

An assessment of elephant–livestock interactions in Amboseli, Kenya: evidence of livestock killing by elephants

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Introduction

People and elephants share landscapes across much of sub-Saharan Africa, and their interactions range from damage to agriculture and disruption to livelihoods to threats to human and elephant lives, but also in some cases, mutual benefits. Human–elephant conflict (HEC) research, however typically focuses on the loss of human life or crop damage, as these represent the most visible and severe impacts. In this field note, we report a comparatively under-reported dimension of HEC: the killing of livestock by elephants.

In the Amboseli region of Southern Kenya, elephants and Maasai pastoralists have a long history of competitive interactions over water resources and grazing, as well as spearings during age-set transitions (Kangwana 2011). Elephants kill livestock during interactions; a behaviour that appears rare elsewhere in Africa, or at least significantly underreported (Gaskamp et al. 2019). Here, we report on elephant–livestock incidents over a 28-year period, and ask whether this is a specific, cultural behaviour unique to elephants in Amboseli, found in areas with similar Maa-speaking pastoralists, or more widespread.

The Amboseli ecosystem in southern Kenya supports an elephant population of approximately 2,000 individuals. Historically, this population was much smaller (~600 individuals) and widely

dispersed across Maasai grazing lands. Coexistence between elephants and Maasai communities was facilitated by transhumant pastoralism by people and behavioural avoidance strategies by people and elephants alike. However, increasing pressures on land and water resources, coupled with changes in land use and policy, have intensified interactions over time.

In Amboseli National Park (NP), when people encounter elephants during livestock herding, water and wood collection, or movements between settlements, these encounters can result in injury or death (Okello et al. 2014), creating lasting fear within communities (Graham 2008). Historically, Maasai warriors (Moran) traditionally speared elephants, as well as buffaloes and lions, during age-set rituals—a culturally significant transition in Maasai society in which young men collectively move from one life stage to the next (most notably from junior to senior warrior status), marked by a series of ceremonies and rites of passage that can span several years. This practice is thought to have contributed to heightened fear responses of elephants toward Maasai compared to other people (Bates et al. 2007), including avoidance of settlements and altered use of key resources such as springs and swamps (Kangwana 1993, 2011). Where possible, elephants and people maintained temporal and behavioural separation, with both male and female elephants demonstrating avoidance and flight behaviour when encountering Maasai herders (Kangwana 2011). Despite this, there

are occasions when elephants and livestock encounter one another unexpectedly, particularly when livestock are spread out grazing, in thick bush, or being herded to water. In such situations, elephants may become surrounded or startled, and livestock may be injured or killed, likely from fear and confusion on the part of elephants. Retaliatory spearing of elephants during livestock encounters is a practice that could exacerbate elephant aggression towards livestock and reinforce cycles of conflict. These dynamics help explain how relatively rare but high-impact events, such as livestock killing, can trigger disproportionate social and behavioural responses by people and elephants, contributing to broader patterns of HEC.

Livestock killing by elephants in Amboseli NP intensified markedly in the late 1990s due to prolonged drought conditions, which reduced the availability of water and forage. At the same time, management decisions by the Kenya Wildlife Service (KWS) allowed large numbers of thirsty livestock to access water within Amboseli NP, increasing spatial overlap between elephants, people, and livestock. Early mitigation strategies, including retaliatory killing of elephants by KWS, proved ineffective and counterproductive, creating further hostility between elephants and livestock.

In response, the Amboseli Elephant Research Project (AERP), in collaboration with Maasai leaders and KWS, introduced a livestock “consolation” scheme in 1998, with payments backdated to 1997. This programme provided small “we are sorry for your loss” payments to livestock owners for animals killed by elephants, to reduce incentives for retaliation while acknowledging community losses. Payments were made exclusively for livestock lost outside the park boundaries, as grazing in most parts of Amboseli NP is restricted. This policy was intentional, as consoling for losses incurred inside the park could potentially incentivize excessive livestock presence within the protected area. The consolation zone encompasses the community and conservancy lands surrounding the park, specifically Olgulului, Kimana, and Eselenkei community areas, where Amboseli Trust for Elephants (ATE) maintains a network of trained community scouts who record and verify incidents. The neighbouring Imbirikani area is

not included within the ATE consolation zone, as it is covered by a separate compensation programme operated by Big Life Foundation.

Results

Since the introduction of the consolation scheme in 1997/98, retaliatory spearing of elephants linked specifically to livestock loss has declined to near zero in areas covered by the programme, although livestock losses themselves have continued. Table 1 shows results for rain years (October–September) from 1996–97 to 2024–25. Elephant deaths due to spearing for age-set traditions or conflict have declined from an annual average of five per year to three since 1998.

From October 1997–September 2025, a period of 28 years, 705 livestock losses have been recorded, equivalent to a mean of 24 animals per year. Losses were dominated by cattle ($n = 529$; 75%), followed by sheep ($n = 109$; 15.5%) and goats ($n = 66$; 9.4%), with donkey losses negligible ($n = 1$; <1%) (Table 1). Annual losses showed substantial variability, ranging from two animals in 1997–98 to a peak of 97 animals in 2008–09, during another prolonged and catastrophic drought.

Total livestock losses to elephants have varied substantially over time, with notable interannual fluctuations that broadly correspond to variation in both rainfall and drought severity index (DSI) values (Fig. 1). Periods of high DSI and lower rainfall predominantly coincide with higher numbers of livestock killed, while wetter years are generally associated with reduced losses. For example, peaks in livestock mortality are evident around 2008–09, 2016–17, and 2021–23. This pattern is consistent with increased competition for water and forage during drought conditions, which likely intensifies interactions between elephants and livestock.

Linear regression models were used to examine the relationship between livestock losses and environmental conditions (rainfall and DSI). Livestock losses increased with higher drought index values ($\beta = 6.94 \pm 3.95$ SE), although this relationship was not significant ($t = 1.76$, $p = 0.089$) and explained a relatively small proportion of the variance ($R^2 = 0.103$). Similarly, rainfall was negatively associated with livestock losses ($\beta = -0.0376 \pm 0.0207$ SE), indicating that losses tended to decrease with increasing rainfall;

however, this effect was also not significant ($t = -1.82, p = 0.080$) and had low explanatory power ($R^2 = 0.109$). Residual variation remained high in

both models (residual standard error ≈ 21.8), indicating substantial unexplained variability in livestock losses among years.

Table 1. Total number of livestock killed each rainfall year and drought index. Rainfall year is October–September. DSI = drought severity index, calculated from rainfall for dry months, where a value of >2.5 indicates drought conditions.

Rainfall year	Number of cows killed	Number of goats killed	Number of sheep killed	Number of donkeys killed	Total number of animals killed	Rainfall (mm)	DSI
1996/97	4	1	1	–	6	197.3	2.53
1997/98	–	1	1	–	2	837.3	0.60
1998/99	–	2	1	–	3	278.4	2.16
1999/00	11	1	–	–	12	205.8	4.86
2000/01	20	1	1	–	22	497.6	1.61
2001/02	1	–	1	–	2	182.9	3.28
2002/03	26	5	2	–	33	408.3	1.22
2003/04	24	2	1	–	27	377.0	1.86
2004/05	45	7	1	–	53	330.8	1.51
2005/06	46	4	5	–	55	269.2	1.86
2006/07	14	1	2	–	17	421.8	1.42
2007/08	18	9	2	–	29	276.5	2.53
2008/09	55	15	27	–	97	190.0	4.21
2009/10	4	2	8	1	15	262.0	2.67
2010/11	6	–	–	–	6	184.0	3.26
2011/12	3	–	–	–	3	493.5	1.22
2012/13	2	1	–	–	3	367.0	1.63
2013/14	2	–	4	–	6	318.0	1.89
2014/15	27	3	5	–	35	270.5	1.85
2015/16	10	2	3	–	15	431.5	1.39
2016/17	29	7	15	–	51	262.0	2.67
2017/18	19	–	5	–	24	751.0	0.80
2018/19	22	–	1	–	23	331.0	1.21
2019/20	3	–	1	–	4	815.0	0.74
2020/21	13	1	5	–	19	556.0	0.90
2021/22	48	1	14	–	63	224.0	2.68
2022/23	46	–	2	–	48	278.0	2.88
2023/24	16	–	–	–	16	835.0	0.60
2024/25	15	–	1	–	16	493.0	1.42
TOTAL	529	66	109	1	705		

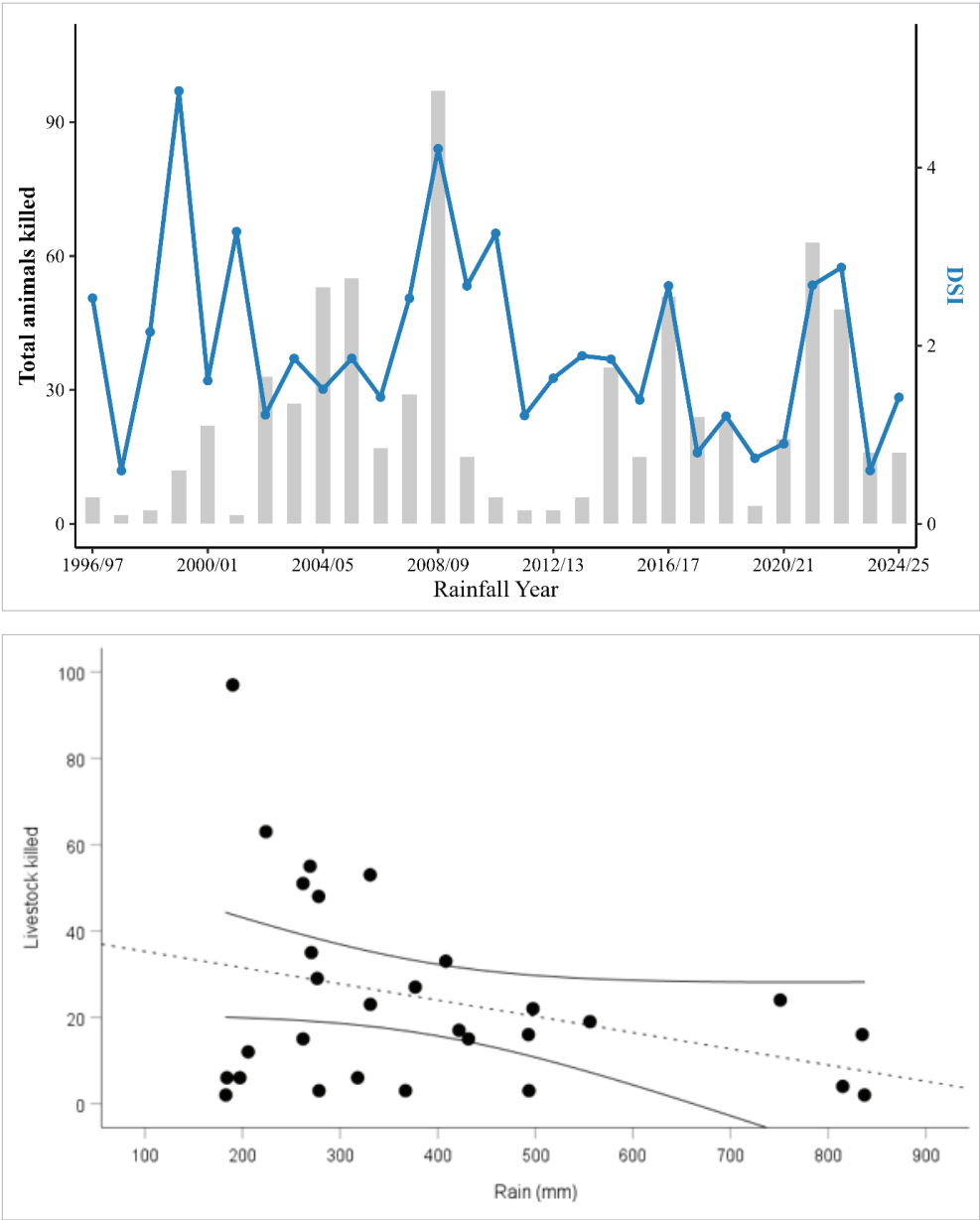


Figure 1. (A) Total elephant–livestock-killing each year and drought severity index (DSI) values. (B) Livestock killed against rainfall to illustrate the general negative relationship. The dashed line shows the fitted linear regression trend between rainfall and livestock killed; the solid lines represent the upper and lower bounds of the 95% confidence interval around this trend.

Figure 2 shows the spatial density of livestock killing incidents across the wider Amboseli ecosystem as a heat map, with colour intensity reflecting the concentration of recorded incidents rather than individual events. The highest density cluster (red shading) is centred on Kitenden Conservancy, in the central area of the conservancy, with lower density clusters (orange shading) evident in Kitirua Conservancy and the Kimana community area. It is important to note that the absence of incidents in other neighbouring areas may reflect lower recording effort or reduced spatial overlap between elephants and

livestock, rather than a true absence of killings.

The drivers of these spatial patterns warrant further investigation. Kitenden and Kitirua are conservancies where livestock and elephants co-occur but permanent human settlement is limited, whereas Kimana has higher levels of human activity and agriculture. Possible contributing factors include the proximity of key elephant movement corridors, the availability of water and forage, and the density of livestock in these areas. We encourage future studies to examine the relationship between livestock killing hotspots and variables such as livestock density, artificial water sources, land use, and elephant ranging patterns.

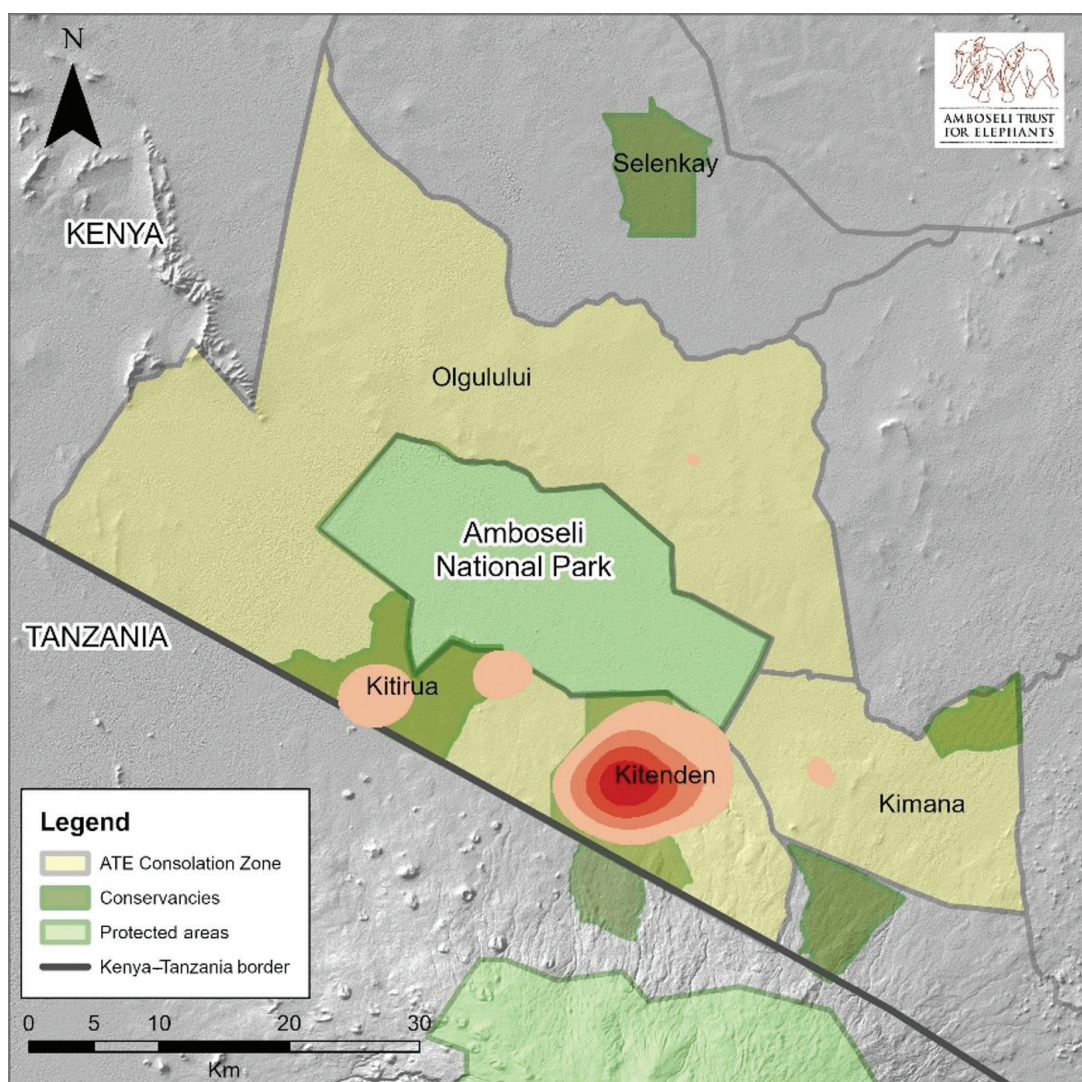


Figure 2. Elephant livestock killing intensity in the wider Amboseli ecosystem. Darker shades of orange/red indicate higher rates of livestock killing.

Discussion

The introduction of the consolation scheme in 1997/98 marked a shift toward coexistence-based strategies for people living with elephants in the wider Amboseli ecosystem. While livestock losses have continued, particularly during periods of low rainfall when competition for resources intensified, retaliatory spearing linked specifically to livestock depredation was reduced in areas covered by the programme. The consolation initiative also improved relationships between conservation actors and local communities and demonstrated the importance of addressing the socio-economic drivers of conflict. These dynamics highlight the central role of livestock loss in shaping human–elephant interactions and underscore the need for integrated approaches that balance conservation with community livelihoods.

Our observations suggest that livestock-killing behaviour is not evenly distributed across the elephant population but instead may be concentrated within specific individuals or family groups. Although data on the identity of individuals involved in these incidents remain limited, patterns in ranging behaviour and the spatial distribution of interactions indicate that certain families may be more likely to respond negatively to livestock. There is some anecdotal evidence that these same families have previously experienced retaliatory spearing, suggesting a potential link between past HEC and subsequent behavioural responses. As proposed by Kangwana (2011), social learning and elephant family memory of such events may contribute to the persistence of both aggressive and avoidance behaviours, highlighting the possible role of experience and cultural transmission in shaping these interactions. These behavioural and cultural hypotheses remain speculative at this stage and require further investigation. Future work incorporating individual identification of elephants involved in these incidents and long-term behavioural tracking will be essential to determine whether livestock killing is indeed concentrated among specific individuals or family groups, and to better understand the role of social learning and cultural transmission in shaping these interactions.

Reports of elephants injuring or killing livestock while being herded are rarely documented in the published literature, though this scarcity may reflect reporting gaps rather than the absence of the behaviour (Gaskamp et al. 2019). Documented cases come primarily from Laikipia (Thouless 1994) and Samburu (Esilaba 2005) in Kenya, regions with similar transhumant livestock-herding cultures and areas of high elephant densities. In Uganda, livestock depredations have not been attributed to elephants (Kolinski and Milich 2021). Across the Maasai steppe in Tanzania, despite high densities of both livestock and elephants, herders reported only two cattle injuries and two deaths over five years (Kioko et al. 2022). Only one incident was reported in Busega District, south of Serengeti in Tanzania (Eustace et al. 2022), while no livestock killings have been reported among herders in southern Tanzania (Mduma et al. 2010). Rare cases have been reported for Asian elephants (Guru and Das 2021) and among Fulani communities in Nahouri Province, Burkina Faso (Campaore et al. 2022). Recent observations from northwest Namibia also record livestock losses to elephants (Wenborn et al. 2025), suggesting the behaviour may be more geographically widespread than the published literature currently reflects. Gaskamp et al. (2019) argue that non-carnivore species, including elephants, are frequently excluded from discussions of livestock protection, potentially contributing to the systematic underreporting of such incidents across elephant range areas.

Thus, the scarcity of observations may reflect underreporting, with a focus on major livestock predators such as lions. Alternatively, it may indicate that livestock killing by elephants is genuinely rare, potentially shaped by local traditions among elephants living in Maa-speaking regions in Kenya and Tanzania, where men historically speared elephants during age-set ceremonies.

Recent studies emphasize how local animal behavioural traditions can influence conservation decisions (Bates et al. 2025; Brakes et al. 2025), highlighting the importance of understanding whether livestock killing by elephants is exceptional or widespread. We have insufficient information on how common this behaviour is among elephants living alongside herding communities elsewhere, making further investigation of high importance given the potential for significant HEC. Therefore, we encourage researchers, conservation practitioners, and community organisations across elephant range areas

to report any observed or documented cases of elephants injuring or killing livestock, or, just as importantly, null observations. Given the limited evidence currently available, improved reporting is essential to better understand the frequency, drivers, and distribution of this behaviour and will help build a more comprehensive picture of elephant–livestock interactions. As this issue has the potential to generate significant conflict between people and elephants, increased documentation and collaboration are critical to informing effective, locally appropriate mitigation strategies. Please contact us (ltiller@elephanttrust.org) to share observations, data, or experiences related to livestock killing by elephants.

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