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The African elephant and food security in Africa: experiences from Baringo District, Kenya

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Abstract

Elephants often impose costs including threats to human life and the destruction of crops and property on the people who share their range. Incidents of human–elephant conflict (HEC), especially crop destruction, are increasing in Africa, undermining efforts towards biodiversity conservation and food security. This study analysed the impact of crop destruction by African elephants on food security in Baringo District, Kenya. The study area was Mochongoi Division, which was stratified into three blocks: Kamailel, Mochongoi and Kimoriot. Data were collected through administering questionnaires to 40 households per block; 120 respondents were interviewed and data analysed using the Statistical Package for Social Sciences (SPSS). Results from this study showed that HEC in the study area had reduced by 15% in 2006, by 20% in 2007, and by 29% in 2008. In addition, HEC was found to reduce household income by 35.1%. The crop most raided by elephants was maize, which accounted for 65.5% of all the HEC losses, next was beans (23.8%), then cabbage and potato. This study establishes that elephant presence in non-protected areas jeopardizes local community efforts to food security and undermines local livelihoods. Conservation agencies need to lobby and support the locals to venture into other income-generating activities, such as curio shops and ecotourism facilities, that are compatible with elephant conservation. Alternatively, Mochongoi elephants could be translocated to parks and reserves earmarked for wildlife conservation.

Additional key words: cash income, crop destruction, human–elephant conflict, livelihood, poverty

Résumé

Les éléphants imposent souvent des coûts, y compris les menaces à la vie humaine et la destruction des cultures et des biens des gens qui partagent leur habitat. Les incidents de conflit homme-éléphant (CHE), en particulier la destruction des cultures, sont en augmentation en Afrique, ce qui compromet les efforts visant à la conservation de la biodiversité et la sécurité alimentaire. Cette étude a analysé l'impact de la destruction des cultures par les éléphants d'Afrique sur la sécurité alimentaire dans le district de Baringo au Kenya. La zone d'étude était la Division de Mochongoi, qui a été stratifiée en trois blocs: Kamailel, Mochongoi et Kimoriot. Les données ont été recueillies en administrant des questionnaires à 40 ménages par bloc; 120 personnes ont été interrogées et les données analysées en utilisant le Logiciel de statistique pour les sciences sociales (SPSS). Les résultats de cette étude ont montré que le CHE dans la zone d'étude s'était réduit de 15% en 2006, de 20% en 2007, et de 29% en 2008. En outre, on a trouvé que le CHE réduisait le revenu des ménages de 35,1%. La culture la plus maraudée par les éléphants était le maïs, qui représente 65,5% de toutes les pertes du CHE, suivi des haricots

(23,8%), puis les choux et les pommes de terre. Cette étude établit que la présence d'éléphants dans les zones non protégées met en péril les efforts de la communauté locale à la sécurité alimentaire et compromet les moyens de subsistance locaux. Les organismes de conservation doivent faire le plaidoyer auprès des habitants et les encourager à entreprendre d'autres activités génératrices de revenus, tels que les magasins de souvenirs et les services d'écotourisme qui sont compatibles avec la conservation de l'éléphant. Alternativement, on pourrait transférer les éléphants Mochongoi vers les parcs et les réserves destinées à la conservation de la faune.

Mots clés supplémentaires: revenus en espèces, destruction des cultures, conflits homme-éléphant, moyens de subsistance, pauvreté

Introduction

Conflict between humans and wildlife today undoubtedly ranks among the main threat to conservation in Africa. Alongside habitat destruction and commercially motivated hunting of wildlife to satisfy the demand for bush meat, conflict presents a real challenge to local, national and regional governments and non-governmental agencies in conservation (Treves and Karanth 2003). Human–elephant conflict (HEC) has become an important issue for conservationists during the last 30 years (Sarker and Roskaft 2010). HEC is a direct outcome of the excessive changes in land-use patterns and the continued conversion of natural elephant habitat to human use (Nelson et al. 2003). Recorded incidents of HEC, in particular crop raiding, are increasing in rural Africa as intensification and extension of cultivation lengthens the human–elephant interface (Hedges et al. 2005).

In addition, large populations of Kenya's elephants range outside protected areas and migrate between such areas and their environs as well as between habitats. Elephant movement is influenced by a number of factors, notably the search for food, water, minerals and in response to disturbance. This movement may be unpredictable and complex in certain situations (Blanc et al. 2003) as elephants tend to shift their movement patterns in response to availability of water and forage. At times the movement may be regular between dry and wet season ranges, in addition to other factors such as human settlement and infrastructure development (Masila 2004).

HEC is a growing concern, particularly in Kenya where elephant habitats are rapidly being converted to farmland and settlement, forcing elephants out of their ranges and into fragmented pockets of habitat. Despite this, elephant numbers in Kenya have risen in recent years due to anti-poaching policies enforced by the government (Omondi et al. 2002). As a result, these re-expanding elephant populations frequently come into conflict with humans. HEC has both direct and indirect cost implications for people in many parts of Africa (Graham et al. 2010). Direct costs are relatively straightforward to quantify. However, indirect costs associated with time and money required to avoid HEC, such as the curfews on school-going children due to presence of elephants on roads leading to school, are more difficult to estimate (Hill 2004).

Despite the disruption of socio-economic activities, pastoral and agropastoral people living in adjacent park areas are denied access to protected areas but are expected to tolerate the presence of elephants wandering on their private and communal lands. This leads to anger and desperation because these communities have to bear the costs associated with hosting elephants. People often respond to HEC by taking actions such as injuring or killing elephants and other wildlife species or creating conflict with elephant authorities (Woodroffe et al. 2005). Most pastoral communities now weigh the costs of tolerating elephants against the profits to be made from selling their land or converting it to more profitable use (Gadd 2005). Not surprisingly, most pastoralists are now practising agropastoralism or leasing their land for intensive irrigation agriculture, such as is happening in Laikipia County. Despite these problems, many pastoral communities seem to tolerate the elephant menace with the hope that a solution will be found one day (Amwata et al. 2006). Therefore, for people and elephants to live in harmony, the importance of elephants in the study area needs to be evaluated.

The elephant situation is particularly problematic because elephants compete with livestock and humans for resources, raid farmers' crops, and threaten livestock, people and property. For elephants to persist on pastoral rangelands, a costs and benefits analysis and its implications for local livelihoods is fundamental. Past studies have focused on elephant distribution, status, movement, and the nature and extent of conflicts

(Blanc et al. 2003) and spatial aspects (Sitati et al. 2003). Others have emphasized elephants in relation to agricultural conflicts. Most of these studies have shown the economic losses attributed to elephants, but few quantitatively approximate the monetary losses. These studies have shown limited interaction between elephant damage and household food security status. It was with this concern that we undertook this study to facilitate a better understanding of the nature, degree of conflicts, and how these conflicts impact household food security and wellbeing.

Materials and methods

Study area

This study was conducted in Mochongoi Division in Baringo County, one of the arid and semi-arid counties in the Rift Valley Province of Kenya (Figure 1). Mochongoi Division covers approximately 390 km^2 and has three main agro-ecological zones: lowland, medium highland and highland. The lowlands comprise the northern plateau, Lake Baringo and Kerio Valley basins (Lelon et al. 2010). The study area is influenced by the intertropical convergence zone, giving it a bimodal rainfall pattern with the long rains from March to July, and the short rains from mid-September to November (Amwata et al. 2006). Average minimum temperature is 20 ºC and the maximum is 35 ºC (Kaimba et al. 2011). Soils are tertiary volcanic in origin, dominated by porous volcanic sandy and clay soils. The soils become soggy and waterlogged in the wet season and rapidly dry and crack during the dry season. The main vegetation type is *Acacia* woodland dominated by *Acacia tortilis, Acacia reficiens* and *Boscia coriacea*. Other major plant species include *Olea africana, Croton megalocarpus, Juniperus procera, Podocarpus gracilor, Cordia sinensis, Salvadora persica, Balanites aegyptiaca* and *Maerua angolensis*. The study area is inhabited by Pokot, Tugen and Njemps pastoral communities. The pastoralists in Baringo District are mainly transhumance pastoralists. They exemplify communities in arid and semi-arid lands that depend on livestock for their livelihood (Kaimba et al. 2011).

Methodology and data collection

Mochongoi Division formed the study area. It was divided into three blocks—Kamailel, Mochongoi and Kimoriot. Primary data were collected by administering questionnaires to 120 households (Figure 2); 40 households were interviewed in each block. Questions were sought on household size in adult equivalents, age composition, sources of livelihood, incidents of human–elephant conflict, household food consumption patterns, types of crops grown, and elephant-related property and crop losses. The questions were dichotomous, multi-choice and open ended to allow ease of capturing the diverse issues under investigation in the necessary detail. Secondary data were obtained from reviewing previous studies, government reports and manuals on land transformation, elephant conservation, land use and food security of the area. The primary data were analysed using the Statistical Package for Social Science (SPSS).

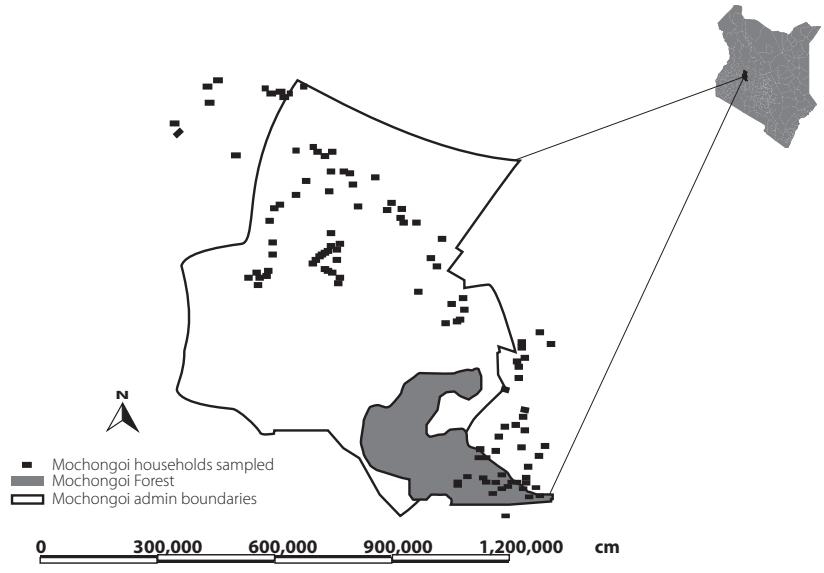

Figure 1. Location of Mochongoi forest and households sampled in Mochongoi Division

Results and discussion

Results obtained from this study show that HEC in the study area has considerably reduced: by 15% in 2006, by 20% in 2007, and by 29% in 2008 (Figure 2). This reduction could be attributed to improved service delivery that was achieved by relocating the Kenya Wildlife Service (KWS) Mochongoi station from Kabarnet to Nyahururu Station. In addition, KWS rangers have been provided with the necessary equipment and facilities, such as motorbikes, spotlights, raincoats and gumboots, which boosted their work morale and motivated them to constantly patrol without waiting for alarm calls from the locals. These regular patrols have greatly reduced contact between people and elephants.

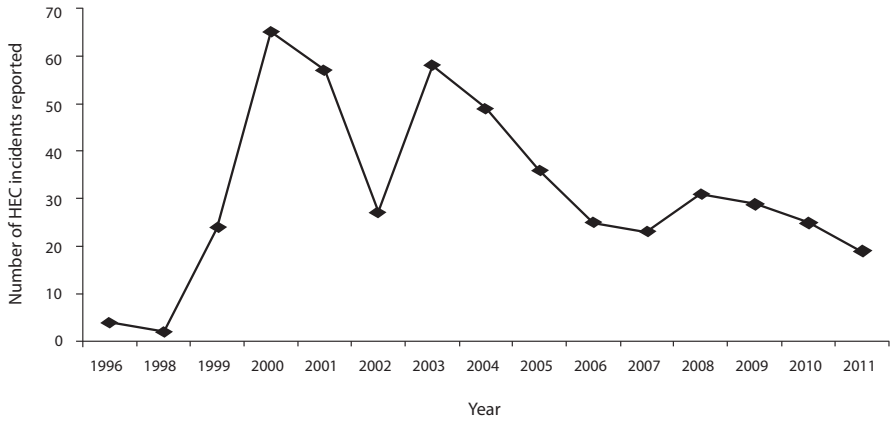

Figure 2. Trends in HEC in Mochongoi Division from 1996 to 2011. (Source: Modified from Amwata et al. (2006); KWS (2011))

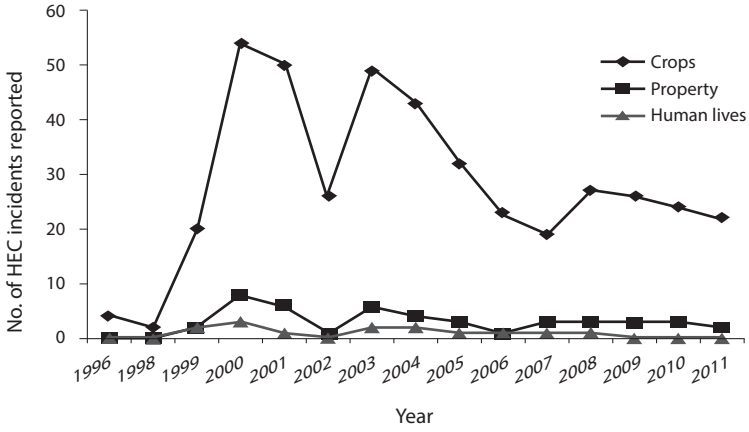

Figure 3. Incidence and different types of HEC, 1996–2011.

Figure 2 shows that the number of HEC incidents declined between 2008 and 2011. Results from this study suggest that with more motivation and provision of transport facilities, the likelihood is that HEC can be further reduced.

From the questionnaire survey and the KWS Occurrence Book, the most prevalent types of HEC were crop destruction, loss of property and threat to human life, in descending order. However, in addition to these types of HEC, Amwata et al. (2006) noted forms of HEC such as human deaths, disruption of school attendance and destruction of water points, which have ceased to occur in the area. Besides, evidence from KWS Occurrence Book for the period 2006–2011 shows that these forms of HEC were never reported (Figure 3).

Previous research studies in the study area by Amwata et al. (2006) noted four different types of land-use activities: livestock production, crop production, small-scale mixed agriculture, and charcoal burning in Mochongoi forest. Charcoal burning was later banned and the forest is recovering. Additionally, households living within the forest boundary were relocated.

All households interviewed in the study area practise some form of cultivation. Crops grown, in order of preference, were maize, beans, irish potato, cabbage, kale, sorghum, onion, banana, peas and carrot (Table 1). The contribution and economic loss of the most common crop types grown by all households to total income is shown in Table 2. Maize was the highest contributor to household income; next was beans, cabbage and lastly potato. Similarly, maize experienced the greatest losses due to HEC, leading to a 62.8% reduction in maize income.

Table 1. Distribution of crops grown by different households in the three blocks

Crop	Kamailel	Kimoriot	Mochongoi	Respondents (n = 120)	% of respondents
Banana	2	1	6	9	7.50
Beans	27	29	31	87	72.50
Cabbage	14	9	18	41	34.17
Carrot	0	4	0	4	3.33
Irish potato	22	19	25	66	55.00
Kale	11	9	16	36	30.00
Maize	40	40	40	120	100.00
Onion	4	14	9	27	22.50
Pea	0	7	2	9	7.50
Sorghum	9	5	15	29	24.17

Table 2. Estimated contribution of selected crops to household income and associated HEC losses

Food type	Contribution to household income (%)	Loss in household income due to HEC (%)
Beans	13.7	23.9
Cabbage	5.1	4.8
Maize	65.2	62.8
Potato	8.9	3.2
Other crops	7.1	5.3

Table 3. Acreage of crops destroyed by elephants in the three blocks

	Maize (acres)		Beans (acres)		Cabbage (acres)	
Block	Cultivated	Destroyed	Cultivated	Destroyed	Cultivated	Destroyed
Kamailel	192	48.50	72.50	25.50	13.50	10.50
Kimoriot	140	65.50	68.50	40.50	7.25	5.00
Mochongoi	126	32.25	58.50	19.50	4.50	2.25
Total	458	146.25	199.50	85.50	25.25	17.75

Table 4. Estimated value of elephant crop destruction in Kenya shillings (KES)

	Value (KES)			
Block	Maize	Beans	Cabbage	Total
Kamailel	2,716,000	1,224 000	126,000	4,066,000
Kimoriot	3,668,000	1,944 000	60,000	5,672,000
Mochongoi	1,806,000	9,360 000	27,000	2,769,000
Total	8,190,000	4,104 000	213,000	12,507,000
% of total crop loss	65.5	32.8	1.7	100.0

USD 1 = KES 85

To estimate the economic implication of elephant destruction, the acreage destroyed for the three major crops: maize, beans and cabbage, was calculated (Table 3). Results from the survey established that average yields of the three major crops were 2,970 kg/acre for maize, 1,440 kg/acre for beans and 1,050 kg/acre for cabbage. Similarly the average market prices per 90-kg bag during that season were Kenya shillings (KES) 2,000 for maize, KES 3,000 for beans and KES 800 for cabbage (USD 1 = KES 85). With these estimates, the economic loss associated with elephants in the 2007 March–August season is tabulated in Table 4.

The questionnaire survey showed that the economic loss from elephant crop destruction was high. Crop production was the main source of livelihood. In monetary terms these losses were approximately KES 12,507,000 annually for Mochongoi Division. This translates to a 35.1% loss in household income annually for the study area. Kimoriot block had the greatest losses; next was Kamailel. Amwata et al. (2006) estimated HEC losses in Mochongoi Division at approximately 48.6% in income per household annually. This difference in estimating losses is attributed to the fact that current estimates have been based on real market values while previous estimates were based on price approximation. Moreover, the number of incidents of HEC has reduced, implying reduced economic losses.

To understand the links between HEC and livelihood, it is critical to understand HEC influence on food security and household income. To investigate the household food security status in the study area, we established household food consumption as a function of minimum energy requirement (MER). The MER in the study area was taken to be 2,250 kcal per active African man equivalence (AAME) per day (Amwata 2004). Several methods have been used to estimate the economic welfare of households. These include head count ratio, poverty gap index, squared poverty gap index and *gini* coefficient. Of these, the head count ratio is commonly used in developing countries because it shows details of how poverty is widespread. Also, these countries have a high preference for food nutritional security, which is consistent with the behaviour of poor people. In this study the food poverty incidence (fpi) was used to proxy the household food security status. The fpi of a household refers to the number of individuals in that household who fall below the food poverty line, given to be 2,250 kcal/adult equivalent (Nyariki et al. 2002; Amwata 2004, 2013). Food-poor households are those that do not have access to enough food to supply 2,250 kcal per AAME per day. To calculate the food poverty incidence, we used the following equation:

$$fp = q/n$$

where fp is the food poverty incidence, q the number of households that fall below the food poverty line, and n the total number of sampled households (Amwata 2004, 2013).

Mochongoi Division depends on agriculture and local natural resources, and members of the community in this division are unable to meet their basic needs, especially for food security, because of the elephants. All three blocks were food insecure. The overall fpi for Mochongoi Division was 0.2, which implies that only 20% of the households in the study area were food secure. Variations in fpi were noted among the three study blocks: Kamailel had the highest fpi of 0.3, next was Kimoriot with 0.2 while Mochongoi block had the lowest with 0.1. The fpi for the study area was found to lie within the ranges that have been reported from other parts of Kenya. In 1997 the fpi ranged between 18% and 70% with Kiambu District having an fpi of 18% (GOK 2000). However, the fpi for the study area was found to be lower than reported in other arid and semi-arid areas such as Kibwezi (46%) and Kilome (36%) (Nyariki et al. 2002), and Rendille in Marsabit District with an fpi of 61% during the wet season and 86% in the dry season (Sunya 2003).

Conclusion

Deforestation, increased human population and settlements have greatly reduced the area under forest cover in Mochongoi Division. This has tremendously contributed to the loss of elephant habitat and biodiversity. As a result, HEC incidents increase threats to the survival of communities inhabiting these areas. It is clear that the presence of elephants inflicts costs, leading to a negative attitude towards the elephants. The survival of both elephants and the local community is at stake. To resolve this problem, there is need to protect rural livelihoods and reduce their vulnerability to HEC. Mitigating losses with benefits derived from community-based conservation and natural resource management may be an effective option. Opportunities should include ecotourism ventures such as curio shops, eco-lodges and sportive destinations. The government could market Mochongoi Division as a tourist destination. This would motivate the locals since they could benefit directly and indirectly from elephants through tourism and its related activities such as curios and gate levies. Besides, tourism helps diversify livelihood sources, employment opportunities and income.

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