
OPTIONS FOR THE CONTROL OF ELEPHANTS IN CONFLICT WITH PEOPLE

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ABSTRACT

With increasing frequency, the management of elephants outside protected areas in Africa has to address the problem of conflict between elephants and people in rural, agricultural situations. In the last decade, three major changes have occurred in the process of human-elephant interaction: the conflict interface has generally increased, even where the elephant range has contracted; elephants have acquired a much greater economic value; and wildlife management is becoming decentralised, with emphasis on utilisation for economic benefit. In Zimbabwe's unprotected areas, elephants are now simultaneously the most valuable wildlife resource and the greatest wildlife pest species. This paper outlines a systematic, more efficient approach to dealing with the problem of conflict, while still conserving elephant populations. It involves a simple system of assessing problem elephant activity over large areas, and using the information to formulate a district strategy which ameliorates, but does not eliminate, the burden of 'problem' elephants. The relative merits and disadvantages of various traditional and contemporary methods of dealing with problem elephants are also discussed. Mention is made of research being conducted on the ecological nature of the interactive processes between human and elephant populations.

INTRODUCTION

Inhabitants of Communal Lands (CLs) in Zimbabwe, where people and elephants are sympatric and often in conflict, have been formally granted authority to manage their own wildlife (Martin, 1986). Rural District Councils (RDCs) have accumulated the financial and development benefits of wildlife utilisation but have also had to assume responsibility for the negative, cost aspects, of their wildlife. In practice this involves having to develop the capability to carry out Problem Animal Control (PAC).

Zimbabwe is probably the first country to try to formalise elephant control as part of a wildlife management strategy at the level of local authorities (Department of National Parks and Wild Life Management, 1993).

CLs with elephant populations exist alongside formally protected State wildlife areas. An example is the Sebungwe region in the central Zambezi valley which is situated in an eco-climatic zone of very low agricultural potential where subsistence crops are nevertheless widely cultivated, providing up to 70% of annual local food requirements (Taylor, 1994). The mean crude density of elephants is 0.6/km² (Taylor *et al.*, 1992) with the density of people varying from 1-7/km² (Government of Zimbabwe, 1992). Such CL elephant populations are being managed primarily for the sustainable offtake of hunting safari trophies. This generates rapid, high financial returns (Taylor, 1993a) in areas where the terrain and low wildlife densities preclude most non-consumptive wildlife activities. The proportion of revenue being generated by elephant utilisation, in CL districts collectively, was 64% of the total CL wildlife earnings in 1992 (Bond, 1994). At the same time elephants have been found to be responsible for 75% to 90% of problem animal activity caused by dangerous species (Hoare & Mackie, 1993), resulting in considerable losses of both economic and social importance. An increase in the elephant-human conflict interface has arisen in the past decade, principally due to the immigration of settlers into areas cleared of tsetse fly infestation and also because elephant numbers have naturally increased within this contracted range (Taylor, 1993b).

Traditional control of elephants

Hitherto, selective shooting of elephants by wildlife authorities has been widely employed throughout Africa as the main method of control. Bell and Mcshane-Caluzi (1984) showed empirically that it had very little effect on crop-raiding elephants in Malawi. In Zimbabwe, a

wealth of anecdotal information and circumstantial evidence (Jones, 1992) suggests that this method provides at best a temporary respite from problem elephants, especially bulls. Elephant shooting has traditionally been employed because it is a cheap method of control with considerable public relations value, especially through the supply of free meat to local inhabitants as a form of indirect compensation for crop damage. However, it does not provide a permanent solution to the problem. In Zimbabwe it simply became a ritual palliative from the government to the affected CL people. Implementation was largely at the discretion of individual wildlife officers. It is suspected that control shooting has been eroding the trophy quality of CL elephants (Child, 1992; Mackie, 1992).

A new approach to elephant control

When elephants had no value to anyone other than the State, unsystematic control shooting sufficed as a control measure. However, this approach is no longer justifiable and the onus is now on each district to develop its own PAC capacity. Under the present approach, technical advisors assist RDCs in developing options for problem elephant control which can ameliorate the burden, bringing it below the tolerance threshold which exists in rural communities. The long-term aim is to decrease the use of control shooting and instead use indirect control methods. At the same time maximum benefit should be gained from those elephants that have to be destroyed on PAC. In these early years of the community-based wildlife programme, called CAMPFIRE (Martin 1986), these objectives have to be achieved without making unrealistic demands on the basic level of management.

ASSESSMENT OF PROBLEM ELEPHANT ACTIVITY

The first stage in a district strategy to control problem wildlife is to quantify problem animal activity. Where crop damage is a problem, there are three broad assessment methods available, which were developed mostly in Malawi and India. These are outlined by Msiska ad Deodatus (1991), as follows:

1. Measuring damaged area in fields
2. Estimating damaged area in fields
3. Counting damaged planting stations.

The detailed economic focus of these methods is time consuming, requiring sampling, extrapolation and

analysis by qualified people. The situation in our CLs demands a system that can be used over large, remote areas to give abroad picture of wildlife damage quickly and cheaply, involving local people in the process. A simple Problem Animal Reporting (PAR) system has therefore been developed (Mackie, 1992; Hoare & Mackie, 1993), for which the objective is to determine the frequency, severity ad distribution of problem animal activity. The immediate use of the information is for management purposes but some data can be utilised for later scientific analysis.

A problem animal reporting (PAR) system

The process starts with the complainant whose property is affected. The complainant alerts the Problem Animal Reporter (PAR) employed in each RDC Ward. These reporters visit the complainant's dwellings or fields as soon as possible after the problem animal incident, recording all relevant particulars on simple but fairly comprehensive report forms. In cases of crop damage the reporters employ the most simple damage evaluation technique - i.e. measuring dimensions of a field and its damaged area by pacing (a form of method 1, above). All incidents are grid referenced by the reporters who are trained in map reading procedures.

The information thus recorded is then summarised and quantified according to area, seasonal incidence, species responsible, type of incident and level of damage. An illustration of such data collected from two districts is shown in Figures 1 ad 2. The gross patterns of problem animal activity are similar in each district within and between years. Crop damage is by far the biggest problem category with a late wet season peak (Hoare & Mackie, 1993; Taylor, 1993b) around harvest time, from February to April, caused mainly by elephants raiding maturing food crops. Bull

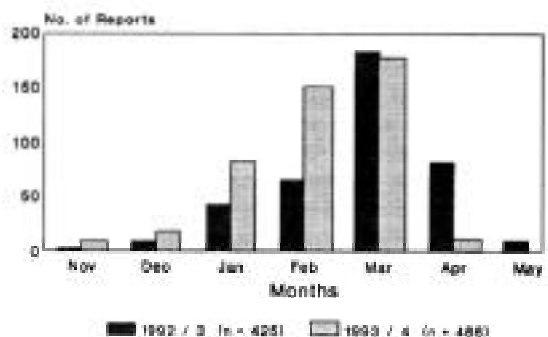


Figure 1. Monthly problem animal reports in NyamiNyami District.

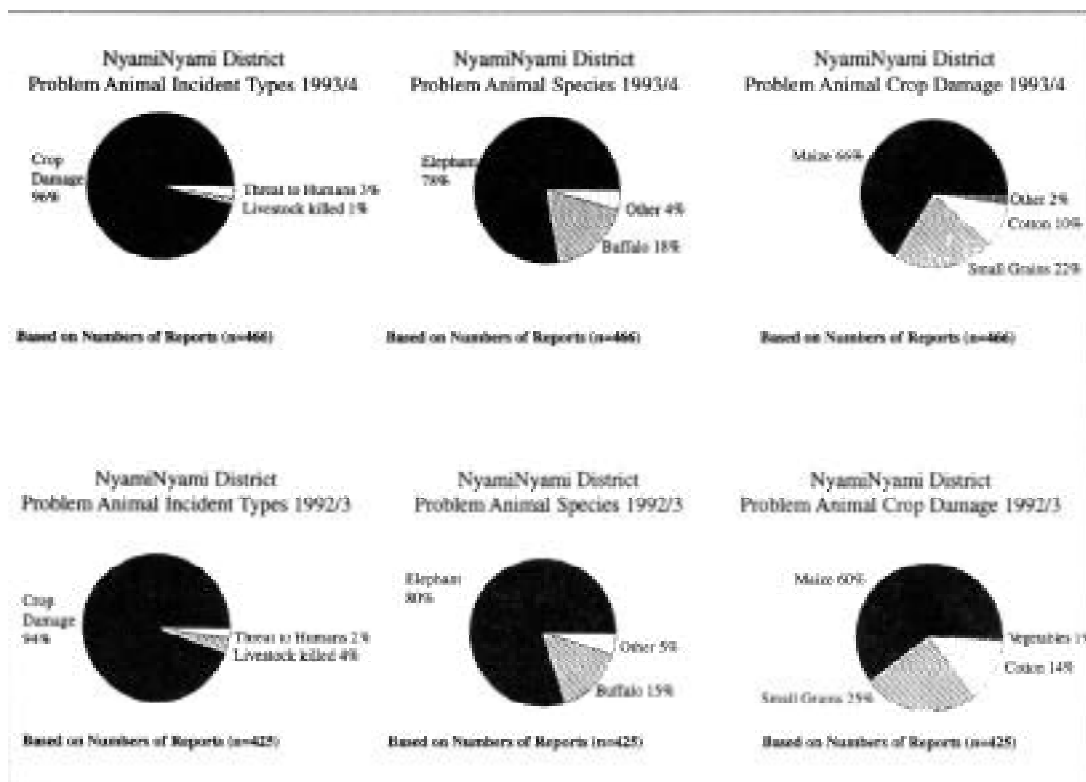


Figure 2. Problem animal reports in NyamiNyami District in 1992/93 and 1993/94.

elephants, either singly or in groups, are primarily responsible for crop damage. This pattern is similar to that observed in Asian elephants (Sukumar & Gadgil, 1988; Sukumar, 1990) and elephants in other African countries (Hoare, 1990), where much of the damage is caused by males who become habitual crop-raiders.

Reacting to serious problem animal incidents

The wildlife unit in the RDC must decide, using its own criteria, if a field-based reaction to problem elephants is required, what form it should take and who should carry it out. While a complainant will argue that all incidents involving elephants are serious, the following protocol can be used to set practical limits, by defining incidents of social or economic importance which should be reported promptly and acted upon without delay. Serious problem animal incidents (Mackie, 1992; Hoare & Mackie, 1993) are those which merit a reaction and are classified as:

- Person killed
- Livestock killed

- Wounded or aggressive animal in or near human habitation
- Immovable property destroyed (e.g. grain store damaged, contents eaten)
- Entire standing crop destroyed in one area
- Repeated, substantial crop-raiding in same area.

In practice, a reaction to problem elephants involves some form of control shooting, usually beginning with disturbance shooting but resorting to killing if the former has been recently shown to be ineffective in the area concerned.

REACTION TO PROBLEM ELEPHANTS

Improving the efficiency of elephant control methods

There are a large number of widely differing measures which can be consolidated into a district elephant control strategy, each contributing in a small way towards increasing the efficiency of the process. The concept is represented as a chain of events and shown

diagrammatically in Figure 3. This is a model and represents all possibilities for refining PAC. Rarely are all measures used simultaneously in any district. The measures are briefly evaluated according to whether they act directly or indirectly on problem elephants.

Direct non-fatal methods

Disturbance shooting

Training field scouts in elephant shooting techniques and equipping PAC teams with motorcycles are techniques which produce, greater mobility and increase the use of local human resources. A field programme to carry these out requires financial resources and clear organisation. In many areas elephants rapidly habituate to non-fatal disturbance shooting, rendering it ineffective.

Experimentation With alternative non-fatal deterrents

Examples of these include bird shot, salt, rubber bullets, bright lights, thunderflashes, olfactory agents (e.g. a *Capsicum*-based irritant spray is being investigated by Osborn [1994]). Generally, skilled or trained personnel are required to operate these methods, and animals habituate to most of them.

Translocation of problem elephants

Recently much attention has been focused on translocating elephants, following the relocation of some 800 animals from a drought-stricken region of Zimbabwe (Putterill, 1993). The purpose of this exercise was to restock new wildlife areas. For the first time whole elephant family units were immobilised and moved. However, the extension of this technique to problem elephant control brings forth a multitude of problems. Exceptionally skilled people are required and great expense is involved: the cost-effectiveness for PAC is very doubtful. Problem elephants are extremely difficult to identify individually and may return to their capture site, as recorded in Asia (Lahiri-Choudhury, 1993), or become problematic at the relocation site. The concept may also be opposed on the grounds that it leads to the removal of a valuable wildlife resource from its owners.

Immobilisation and treatment of problem animals

This has limited application. An example is the treatment of an animal which has become aggressive due to a snare or an injury. A skilled person is required.

Direct fatal methods

If non-fatal methods are impractical or prove to be ineffective, killing may have to be resorted to. There are a number of measures which can be employed at the district level in Zimbabwe to make killing more efficient while limiting its adverse effects on a valuable resource.

Division of quotas

A legal offtake quota is mandatory because the combined elephant offtake consists of safari hunting, PAC and illegal activity. Elephant quotas for each district are set in advance of the calendar year (Child, 1993), based on 0.75% of population numbers from annual aerial surveys (Martin, 1990). The total elephant offtake quota for each district is agreed upon between the Department of National Parks and Wild Life Management (DNPWLM) and RDCs who are now permitted to decide how to allocate their quota between trophy hunting and PAC offtake. An elephant offtake form, with full details of all elephants shot, has to be maintained and updated throughout the year for return to the DNPWLM.

Female (non-trophy) elephants can be used to increase the quota. This has taken the form of a culling quota of females to provide meat as a form of compensation, since no females are killed by safari hunters. The reality is that in many areas of severe problem elephant activity, male elephants are predominantly present.

Marketing wet season hunts by safari operators

Revenue can be obtained from problem elephants by safari-hunting them and returning the revenue directly to people in affected localities. This is an innovative scheme in Zimbabwe, explained in detail by Taylor (1993b). Without close monitoring, however, there is some potential for non-culprit animals to be killed and the PAC quota to be manipulated. Although such wet season hunts are cheaper, in practice safari operators have experienced some difficulties in marketing them. Table 1 illustrates that a coherent problem elephant management strategy, such as shown in Figure 3, can drastically reduce the number of bulls destroyed and simultaneously extract a considerable benefit from the few that are killed.

Restriction of PAC for elephants to a designated season

The peak time for problem elephant activity is when crops are maturing (Figure 1). If elephant control

Figure 3. Problem elephant control strategy at district level in Zimbabwe.

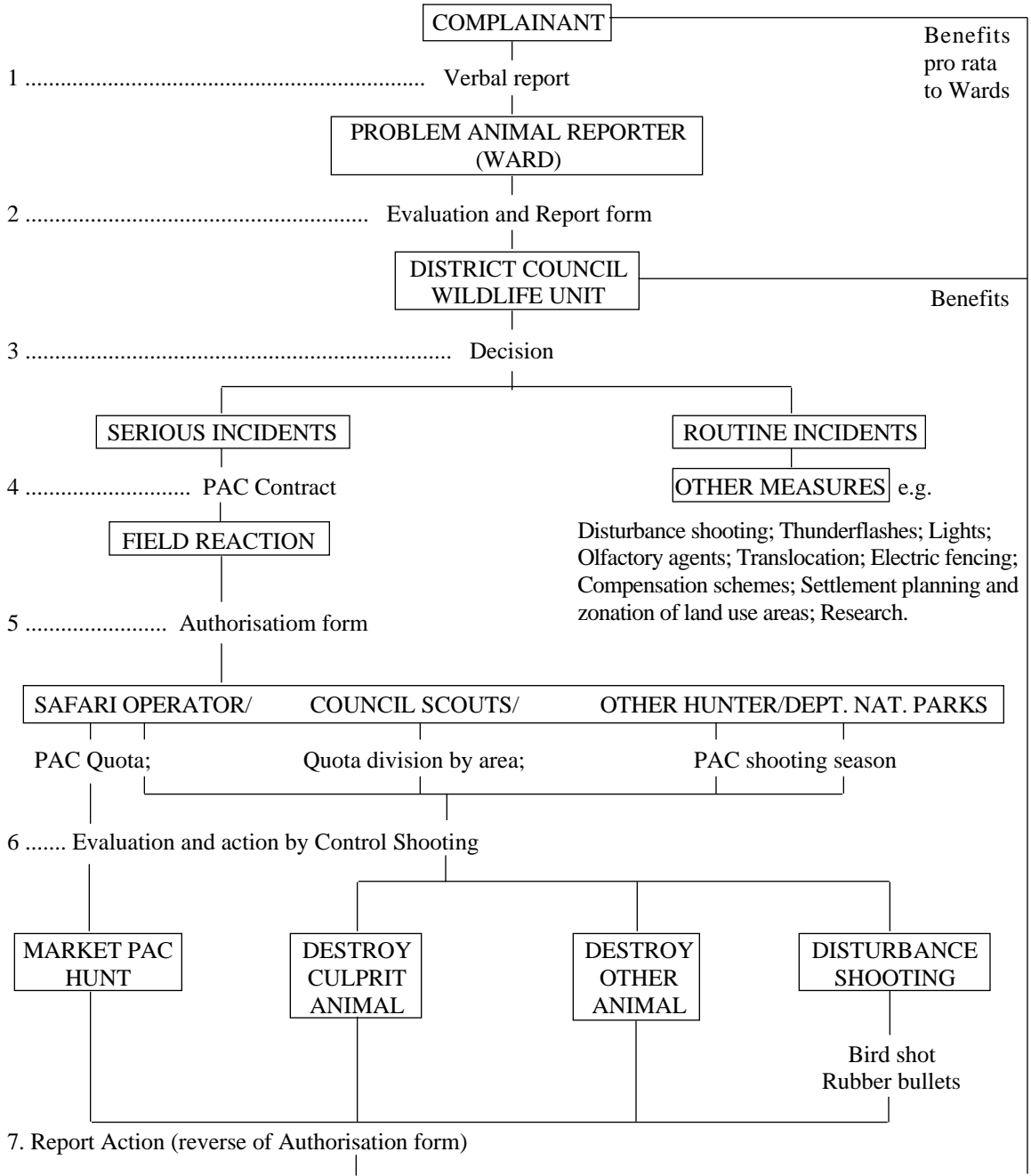


Table 1. Revenue from problem elephants destroyed: Gokwe District, Zimbabwe.

Season	Total problem animal reports	% elephant reports	Elephant bulls shot on PAC	Revenue gained (US\$)	Comments
1990/91			44	0	Before CAMPFIRE was started
1991/92	163	76%	14	400	Skin sales only
1992/93	182	60%	4	9530	Marketed PAC hunts
1993/94	246	84%	1	3600	Marketed PAC hunts

Resident elephant population estimate:700.

efforts are maximised during this time, more effective use of limited resources can be made and the temporary deterrent effect of control shooting can be exploited fully. The use of a short PAC season facilitates monitoring the effect of PAC on animals, marketing wet season hunts and controlling quota abuse. Shooting females, as mentioned above, has only been attempted in one district. If shooting females is carried out at the peak of crop-raiding activity in the wet season, the deterrent effect on elephants can be dramatic (B. Ball, pers. comm.).

PAC contract between RDC and PAC hunters

A clear contract can define authority and clarify the protocol for reacting to problem elephant incidents. A contract (Figure 3, Step 4) defines the overall responsibilities and ensures that incidents of control shooting are carried out with an authorisation form (Step 5). The reverse of the form is used to record details of the control action taken (Step 7). The original PAR form (Step 2) should accompany the team.

Division of PAC quotas fairly amongst worst affected areas

Up to now, the distribution of animals shot has not been sufficiently coincidental with the distribution of problem elephant activity. The fairest way to help complainants is for the RDC to divide the district elephant quotas according to severity of problem activity in different areas. This requires a working PAR system to be in place.

Use of professional hunter trainees for control work

Field evaluation of problem elephant activity, prior to action being taken, is a much neglected side of PAC. Trainee hunters, who have been engaged by some districts during their apprenticeship period,

represent a cheap and widely available source of semi-skilled manpower which could be considered for field evaluation exercises. However, licence regulations do not permit trainees to be unsupervised during actual control shooting exercises.

Indirect methods

Monetary compensation schemes

Compensation schemes for crop damage have been tried in several countries and abandoned. They do not work and are not recommended for a number of reasons: schemes are cumbersome and expensive to administer; widespread cheating occurs on claims; there are never sufficient funds; fair quantitative evaluation is impossible and there are unquantifiable opportunity costs (Ngiye, 1992) which cannot be taken into account; the strategy does not attempt to solve the problem.

PAC dividend

The money realised from a marketed PAC hunt (Taylor, 1993b) should be promptly returned as a household dividend to residents of the Ward where the elephant was destroyed. This is the only form of monetary compensation which appears to be workable. It establishes a linkage for the local people between the cost and benefit of living with dangerous or destructive animals.

Electric fencing

The use of electric fencing in order to separate agricultural activity from the elephant range is perceived as the most permanent solution to problem elephants. The use of this technology has been tested in Zimbabwe through a number of pilot projects which have been carefully planned and monitored. Interfaces between

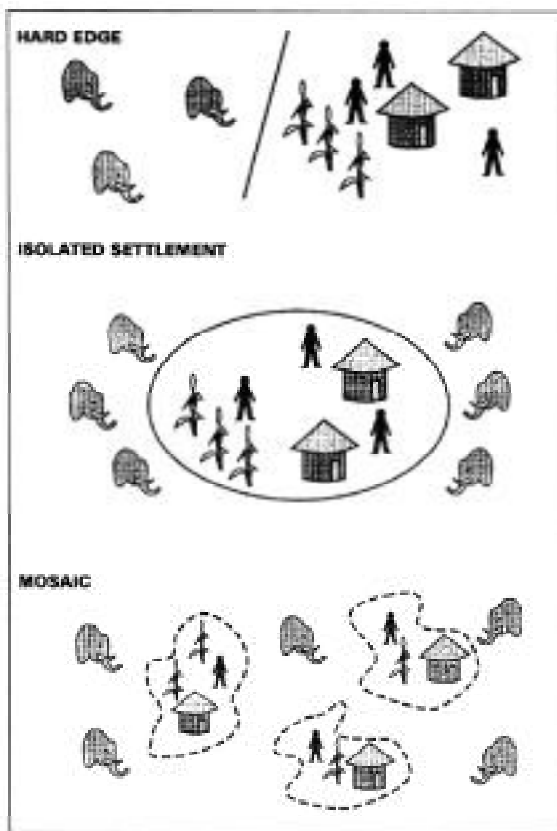


Figure 4 Interfaces between elephants and people.

elephants and CL people were first defined (Figure 4), and where the use of electric fencing was appropriate, projects were conceptualised for planning purposes according to models (Hoare & Mackie, 1993) which are illustrated in Figure 5.

As long as they are sited well and maintained assiduously, simple electric fences can withstand high levels of problem elephant challenge, as shown in Table 2. If abrupt separation of land-use is desirable for a fairly small area, and if the high capital cost (Table 3) can be met and the capability exists to carry out thorough daily maintenance, electric fencing is the deterrent method of choice against elephants. It is not, however, universally applicable and definitely works best for smaller projects (Hoare & Mackie, 1993). The pilot project sample is small and circumstances are very site-specific, but the following can be concluded (Figure 5): Model 4 (park boundary fence) gave poor results, while Model 3 (deflecting fence) was mediocre compared to complete enclosures (Models 1 & 2). This would strongly suggest that enclosures around agricultural targets deter problem elephants better

than attempts to demarcate wild land and enclose elephants within a designated range.

In practice, such projects still suffer from an unacceptably high level of institutional or common property management problems. Accordingly, the next stage is to experiment with the use of small individually-owned fence projects (Model 5, Figure 5) encompassing only the area cultivated by one or two households. The benefits of this method could be threefold: the use of locally-made components with very low specification (one or two wires as in India [Schultz, 1988]) would overcome the high capital costs and be more efficient in terms of the area protected (Table 3); the incidents of component theft could be eliminated; and the maintenance deficiencies seen in community projects could be much reduced.

Table 2 Effectiveness of a well-maintained community enclosure (Figure 5, Model 2) fence.

SEASON	ELEPHANT ACTIVITY OUTSIDE FENCE	ELEPHANT ACTIVITY INSIDE FENCE
1991/2	132 Crop Raiding Incidents	No Crop Raids
1992/3	27% of Fields Raided	No Crop Raids
1993/4	43% of Fields Raided	No Crop Raids

Land-use and settlement planning

The RDC should co-ordinate the expansion of settlement taking into account the needs of wildlife, but avoiding the development of a mosaic situation (Figure 4) which only increases the human-wildlife interface. Land-use areas should be zoned on the basis of their natural resources. The creation of buffer zones around core wildlife areas has been advocated for many years (Taylor, 1982). It is becoming a feasible option now that local authorities have more authority. The immigration of settlers into potential conflict zones and areas unsuitable for cultivation must be curtailed.

The RDC should mount a vigorous publicity campaign to explain to affected people the limitations of short-term PAC measures and the importance of development planning as a longterm preventative measure. It is especially important, from a public relations point of view, to make the populace aware of how control shooting measures have been reorganised and who has contractual obligations to carry them out.

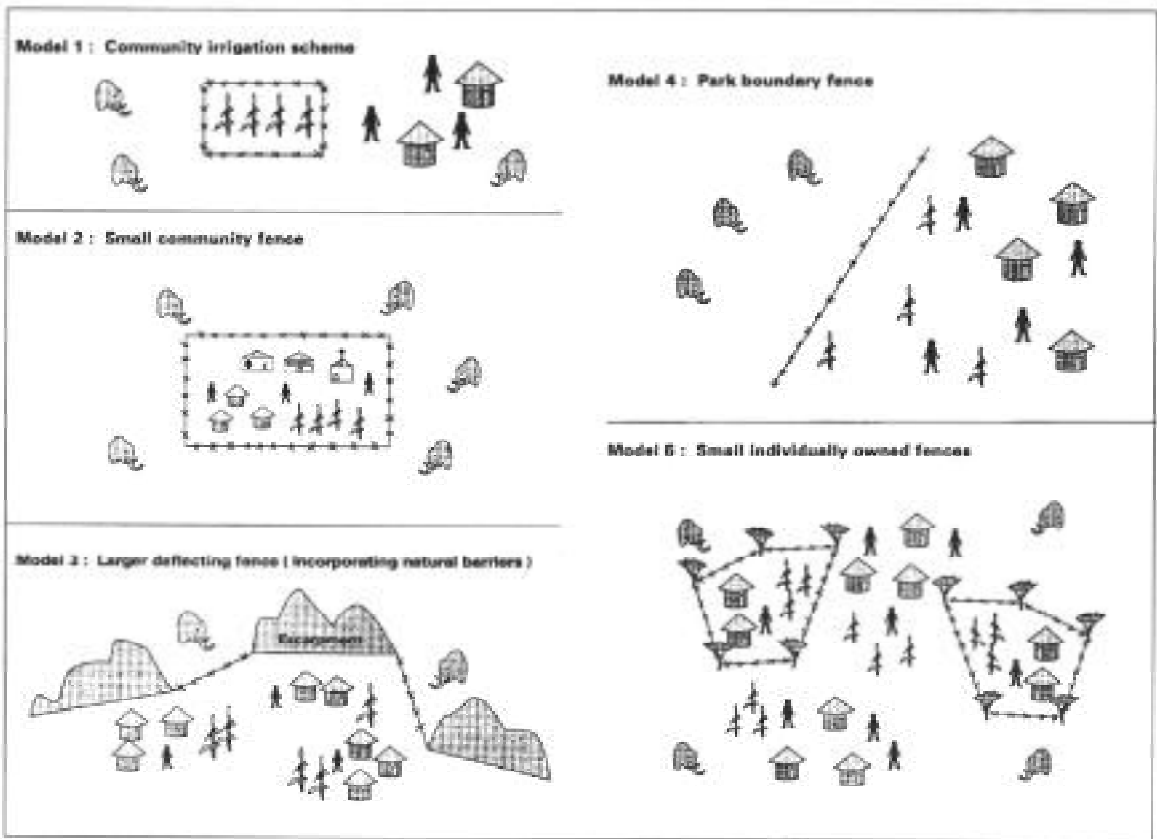


Figure 5. Fencing projects to deter problem elephants.

Table 3. Costs of fencing against elephants in Zimbabwe (US \$).

FENCE MODEL (Fig. 5)	2	2	3	4	5*
Cost/km fencing	1185	1368	1476	495	170
Cost/km ² protected	484	1430	503	104	255
Cost/household protected	41	123	50	?	?
Elephant density in area (maximum per km ²)	1.7	1.8	0.5	1.0	?
Maintenance cost (% of capital cost/year)	?	5%	?	8%	?
Fencing elephant IN/OUT	OUT	OUT	OUT	IN	OUT
Fence is a community property resource	Yes	Yes	Yes	No	No
Efficacy	+++	++++	+++	+	?

* = not yet tested

? = no data

Data from pilot projects 1991- 1994.

Participation by local people in any planning process is of paramount importance. Without their input, the whole PAC strategy will be regarded with suspicion and will ultimately fail.

Research

Technical support personnel would be unjustified to make recommendations for any of the above management strategies without the backup of research to investigate and attempt to understand the interactive processes between people and elephants. A research initiative is currently being pursued in which three doctoral thesis projects operate at different but complimentary levels in the same eco-climatic zone. Firstly, an investigation is being conducted into the socio-economics of subsistence agriculture at village level in an environment having many types of problem wildlife. Secondly, the behavioural ecology of male problem elephants is being studied and alternative deterrents, such as olfactory agents, are being tested against them (Osborn, 1994). Thirdly, there is a study to ascertain the nature of seasonal ecological interactions between sympatric human and elephant

populations. Aspects of elephant biology will be compared both inside and outside protected areas, and **the study will try to determine whether human activity is the cause of any observed differences. The study areas encompass a land-use and agricultural mosaic where the full spectrum of conservation endeavour, both traditional and contemporary, is represented.**

DISCUSSION

Although in Zimbabwe the adoption of a socioeconomic philosophy of decentralised utilisation of wildlife has challenged the traditional model of government-controlled conservation, the conflict between rural peoples and elephants remains a widespread problem. The costs of living with elephants, which are presently borne by CL people, cannot be offset entirely by harvesting economic benefit from the elephant resource (Anon., 1994; E. Nobula, pers. comm.). Furthermore, the perceptions of affected people and of wildlife managers as to what constitutes effective elephant control are often radically different. A coherent but flexible strategy to limit problem elephant activity is therefore essential. This must be based on 'adaptive management', by mixing old and new control measures with support from appropriate research.

The subjective assessment of problem elephant activity (e.g. by a hunter) and the unsystematic action which accompanied it, as was traditionally practised by state wildlife control officers, is no longer acceptable on conservation and economic grounds. Assessments on the basis of mere counts of incidents in Wild Life Department reports or occurrence books, or totals of annual human deaths in each district, such as is done in Kenya (Ngure, 1992; Thouless, 1994), are considered inadequate indices of real problem elephant activity.

The PAR system, whereby individual incidents are recorded on forms in some detail and used to quantify the frequency, severity and distribution of incidents, is a suitable method of assessment. It supplies enough data for a district elephant control strategy to be developed. A chain of responsibility in the district (Figure 3) should allow for accountability at each step, so that local management of a local problem by local people can be realistically achieved. Such a scheme is possible to implement even in countries where trophy hunting is not practised. The only constraint which CL districts now have in Zimbabwe is that of the legal offtake quota for elephants, approved by the DNPWM. District

authorities and affected people naturally feel the offtake quotas do not reflect the extent of the PACproblem. However, at this stage, abolition of quotas is not negotiable as far as the DNPWLM is concerned (Child, 1992), regardless of the severity of the problem. This represents the last vestige of central government control over local-level wildlife management of all hunted species.

The conflict between humans and elephants is the greatest long-term threat to the species outside declared refuges (Dublin, 1994). While valuable conservation lessons can be learnt from the situation in Asia (Jayewardene, 1990; Sukumar, 1990, 1991), the great social, cultural and ecological differences existing between Asia and Africa demand that solutions be found which are tailored to Africa's changing local requirements.

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