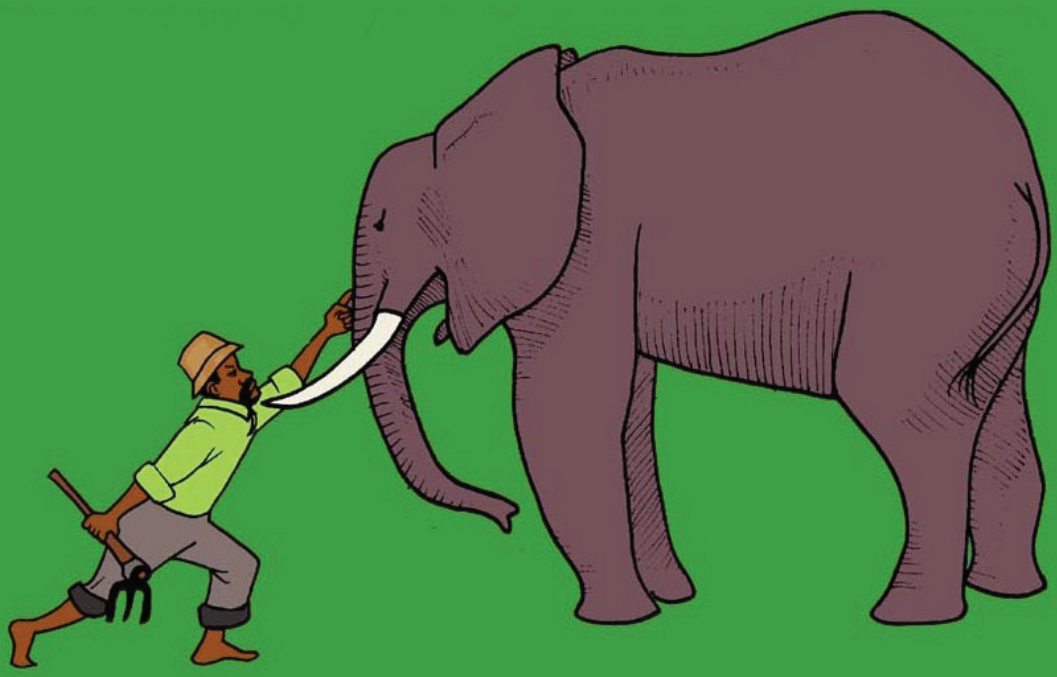

The Use of Electrified Fences to Limit Human Elephant Conflict: A Case Study of the Ol Pejeta Conservancy, Laikipia District, Kenya

Laikipia Elephant Project
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The Use of Electrified Fences to Reduce Human Elephant Conflict: A Case Study of the Ol Pejeta Conservancy, Laikipia District, Kenya

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Executive Summary

Human-elephant conflict is a significant problem in Africa and Asia, particularly where land managed for conservation adjoins land under cultivation. Electrified fences are increasingly used to reduce such conflict by preventing access by elephants to vulnerable land. However, despite the growing number of electrified fences erected to address human-elephant conflict, there have been few empirical studies of their effectiveness. Here we assess the performance of an electrified fence constructed around the 370km2 Ol Pejeta Conservancy on the Laikipia Plateau in north-central Kenya.

Ol Pejeta's perimeter fence was upgraded in February 2006 to carry a high voltage (between 6 and 7 KV). Various fence configurations were used, but all included 1 m 'outriggers' to discourage elephants from challenging the fence. The Ol Pejeta Conservancy rigorously enforced the new fence, scaring away elephants that challenged it and identifying and destroying seven consistent fence-breaking elephants.

The fence upgrade and associated enforcement had a significant impact on levels of human-elephant conflict. The number of breakages by elephants on fell from 107 in the year prior to the upgrade to 23 in the year after. Crop-raiding incidents within 1.6 km of all of Ol Pejeta's boundaries declined by 43% from 692 in the year prior to the fence upgrade to 392 incidents in the year after. Crop-raiding to the east of Ol Pejeta declined dramatically from 200 incidents in the year before the fence upgrade to just 5 incidents in the year after. A male elephant fitted with a GPS collar on Ol Pejeta spent just 1.4% of its time outside of Ol Pejeta in the year after the perimeter fence was upgraded compared with almost 13% of its time in the year before the upgrade.

Elephant crop-raiding continued on small-scale farms to the west of Ol Pejeta after the fence upgrade, largely by elephants from the adjoining ADC Mutara Ranch, which lacked an electrified fence on its southern boundary. A new electrified fence has now been built on this boundary. Maintenance and enforcement will be needed if crop raiding to the west of Ol Pejeta is to decline as significantly as it did to the east.

This study demonstrates that electrified fences can alleviate human-elephant conflict when well maintained and vigorously enforced. However the cost of constructing, maintaining and enforcing OPC's fence is high and therefore this approach may only be applicable in well-resourced conservation areas. Elsewhere, resources might be better focused on cheaper fence configurations, stronger enforcement and/or on support for small-scale farmers in adopting simple farm-based deterrents.

The success of the Ol Pejeta Conservancy's approach to managing human-elephant conflict has had an ecological cost through the effective closure of an elephant corridor South from Ol Pejeta to Solio Ranch, which was formerly connected via a habitat corridor to the Mt. Kenya Forest. Ol Pejeta continues to be connected to the rest of the Laikipia ecosystem through gaps in the perimeter fence especially established on the northern boundary.

Introduction

Despite significant declines in populations of African elephants in the twentieth century (Douglas-Hamilton 1987), human-elephant conflict remains a significant problem, especially where land managed for conservation adjoins farmland (Thouless 1994; Kangwana 1995; Barnes 1996; Woodroffe et al. 2005). Human-elephant conflict (HEC) includes loss of crops, damage to property and risk to life. In some countries such as Kenya, people are killed by elephants, and crop-raiding elephants are killed legally and illegally, every year (Omondi et al. 2004). These problems are exacerbated by the expansion of settled agriculture onto rangeland and the fragmentation of areas of open savanna. Wildlife populations outside protected areas are falling (Norton-Griffith 2000).

Various methods have been tried to reduce HEC (Sitati and Walpole 2006; Graham and Ochieng 2008, Walpole and Linkie 2007). These include traditional farm-based deterrents (the use of watchtowers, fires, ditches and loud noises), novel farm-based deterrents (chilli grease fences, fireworks and powerful electric lights) and electrified fences. Fencing has become an increasingly important strategy for reducing human-animal conflict (Hoare 1995). Electric fences are costly to build and maintain, but are recognised as a potential means of reducing conflict by preventing access to vulnerable land, or by separating people and elephants at a landscape scale (Jenkins & Hamilton 1982; Thouless and Sakwa 1995; Thouless et al. 2002).

The effectiveness of electric fences in controlling crop raiding (particularly by large species such as elephant) depends on a number of factors, including design (number of strands, number electrified, configuration), the effectiveness of maintenance, and the kind and effectiveness of responses to fence-breaking animals. This paper discusses the effectiveness of electric fencing around a wildlife conservancy on the Laikipia plateau in north-central Kenya, the Ol Pejeta Conservancy (OPC). Here the perimeter fence was upgraded and aggressively enforced after February 2006. We compare fence-breakages, crop-raiding incidents and the movement of a single collared elephant in the year before and after February 2006.

Study Area

The Ol Pejeta Conservancy covers 370km2 of savanna on the Laikipia Plateau, in north-central Kenya (Fig. 1; N0°.00' – S0°.02'; E36°.44' – 36°.59'). The Ewaso Ngiro River, with tributaries in Mt Kenya and the Aberdare Range, flows through the conservancy. Mean annual rainfall is 800 mm, falling predominantly in two seasons; the long rains from March to May, and the short rains, from October to December. The vegetation is a mosaic of grassland, Acacia drepanolobium woodland, Euclea divinorum bushland, and riverine woodland dominated by Acacia xanthophloea. Black cotton soils dominate the conservancy.

Irrigated small-scale farming occurs on densely settled smallholder land to the east and south-west of OPC. Rain-fed small-scale farming occurs on less densely settled smallholder land to the west. A large-scale commercial wheat farm, which occurs within and is leased out by OPC, is located to the south. Large-scale commercial ranches and absentee smallholder land, the latter occupied by pastoralists, occur to the north (Fig. 2). Crop-raiding by elephants on cultivated smallholder land around Ol Pejeta has been reported as a problem since elephants moved onto the Laikipia plateau in the late 1970s but particularly within the last 20 years (Mulama 1990; Thouless 1994).

Fig 1: Location of Laikipia and the Ol Pejeta Conservancy within Kenya

Prior to 2003 the western part of Ol Pejeta was managed for commercial cattle ranching while the eastern part was a livestock-free wildlife sanctuary, managed for wildlife-based tourism and known as Sweetwaters (Lamprey and Juma 2007). At this time Ol Pejeta, with the exception of the Sweetwaters wildlife sanctuary, was fenced to control livestock movement, with a simple non-electrified five strand fence. Elephants frequently broke out of Ol Pejeta to raid crops on the surrounding smallholder land. A single live electric wire was added to this stock fence where fence breaking by elephants was frequent. However this was not effective and human-elephant conflict continued to be a major problem for the communities neighbouring Ol Pejeta. Various measures were taken to address this conflict including the translocation of eleven problem elephants between 2000 and 2001 to Meru National Park (Omondi et al 2002), construction of moats and support to community scouts to scare elephants away from farms.

In 2004 Ol Pejeta Ranch was purchased by an international conservation NGO, Fauna and Flora International, and subsequently the property became the Ol Pejeta Conservancy specifically mandated to focus on wildlife conservation and community support. With the transition in ownership several major changes occurred on Ol Pejeta. Firstly, the internal electric fence separating Sweetwaters wildlife sanctuary from the rest of the ranch was removed to create a single conservation unit, accommodating both wildlife and cattle ranching (the latter are now corralled at night in predator proof 'bomas'). Secondly, between October 2005 and February 2006, OPC management upgraded and modified the perimeter fence to control movement of wildlife, in particular elephants.

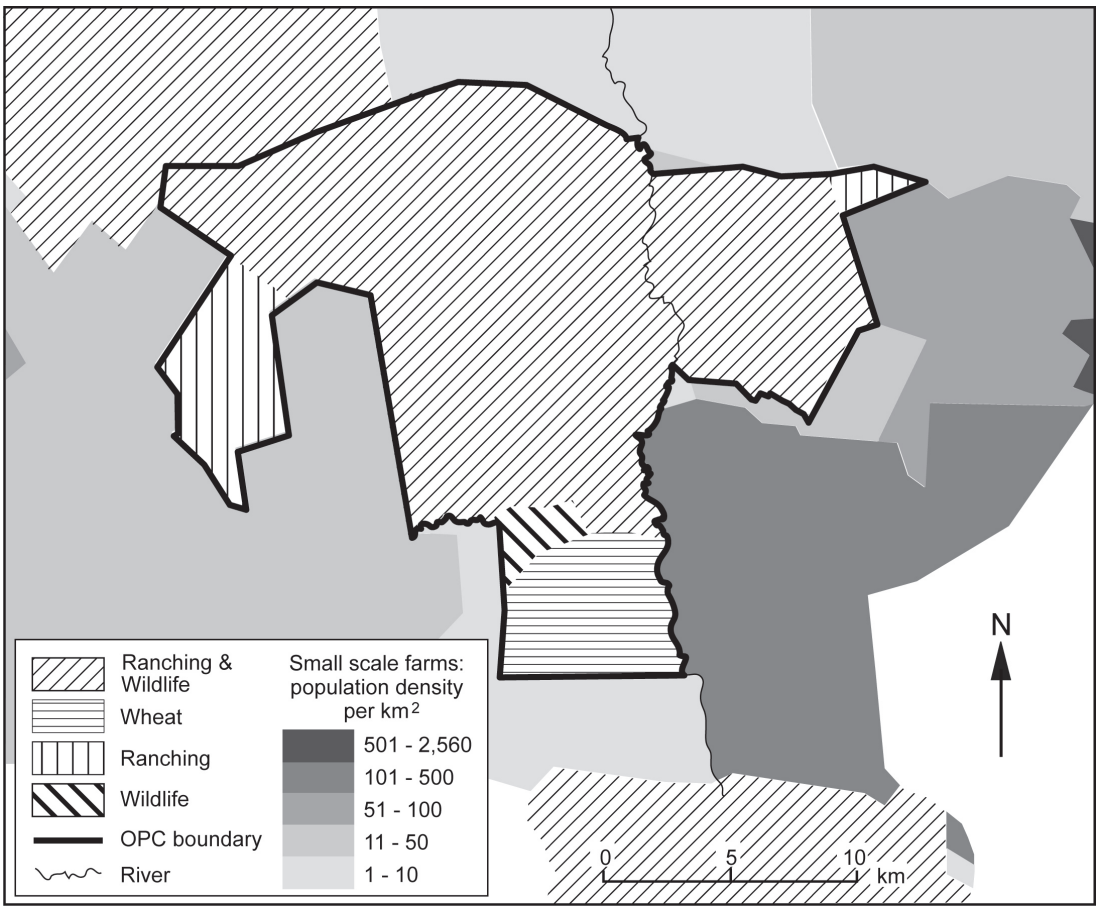

Fig 2: Land use within and around Ol Pejeta Conservancy

There are approximately 300 to 400 elephants that live on Ol Pejeta (Ol Pejeta Conservancy, unpublished data). Recent analysis of movement data collected from elephants fitted with GPS collars on Ol Pejeta shows that this population occasionally moves north and south onto the neighbouring large-scale ranches (Graham 2007).

Methods

Data Collection

HEC enumeration:
Three local enumerators, 'elephant scouts' employed by the Laikipia Elephant Project systematically collected data on crop-raiding and fence breakages in and around Ol Pejeta between February 2005 and March 2007. Enumerators were trained on data collection protocols, adapted from the IUCN's 'Training package for enumerators of elephant damage' (Hoare, 1999).

GPS tracking:
Elephant movement data reported in this paper came from a GPS collar fitted to an elephant resident in OPC ('Kimani') by Save the Elephants (STE). The methods used are described in Thouless (1996), Douglas-Hamilton (1998) and Graham et al. (in prep.). The collar used a global system for mobile communication (GSM) modem for two-way data communication through mobile phone network ground stations installed by Safaricom Ltd. This enabled hourly location data to be downloaded remotely via the internet to a laptop computer.

Fence configuration

Data on fence configurations were collected by direct observation. The entire perimeter fence was surveyed both before and after the change in OPC management, with the start and the end of each configuration marked with a GPS and recorded in a field notebook. Data collected on each configuration included the height, spacing between posts, number of strands, number of live wires and other modifications added to improve its effectiveness such as outriggers and wire mesh.

Elephant management

Information on management measures used to discourage elephants from breaking Ol Pejeta's perimeter fence was collected through informal interviews with Ol Pejeta's management team.

GIS Data

Background digital maps of Ol Pejeta and the surrounding area were made available from the Centre for Training and Research in Arid and Semi-Arid Land Development (CETRAD) and the OPC GIS database.

Data Analysis

All spatial incident data was imported into a GIS and separated into two time periods for comparative purposes using ArcGIS 9.2 (ESRI 2004): 1) March 05 to February 06 and 2) March 06 to February 07. Fence breakage data was assigned to different sections of the Ol Pejeta perimeter fence, with each section corresponding to a different configuration created under the new management regime (i.e. post Feb 06). The number of fence breakages by elephants that occurred along each section before the fence upgrade and introduction of associated fence management was compared with the number of fence breakages that occurred along each section after the fence was upgraded. An analysis of crop-raiding data across Laikipia showed that incidents occur on average within 1.6 km of elephant refuges such as large-scale ranches and/or forest reserves (Graham 2007). We compared crop-raiding on smallholder farm land within 1.6 km of Ol Pejeta before and after the fence upgrade. To provide a visual illustration of the changing pattern of crop-raiding around Ol Pejeta between the two time periods, crop-raiding incident data were superimposed onto a 5 x 5 km grid. The hourly GPS fixes collected from the individual male elephant fitted with a GPS collar were classified as being either inside or outside Ol Pejeta. The number and proportion of fixes that occurred outside of Ol Pejeta were compared between the two time periods to gauge the impact of the fence upgrade and associated elephant management on elephant movement in and around Ol Pejeta.

Results

Fence Design, Management And Breakages Before And After February 2006

Prior to 2006 most of the western, northern and southern boundaries of Ol Pejeta Ranch were demarcated by a simple four strand livestock fence, originally constructed in the 1950s, with an additional electrified wire placed on top to act as a deterrent to the movement of both wildlife and livestock (Fig.3). A more elaborate electrified fence existed around Sweetwaters' Wildlife Sanctuary with the intention of protecting the black rhino population as much as to control elephant movement. Additional electrified fences were erected around the commercial wheat farm located in south Ol Pejeta along the Ewaso Ngiro River just south of Sweetwaters and along the Ngobit River in the south-west. All three of these latter fences were created to prevent wildlife, in particular elephants, from moving into cultivated areas. Fence breaking by elephants was a regular occurrence with 107 fence breaking incidents recorded in the 12 month period between March 2005 and February 2006. The highest intensity of pressure from elephants, as measured by breakages per km of fence, was experienced along the eastern boundary along section C, followed by section E along the western boundary (Table 1).

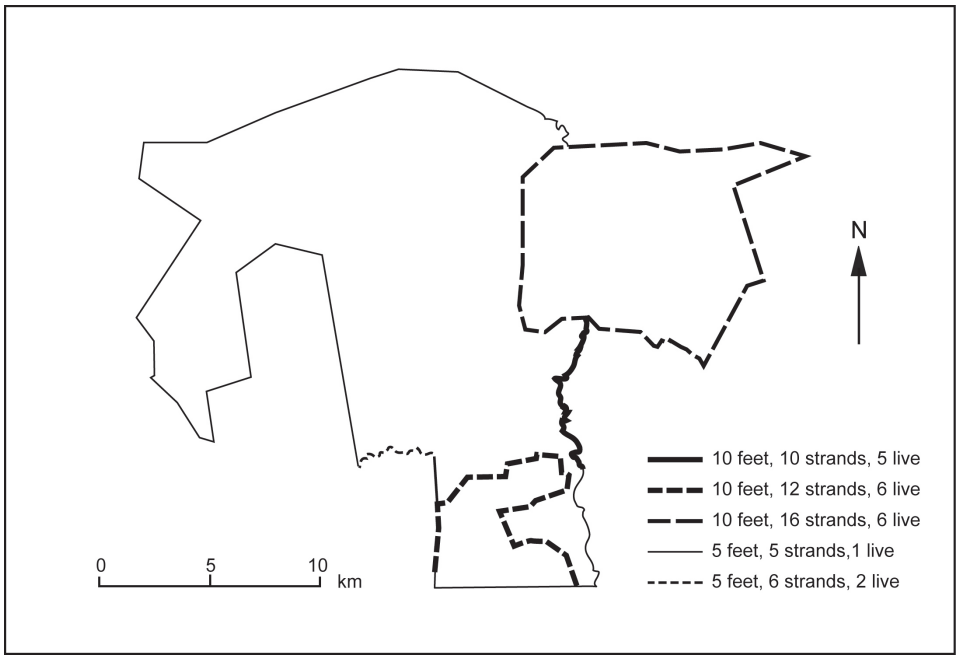

Fig 3: Ol Pejeta Ranch old fence configurations (Before Feb 2006)

With the change in Ol Pejeta's ownership and its conversion from a ranch into a private conservancy, US$1,015,446 was invested to upgrade the perimeter fence. The new perimeter fence was electrified, with on average of 6.7KV. In response to the different levels of pressure from elephants along the fence, various fence configurations were developed, including, in different places, electrified outriggers, wire mesh and where pressure from elephants was particularly high, an additional single short fence with outriggers was constructed (Fig. 4).

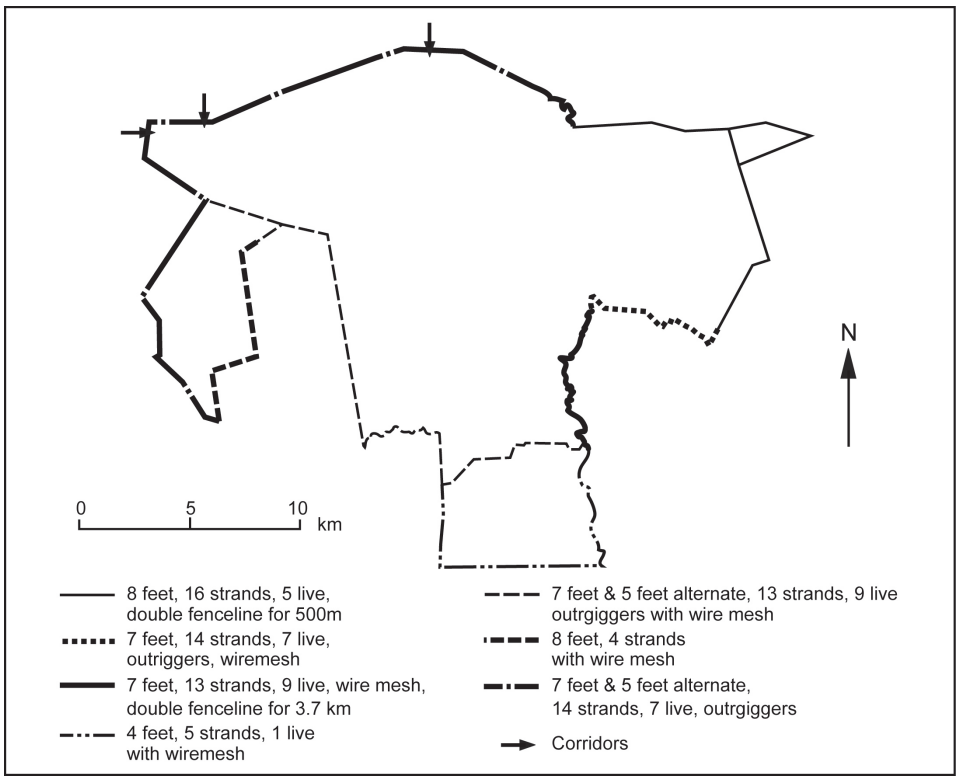

Fig 4: Ol Pejeta Conservancy new fence configurations (after February 2006)

This short fence was constructed in front of the existing electrified fence to create a double barrier to elephant movement. Electrified outriggers are 1 m lengths of high tensile wire attached to the electrified wires approximately 1 m from the ground, in 2 metre intervals so that they project upwards and outwards at a 45 degree angle perpendicular to the fence facing into the direction of elephant pressure (i.e. internally). The decision was taken in January 2006 to continue to accommodate the movement of elephants north, and into the wider Laikipia ecosystem, through the creation of three gaps 'corridors' in the north perimeter fence. However due to the presence of commercial wheat land, small-scale farming and a single elephant-intolerant ranch (Solio Ranch), the decision was taken to discourage the southern movement of elephants by fencing off an elephant corridor in the south-east corner of Ol Pejeta, which ran parallel with the commercial wheat farm.

In addition to the fence upgrade, from 2005 Ol Pejeta Conservancy put in place a system to enforce the fence. To do this a mobile rapid response team was created to respond to reports of elephants attempting to challenge the perimeter fence. The team aimed to get to the site and scare away the elephant/s before the fence could be damaged. Elephants that did break the perimeter fence were identified by a trained elephant researcher. If these identified elephants challenged the fence more than three times, they were destroyed by or with the consent of the Kenya Wildlife Service. Seven fence breaking elephants were destroyed on Ol Pejeta Conservancy in this manner.

The overall impact of the fence upgrade and associated elephant management was dramatic with the total number of breakages reduced to just 27 in the 12 month period between March 2006 and February 2007. The most dramatic declines in fence breaking were experienced along sections B, C and D (Fig.5 and Table 1). Significant fence breakages continued to be experienced along section E, though these were just one third of the total number experienced prior to the fence upgrade.

Fence Section	Length (Km)	Breakages Before	Breakages After	Breakages/Km Before	Breakages/Km After
A	23	0	2	0.0	0.09
B	8	14	0	1.75	0.0
C	8	31	1	3.88	0.13
D	18	14	0	0.78	0.0
E	20	43	16	2.15	0.8
F	11	3	4	0.27	0.36
G	41	2	0	0.05	0.0
Total	129	107	23	0.82	0.17

Table 1: Fence breakages on Ol Pejeta Conservancy one year before and one year after the perimeter fence was upgraded (See Fig. 5 to locate each of the fence sections indicated).

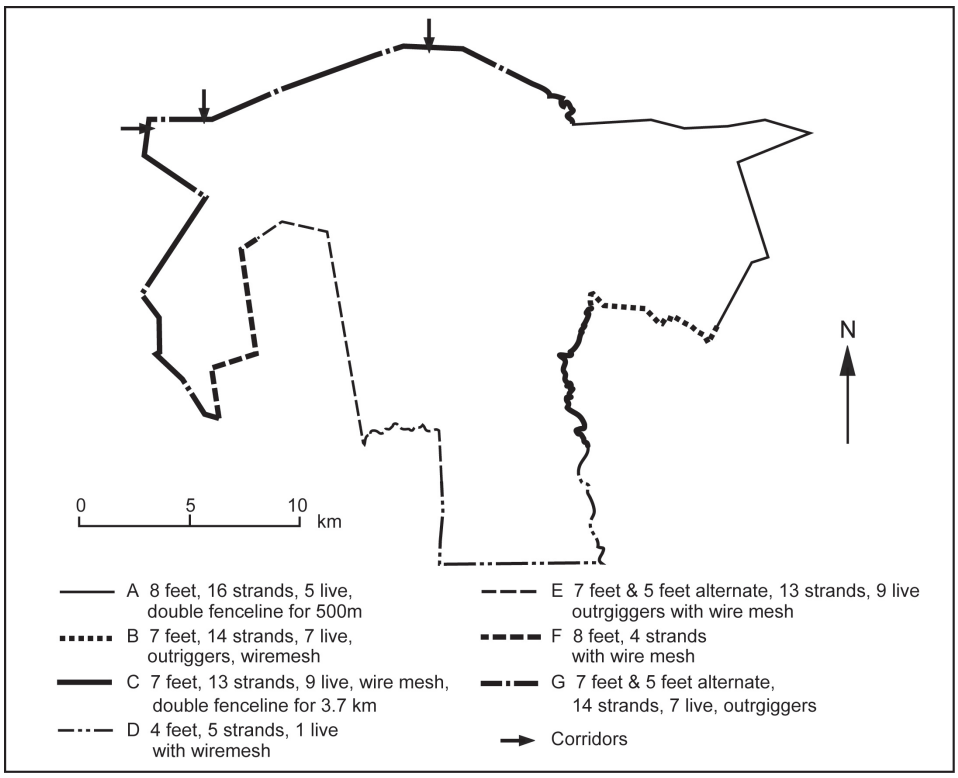

Fig. 5 Map of Ol Pejeta Conservancy showing different perimeter fence sections to illustrate location of breakages as indicated in Table 1

Crop Raiding On Small-scale Farms Around Ol Pejeta Before And After February 2006

For the 12 months from March 2005 to February 2006, 692 crop raiding incidents were recorded, whereas for the period from March 2006 to February 2007, after the perimeter fence had been upgraded and the associated introduction of direct management of fence breakers, 392 raids were recorded, a reduction of 43%. Crop raiding before the change of management occurred in both the east and west of Ol Pejeta. After the fence upgrade, crop raiding in the east decreased dramatically to negligible levels but continued to occur on smallholder farms to the west of Ol Pejeta, particulary in the Ex Erok area which is located in the north-west of Ol Pejeta (Fig.6).

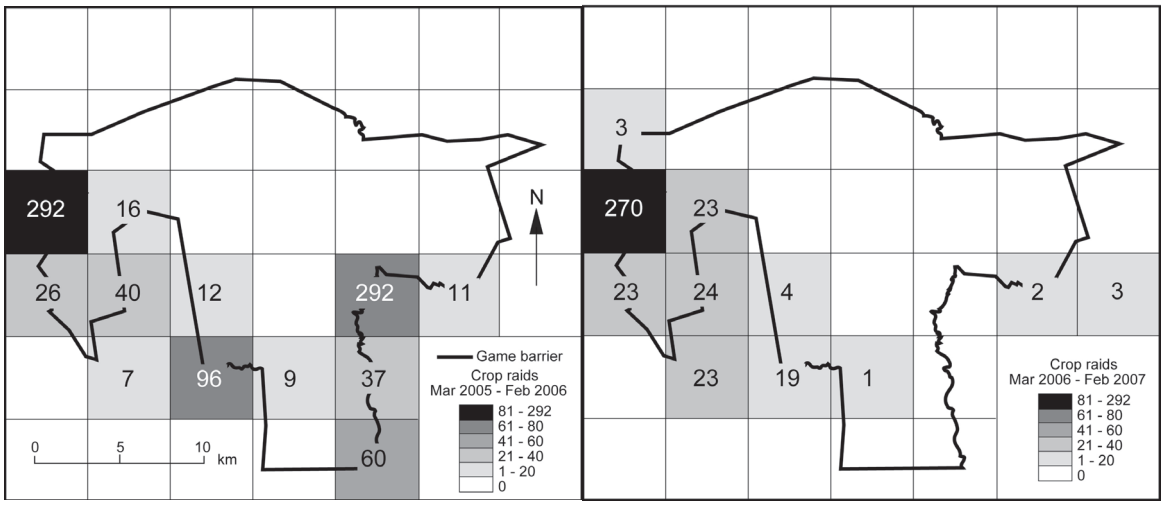

Fig.6: Crop-raiding intensity around Ol Pejeta Conservancy before and after the perimeter fence was upgraded.

Elephant Movement Patterns Before And After The February 2006

During the 12 month period between March 2005 and February 2006, 7,996 GPS positions were recorded for Kimani, a male elephant fitted with a GPS collar on Ol Pejeta by Save the Elephants as part of their wider tracking programme within the ecosystem. Of these positions, 12.94% occurred outside of Ol Pejeta. After the perimeter fence was upgraded on Ol Pejeta and aggressively enforced under the new management arrangements, Kimani spent far less time outside of Ol Pejeta with just 1.36% of the 8007 positions recorded between March 2006 and February 2007 occurring outside of Ol Pejeta.

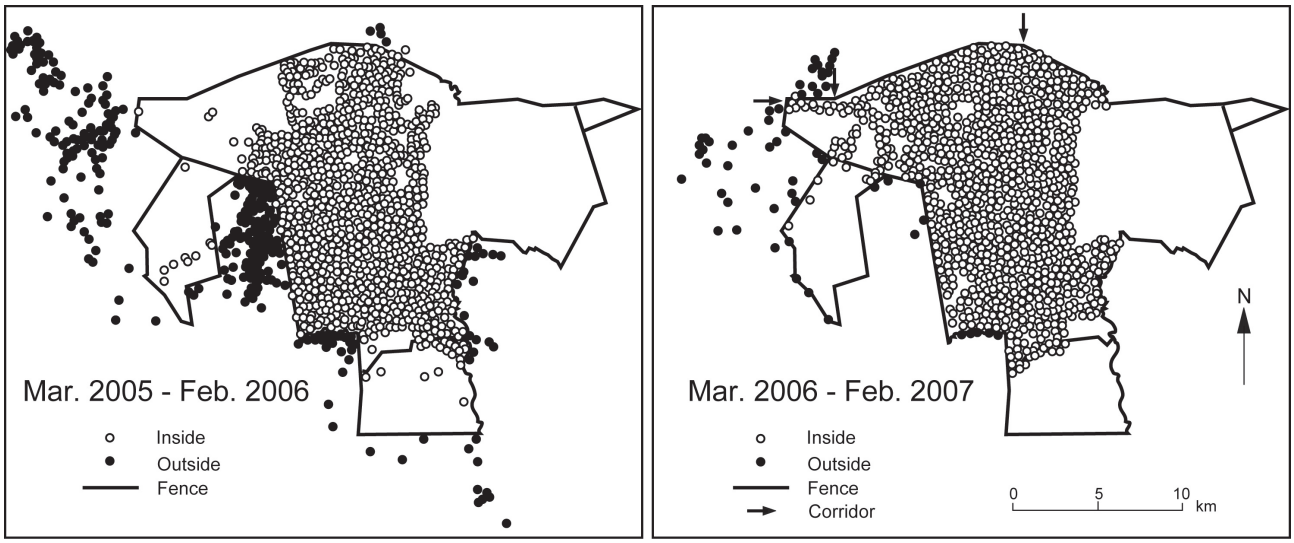

Fig. 7: Hourly GPS positions for Kimani one year before and one year after the perimeter fence was upgraded on Ol Pejeta

Figure seven illustrates how the movement patterns for Kimani changed between the two time periods. Prior to Ol Pejeta Conservancy upgrading the perimeter fence, Kimani moved south through smallholder land and onto another private ranch called Solio, and west onto small-scale farms. After the fence upgrade, Kimani no longer moved south and spent significantly less time on small-scale farms west of Ol Pejeta.

Discussion

The new approach adopted by the Ol Pejeta Conservancy for the management of HEC has largely been successful in its intended purpose. The fence upgrade and associated enforcement resulted in a dramatic decline in fence breakages and the reduction in crop-raiding east of Ol Pejeta from chronic to negligible levels that can be tolerated by neighbouring farmers. This demonstrates that electrified fences can work to reduce human-elephant conflict, providing sufficient resources are available for their construction and maintenance. However such resources are expensive. Upgrading Ol Pejeta's perimeter fence to the new configuration cost $US 1,015,446. There is evidence from other studies of fences in Africa that without proper maintenance even well designed electric fences will fail to deter elephants (Thouless and Sakwa 1995; O'Connel-Rodwell et al 2000; Hoare 1995). It is critical therefore that when and where electrified fences are constructed, sufficient resources are available for maintenance. The Ol Pejeta Conservancy spend approximately $126,000 per annum on fence maintenance. However as is evident from this case study even a well designed and properly maintained electrified fence will not necessarily be a 100% effective barrier to elephants as they can and will find ways to get through even the most sophisticated of fence designs (Thouless and Sawka 1995). An important element of fence management demonstrated in the Ol Pejeta case study is fence enforcement. This includes non-lethal control (locating elephants as soon as they break the fence and scaring them back, for example using lights, vehicles, fireworks or shotgun blasts) and identifying and eliminating elephants that break fences repeatedly.

An effective fence enforcement team capable of undertaking this work is expensive to recruit and maintain. To identify and monitor elephants that break fences and destroy crops with a view to supporting elephant management decisions, the Ol Pejeta Conservancy invests approximately $9,000 per annum. This covers the cost of a research assistant and his motorbike running costs. Capital equipment for elephant monitoring cost a further $ 4,600 (motorbike, GPS unit and digital camera). In collaboration with the Kenya Wildlife Service, Ol Pejeta Conservancy personnel identified and destroyed seven fence breaking elephants between 2005 and 2007. The rapid response team deployed by the Ol Pejeta Conservancy to assist with lethal and non lethal problem animal control consists of a vehicle which costs approximately $US 17,567 to buy and $6,757 per annum to run, and a team of two fencers, a driver and an armed scout, which costs $5,439 per annum. The team is equipped with a powerful spot light ($135) and a VHF radio ($608). So in total the Ol Pejeta Conservancy spent an initial $1,038,356 on capital equipment and thereafter $147,196 per annum to construct, maintain and enforce 129 km of electrified fences to reduce human-elephant conflict.

Crop-raiding to the west of Ol Pejeta has persisted despite the fence upgrade and associated fence enforcement. While this is in part due to persistent breaking of Ol Pejeta's western boundary fence by elephants, another major contributory factor for sustained levels of crop-raiding west of Ol Pejeta was the creation of gaps in Ol Pejeta's northern perimeter fence and the absence of an effective electrified fence on the neighbouring ranch's (ADC Mutara Ranch) southern boundary with small-scale farmland. The gaps in Ol Pejeta's fence were created in consideration of elephant behaviour and the ecological risks that may occur as a result of restricting a biological community in an enclosed area, such as inbreeding and decreased carrying capacity. However judging by Kimani's movements it appears that elephants have learnt to leave the ranch through the gaps created in Ol Pejeta's northern perimeter fence and go round the fence until they reach their preferred crop-raiding farms south of ADC Mutara Ranch. Then they follow the same route back into the conservancy. A local conservation NGO, the Laikipia Wildlife Forum completed construction of an electrified fence in 2008 with a view to preventing elephants from raiding crops south of ADC Mutara (and west of Ol Pejeta). Ensuring this fence is effective must be a priority for the Ol Pejeta Conservancy and other local stakeholders if human-elephant conflict is to decline significantly on smallholder farms located west of Ol Pejeta.

The significant reduction in the proportion of time spent outside of Ol Pejeta by the radio-tagged elephant, Kimani, illustrates the impact of the fence upgrade and associated management on elephant movement in and around Ol Pejeta. Kimani now spends far less time on small-scale farming land outside of Ol Pejeta, and therefore is likely to be raiding crops far less which could be considered a major success for Ol Pejeta Conservancy's wildlife management team. However the dramatic curtailment of elephant movement south of Ol Pejeta illustrated by Kimani's changing movement patterns could have negative ecological consequences over the long term. This is because by closing off an elephant corridor between the Ol Pejeta Conservancy, Solio Ranch and ultimately the Mt. Kenya Forest, opportunities for genetic exchange between elephant populations and access to seasonally important resources have been impaired. Furthermore the concentration of elephants into smaller areas of habitat will have localised impacts on woody vegetation and cover. Clearly when taking major wildlife management decisions such as these, consideration of what is best for the regional elephant population and wider ecosystem need to be balanced with the social and political considerations of what is best for the small-scale farmers that neighbour OPC. In this case the decision taken has resulted in a main link between the Mt. Kenya and Laikipia ecosystems and at the very least between Solio Ranch and Ol Pejeta being lost. This may be an acceptable cost for reducing human-elephant conflict south of OPC but it is an unfortunate loss for conservation.

Another unforeseen impact resulting from the fence upgrade at Ol Pejeta and associated mitigation of human-elephant conflict has been an intensification of cultivation on riparian land along the Ewaso Ngiro River which forms Ol Pejeta's eastern boundary. Farmers are no longer vulnerable to crop-raiding in this area and have therefore cleared the riparian woodland and are irrigating their crops right on the Ol Pejeta boundary. This is likely to be having an impact on river flow and water availability to downstream users.

The Ol Pejeta Conservancy's management approach for reducing human-elephant conflict could be replicated in conservation areas that are well resourced. Unfortunately, however, most protected areas in Africa are under-resourced. In these situations it may be that less expensive fence configurations might be more appropriate, with greater emphasis on fence enforcement. There is evidence to suggest that even fairly basic electrified fences can be effective if well enforced (Thouless and Sakwa 1995). Obviously this approach may have ethical implications, in terms of the number of elephants destroyed, that will need carefully consideration. We would suggest that this approach is not worth pursuing unless problem elephants can be properly identified.

The development of non-lethal methods of fence enforcement should be priority for future research to address the ethical implications of lethal fence enforcement. One particular tool that offers promise in this regard is the geo-fence or e-fence tool developed by Save the Elephants (www.savetheelephants.org) and under trial in Laikipia in collaboration with the University of Cambridge and the Ol Pejeta Conservancy. This system is designed such that a problem elephant is fitted with a GPS/GSM collar. The collar is programmed so that when the elephant approaches a designated boundary, a text message warning is sent via the mobile phone network to a manager or any person who can take preventative action.

Where resources do not exist for fence construction, as is the case in much of the African elephant range, supporting local farmers to use simple farm-based deterrents to deter crop-raiders may be the most appropriate intervention to alleviate human-elephant conflict. This approach has had some success (Osborn and Parker 2003; Sitati and Walpole 2006; Graham and Ochieng 2008; Walpole and Linkie 2008).

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Laikipia Elephant Project
Working Papers

1. The Use of Electrified Fences to Reduce Human Elephant Conflict:
A Case Study of the Ol Pejeta Conservancy, Laikipia District, Kenya (2009),
Max Graham, Nathan Gichohi, Francis Kamau, George Aike, Batian Craig,
Iain Douglas-Hamilton, and William M. Adams

Building Capacity to Alleviate Human-Elephant Conflict in North Kenya

DEFRA Darwin Initiative Grant 741

This project aims to enhance the conservation and management of Kenya's second largest elephant population (over 5,000 animals) and the ecosystem they inhabit through the implementation of an integrated and sustainable community based approach for alleviating human-elephant conflict (HEC).

The purpose of this project is to alleviate human-elephant conflict and promote tolerance of elephants in Laikipia District, Kenya.

The project works to support local partners in the following activities:

- Research on the development of systems to provide early warning of human-elephant conflict using local knowledge, Mobile phone ('push-to-talk') technologies and GPS/GSM collars;
- Dissemination of information on elephant conservation and human-elephant conflict management in vulnerable communities and local conservation organisations and land managers;
- Assess the feasibility of establishing economic activities that promote sustainable livelihoods and reduce negative human-elephant conflict;
- Promote the establishment of strategy and revenue streams to support for long term human-elephant conflict management in Laikipia;
- Support local organisations in the development of the institutional capacity to manage the West Laikipia Elephant Fence.

The project's partners are:

CETRAD
Elephant Pepper Development Trust
Kenya Wildlife Service
Mpala Research Centre
Ol Pejeta Conservancy
Rivercross Technologies
Save the Elephants
Symbiosis Trust
The Laikipia Wildlife Forum

www.laikipiaelephantproject.org
www.geog.cam.ac.uk/research/projects/heccapacity/

OL PEJETA CONSERVANCY

Laikipia Wildlife Forum

SAVE THE ELEPHANTS

UNIVERSITY OF CAMBRIDGE

KENYA WILDLIFE SERVICE

The Symbiosis Trust

ELEPHANT PEPPER

People living with elephants