (13, 48, 53 & 99), also remained resident in the Mavuradonha throughout the year (Figure 4).

#### *Valley animals*

Of the two elephant bulls collared in the settled areas of Muzarabani in the Zambezi Valley, one (84) has remained on the valley floor. The other (82) has exhibited the same valley-to-escarpment movement as noted for some of the animals collared in the Mavuradonha, but has repeated this movement more often over two consecutive years. It generally spends the dry months of June to November in the Mavuradonha, and the wet and early dry season, from December to May, on the valley floor. No. 82 is the project's most interesting animal, and regular monitoring shows that it moves extensively between areas near Gonono in Guruve district, the Gonono Sand Ridge on the Mozambique border, the Kadzi river, the Utete river, the Mahuwe-Mushumbi Pools road, and throughout the Mavuradonha (Figure 3).

Since animals collared in Muzarabani were routinely moving into Guruve District, it was decided to formally extend the project into Guruve. Seven more animals, both bulls and cows, were radiocollared in March 1999, at the end of the wet season, around Gonono and in the Zimbabwe-Mozambique border area. This brought the total number of radiocollared animals to 18.

A further question now being asked was whether any of these animals would reciprocate the previously observed movement into the Mavuradonha or other parts of the Zambezi

escarpment. One bull (94) did so, and occupied the Mavuradonha for the same dry season months of July-November 1999 as No. 82.

Monitoring to date has revealed that Gonono animals spend considerable time in Mozambique (Figure 5, page 8). Within the study area, the border is merely represented by the 16th parallel of latitude, is not defined in any way on the ground, and thus presents no physical barrier to wildlife movement.

#### *Illegal hunting*

One mature elephant (92) that had been collared in the Gonono area in Zimbabwe during March 1999



*An aircraft is used to monitor long-range elephant movements*

was discovered dead during a tracking flight in Mozambique in June 1999. Its single large tusk was missing. The relevant authorities on both sides of the border were contacted and a ground team of researchers and officials organised a border crossing and 20 km walk into Mozambique from Zimbabwe a few weeks later, in order to investigate the death and retrieve the radiocollar.

Not only had the ivory been removed: the carcass had also been stripped of meat, and there was evidence that the meat had been brought back to Zimbabwe for possible sale (MZEP 1999a). The radiocollar was initially left with the carcass but after a number of aerial observation visits, which presumably alerted the illegal hunters, it was removed, cut up and buried some distance away. Fortunately the transmitter was still emitting a signal and was therefore found and retrieved.



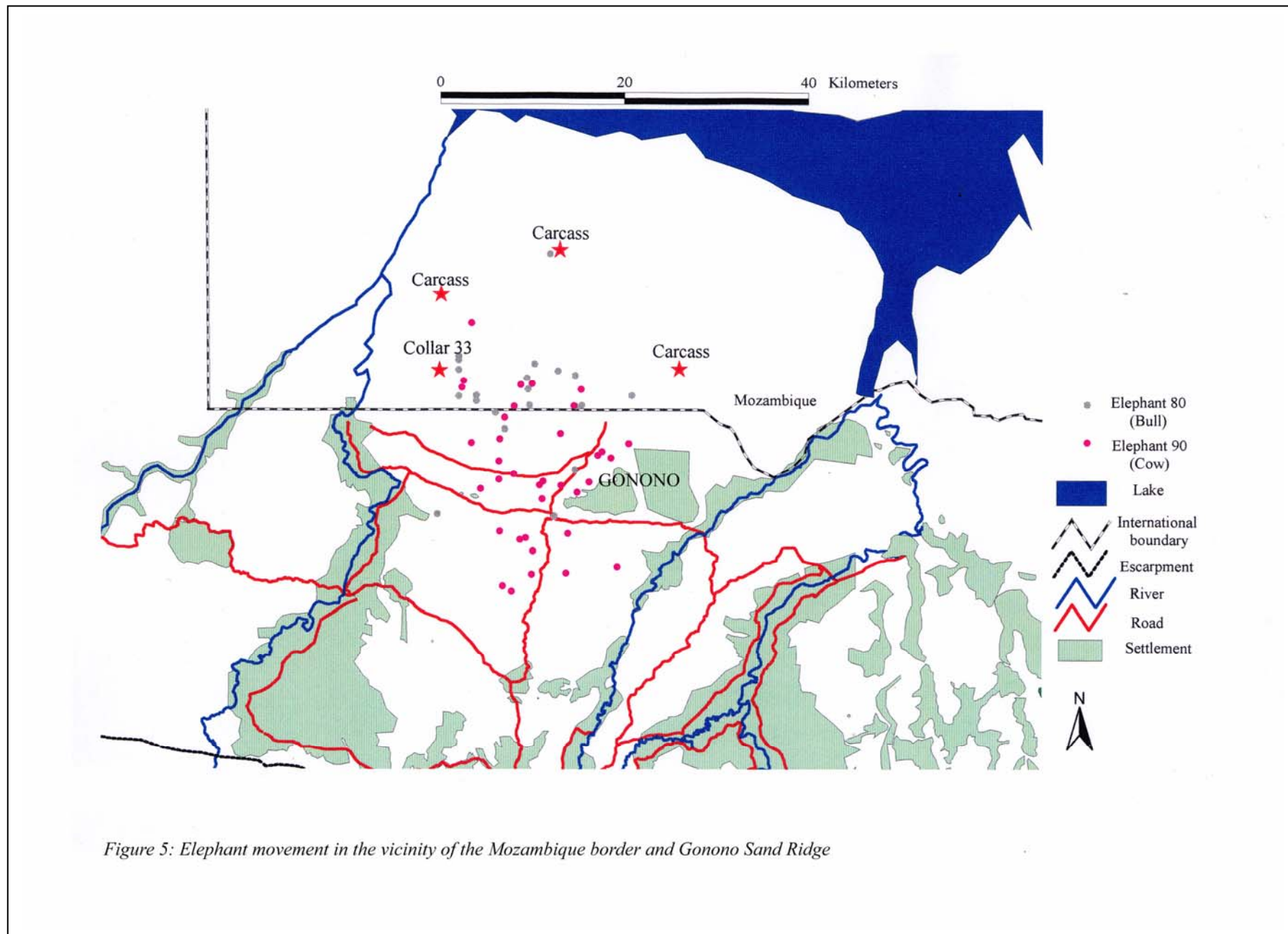


Figure 5: Elephant movement in the vicinity of the Mozambique border and Gonono Sand Ridge

*Emerging patterns of movement*

Several movement patterns have begun to emerge from the monitoring programme, summarised as follows: -

- Some animals have apparently remained within, or very close to, the Mavuradonha Wilderness Area throughout the study period (see e.g. Figure 4, nos. 53, 48 & 28). However, although the Mavuradonha Wilderness Area is surrounded by commercial farmland to the south and communal land to the east, north and west, some elephants do undertake long-range movements out of this refuge. This was unexpected.
- The elephants that move in and out of the Mavuradonha are all bulls. They move to the north-west into Guruve district (see e.g. Figure 3, nos. 33 & 82), where the closest extensive area of unsettled natural habitat is situated around the Kadzi river.
- These animals are using a narrow “corridor”, through farmland in Hwata ward and connecting to the north-west corner of the Mavuradonha, to make these movements (Figure 3).
- The area around Gonono, in the Chiriwo ward of Guruve district, and the Mozambique border, including the Gonono Sand Ridge, where these animals subsequently move to and spend most of their time away from the Mavuradonha, appears to be another important elephant refuge (see e.g. Figure 5, nos. 80 & 90). A particularly interesting mosaic of vegetation types is present in this area.

*Elephant sightings*

Trained enumerators in each ward also collected reports of general elephant movements in addition to the radio tracking information. These movements were logged and mapped over a two-year period. The data that were collected from these sightings provided evidence to support the existence and location of the movement corridor in Hwata ward. It highlighted the importance of several thicket sites along the Utete and Musengezi rivers as important elephant refuges, mainly during the dry season; and it also provided an indicator of elephant abundance that could be related to crop raiding incidents.

**Interpreting the movement data**

Interpretation of the research data acquired since the commencement of the project inception in November 1997 up to September 2000, a period of 34 months or nearly three annual cycles, shows that: -

- *There are broadly four types of elephant movement in the project area.* These movement types are: long range movements from and to the Mavuradonha Wilderness Area (Figures 2 & 3); short range “excursions” out of the Mavuradonha, into Zambezi Valley wards (Figure 4); year-round residency in the Mavuradonha Wilderness Area (Figure 4); and local movements by animals resident on the Zambezi Valley floor (Figure 5).
- *There is proof of some seasonal elephant movement between the Zambezi escarpment and the Zambezi Valley floor.* One can hypothesise that this is due to the greater availability of dry season water in the escarpment, and speculate that historically this may have involved many more elephants than it does today. It now appears that only elephant bulls will take the risk of crossing human settlement in order to interact with other populations. Elephant bulls are known to move more for social and reproductive reasons, principally to seek out cows in oestrus, but young bulls which are unlikely to be breeders are



*Elephants co-exist with dense human settlement in parts of Muzarabani district*

also making these movements. Young bull movements may be concerned with exploring bigger home ranges for future use. Cows do not appear to move from reasonably safe refuges consisting of quite large areas of natural habitat undisturbed by agriculture (see e.g. Figure 4, no.



28 and Figure 5, no. 90). This again fits with observations elsewhere: elephant cows live in cohesive family units in fairly well defined home ranges, maybe because they are reluctant to put calves at risk by unnecessary travel. As some elephants do not move out of refuges, clearly both the Mavuradonha Wilderness Area and parts of the Zambezi Valley provide adequate year-round habitat for resident elephants of both sexes.

- *There is still a contiguous elephant population in this part of the Mid-Zambezi Valley.* This is despite widespread fragmentation of natural habitat in the valley floor by unregulated and unplanned subsistence agriculture. The connection between Guruve district and the Mavuradonha Wilderness Area was not anticipated when the project began. The first obvious implication for the future is that the elephant movement corridor between the two districts should be maintained (Figure 3) and work on the detailed mapping of this corridor is currently under way. This is being done using GIS and employing least-cost pathway analysis by using data on settlement patterns, habitat types, known elephant locations and refuge areas. The second is that this population should now be managed as a single entity by stronger collaboration between Guruve and Muzarabani Rural Districts, the Zimbabwean National Parks Estate, and the Tchuma Tchato project in Tete province, Mozambique.

- *If a resident and breeding population of elephants is to be assured of a future in any part of the Zambezi Valley which it must share with human settlement, a reasonably large refuge of undisturbed habitat will have to be maintained.* If there are no such areas, the bulk of the elephant population may be displaced. In settled areas the population will then consist merely of occasional itinerant bulls, some of which will become a seasonal nuisance as crop raiders. We can confidently predict this because of the results of the monitoring of elephant bulls in the valley wards of Muzarabani district, which are already heavily settled. Elephant bulls make wet season forays into farmland to feed on crops, and dry season raids on fruiting masau trees and irrigated vegetable gardens along the rivers (Parker & Osborn, 2000). This area has no year-round resident elephants from which it can be assured of

gaining some revenue, yet it has to endure the costs and disadvantages of living in proximity to these animals. Such a seasonally resident population of itinerant bulls will be gradually eliminated through legal safari hunting and problem animal control, or illegally through poaching, so that eventually the population will not be viable for any income-generating activities.

- *Some elephant refuges on the valley floor consist of areas identified as sites of important botanical interest (Timberlake & Cunliffe, 1997).* The dry forests on the Gonono sand ridge along the Zimbabwe-Mozambique border are



*Rikonde forest, Muzarabani district*

especially favoured by elephants, and have been identified in another project as a particularly important botanical site of special conservation importance. Similar smaller refuges also survive even in heavily settled areas, such as the Rikonde forest on the Muzengezi river not far from Muzarabani growth point.

- *There is direct evidence of an illegal hunting problem in this elephant population.* People from both sides of the international boundary may be involved. One collared elephant has been poached, and one more has died of unknown causes. Another carcass of a young elephant has been sighted (Figure 5). Natural mortality in elephants over about one year old is rare, and these deaths can be treated as a possible indication of illegal activity.



## **MONITORING PROBLEM ANIMALS**

The presence of elephants creates costs as well as benefits for rural people. Problem elephants damage crops, raid grain stores and water installations and occasionally injure or kill people in many parts of rural Zimbabwe. If these costs outweigh the benefits that communities derive from elephants, the resulting pressures can lead to the loss of the elephant population. Few areas or projects have quantified this problem by the systematic collection of unbiased data in order to produce a true picture of what problem elephants actually do; yet effective management action to address this issue requires unbiased information, collected for an adequate period.



*Radiotracking elephants on the ground*

### **The research questions**

Several relevant questions were framed for this investigation to answer:

- Which areas of the district are affected by elephant problems?
- At what time of year is the problem most severe?
- Which crops are being damaged?
- How severe is the damage to crops and property?
- Which elephants are causing these problems?

- Do problem elephants in Muzarabani District have daytime refuges in the Mavuradonha Wilderness Area, in patches of natural habitat in the affected wards, or in surviving habitats in Guruve district?
- Is there evidence that certain individual elephants are regular crop raiders?

### **Collecting the data**

A problem elephant reporting scheme was initiated in Muzarabani district and carried out for two consecutive years, from 1998 to 2000. The scheme involved the training, employment and supervision of a total of fifteen local enumerators, one of whom was then positioned in each ward.

An enumerator was alerted by farmers when an elephant raid had taken place within his area, and recorded all details of the incident in a standard format. This information was then collected and processed by the research team.

The result is an accurate account of the crop damage across the entire district for the two year period. (Figure 6, page 12). Because the data have been collected systematically, the damage levels in each ward are directly comparable.

If an incident was serious, the enumerator's information was quickly relayed to the District Council, who could then take action. Researchers also followed some of the radiocollared elephants at night to see if they were involved in crop raids.

### **The research findings**

The major findings from the monitoring of problem elephant activity can be summarised as follows:

- *There is a seasonal division of problem elephant activity.* Dry land summer crops, mainly maize and cotton, were damaged in the wet season. Irrigated gardens with vegetables were damaged during the dry season (Parker & Osborn, in prep).
- *In the wet season elephants raided crops mainly along the border of the Mavuradonha Wilderness Area. This suggests that elephants resident within the Mavuradonha make nocturnal forays to nearby fields.* During the dry season incidents were concentrated along the

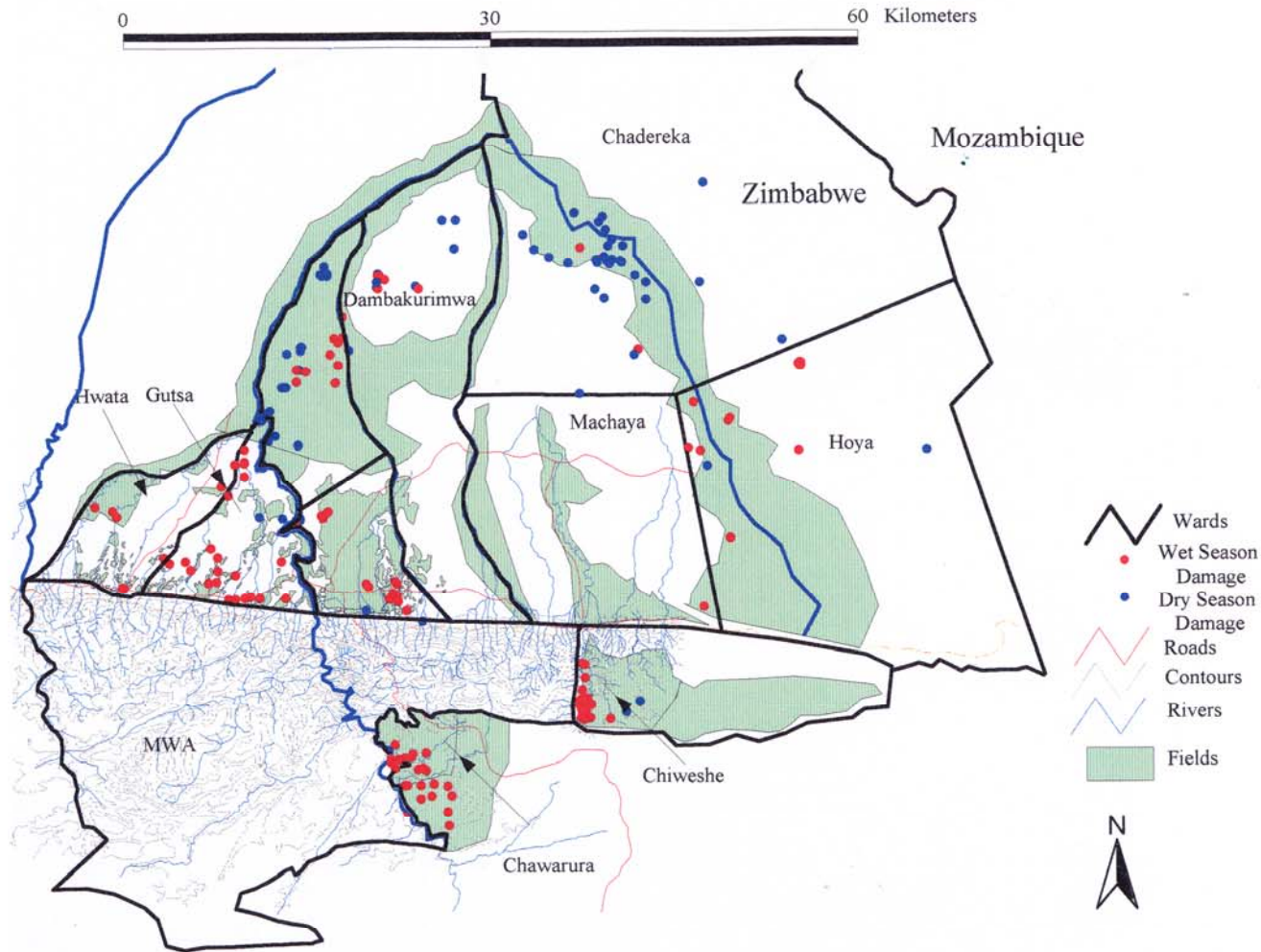


Figure 6: Wet & dry season crop damage incidents in Muzarabani district

major rivers of the area, and sightings reports suggest that the elephants concerned were using riverine thickets on the valley floor as daytime refuges (Parker & Osborn, in prep). The data on movements suggest that the animals responsible may be from the valley floor population.

- *There were roughly 150 problem elephant incidents over the whole district in each year. More than 90% of these incidents involved crop damage, while less than 10% involved property, principally grain stores.*

- *Approximately 60% of incidents were classified as non-serious. These involved trampling of crops or light damage. Only about 13% of raids were classified as serious incidents. The remainder were considered as “intermediate damage” (ZAMSOC & MZEP, 1998).*

- *In the 1998 wet season collared elephant no. 53 was radiotracked in the fields in Chiweshe ward on three separate occasions. He was a part of a group of 14 bulls that was reported as crop raiding on fifteen occasions during the months of March and April. Though these may have been different individuals, it seems likely that, in an area of low elephant density, the same group repeatedly raided crops in the same area (Osborn & Parker, 1999).*

#### **Interpreting the crop raiding data**

As with the movement data, interpretation of the crop raiding data has generated several findings, as follows: -

- *In many ways the crop raiding patterns found within Muzarabani were typical of findings elsewhere. Crop raiding occurred in a distinct peak at the height of the wet season, when crops were maturing. Most wet season incidents occurred in farmland along the edge of the protected area, a situation common to a number of studies. The dry season damage has been documented before (Osborn, 1998), but has generally been perceived as unusual and fairly minor in impact. This perception may not be altogether correct for Muzarabani district.*

- *The seasonal incidence of crop damage within Muzarabani District may be influenced by fruiting riverine trees. Wild fruiting masau trees (*Ziziphus mauritiana*) situated along major rivers attract elephants, which then raid nearby irrigated gardens. The edible masau yield, some of which*

is harvested by local people and sold commercially, varies according to the type of rainy season experienced. In years when it is less abundant, the loss of harvestable masau to elephants is an additional cost borne by local people in this area. Although Muzarabani has fewer problem incidents than several other rural districts in Zimbabwe, it has to endure elephant depredation for longer in the annual cycle because of the additional winter activity peak.

- *Elephant raids occurred all over the district but with a distinct west-to-east gradient, so it is likely that the animals responsible are being drawn in to cultivated areas from both the Mavuradonha Wilderness area and from parts of neighbouring Guruve district. Both these areas have sufficient natural habitat to act as diurnal refuges for raids into the western wards of*



Muzarabani district. The eastern parts of the *Elephants are protected in the Mavuradonha, but raid crops in surrounding areas*

district either have very dense settlement and no refuges, or large areas with no surface water for elephants or humans.

- *In Muzarabani, mixed groups of bulls, cows and calves raid quite frequently. In most other areas where the problem has been studied,*



elephant incidents are mainly caused by bulls, either singly or in groups. This difference may reflect the observation that mixed groups of elephants predominate in the Mavuradonha population.

## **C**ONSERVATION RELEVANCE

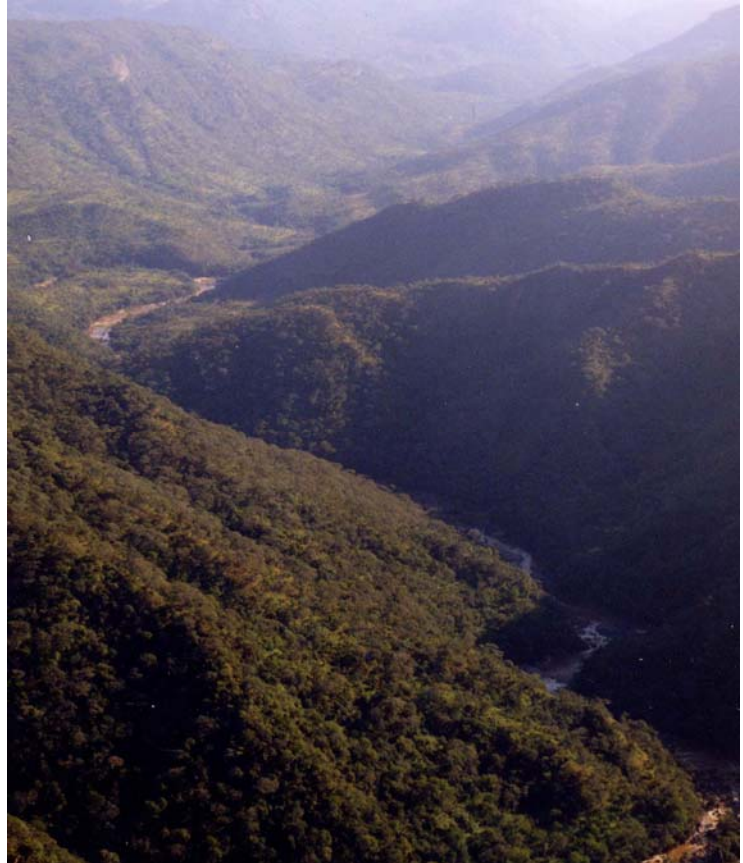
This project is unusual among current elephant research and management initiatives in Africa. Firstly, it combines research and management outputs simultaneously. Secondly, it addresses a range of important conservation issues, some of which have not previously received attention. The following are examples of important conservation issues which this study is revealing or addressing. For clarity they are divided into research (more general) and management (more local) issues, but aspects of both are of course interrelated.

### **Research**

- *The process of range loss in elephants due to agricultural expansion has never been closely studied or quantified.* The minimum size of habitat patch required to sustain elephants is a critical piece of elephant management information for savanna ecosystems. This study is among the first to record this.
- *Sex differences in refuge requirements for unprotected elephant populations are not well understood.* Male and female elephants exhibit marked sexual dimorphism and correspondingly marked behavioural differences. This study has confirmed that some itinerant male elephants are “disturbance tolerant” and use narrow corridors which are already heavily transformed by agriculture, whereas females with young are usually found further from permanent disturbance. Thus if a resident, breeding elephant population is to be retained it may require a reasonably large, relatively undisturbed natural refuge. What constitutes an adequate or “workable” corridor between population refuges for both itinerant and relatively sedentary elephants should become clear in this study.
- *Elephant refuges consisting of important botanical sites identified in other studies may be suffering damage by elevated elephant densities associated with compressed elephant ranges.* A proposed study will investigate linkages between elephant densities, human settlement and levels of

diversity of other species in selected habitat sites in the contiguous elephant range in Zimbabwe and Magoé district. Ecologists have long been concerned about the effects of elephants on biodiversity, but very few studies have so far addressed this issue.

- *A year-long study of elephant feeding preferences was undertaken using four radiocollared animals in the Mavuradonha Wilderness area.* A series of vegetation surveys were conducted, and important elephant feeding



*The Mavuradonha is one of a few areas of the Zambezi escarpment that has not been heavily impacted by elephants*

areas and control areas were surveyed for tree species composition and visible elephant damage, with the objective of evaluating compositional change within the miombo woodland vegetation of the Zambezi escarpment. The findings documented ten most frequently used browse species and suggested that elephant bulls may exhibit a preference for *Brachystegia boehmii* (mufuti) and *Bauhinia petersiana* (white bauhinia). *B. Boehmii* appeared to be suffering much more serious damage than other species (MZEP, 1999b). The results of this “focal animal” study could be informative because this is one of the few areas of miombo woodland in

Zimbabwe's Zambezi escarpment which has been relatively lightly impacted by elephants.

### **Management**

- *A major effort will be made, in collaboration with the Guruve and Muzarabani Rural District Councils and relevant ward communities, to avoid further agricultural degradation of the "elephant corridor" between the northwestern Mavuradonha and the Kadzi River. Maintenance of this corridor will ensure continuity of elephant interaction between Guruve district and the Mavuradonha Wilderness Area, which is Muzarabani's main elephant refuge. In the long term, geographic and therefore genetic isolation of the Mavuradonha population should be avoided if at all possible. Future exchange of individuals is essential to maintain healthy breeding of resident elephant sub-populations from which both districts can have a sustainable, revenue-earning offtake. There is also the possibility that elephant raids will intensify around the Mavuradonha if this population becomes isolated from the remainder of the elephant range.*

- *Problem elephant activity can be managed if the distribution, frequency and severity of elephant raids has been quantified (Hoare, 1995). Although the problem in Muzarabani probably cannot be eliminated, the intelligent use of the problem elephant information resulting from a reliable reporting scheme means that scarce Rural District Council resources can now be more effectively deployed to ameliorate it. Researchers are currently developing an effective community-based problem elephant control methodology in two high-conflict sites within the study area. The system incorporates both traditional and introduced deterrent methods alongside micro-scale agricultural management. Trials in the 2000 wet season proved successful, and rigorous testing will continue in the 2001 season.*

- *The problem elephant reporting scheme in Muzarabani has been used as a case study in the development of a standardized data collection and analysis protocol for applying to other human-elephant conflict situations in Africa (Hoare, 2000).*

- *Cross-border elephant populations in Africa are especially vulnerable to poaching. Ironically, in the case of the mid-Zambezi elephants the*

biggest population "sink" may at present actually be where they have the least disturbance from agriculture and the best habitats available – in other words, in the large and relatively undisturbed range extending from Guruve district to Lake Cabora Bassa, where they should be thriving. This study has become a catalyst for transborder wildlife management between Zimbabwe and Mozambique. Discussions aimed at establishing a trans-boundary conservation initiative for all wildlife in the lower Guruve, Magoe and Cabora Bassa areas, possibly incorporating a conservancy under the management of the communities and local authorities in the area, are already under way and attracting growing interest (The Zambezi Society, 2000). Elephants are acting as a "flagship species" in this process because of their values and their need for large areas of habitat. In summary, it can confidently be stated that the elephant research project has been responsible for greatly increased transborder collaboration in the area.

- *Routine annual aerial census of elephants and other wildlife in the Zimbabwean portion of the Zambezi valley has been extended to incorporate the area of Mozambique south of lake Cabora Bassa. The 1999 census estimated the Mozambique component of the shared elephant population to be about 400 animals at that time.*



(Appendix I) (Davies 1999). Sixteen other Important wildlife populations still survive in Mozambique south of lake Cabora Bassa

mammal species were seen in the survey, all in low numbers: eland, hippo, impala, kudu, roan, sable, zebra, baboon, bushbuck, grysback, klipspringer, porcupine, steenbuck, warthog and, most significantly, wild dog. A repeat census is planned in late 2000. This shows that the western Magoe is an important wildlife area with low human densities, a wide range of wild species, and great potential for conservation and revenue

development. Management of this area would benefit greatly from collaborative management with Guruve district and possibly also with Muzarabani district.

- *Mozambique formulated a national elephant conservation strategy in 1998 in which safari hunting of elephants was approved in principle.* The Tchuma Tchato project has requested an elephant quota for sport hunting, and the information from the present project and from the associated aerial surveys will assist in identifying how, where and when any such hunting can take place. As the cross-border component of this project intensifies, this elephant range may become the second most closely monitored of the seven elephant ranges described in Mozambique (Barnes *et al.*, 1999). Both routine radiotracking flights and aerial surveys record elephant carcasses (Figure 5). Therefore, if illegal hunting continues on a regular basis, some indication of a trend may emerge. Such information should assist in the formulation of effective strategies to counter illegal hunting in the area.

- *The locations of elephants killed by safari hunters have been related to the movement data from radiocollared animals to see where revenue-earning trophy bulls are encountered and how their presence relates to water, settlement and vegetation types.* In Guruve District's CAMPFIRE programme, annual revenue from legal elephant trophies amounted to US\$ 133 000 in 1997. This constitutes about 40% of the total of US\$350 000 earned from the overall 1997 sport hunting quota (PriceWaterhouseCoopers 1998).

## **F**UTURE DIRECTIONS

The most urgent output from the project is a set of management recommendations for Muzarabani Rural District Council, based on the project findings. These recommendations include

- The demarcation and maintenance of the elephant movement corridor between the Mavuradonha Wilderness Area and Guruve district
- The initiation of discussions concerning elephant management between Muzarabani and Guruve Rural District Councils. The elephant population is shared between these two districts - and indeed also with Tete province in Mozambique - and should be the subject of a mutually acceptable level of joint management,

especially as regards quota setting and problem animal control (PAC).

- The continuation of crop damage monitoring and the focusing of PAC efforts on problem areas.
- The return of a proportion of the benefits from sport hunting specifically to wards affected heavily by elephants. At present, these benefits are allocated to the wards in which elephants are taken by hunters, which may not necessarily be those in which conflict between humans and elephants is greatest. Efforts by the council to increase the direct benefits to farmers affected by crop-damage should be enhanced and based on crop damage information.

Work has begun on the detailed identification of the movement corridor between the Mavuradonha Wilderness Area and Guruve district, and the implementation of elephant management strategies is under discussion with Muzarabani Rural District Council.

Some animals originally radiocollared in the Mavuradonha Wilderness area have not made any significant movements at all. The radiocollars were removed from seven of these elephants during two exercises in April and August 2000.

However, several animals from the original sample are still providing extremely valuable information on their long-range movements, and these animals will be fitted with new collars when necessary.

Meanwhile, aerial and ground monitoring of these animals, and of the further sample radiocollared in Guruve district, is continuing across the project area; and work on crop damage reporting and mitigation is continuing in Muzarabani and Guruve districts.

The unexpectedly contiguous nature of the elephant population in the project area has catalysed important discussions, not only on the transboundary management of the elephant population, but on transboundary land planning for biodiversity conservation and natural resource management in general. These discussions include joint approaches to ecotourism between the districts concerned, and the possibility of the establishment of a transborder community conservancy incorporating parts of Guruve and Magoe districts.



## REFERENCES

- Barnes, R.F.W., Craig G.C., Dublin, H.T., Overton, G., Simons, W., & Thouless C.R. (1999) African Elephant Database 1998. IUCN/SSC African Elephant Specialist Group. IUCN Occasional Paper No. 22, IUCN Publication Services Unit, 219c Huntingdon Rd, Cambridge CB3 0DL, UK. 247pp.
- Cunliffe R (1992) The Great Dyke State Land: agricultural development or incorporation into the Mavuradona Wilderness Area? Project Paper No. 24. WWF SARPO Multispecies Project, PO Box CY 1409, Causeway, Harare. 46pp
- Davies, C. (1999) Aerial survey of elephants and other large mammals in the Magoe District of north-west Tete Province, Mozambique. Project Paper No. 74. WWF SARPO Multispecies Project, P.O. Box CY 1409, Causeway, Harare. 14pp.
- Hoare, R. (1995) Options for the control of elephants in conflict with people. *Pachyderm* 19: 54 – 63.
- Hoare R. (2000) Projects of the Human-Elephant Conflict Taskforce – Results and Recommendations. *Pachyderm* 28: 73 – 77.
- Mid-Zambezi Elephant Project (1999a) Recovery of Radiocollar 92 in Mozambique 4 - 7/07/99. MZEP, 37 Lewisam Ave, Chisipite, Harare. Typescript 4pp.
- Mid-Zambezi Elephant Project (1999b) Vegetation surveys at elephant feeding sites within Mavuradona Wilderness Area. MZEP, 37 Lewisam Avenue Chisipite Harare.
- Osborn, F.V. (1998) The ecology of crop raiding elephants in Zimbabwe. PhD thesis, University of Cambridge
- Osborn, F.V. & Parker, G.E. (1999) USFWS final report (#4). MZEP progress report. MZEP, 37 Lewisam Avenue Chisipite Harare.
- Parker, G.E. & Osborn, F.V. (in prep) Seasonal patterns of elephant crop damage within the eastern Zambezi valley of Zimbabwe *Pachyderm*.
- PriceWaterhouseCoopers Ltd 1998 Strategic Tourism and Hunting Plan for the Dande Communal Land, Guruve District. Guruve Rural District Council. 57pp + 4 Appendices.
- Timberlake, J. & Cunliffe R. (1997) Sites of interest for botanical conservation in the communal lands of the Zambezi valley in Zimbabwe. Consultant's Report, Biodiversity Foundation for Africa and Zambezi Society, P O Box HG 774, Highlands, Harare. Phase I, 52pp + Phase II, 46pp.
- Zambezi Society (2000) Zambezi Society projects within the ZIMOZA transboundary area. The Zambezi Society, PO Box HG 774, Highlands, Harare (unpubl).
- Zambezi Society and Muzarabani Elephant Project (1998) Muzarabani Elephant Research and Monitoring. Joint interim report to the Muzarabani Rural District Council. The Zambezi Society, P O Box HG 774, Highlands, Harare. 19p



## APPENDIX I

**Table 1:** Estimates for the elephant population from annual aerial census in the survey strata adjacent to the Zimbabwe-Mozambique border.

| <b>Stratum</b> | <b>1992</b> | <b>1993</b> | <b>1995</b> | <b>1996</b> | <b>1997</b> | <b>1999</b> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Kadzi          | 0           | 632         | 0           | 21          | 0           | 1151        |
| Chisunga       | 372         | 141         | 593         | 485         | 196         | 124         |
| Dande SA       | 784         | 1405        | 1433        | 1285        | 1385        | 909         |
| Chapoto        | 54          | 95          | 24          | 469         | 147         | 406         |
| Magoë*         | **ns        | ns          | 137         | ns          | ns          | 400         |

\* Magoë is in Mozambique, while the other strata are in Zimbabwe

\*\* not surveyed

### Notes

- The greatly fluctuating numbers within strata may be evidence supporting the hypothesis of extensive local elephant movements in this part of the Zambezi valley.
- Communal land strata (all strata except Dande Safari Area, which is part of the National Parks Estate) show lower numbers and more variation; Dande Safari Area has consistently higher numbers.
- Kadzi is the stratum which the MERMP's "mobile" elephants traverse. It is the one in which the proposed movement corridor is situated and has the most new human settlement encroaching on natural woodland.
- The two estimates for Magoë are not strictly comparable since the surveys covered different areas.

Data sources: Davies (1999); PriceWaterhouseCoopers (1998).



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Zambezi Society



Maps produced by the Mid-  
Zambezi Elephant Project

Photographs by Rob Cunliffe, Richard Hoare,  
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