Human-Elephant Conflict and Community Development in Niassa Province, Mozambique

Report on Field Training and Implementation of Community-based Crop Protection Methods, Matchedje Village, Sanga District, Niassa Province

Consultancy for WWF/SARPO
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List of Acronyms

GOM	Government of Mozambique
HEC	Human-elephant conflict
IUCN	International Union for the Conservation of Nature
MZEP	Mid Zambezi Elephant Project
PAC	Problem Animal Control
PCC	Programa Chipanje Chetu
PRA	Participatory Rural Appraisal
SARPO	Southern African Regional Programme Office
SPFFB	Provincial Services for Forestry and Wildlife
SGDRN	Society for the Management and Development of Niassa Reserve
WWF	World Wide Fund for Nature

Terms of Reference

This consultancy is the second in a series of WWF/SARPO contracts designed to reduce human-elephant conflict in communities around Niassa Reserve, Mozambique. The terms of reference were identified from recommendations made by F.V. Osborn and S. G. Anstey in April 2002[1], in which the implementation of crop protection methods to sites within Niassa Province was identified as a major priority.

Objectives

To:

1. Implement a community-based crop protection strategy in Matchedje Village through the training of community members and the establishment of a demonstration site;

2. Assess the nature, extent and determinants of conflict and establish a monitoring programme; and,

3. Introduce chilli pepper as a deterrent, and investigate its potential as a cash crop.

Methods and approach

The following activities were carried out during a week-long site visit to Matchedje Village in August 2002:

1. Introduced villagers and community scouts to community-based crop protection techniques and established a demonstration site;
2. Trained villagers and community scouts in key methods of crop protection;
3. Provided basic equipment necessary to continue deterrent strategy;
4. Established a crop damage monitoring system, trained community scouts;
5. Assessed history and nature of crop damage in local environs through group discussions and site visits;
6. Demonstrated chilli growing, harvesting and storage techniques; and,
7. Reported back to Andre Abacar, head of SPFFB in Lichinga.

[1] See Osborn F V & Anstey S G (2002): Elephant-Human Conflict and Community Development around the Niassa Reserve, Mozambique. Report to WWF/SARPO. MZEP, 37 Lewisam Avenue, Chisipite, Harare, Zimbabwe.

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Summary

Guy Parker and Simon Anstey of the Mid-Zambezi Elephant Project were contracted by WWF/SARPO to implement a trial crop protection strategy in Niassa Province, Mozambique. This report covers the training in community-based crop protection methods undertaken by MZEP in Matchedje Village, Sanga District in August 2002.

A strategy for reducing elephant-human conflict was implemented at Matchedje village, previously identified as a site of high conflict. We introduced a range of robust, low cost methods to be used by farmers to protect their crops from elephants and other wild animals. The methods included basic fencing and alarm systems, chilli-based deterrents and noisemakers.

These methods were introduced through community meetings and the establishment of a demonstration site. The participants included: a) affected farmers from the village and community representatives of the CBNRM programme; b) 2 community scouts from this programme; c) provincial government officials (government scouts from Sanga and from Maua districts, 2 officers from the provincial wildlife office); and d) a film crew from TVM, the Provincial and National television company.

A demonstration plot was constructed by local farmers and the MZEP team. A simple fence was placed around a crop area that had recently experienced significant elephant damage. Chilli pepper dung bricks and fire crackers were demonstrated at night, when elephants were present in the fields. A simple monitoring system was designed to assess human-elephant conflicts from this point forward.

Finally, practical training was provided on the growing of chilli peppers, an elephant-resistant crop from which deterrents can be made. Seven local farmers displayed an interest in growing this crop.

Introduction

Guy Parker and Simon Anstey of the Mid-Zambezi Elephant Project were contracted by WWF/SARPO to implement a trial crop protection strategy at a single site in Niassa Reserve. This field training follows on from recommendations made in a meeting in Niassa Reserve in April 2002 (Osborn & Anstey, 2002), in which practical steps required to address human-elephant conflict were identified.

The immediate objectives noted at the meeting were:

- to reduce human-elephant conflicts in targeted areas of the province;
- to provide practical training to agencies and their staff involved in these issues;
- to support the implementation of pilot initiatives to reduce crop damage; and,
- to assess the potential for local income generation from wildlife-resistant crops such as chilli.

Due to the limited availability of funds the original plan of holding a 'training of trainers' course in Niassa Reserve for participants from various agencies, who would then implement pilot initiatives in a range of zones in Niassa, proved unfeasible.

In order to maintain some momentum, MZEP was requested by Provincial authorities (Antonio Abacar; Head of Forestry & Wildlife, SPFFB-Niassa) to undertake a smaller scale training and implementation of crop protection methods to Matchedje village, Sanga District.

Community-Based Problem Animal Control

Human-elephant conflict is one of the critical management issues in conservation today. Current Problem Animal Control (PAC) techniques designed to reduce the impact of elephant crop damage include electric fencing and shooting problem animals. Such methods are generally unsuitable, either being too expensive for rural farmers to afford, or being logistically unworkable in remote rural locations.

Mid-Zambezi Elephant Project has developed a series of PAC methods that are designed for use by rural communities. The methods are cheap, and generally utilise locally available equipment. They are designed to reduce the impact of elephants upon the livelihoods of semi-subsistence farmers. The methods have been developed in the Mid-Zambezi Valley of northern Zimbabwe and are currently being used by seven communities to combat elephant crop-raiding. In March 2002 the system was introduced to communities in South Luangwa, Zambia.

Matchedje Village

History

Matchedje village is one of five settlements in the north sector of Sanga District, which covers an area of around 6,000km^2. These communities are involved in a community based management programme (CBNRM) called Programa Chipanje Chetu, or PCC, which was initiated in 1998/9. Population density within Northern Sanga is very low at less than 1 person/km^2. The PCC has the goal of transferring land and natural resource rights and benefits from their management or use in this 6,000km^2 to the residents of the area. These residents are represented by an elected committee in each of the villages (*Comites*) and each Comite is supported in field management by 'community scouts'. Currently the main income of the Comites is from sport hunting trophy fees but this is supplemented by initiatives relating to honey production and timber. Matchedje village is located in the more remote north-east section of the PCC area, near the Rovuma River and the Tanzanian border. It has a population of around 100 households.

Since the return of people from Tanzania in the mid 1990s no significant human-elephant conflicts were recorded. The first year of such conflicts was in 2001. These conflicts have impacted on community attitudes to wildlife management that are part of PCC – specifically that the costs of wildlife conflict are equalled or exceed by the benefits of their management. Human-elephant conflict not only threatens the viability of PCC but also significantly challenges protected area management initiatives within Niassa Reserve. Farmers are becoming increasingly vocal about needing solutions to crop destruction by elephants.

Matchedje was selected by SPFFB as an important initial site for training and practical demonstration of methods to reduce human-elephant conflicts.

Agricultural system

Machambas

In Matchedje agriculture is seasonal and most crops are grown during the wet season (Table 1). Most crops are grown for subsistence, but several crops such as bananas and rice are sold in cross-border trade with Tanzania. Crops are grown in defined areas, or *machambas*, which are chosen for their fertile soils and water availability. There are three main machamba sites in Matchedje village:

- Machamba 1 is sited in a 'swamp' which is fed from the Liunde River. The area is very fertile and there is high crop productivity as a result. The area is roughly 4 x 5 km.
- Machamba 2 is less fertile than Machamba 1, and so is less productive, but covers a larger area, approximately 6 x 5 km, on the lower section of the Liunde River near the confluence with the Rovuma River.

- Machamba 3 is a small area of low soil fertility which is only suitable for rice growing. This swamp area is on the confluence of the Naitimbe River and Nkwasi River close to the Rovuma river floodplain.

Table 1: Major crops grown

Crop	Season	Major use
Maize	Wet	Food-staple
Rice	Wet	Cash crop/food
Sugarcane	Wet	Food
Tobacco	Wet	Local use
Vegetables	Dry	Food
Cassava	Dry	Food
Banana	Dry	Food/cash crop

Crop damage

The nature and extent of crop damage experienced in Matchedje was explored through group discussions with the community and game scouts. Participants were asked to identify any animals they experienced problems with, and what type of problems they caused. They were then asked to rank these animals in terms of the significance of the problems caused. These results are displayed in Table 2 below.

Table 2: Crop pest species

Species	Crop affected	Season	Rank problem
Elephant	Maize	Wet	1
	Rice	Wet	
	Sugarcane	Wet	
	Cassava	Wet/Dry	
	Banana	Dry	
	Vegetables	Dry	
Wild pig	Maize	Wet	2
Cane rat	Sugarcane	Wet	2
Baboon	Maize/sugarcane	Wet	4
Reedbuck	Cassava	Wet	5
	Tobacco	Wet	
Kudu	Cassava	Wet	5
	Tobacco	Wet	

Six animals were identified as a problem and in every case the problems were of damage to crops. Elephants were ranked number one problem animal by both the farmers and the game scouts due to their extensive damage and the fact that they raided a wide range of crops.

They were the only animal which raided crops both in the wet season and the dry season. Game scouts and farmers also found chasing elephants difficult and dangerous.

Elephant crop damage

Elephant conflicts were then discussed in more detail. The crops damaged by elephants were ranked according to the significance of the damage to the farmers (Table 2). The broad patterns of crop damage were then discussed.

Table 3: Crops and ranking of damage

Crops	Rank (significance of damage)
Banana	1
Sugarcane	2
Maize	3
Rice	4
Cassava	5

Bananas were the crop considered to be most significantly damaged by elephants. This was because elephants damaged the banana groves extensively (see photo below), but also because bananas represent one of the few trading opportunities for farmers.

Elephant crop damage is a recent occurrence, only beginning in the 2001 growing season. In 2001 elephants raided crops between April and October. The peaks of activity coincide with the two crop harvesting periods; the first being in April/May, and the second being in September/October. This pattern is being repeated in 2002. Only machamba 1 is currently affected by elephant crop damage. During the rains the soil is believed to be too boggy for elephants to move through.

Elephant damage to bananas in Matchedje.

Elephants may visit the machamba every night during the peak periods. The group size varies from 1-20, but is usually 8-10 animals. Cows and calves are believed to crop-raid alongside bulls. In every case elephants entered machamba 1 from the south east, along a well-defined path that runs close to the Liunde River. There are no cases of elephants entering the machamba village or the main village, and no incidents of damage to property.

Elephants are believed to stay in a patch of forest 10 km to the south east of the fields during the day, where there is permanent water and thick bush.

Determinants of crop damage
It is believed locally that elephants are moving into the Matchedje area from surrounding areas in response to increasing pressure from illegal hunting. The local elephant population densities have also increased, and this has triggered the recent crop raiding activity.

Discussing crop damage with community members and game scouts.

In the past, up to ten elephants per year were hunted in Matchedje, and this is believed to have deterred the elephants from the area around the village. Local hunting has now stopped, and villagers believe that the elephants have lost their fear of humans.

Villagers believe that in part the elephants are crop-raiding between May and October because the grass in the bush loses quality as it dries out, and much of it is destroyed by fire later in the season.

Problem animal control

Across the whole of Niassa Province there has been little in the way of investment in formal conflict mitigation. An electric fencing scheme has targeted many villages in Mecula District, but outside this area people rely upon scaring the elephants using traditional methods. Game scouts with firearms conduct disturbance shooting in some locations, and occasionally an elephant will be shot on problem animal control.

In Matchedje two community game scouts are based within the village, and they have limited access to a rifle and ammunition via the Provincial game scout. However, elephants have become habituated to rifle shots in the past 2 years. During one evening in the 2002 season, a herd did not respond to 20 shots fired over their heads by the professional hunter and Provincial Head of Wildlife (A. Abacar, pers. comm.).

Safari hunters shot one elephant bull for PAC during the 2001 crop season. This apparently reduced the pressure of crop raiding in the following month, but had no discernible effect in the longer term.

The farmers attempted to chase elephants from their machambas during the wet season by shouting and clapping hands. Each individual farmer is responsible for their own crops, and there is no coordinated effort at crop protection.

The head of the village committee responsible for natural resource issues (President of *Comite*) does not himself have a field in the particular machamba where most crop raiding occurs, and so crop protection does not receive his support. While the village traditional leader (Regulo Massogo) shows more interest it is clear that a wider cooperative approach by the village is less likely in the short term than individual farmer responses.

Constraints on effective PAC

- There is reliance upon disturbance shooting, which in other areas has proven to become ineffective over time. Game scouts struggle to access guns and ammunition and have little formal training in PAC techniques.

- There are few traditional strategies for chasing elephants because crop-raiding is a new issue. Elephants may rapidly habituate to the simple noise-making routines that are used.

- Farmers are used to interventions from the Game scouts and the occasional safari hunter. There is some local resistance to the idea of taking responsibility for PAC efforts.

Training in Community-based PAC

MZEP conducted a full demonstration of community-based PAC methodologies, first in a community meeting where the basic principles were explored and the equipment displayed, and second through the construction of a demonstration plot.

Overview of community-based PAC
The PAC methods can be broadly grouped into two categories:

Passive methods, which alert farmers to approaching elephants and impede a crop-raiding elephants' passage into the field. These include simple fencing and alarms.

Active methods, which are used by farmers to chase crop-raiding elephants away, include chilli bricks and noisemakers.

Passive methods

Buffer zones: A buffer zone is an area of 5m at the edge of the fields in which all vegetation is cleared. It has two purposes: first, it defines the boundary between the fields and the bush; and second, it enables farmers to sight approaching elephants. *(Tools needed: slashers, axes).*

String fences: Three-metre long poles are cut and placed at 30 metre intervals along the buffer zone. Bailing twine is then strung between them and squares of mutton cloth are tied at 5 metre intervals along the string. Poles can be of either living trees or cut from species that will re-grow to make 'live poles'. *(Equipment needed: Axes, string (nylon, sisal or bark), mutton cloth).*

Alarm systems Alarm systems have a great security value, as they warn farmers of approaching animals. There is often some distance between the homestead or watch tower and the edge of the fields, and without a warning system farmers would have to stay awake all night to protect their crops. Simple alarm systems can be set up using string and cowbells or tin cans that will be disturbed when an elephant tries to enter a field. *(Equipment: cowbells or any other metal objects, string).*

Grease and hot pepper oil are mixed together and applied to the string. The pepper oil is a concentrate made from hot chillies. The grease acts as a waterproof medium that holds the pepper oil in place. If elephants make contact with the string the pepper oil and grease will cause irritation to the animals. *(Equipment: grease, chilli oil, gloves).*

Active methods

Fires are kept burning all night in areas where elephants are regular visitors. In some areas firewood is difficult to obtain, so any material that smoulders can be used.

***Pepper dung*:** Elephant dung is mixed with ground chillies, compacted into a brick mould, then dried in the sun. These bricks are burned in fires along the field boundaries to create a noxious smoke that lasts for 3-4 hours. *(Equipment: elephant dung, dried chillies, mould)*

Noisemakers are used by farmers to chase elephants from the fields. The noisemakers are currently bought commercially and are far less expensive than ammunition used by wildlife authorities. Many communities know how to make their own gunpowder, and a community-based option is currently being developed. *(Equipment: fire crackers or homemade bangers).*

PAC Practical Training

Following the overview of different farmer-based PAC options, the MZEP team and game scouts worked with for 2 days with the community to erect a demonstration plot around a single grove of bananas (approximately 1 km of fencing). This was then further extended to cover the entrance route of elephants passing down the Liunde River plain. Cloths were added to the fence and the whole structure was smeared with chilli grease. Cowbells were attached to the fence to act as an alarm system. Chilli bricks were constructed and dried in preparation for burning at the fence.

The game scouts, some of the farmers and MZEP staff conducted PAC tours at night in the machambas to demonstrate the importance of vigilance, and of actively chasing the elephants as they entered the machambas. The following equipment was left in the village to support continued PAC efforts:

Table 4: Equipment left in Matchedje

Equipment	Quantity
Pepper spray	2 canisters
Fire crackers	6 units
Chilli oil	5 litres
String	4 bales
Grease	500ml
Axes	3
Slashers	5

Monitoring

Monitoring is a critical component of PAC. A good monitoring system will enable the assessment of the effectiveness of such methods, and will also provide a baseline of information on the nature and patterns of crop damage within the area. This is particularly important in Sanga where there is currently no quantitative assessment of wildlife conflicts.

Bearing in mind the remote location and lack of formal education among the Matchedje community, a scaled-down monitoring system was devised. Each report detailed the timing and location of conflict incidents, the number of elephants, and a description of the damage caused. Details of the PAC methods and the elephant reactions were included. The report was translated into Portuguese and Swahili (See Appendix 1).

Chilli pepper crop demonstration

Chillies were introduced primarily to provide materials for chilli-based deterrents. Farmers who could produce a small quantity of chilli locally would become self-sufficient in their crop protection efforts. If chilli production proves successful then the potential for chilli, and other crops, to be grown as wildlife-resistant cash crops can be explored.

Having grown solinaceous crops such as tomatoes and tobacco in the past, farmers in Matchedje were familiar with the basic principles of seed bed production and planting out. MZEP demonstrated the following agricultural techniques:

- Preparation of seed beds;
- Preparation of land;
- Transplantation of seedlings;
- Harvesting and drying of chilli pepper fruits, and
- Storage of dried chillies.

There was considerable interest in this aspect of the practical training. Some farmers saw possibilities of diversification of cash cropping from the existing limits of selling bananas, sugar cane and rice to Tanzania, a process complicated by currency and border control constraints. MZEP provided seeds to those farmers that expressed an interest.

Potential for chilli to improve livelihoods
The mean household cash income in Matchedje is extremely low at around USD $35 per year (PCC studies 2000). Therefore alternative and increased cash income via a chilli-pepper crop that is relatively simple to grow and whose produce requires limited processing and is resistant to elephant damage or decay could offer a feasible new livelihood option.

In order to investigate the potential for chilli as a cash crop the following income calculations were made. The price per kg for chilli was estimated from national market prices:

a. First quality- Mt 10,500 per kg (USD 0.50)
b. Second quality- Mt 4,500 per kg (USD 0.25)

Based on observations in Zimbabwe it is assumed that a farmer could grow 250kg of chilli once experienced at growing the crop. This would return an income of between USD $62.50 and $125.00. This compares favourably with most other sources of local cash income and with the current household dividend from the community-based resource management programme of around USD $10 per household.

It would be useful to regard chilli growing at Matchedje village as a pilot process to learn more about the farmers viewpoints/experiences, and additionally the chilli pepper's feasibility as cash crop.

An expanded chilli-growing programme, which is linked both to the CBNRM initiative and to crop damage control efforts, offers the potential for improved livelihoods in communities disturbed by conflict. But it must be noted that the potential for chilli and other cash crops to improve local livelihoods is entirely reliant upon access to local markets. Further research into market linkages is required before the use of wildlife-resistant cash crops be advocated in the Province.

Future actions

The training in Matchedje was a relatively limited intervention restricted by a minimal budget, the large amount of travel required to reach and return from the site and thus the limited time it was possible to be in the village.

Given that the methods of MZEP are not a "one off solution" but rather a combination of methods undertaken and driven by the farmers, it is important to stress that the training and practical demonstrations are the first steps of a much longer process of support and feedback. This role is best undertaken by the PCC and its relevant agencies (SPFFB in particular) with any further MZEP interventions being on the basis of specific request for follow up.

If PCC can maintain support to encourage collection of data on the effects of the trial fences and encourage more cooperative community-based deterrent methods (passive and active) over the next 6 months, then Matchedje can be a useful demonstration plot for guidance to other farming communities experiencing similar problems.

A broader conclusion is that while this training exercise was a positive step forward in meeting the objectives and activities outlined in the April 2002 meeting, it was limited to practical efforts to one zone and one community. As 5 months have passed since the province based strategy was drawn up as an urgent plan of action, it may now be worth the relevant agencies reconsidering how this issue can be most rapidly and practically addressed and how to find the relatively small funds needed to make it happen.

While these issues are being clarified, it would be very useful for the relevant agencies (e.g. SPFFB Niassa and Niassa Reserve management body) to collect basic data on elephant-human conflict in communities across the Reserve (Appendix 1 has such a data form in English, Portuguese and Swahili). This would help add objective information to what seems as much a 'political problem' as a 'livelihood problem'.

MZEP has also recently developed a 'Manual' or guide in Portuguese on:

1) implementing active and passive control measures; and,
2) growing chilli peppers for small-scale production.

These provide detailed information on implementation and could support efforts to expand community-based PAC methods to a wider audience.

Recommendations

The following are the main recommendations for follow up on the Matchedje training:

PAC

- PAC training and exposure for 1-2 game scouts from PCC in Zimbabwe with MZEP.
- Provision of equipment to game scouts/community for active PAC, including capsicum oil, cloth and firecrackers.
- Development of techniques for local production of capsicum oil.
- Evaluation and support trip to Matchedje in November 2002 in order to -
    - Assess efficacy of PAC methods through monitoring data, interviews and group discussions;
    - Evaluate the monitoring system.

Chillies

- Training of one extension officer in Zimbabwe.
- Provision of sacks, shade cloth for drying and storing chillies.
- Return trip to Matchedje in November 2002 for extension and support.

Appendix 1

Problem Animal Control Report Form

[In English/ Portuguese /*Kiswahili*]

1) Date/ Data/ *Talehe*
2) Time/ Hora /*Saa*
3) Location/ Locale/ *Sehemu*
4) Farmer affected/ Dono da machamba/ *Jina la mwenye shamba*
5) Number of elephants/ Numero des elefantes/ *Namba ya tembo*
6) PAC method/ Metodo utilizado/*Ujuzi gani umetumika*
7) Elephant reactions/Reacçao des elefantes/ *Baada ya hayo tembo wamefanya nini?*
8) Crop damage/ Danos causados/ *Wameharibo nini*
9) PAC team/ Equipa envolvido/ *Hiyo kazi imefanywa na nani?*

Appendix 2

Trip Log

23rd August:	Harare, Zimbabwe to Mangochi, Malawi.
24th August:	Mangochi, Malawi to Lichinga, Mozambique
25th August:	Lichinga to Matchedje, Sanga District
26th August:	Transect walk along elephant paths, discussions of current elephant problems. Meeting with community at crop fields-background to elephant problems. Introduction to MZEP's programmes, and demonstration of PAC methods.
27th August:	Established demonstration fence plot around banana grove, with community. Collect film crew, and conducted interviews for TVM. Demonstrated chilli dung recipe. Mapped village and crop fields with game scouts. Conducted PAC in the banana groves.
28th August:	Extended fence along banana groves with community. Demonstrated seed-bed planting, discussed chilli production. Discussed grading of chilli peppers. PAC with game scouts in crop fields.
29th August:	Trained game scouts in pepper spray and firecracker use. Returned to Lichinga.
30th August:	Report back to A. Abacar. Planning workshop for PCC in Lichinga. Truck repairs.
31st August:	Lichinga to Tete, Mozambique.
1st September:	Tete to Harare.