Conservation and Society 15(3): 280-291, 2017

Article

Well-Being Impacts of Human-Elephant Conflict in Khumaga, Botswana: Exploring Visible and Hidden Dimensions

Allison L. Mayberry[a], Alice J. Hovorka[b,#], and Kate E. Evans[c]

[a]Department of Geography, University of Guelph, Guelph, Ontario, Canada

[b]School of Environmental Studies and Department of Geography and Planning, Queen's University, Kingston, Ontario, Canada

[c]Elephants for Africa, Botswana & The University of Bristol, Bristol, United Kingdom

[#]**Corresponding author. E-mail:** alice.hovorka@queensu.ca

Abstract

High densities of wild African savannah elephants (*Loxodonta africana*) combined with widespread human land-use have increased human-elephant conflict in northern Botswana. Visible impacts (e.g. crop/property damage, injury/fatality) of elephants on human well-being are well documented in scholarly literature while hidden impacts (e.g. emotional stress, restricted mobility) are less so. This research uses qualitative methods to explore human experiences with elephants and perceived impacts of elephants on human well-being. Findings reveal participants are concerned about food insecurity and associated visible impacts of elephant crop raids. Findings also reveal participants are concerned about reduced safety and restricted mobility as hidden impacts threatening livelihoods and everyday life. Both visible and hidden impacts of elephants contribute to people's negative feelings towards elephants, as does the broader political context. This research emphasises the importance of investigating both visible and hidden impacts of elephants on human well-being to foster holistic understanding of human-elephant conflict scenarios and to inform future mitigation strategies.

Keywords: Elephants, human-elephant conflict, hidden dimensions, well-being, rural livelihoods, conservation, Botswana

INTRODUCTION

Human-wildlife conflict threatens wildlife conservation (Hoare 1999; Naughton-Treves and Treves 2005; Lamarque et al. 2009). Conflict also adversely affects the well-being (e.g. personal security and freedom, material livelihoods, health, and social relations) of humans living in subsistence-based or low-income communities, particularly those adjacent to protected areas (Agrawal and Redford 2006; Adams and Hutton 2007; Barua et al. 2013). In Asia and Africa, high elephant densities combined with growing human land-use generates considerable conflict (Hoare 2000; Woodroffe et al. 2005). Such is the case in Botswana, a land-locked country in southern Africa, which is home to an estimated 130,451 wild African savannah elephants (*Loxodonta africana*) (Chase et al. 2016). Elephants benefit from conservation efforts on account of their international vulnerable status, and in turn play an important role in Botswana's wildlife tourism industry, ecology and economy (Lamarque et al. 2009; CSO 2010; DWNP 2012). Protected areas in northern Botswana (e.g. Chobe National Park, Moremi Game Reserve) are generally considered the primary habitat of elephants. However, elephants have high energetic demands and vast home ranges; because of this, they are a highly mobile species that utilise land outside of protected areas bringing them into contact with humans and their resources (Jackson et al. 2008; Bolla and Hovorka 2012).

Like elephants, humans living in rural Botswana have substantial spatial requirements. Subsistence agriculture

Access this article online	
Quick Response Code:	Website: www.conservationandsociety.org
	DOI: 10.4103/cs.cs_16_132

is the mainstay of Botswana's rural economy (Darkoh and Mbaiwa 2002; Sallu et al. 2010) and the practices of rearing communally grazing livestock and ploughing arable crops require significant areas of land (Behnke 1987; DEA and CAR 2010a). Moreover, citizens of Botswana (Batswana) live very mobile lifestyles, and move regularly between villages, cattle posts, ploughing fields and urban settlements (Brown 1983; Sporton et al. 1999; Suggs 2002). Because of their agricultural livelihoods and cultural inclinations, humans have significant spatial requirements that overlap with those of elephants in the rural north.

Human-elephant conflict is broadly defined as any interaction that 'results in negative effects on human, social, economic, or cultural life, on elephant conservation, or on the environment' (Parker et al. 2007: 11). Approaches to studying and mitigating conflict, however, are narrowly focused on visible impacts such as crop loss, property damage and injury or fatality to humans (Hoare 2000; Dublin and Hoare 2004; Thirgood et al. 2005). Hidden impacts such as restricted movements, emotional stress, and added labour demands remain poorly addressed. Whether they are visible or hidden, the impacts of conflict can adversely affect the well-being of humans who live in close proximity to elephants.

Visible impacts can be characterised by the following criteria—1) they have material or economic consequences for human well-being (e.g. reduced food supply, income loss, death) 2) they generally occur through a direct chain of causation (e.g. an elephant raids a farmers' crops, the farmer suffers reduced yield) (Lamarque et al. 2009; Ogra 2008; Barua et al. 2013). Considering these criteria, visible impacts are typically measured by collecting quantitative data and are subsequently well-represented in the literature on human-wildlife conflict, a field rooted in biological sciences (Peterson et al. 2010). Existing literature on human-elephant conflict in Africa broadly (Hoare 2000; Dublin and Hoare 2004; Woodroffe et al. 2005) and Botswana specifically (WB 2005; WB 2008; Songhurst 2010) highlights crop loss and property damage as the most prevalent visible well-being impacts.

Hidden impacts can be characterised by the following criteria—1) they have immaterial and emotion-based consequences for human well-being (e.g. persistent fear or worry, changed behaviours, lost opportunities) 2) they typically occur through an indirect chain of causation (Hill 2004; Barua et al. 2013; Khumalo and Yung 2015). For example, if an elephant mock charges a human while they are collecting water, its direct action may cause the human to be fearful of elephants, which then affects their future behaviour and willingness to collect water in areas where elephants are present. Despite acknowledgment of their significance (Hoare 2000; Parker et al. 2007; Roskaft et al. 2014), they have yet to be thoroughly discussed within the conflict literature. Due to their immaterial nature, hidden impacts are not easily measured through an objective lens. Instead, they require qualitative data collection, documentation of humans' perceptions and qualitative analysis. To date, studies that have explored the hidden well-being impacts of conflict name opportunity costs, transaction costs and health impacts as key hidden impacts (Ogra 2008; Barua et al. 2013).

Opportunity costs arise when elephant presence or actions cause humans losses of time or productivity; when fear and safety concerns disrupt daily routines and chores (Kimega 2003; Lamarque et al. 2009; Barua et al. 2013) and create competition for access to water sources or fuelwood (Hoare 2000; Ogra 2008; DEA and CAR 2010b; Roskaft et al. 2014). Transaction costs arise through bureaucratic inefficiencies associated with compensation schemes that reimburse farmers for financial losses incurred by elephants in theory, yet in practice yield burdensome barriers in people's lives (e.g. fraud and corruption, travel inconveniences, extensive paperwork) (Nyhus et al. 2005; Ogra and Badola 2008; DeMotts and Hoon 2012). Health impacts include impairments to humans' physical or mental well-being (e.g. alcoholism, post-traumatic stress disorder, anxiety of potential elephant encounters) that stem from elephant actions (e.g. attack on family breadwinner, past dangerous encounters) (Jadhav and Barua 2012).

The well-being impacts of human-elephant conflict are also influenced by the broader political context in which they are situated. Government conservation authorities in Botswana oversee wildlife management. This control of elephant conservation places them in a position of relative power in the eyes of low-income communities experiencing conflict. This perceived state 'ownership' of elephants represents a practical and symbolic loss of control for local communities (DeMotts and Hoon 2012), which in turn contributes to perceptions of vulnerability and exacerbates public outcry relating to conflict issues (Madden 2004; Naughton-Treves and Treves 2005). A lack of timely communication and genuine consultation, combined with insufficient mitigation outreach, also contributes to negative relations between government authorities and communities (Jachowski et al. 2014; Madden and McQuinn 2014; Dickman 2010; Madden 2004). Overall, this conflict amongst human stakeholders shapes people's experiences with and perceptions of elephants, as well as the visible and hidden well-being impacts themselves (MEA 2005; Dickman 2010; Madden and McQuinn 2014;).

The goal of this paper is to explore the visible and hidden impacts of human-elephant conflict in Greater Khumaga, Botswana by assessing humans' perceived well-being. The organisational structure of this paper aligns with four objectives—1) the circumstances in which participants encounter elephants during the dry, post-crop harvest season are documented 2) the influence of these encounters and general experiences with elephants on participants' perceptions of well-being is detailed 3) the extent to which these perceived well-being outcomes are influenced by visible or hidden impacts is explored 4) the broader political contexts and their influence on elephant impacts and perceived human well-being are considered. The paper concludes by considering the overall impact of human-elephant conflict on the lives of humans in Greater Khumaga and discussing future directions for mitigation strategies.

METHODOLOGY

Study Site

Research took place in Greater Khumaga in the western Boteti region of Botswana's Central District. This area is characterised by the Boteti River, which separates Makgadikgadi Pans National Park (MPNP) from community residential and agricultural lands, including Greater Khumaga (Figure 1). Prior to 2009, the ephemeral Boteti River had been dry for nearly 20 years. Its resurgence combined with increasing competition for resources in the Okavango Delta and Chobe regions of Botswana has resulted in an influx of elephants to the area (DEA and CAR 2010b) which are predominantly male (Elephants for Africa unpublished data). In turn, pressures of human population growth and agricultural land-use have led to increasing numbers of human-elephant encounters and intensity of conflicts.

Greater Khumaga is a community where humans and elephants coexist in a mosaic of village dwellings, cattleposts, arable agricultural fields, and uncultivated savannah grassland (veld). Clusters of cattleposts run parallel to the main tarred road, Boteti River, and western boundary of the MPNP some forty kilometres north and south of the village centre. Greater Khumaga is home to 1,252 residents with the majority residing in the village proper (n=925) and the remainder (n=327) residing at nine associated cattlepost clusters (CSO 2012a). Livelihood strategies are primarily subsistence-based including livestock husbandry and arable crop farming (DEA and CAR 2010a). For many, domestic animals are material assets providing sustenance (e.g. meat and milk), wealth (e.g. akin to a savings account), and social status (Lamarque et al. 2009; Hovorka 2012), while crop yields mainly provide sustenance.

Figure 1
Study site: Western Boteti region, Central District, Botswana.
Source: Created by Allison Mayberry

The MPNP is home to a male-dominated population of 2,242 elephants, most of whom congregate near the westernmost boundary (Chase et al. 2016; Chase 2011). Recent research and monitoring efforts suggest that these male groupings are dynamic and transient and to date, over two thousand individual males have been identified with sightings of breeding herds increasing (Elephants for Africa unpublished data). Aerial surveys conducted as part of the Great Elephant Census suggest that the MPNP elephant population has increased at a rate of 15% per year since the 2010 survey (Chase et al. 2016). These elephants transgress the westernmost park boundary during both rainy and dry seasons, mainly between Khumaga Village Centre and the cattleposts of Tsoi, as well as Bosubeya and Menoakwena (Kesch 2015). Elephant-related crop damage is a concern for residents of Greater Khumaga, where in 2016, the average cost of damage per field amounted to BWP 2173 (USD 206) (Chamberlain 2016).

Well-Being Framework

This research is guided by a well-being framework adapted from Barua et al. (2013) that comprehensively reviews the visible and hidden impacts of human-wildlife conflicts on human well-being in the Global South. Well-being constituents include Personal Security and Freedom (e.g. safety, mobility), Material Livelihoods (e.g. food, water, other resources, property/infrastructure, work/wealth), Health (e.g. physical, mental) and Social Relations (e.g. family/community, government), as detailed in Table 1. These constituents were used to develop semi-structured interview guides and served as coding themes during data analysis.

Data Collection & Analysis

Data collection took place from May - August 2014 in Greater Khumaga, Botswana using primarily qualitative methods, including semi-structured interviews with residents, key informant interviews with community experts, and participant observation.

A total of 61 semi-structured interviews were conducted using a purposive and opportunistic sampling strategy to recruit individuals who had experienced an elephant encounter in the past six months to ensure reliability of recall. All participants were assigned a personal identification number (PIN) to ensure the anonymity of their responses. During interviews, participants were asked to recall their most recent elephant encounter (e.g. location, activity involved, personal reaction) and to describe their general perceptions of how living amongst elephants impacts their well-being (according to Table 1 constituents). Demographic data were also collected for each

participant, including gender (30 female, 31 male participants), age (mean of 45), education level (32% completing ten years of basic education), livelihood strategies (primarily subsistence agriculture, 8% formally employed), and level of wealth (using livestock as a proxy to income participants owned on average 7.33 cattle ranging in value from approximately BWP 22,000 (USD 1960) to BWP 40,000 (USD 3560)).

Additional data collection methods included key informant interviews with eleven local experts on human-elephant conflict and well-being (e.g. elephant researchers, government personnel, community leaders) to provide context and guidance for in-kind protocols. These were conducted periodically throughout the four months of data collection, according to the availability of key informants. Participant observation took place during community (kgotla) conflict mitigation consultation meetings, offering important insights on interactions between residents and the Ministry of Environment, Wildlife, and Tourism (MEWT)[1]. The first author and a bilingual research assistant (Setswana and English-speaking) were present for these meetings, which were conducted primarily in Setswana. Data were collected using an audio recorder and detailed written notes by the research assistant, both of which were later translated to English.

Table 1
Well-Being Framework

Well-Being Constituents	Operational Definition
1. Personal Security & Freedom	
a) Safety	The condition of being protected from risk
b) Mobility	The ability to move freely and easily as needed or desired
2. Material Livelihoods	
a) Food	Access to adequate food to maintain a healthy lifestyle
b) Water	Access to adequate water for drinking and cleaning
c) Other Resources	Access to adequate essential resources
d) Property & Infrastructure	Access to adequate shelter for the individual and their belongings
e) Work & Wealth	Ability to acquire and maintain adequate monetary income or valuable assets through livelihood strategies
3. Health	
a) Physical Health	The state of being free of illness or injury
b) Mental Health	The state of being free of psychological or emotional impairment
4. Social Relations	
a) Family & Community	Positive connections and interactions with kin and neighbours
b) Government	Positive connections and interactions with government authorities and bodies

Adapted from Barua et al. 2013

Data analysis was qualitative; transcripts (semi-structured and key informant interviews) and notes (participant observation) were thematically coded using deductive qualitative content analysis. Specifically, well-being constituents and sub-constituents (Table 1) were used as coding themes and software systems including NVivo (version 10.1.0) and Microsoft Office (Excel and Word, 2012) facilitated data organisation and analysis around these central themes. Once qualitative analysis was complete, we tabulated participant response rates to express qualitative trends numerically (expressed as frequencies and percentages) in order to demonstrate their strength (or lack thereof). Well-being outcomes were then categorised as either visible or hidden considering the criteria (e.g. material/immaterial nature, chain of causation) outlined in section 1.

ARGUMENT

In the remainder of this paper the central argument is developed by presenting and discussing qualitative findings aligning with four research objectives—1) documenting the circumstances in which participants encounter elephants during the dry, post-crop harvest season; 2) detailing the influence of these encounters and general experiences with elephants on participants' perceptions of well-being; 3) exploring the extent to which these perceived well-being outcomes are influenced by visible or hidden impacts; and 4) considering how broader political contexts influence elephant impacts on perceived human well-being.

Elephant Encounters

Participants[2] described the circumstances of their most recent elephant encounter, including type of encounter, time of day and location (Table 2) as well as their activity at

Table 2
Classification, Location, and Time of Most Recent Elephant Encounters During the Dry, Post-Harvest Season

Variable	Category	Participants # (%)
Classification (n=61)	Direct	41 (67)
	Indirect	20 (33)
Total		**61 (100)**
Location (n=61)	Near Cattlepost or Field	26 (43)
	Veld[a]	20 (33)
	Boteti River[b]	15 (24)
Total		**61 (100)**
Time (n=57)	Morning	25 (44)
	Afternoon	28 (49)
	Evening	3 (5)
	Night	1 (2)
Total[c]		**57 (100)**

[a]Most of these encounters occurred near road networks (e.g. tarred road, human footpaths) [b]Most of these encounters occurred near cattlepost clusters, rather than Khumaga Village Centre [c]Data are missing for four participants (one unable to recall, three did not share this information)

time of encounter and behavioural and emotional reactions (Table 3). The majority of participants reported direct encounters (e.g. presence of one or more elephants in vicinity), while fewer participants experienced encounters that were indirect (e.g. came across tracks, spoor, or damage). Nearly all encounters occurred during either the morning or afternoon, with very few occurring during the evening or the middle of the night[3]. With regards to elephant encounter locations, Key Informant 5 noted that elephants 'will not directly come into the village [Khumaga village centre] they come to the outskirts [cattlepost clusters and the veld surrounding them]'. Confirming this, encounters mainly took place near cattleposts or fields, or in the veld spaces in between. Several encounters also took place on the banks of the Boteti River, most of which were nearest cattlepost clusters rather than Khumaga village centre. When elephants were observed on the national park side of the river and participants remained on the community side, encounters were perceived as less threatening.

At the time of encounter, participants were engaged in a variety of tasks (Table 3) including doing chores, in transit, or at leisure. Specifically, the majority of participants were tending to livestock (e.g. herding, kraaling, fetching), followed by those who were in transit (e.g. travelling to and from cattleposts, fields, Khumaga village centre, or the Boteti river). The remainder of participants (in order of frequency) were at leisure, conducting property maintenance and operations (e.g. weeding crops, clearing fields, repairing fences), collecting water, and collecting fuelwood.

Behaviourally, participants reacted to these encounters in various ways (Table 3). Overall, the majority of participants continued with their tasks, whereas fewer abandoned (e.g. stopped completely and immediately) or interrupted (e.g. stopped momentarily and/or altered) their tasks. When sub-stratified according to task, the majority of those who were collecting water, fuelwood, or maintaining property chose to abandon doing so. By contrast, half of those who were tending to livestock or were at leisure, and most of those who were in transit continued with their tasks. Emotionally, the majority of participants reacted to these encounters negatively (e.g. with shock, anger, frustration, worry, etc.). Only one participant reacted positively (e.g. enjoyment), and the remaining participants felt unaffected. When sub-stratified according to task, these trends remained the same.

Perceived Well-Being

Personal Security & Freedom

Sixty-one participants commented on both their feelings of safety and mobility, considering regional elephant presence. Forty-four participants (72%) stated that they feel unsafe in the presence of elephants given their large size, potential harm to humans, or that they are unfamiliar creatures. Notably, these participants felt relatively safe in Khumaga Village Centre where elephants are rarely encountered compared to the outskirts, including cattlepost clusters, crop fields, and veld, where elephants often travel. The remaining participants stated that they felt safe around elephants because they are used to living amongst them and feared only injured (and subsequently out of control and dangerous) individual elephants.

These predominant feelings of compromised safety, in turn, influence participants' perceptions of mobility within Greater Khumaga. As one participant explained: 'Elephants are … in our cattleposts here. If I walk around here and I encounter an elephant, it might kill me or be dangerous for me' (Participant 43). Thirty-four participants (56%) made statements about their inability to walk freely in Greater Khumaga, many of whom connected restrictions to particular veld-based tasks (e.g. collecting water/fuelwood) and social engagements (e.g. visiting relatives). For example, Participant 50 stated '[N]owadays we don't have that freedom of movement, like when I go to the riverbank [to collect water]. I just go checking whether the elephant around and when it is we are afraid of it'. With reference to fuelwood, Participant 40 said 'Here [at the cattlepost] we don't have electricity to do things like cook, we only use fuelwood to cook. But when I have to go and collect fuelwood in the bush and I see them [elephants], sometime I can't afford to get the fuelwood'. With reference to social engagements, Participant 38 said:

> So […] we do not have that freedom of movement [...] nowadays we are not free to visit our relatives. Even if someone is sick in the night, you cannot just go to your neighbour's to assist them […] you are afraid that if you go out, you will meet the elephants.

Table 3

Task, Behavioural and Emotional Reactions to most recent elephant encounter

Task during Encounter		**Behavioural Reaction of Participants # (%)**				**Emotional Reaction of Participants # (%)**		
		Abandoned	**Continued**	**Interrupted**	**Total**	**Negative**	**Unaffected**	**Positive**
Chore	Tending to Livestock	8 (13)[d]	11 (18)[e]	3 (5)	**22 (36)**	15 (25)	7 (11)	0 (0)
	Property Maintenance & Operations	4 (7)	3 (5)	0 (0)	**7 (11)**	6 (10)	1 (2)	0 (0)
	Collecting Water	3 (5)	2 (3)	0 (0)	**5 (8)**	3 (5)	2 (3)	0 (0)
	Collecting Fuelwood	2 (3)	1 (2)	0 (0)	**3 (5)**	2 (3)	1 (2)	0 (0)
Transit		4 (7)[d]	11 (18)[e]	1 (2)	**16 (26)**	9 (15)	7 (11)	0 (0)
Leisure		4 (7)	2 (3)	2 (3)	**8 (13)**	5 (8)	2 (3)	1 (1)
Total		**25 (41)**	**30 (49)**	**6 (10)**	**61 (100)**	**40 (66)**	**20 (33)**	**1 (1)**

[d]The majority of these encounters are classified direct (Tending to Livestock: 6; Transit: 4) [e]The majority of these encounters are classified indirect (Tending to Livestock: 6; Transit: 7)

Given the importance of livestock ownership in Batswana culture, participants also expressed greatest hesitance to abandon livestock herding efforts. According to, Participant 58 'Even our sons, they are afraid of these elephants. The thing is they don't have an option […] so they just go into the bush even though they are afraid of these elephants'.

Material Livelihoods

Sixty participants commented on their ability to access food, considering the regional presence of elephants. Of these, fifty-four participants (90%) claimed that elephants threaten their ability to access food. Most of them elaborated that elephants do so by raiding their crops, ultimately reducing the yearly food supply, while others explained that it is difficult to access crop fields (to maintain crops, access food stores) because elephants often travel through the nearby veld[4]. Others cited experienced reduced ability to access food due to reasons unrelated to arable agriculture, including elephants preventing access to the river for fishing, collecting water for cooking, and collecting livestock for milking. Only six participants (10%) felt that elephants do not threaten their ability to access food.

Many participants also explained that they experience barriers accessing replacement foods when crops are raided. They stated that food products sold in local shops are expensive and can only be purchased if livestock are sold, government welfare payments are received, or if income is obtained in some other way.

Fifty participants commented on their ability to access water, considering the regional presence of elephants. Of these, thirty-two participants (64%) confirmed that elephants threaten their ability to access water. They reasoned that elephants are often present at the Boteti River (cattlepost dwellers' main water source) or on pathways leading to it and people will abandon their tasks if elephants are encountered. Fifteen participants (30%) felt that elephants do not threaten their ability to access water given that they collect water primarily from community standpipes in Khumaga Village Centre or that they are unafraid of elephants. Finally, the remaining three participants (6%) said that elephants sometimes threaten their ability to access water and that the outcome will depend on the elephant's reaction (e.g. if it chooses to move or stay between a human and the river).

Forty-seven participants commented on their ability to access other important resources, considering the regional presence of elephants. Of these, thirty-two participants (68%) confirmed that elephants threaten their ability to access other important resources. Most of these participants referred to livestock or fuelwood, and some participants mentioned other natural resources (e.g. thatching grass, tree branches to construct traditional posts, water lilies and reeds, and sand to construct traditional huts). The remaining fifteen participants (32%) felt that elephants did not affect their ability to access other important resources.

All study participants commented on whether or not elephants had damaged their property within the past year. During the 2014 growing season, nineteen participants (31%) experienced an incident where elephants damaged their crops (e.g. watermelon, beans, maize, millet, sorghum) or fences (e.g. high strain wire, gumpoles, traditional posts). The majority of those participants who experienced property damage incidents filed reports with the Department of Wildlife and National Parks (DWNP)'s Problem Animal Control (PAC) registry in Rakops. All expected to receive compensation but did not know how much they would receive or when they would receive it. Reports were filed between March and May, but as of mid July 2014, PAC officers in Rakops confirmed that payments had not yet been distributed to successful applicants (M. Maeza pers. comm. 2014). Those who did not file reports at all explained that damages were not extensive and could be repaired easily or that the compensation provided was not worth the effort. Despite their tendency to apply for compensation, nine participants complained of insufficient payments or of temporal delays associated with the assessment and payment procedures.

Health

All participants confirmed that elephants have never injured or killed a human in Greater Khumaga. Despite this, fifteen participants (25%) maintained a very intense fear that elephants would imminently cause physical harm to humans. For example, Participant 30 explained 'I am not feeling safe because elephants are so huge. We don't know when will the elephant kill somebody. We can keep on saying "we are living with them", or "we are used to them", but at the end they will kill someone'.

When asked about the impact of elephants on their health, forty-five participants (74%) noted that experiences with elephants influenced them both physically and mentally. Specifically, many participants connected food insecurity (e.g. reduced supply and quality) to their physical health status. For example, Participant 61 stated:

> So they affect our health by raiding our crops, and destroying trees. Because according to our culture, we believe that the crops we plough from the fields are more nutritious then the ones we buy in the shops. Even veld fruits, they are more nutritional.

Others cited chronic fears and worries that elephants would raid crops and approach their property. Many stated that this lead to loss of sleep and hesitance walking through the veld. For example, Participant 29 proclaimed: "I don't sleep the whole night because I am worried that the elephants will come and destroy the whole house".

More broadly, when asked if they felt that they were living overall good lives twenty-one participants (34%) stated that they are not living good lives on account of elephants, specifically due to reduced feelings of safety and lost crops. These persistent sentiments, paired with acute feelings of fear and worry experienced during participants' recent encounters (Table 3), makes elephant-related stress a burgeoning mental health well-being concern.

Social Relations

Forty-five participants commented on whether elephant presence impacts family and community relations. Twenty participants (44%) stated that they are unable to travel between cattleposts during the evening to socialise with neighbours or relatives given their fear of encountering elephants. Six participants (13%) stated that they feel obligated to share food supplies with extended family when crops are raided. Finally, sixteen participants (35%) felt that elephants do not affect their relations with others while three participants (7%) were unsure.

Results of participant observation and semi-structured interviews also revealed tensions between members of Greater Khumaga and MEWT. Fifty-one of sixty participants (85%) felt that the government should be responsible for managing regional elephant problems. Despite reaching out to the PAC division of MEWT in light of damage incidents (Sub-section 3.2.2), many participants felt uninformed and frustrated.

> So now we are sick and tired with the DWNP [Department of Wildlife and National Parks, a division of MEWT], because even though we report these matters to them they don't even respond. We don't know what they are thinking or what they are putting in place to solve this conflict. (Participant 58)

For example, at the time of data collection, government authorities argued in favour of moving the MPNP game fence from its current location (primarily along the banks of the Boteti River) to the eastern shoulder of the main tarred road, removing a highly valued physical barrier between wildlife space and community lands. However, forty-nine participants (80%) hoped for mitigation strategies involving complete physical separation from wildlife, with nineteen referring specifically to the electrification or maintenance of the current park fence.

> The government doesn't want to solve this problem. I am confused because the government is saying farmers of this area - they must plough their fields as they are being given seeds free of charge. At the same time, he [MEWT] doesn't want to maintain this fence. Because this fence is the only solution. (Participant 30)

While MEWT provided sound justification for moving the fence (e.g. too damaged to be an effective barrier, difficult to maintain in its current location), their consultation efforts were perceived as indirect and ingenuine by some community members. While government officials called the kgotla meeting to initiate consultation with the community, residents informed the researchers that they had received past correspondence (e.g. letters signed by MEWT) suggesting that the decision to move the fence had already been made. This apparent contradiction evoked frustration and skepticism from community members, which was expressed at the kgotla meeting:

> We had been hearing rumors that the fence will be moved along the tarmac road, the government said we will have to live with elephants but I just don't understand how people can live with elephants. All of the livestock will have to be moved to the other side of the fence and we will be stuck here with the elephants. (Participant 60)

Elephant Impacts on Well-Being

Visible Impacts

Crop & Property Damage

Research results illuminate visible impacts of human-elephant conflict in Greater Khumaga, with specific regard to material livelihoods, confirming that hardships are incurred through elephant crop raids and but not property damage or injury/fatality incidents. Similar to other studies, crop loss on account of elephants generates widespread concern for community members in terms of food quantity (Hill 1998; Kaswamila et al. 2007; Mackenzie and Ahabyona 2012). However, participants also experienced problems with food accessibility and affordability, also revealing hidden impacts stemming from crop raids. These consequences are not consistently addressed in existing studies where crop raiding impacts are generally measured quantitatively in terms of field area damage, monetary value, or compensation awarded. Yet, participants in Greater Khumaga experience both physical barriers (e.g. elephant presence deters travel to fields) and economic barriers (e.g. food in local shops too expensive) to foodstuffs, constraining their ability to access their own crops or purchase available food products. Future studies should examine both visible and hidden impacts of crop raiding on people's food security in conflict scenarios (Kaswamila et al. 2007; Mackenzie and Ahabyona 2012).

Property damage represents a minor visible well-being concern for residents of Greater Khumaga primarily because financial repercussions are only associated with the destruction of high quality fences. While high quality fences offer better crop protection, the supplies required to build them (e.g. gumpoles, high strain wire) are too expensive for local residents. Instead, the majority build traditional fences from nearby tree branches and brush. Participants who mentioned damages to traditional farm fencing did not feel burdened, stating that these repairs do not take much time, effort, or money. This is contrary to evidence of Ogra (2008) who found that participants reported subsequent hidden impacts such as increased workloads (e.g. takes up to two days to complete repairs) and risks (e.g. must illegally take materials from protected areas) associated with fence reparation.

Injury & Fatality

Interestingly, Greater Khumaga has never had an incident of injury or fatality caused by elephants (DEA and CAR 2010b), yet residents maintain a very intense fear that this will happen. Since elephant-caused injuries to humans are most common in the circumstances under which participants encountered elephants, on pathways between dwellings and water sources (DEA and CAR 2010b), this region can, indeed, be considered

a high-risk zone for elephant attacks. However, these findings point to a great disparity between the actual and perceived likelihood of attacks occurring. While they may not mirror reality, these perceptions represent the lived experiences of participants and offer glimpses into their decision-making. The following sub-section discusses the cascading hidden well-being impacts of participants' perceived fear of elephants and demonstrates the substantial importance of examining perceptions of conflict.

Hidden Impacts

Opportunity Costs

Results confirm that participants' fear of elephants generates safety concerns and restricted mobility, as acknowledged yet backgrounded in human-elephant conflict research (Naughton-Treves and Treves 2005; Thirgood et al. 2005; Lamarque et al. 2009). Participants experienced negative encounters with elephants during the dry post-crop harvest season when few crop-raiding incidents took place. Interviewees recalled that these interactions compelled them to interrupt or abandon their livelihood tasks (51% of cases), and feel fear, worry or frustration (66% of cases). These encounters tended to occur while participants were collecting water and fuelwood, walking between cattleposts, or tending livestock, which generated opportunity costs around the ability to complete these tasks.

First, elephant-imposed safety concerns and mobility restrictions compromised participants' ability to collect fuelwood and water. Rural Botswana is marked by low levels of connectivity to the national electrical energy grid (Ketlogetswe et al. 2007; Bernard 2010), creating a reliance on fuelwood as a source of energy for 86.5% of all households in the Makgadikgadi region (DEA and CAR 2010a). Participants confirmed that fuelwood is a key energy source for cooking and heating, and is collected on a daily basis while traveling on foot. Perceived threats of elephant encounters also compromised participants' ability to collect water, particularly at cattleposts where access to standpipes is limited and elephant encounters are abound (around the Boteti River). Daily access to fresh potable water is an essential human need that is often collected on foot at a distance from homesteads. Opportunity costs, thus threatened participants' material livelihoods and health on account of curtailed fuelwood and water gathering activities.

Second, elephant-imposed safety concerns and mobility restrictions challenged participants' ability to travel for social between cattleposts for purposes. While participants regularly travelled during the day, many felt that it is not wise to do so after dark. Similar constraints were found in the Taita Taveta District of Kenya, near Tsavo National Park, where night-time curfews have been implemented in response to frequent movement of wildlife through areas of human settlement (Kimega 2003). While no formal rules have been implemented within the greater Khumaga community, participants have placed informal temporal restrictions upon their nighttime movements. As such, opportunity costs compromised participants' well-being where relations with community and family are concerned.

Third, elephant-imposed safety concerns and mobility restrictions challenged participants' ability to herd livestock. It is well known that predators (e.g. lions, African wild dogs) threaten rural farmers, their livestock, and their husbandry practices (Hemson et al. 2009; Gusset et al. 2009; Lamarque et al. 2009), but relatively little has been documented regarding the influence of elephants. The results of this study reveal that encountering elephants in the veld while tending to livestock compels people to flee and leave culturally and financially valuable livestock unattended. This contrasts with other studies, which conclude that herders are relatively tolerant of elephants and their veld presence (Gadd 2005; Hanks 2006; Marchais 2008). An inability to care for livestock during elephant encounters can have particularly dire consequences for human livelihoods in this area given that cattle ownership and rearing are a mainstay of Botswana's economy (Darkoh and Mbaiwa 2002; Sallu et al. 2010) and society (Lamarque et al. 2009; Hovorka 2012). Thus, opportunity costs compromised participants' well-being where material livelihoods, wealth, and relations with community relations are concerned.

Health & Transaction Costs

By contrast to opportunity costs, and due in part to limitations on the data collected, this research did not reveal widespread concerns regarding health or transaction costs. However, it did offer glimpses into these hidden impacts. With respect to health stressors, the majority of participants noted that elephants influenced them physically and mentally, citing chronic fears, worries and stress about living with elephants. To date, literature exploring the mental health impacts of conflict is sparse. Existing studies detail psychological issues (e.g. alcoholism, depression) stemming from crop damage incidents and elephant attacks in other geographic contexts (Ogra 2008; Jadhav and Barua 2012; Barua et al. 2013). No known investigations on the stressors associated with fear of elephants and opportunity costs have taken place within the African context, yet are warranted given the intense fear of elephants and regular occurrences of encounter-related emotional distress. Importantly, seemingly minor negative emotional reactions to elephant encounters can, in the long-term, prevent residents of Greater Khumaga from living sustainable and sociable rural livelihoods.

The results of this research also provide little evidence that residents of Greater Khumaga experience transaction costs, particularly where the government-implemented compensation scheme is concerned. Nearly all participants who experienced crop or property damage during the 2014 growing season applied for monetary compensation from the nearest PAC office in Rakops. By contrast to other studies (DeMotts and Hoon 2012; Ogra and Badola 2008; Nyhus et al. 2005), this suggests that those who are affected by crop and property damages experience are motivated to apply for compensation and experience few barriers. Despite this, some participants' complaints reflected common critiques of compensation specifically that it is inadequate, temporally delayed (officers slow to attend to reports and distribute payments), and

economically unsustainable (Nyhus et al. 2003; Ogra and Badola 2008). However, participants were only asked their opinion of compensation schemes if they had informed the interviewer that they experienced crop or property damage during the 2014 harvesting season (December to May). The complaints arising from this limited sample of participant responses may indicate more widespread trends. Since there is ample evidence demonstrating that transaction costs impact upon the wealth and community-government relations in other regions (DeMotts and Hoon 2012; Ogra 2008; Nyhus et al. 2003), future research focused on compensation uptake in Greater Khumaga is necessary.

Political Influences on Well-Being

Finally, research results confirm that elephant-rooted frustrations are exacerbated by conflict between humans about elephants (Madden 2004; Dickman 2010; DeMotts and Hoon 2012). Specifically, relations between Greater Khumaga and MEWT are fraught, largely due to conflicting priorities for conflict mitigation and communication.

Frustration with MEWT stems originally from the fact that the community perceives the government as elephants 'owners' and thus considered them responsible for elephant management and accountable for mitigating conflict (O'Connell-Rodwell et al. 2000; Hill 2004; DeMotts and Hoon 2012). By struggling to offer a short-term solution to such a complex problem, or by offering long-term solutions (e.g. movement of park game fence) that do not align with their own priorities (e.g. maintenance and electrification of park game fence) community members felt that the government is inflicting additional hardship upon them. This is consistent with studies from East Africa, which argue that communities feel powerless relative to conservation authorities and that this generates resentment (Naughton-Treves 1998; Naughton-Treves and Treves 2005; Hill 2015). Similar sentiments have also been documented in the Okavango Panhandle, where DeMotts and Hoon (2012) argue that perceived state "ownership" of elephants represents a loss of autonomy from the perspective of conflict-affected communities.

In these situations, human-human conflict can be prevented when communities and conservation authorities engage in genuine consultation and open communication. However, as of August 2014, residents of Greater Khumaga were confused and frustrated by MEWT's correspondence regarding plans for the MPNP fence. This perceived insufficient information exchange has generated community backlash and given rise to conflict between humans about elephants (Madden and McQuinn 2014; Jachowski et al. 2012; Madden 2004). Conflict currently centres on the community and government's differing priorities regarding the MPNP game fence, which was originally built to deter predators (Kesch 2015; Gupta 2005; Meynell and Parry 2002). The recent influx of elephants to the region, and their need to access water from the Boteti River, has damaged the fence beyond affordable and realistic repair and maintenance by government authorities. Still, community participants strongly viewed the fence as a necessary barrier that must be maintained to ensure human well-being; indeed, traditional fencing serves as a "visible and culturally recognised barrier between humans and wildlife" (Jachowski et al. 2012: 193). Thus, the decision to make changes to traditional fencing must be accompanied by timely and transparent communication and community consultation meetings. Community skepticism, frustration and criticism of government officials and their efforts largely stems from delayed consultation and future frustrations can be quelled by more thorough efforts.

CONCLUSION

Elephant encounters can have a complex and cumulative impact on the well-being of humans who live amongst them (MEA 2005; Barua et al. 2013). While elephant impacts and political influences were articulated above in a linear fashion, they are highly dynamic and interconnected. Figure 2 categorises each major research finding according to type of well-being impact (by colour), as either a visible or hidden impact (by box outline), and whether they occur directly or indirectly as the result of an elephant action (type of line between boxes).

Given that there are a number of impacts that occur through an indirect chain of causation, one must consider the system of impacts, rather than its individual parts alone, in order to fully understand the implications of human-elephant conflict on human perceptions of well-being (Madden 2004; Ogra 2008; Barua et al. 2013). This will shed improved light on a complex problem and help inform development and implementation of conflict mitigation strategies in local communities.

This research provides an empirical investigation of both visible and hidden well-being impacts of elephants on the lives of humans. To date, few studies have thoroughly documented and highlighted the significance of hidden well-being impacts, particularly the ways in which perceived safety and mobility concerns influence daily decision-making. Most recent encounter data demonstrates that humans regularly encounter elephants under circumstances that do not involve crop raiding or injury/fatality (e.g. while herding livestock, collecting water, walking throughout the community, etc.) and that these are detrimental to people's livelihoods and well-being (e.g. causing acute stress and disrupting daily productivity). Participants' general perceptions of elephant impact on their safety, mobility, and access to essential resources reinforce this narrative over the long term. In summary, this study provides evidence of the importance of investigating hidden well-being impacts and argues that researchers must strive to account for more diverse variations of conflict when examining dynamics between human and elephant populations.

While this study revealed key findings concerned the hidden well-being impacts of human-elephant conflict, a few study limitations should be acknowledged. Due to its focus on human perceptions of conflict and primarily qualitative approach, this research offers a relatively limited examination of visible impacts by contrast to hidden impacts. Further, given that a case

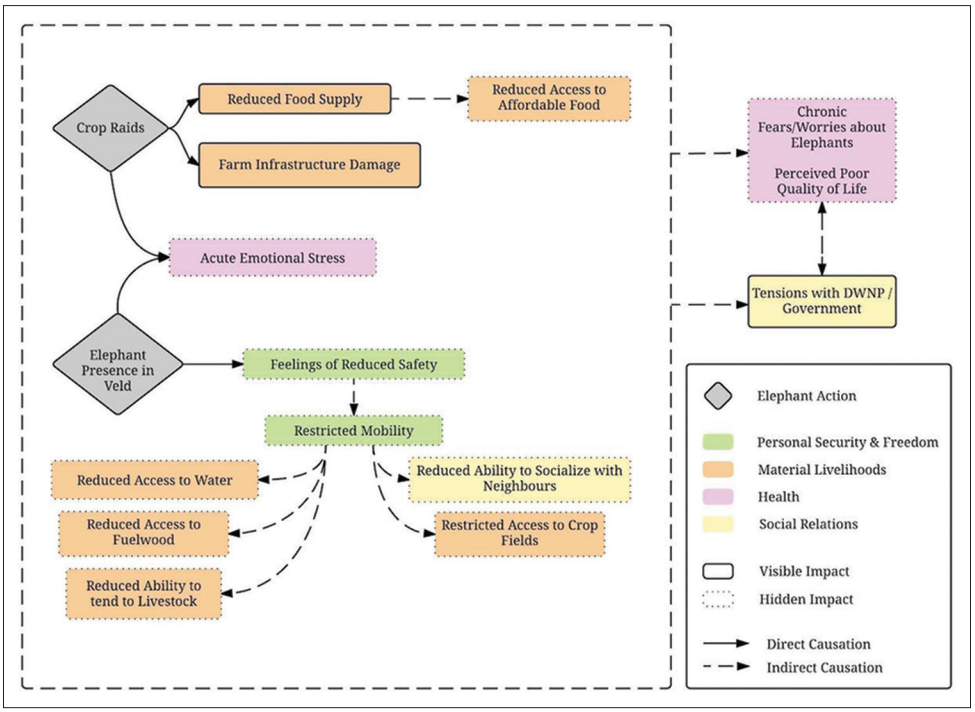

Figure 2
A visual summary of the hidden and visible well-being impacts of interactions with elephants on humans in Greater Khumaga.
Source: Created by Allison Mayberry

study approach was used, results are best applied to Greater Khumaga and may vary from the experiences of humans in other contexts.

This study implores new directions for regional human-elephant conflict mitigation strategies. Given the lack of empirical research on the hidden well-being impacts of human-elephant conflict, little has been done to alleviate these concerns. Greater Khumaga would benefit from the implementation of mitigation strategies that address hidden dimensions - namely safety, mobility and resource access concerns, as well as broken communication and tensions with the government.

To address opportunity costs stemming from safety and mobility concerns, the residents of Greater Khumaga would benefit from a community coexistence programme that provides education and greater access to conflict mitigation resources. Specifically, residents would benefit from training on basic elephant behaviours so they may understand how to deal with elephant encounters and best avoid them. Since elephants have only recently moved back into the region, many residents who are currently living amongst elephants are unfamiliar with their body language. For example, one participant stated:

> I would like the DWNP to know that we are living with elephants in this area. It's upon their responsibility to come and inform us about how to react when we see one. Because when we see an elephant, we get scared and we run away. We don't know how to react when we encounter the elephants. (Participant 44)

Assisting residents through education and exposure to non-conflict situations (e.g. guided safari visits to the MPNP) can give them the tools they need to avoid dangerous situations. This can subsequently reduce the heavy burden of fear of elephants and empower residents in their daily encounters with elephants, and should thus be brought to the forefront of the regional mitigation strategy.

Finally, tensions between the government and residents of Greater Khumaga regarding human-elephant conflict can be addressed through improved communication and information exchange. This is a highly important, but often overlooked or poorly practiced strategy in human-wildlife conflict management (Hill 2015; Dickman 2010; Madden 2004) and is certainly not unique to Botswana. With regards to this specific context, conflicting priorities and the decision to move the MPNP game fence were central to community government tension. Since completion of this research work has started to move the MPNP game fence to the western side of the Boteti River. Moving forward tensions could be eased by earlier consultation with communities, clear communication of any proposed changes that will directly impact the community, such as the role of fences in human-wildlife conflict mitigation, and why it is important for their security and well being.

ACKNOWLEDGEMENTS

This study would not have been possible without the residents of Greater Khumaga, who so kindly welcomed us to their community and shared valuable insights regarding their life with elephants. We are grateful to the Department of Wildlife and National Parks / Ministry of Environment, Natural Resource Conservation and Tourism and the Department of Environmental Sciences, University of Botswana

for permitting and facilitating this research. Our thanks also go out to Elephants for Africa staff and students for their in-kind support and to the three anonymous reviewers whose feedback strengthened this paper. Funding for this research was provided by the Social Sciences and Humanities Research Council of Canada (SSHRC) and the Ontario Veterinary College Animal Welfare Club.

NOTES

1. MEWT is now known as the Ministry of Environment, Natural Resource Conservation, and Tourism (MENT)
2. It should be noted that participants were not obligated to answer all questions; thus total number of responses per question may vary throughout this section.
3. This may be due to the fact that the majority of people are sleeping and not moving around at night, and are therefore less likely to encounter elephants. This may not represent the movements of elephants, as studies show that elephant movement throughout human settlements and crop raiding is common at night (Jackson et al 2008; Chiyo et al. 2005).
4. Despite widespread concern for crops, key informants claimed that it is uncommon for residents to guard their crops at night.

REFERENCES

Adams, W.M. and J. Hutton. 2007. People, parks and poverty: political ecology and biodiversity conservation. *Conservation and Society* 5(2): 147–153.

Agrawal, A. and K. Redford. 2006. Poverty, development, and biodiversity conservation: shooting in the dark? New York, NY: Wildlife Conservation Society Working Paper No.26.https://www.cbd.int/doc/books/2009/B-03162.pdf. Accessed on March 19, 2015.

Barua, M., S.A. Bhagwat, and S. Jadhav. 2013. The hidden dimensions of human wildlife conflict: health impacts, opportunity and transaction costs. *Biological Conservation* 157: 309–316.

Behnke, R.H. 1987. Cattle accumulation and the commercialization of the traditional livestock industry in Botswana. *Agricultural Systems* 24: 1–29.

Bernard, T. 2010. Impact analysis of rural electrification projects in sub-Saharan Africa. *The World Bank Research Observer* 27: 33–51.

Bolla, A. K. and A.J. Hovorka. 2012. Placing wild animals in Botswana: engaging in geography's transpecies spatial theory. *Humanimalia* 3(2): 56–82.

Brown, B.B. 1983. The impact of male labour migration on women in Botswana. *African Affairs* 82(368): 367–388.

Chamberlain, A.L. 2016. *An analysis of the human elephant conflict situation in the Boteti area, Botswana: the economic cost of elephant crop raiding*. M.Sc. thesis. University of Bristol, Bristol, UK.

Chase, M. 2011. *Dry-season fixed wing aerial survey of elephants and wildlife in northern Botswana, September–November 2010*. Kasane, Botswana: Elephants Without Borders. Conducted jointly with the Department of Wildlife and National Parks Botswana and the Zoological Society of San Diego, California, USA.

Chase, M., S. Schlossberg, C. Griffin, P. Bouche, S. Djene, P. Elkan, S. Ferrreira, et al. 2016. Continent-wide survey reveals massive decline in African savannah elephants. *PeerJ* 4: 2354.

Chiyo, P.I., E.P. Cochrane, L. Naughton, and G.I. Basuta. 2005. Temporal patterns of crop raiding by elephants: a response to changes in forage quality or crop availability? *African Journal of Ecology* 43: 48–55.

CSO (Central Statistics Office). 2010. A statistical review of tourism 2009.http://www.cso.gov.bw/templates/cso/file/File/TOURISM%20STATISTICS %202010%20Apr%202014.pdf. Accessed on September 26, 2013.

CSO (Central Statistics Office). 2012a. Populations of towns, villages, and associated localities. http://www.cso.gov.bw/templates/cso/file/File/population_town.pdf. Accessed on October 30, 2014.

Darkoh, M.B.K. and J.E. Mbaiwa. 2002. Globalization and the livestock industry in Botswana. *Singapore Journal of Tropical Geography* 23(2): 149–166.

DeMotts, R. and P. Hoon. 2012. Whose elephants? conserving, compensating, and competing in northern Botswana. *Society & Natural Resources: An International Journal* 25(9): 837–851.

DEA (Department of Environmental Affairs) and CAR (Centre for Applied Research) 2010a. Makgadikgadi framework management plan: volume 1 main report. http://www.the-eis.com/data/literature/Makgadikgadi%20Framework%20Management%20Plan_Vome%201_2010.pdf. Accessed on February 23, 2015.

DEA (Department of Environmental Affairs) and CAR (Centre for Applied Research). 2010b. Makgadikgadi framework management plan volume 2: chapter 5 wildlife resources and human wildlife conflict. http://www.car.org.bw/temp/documents/MFMP%20Vol%202%20Chapter%205%20wildlife.pdf. Accessed on February 23, 2015.

DWNP (Department of Wildlife and National Parks). 2012. *Aerial census of animals in Botswana*. Gabarone: Botswana.

Dickman, A. J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation* 13: 455–466.

Dublin, H. T. and R.E. Hoare. 2004. Searching for solutions: the evolution of an integrated approach to understanding and mitigating human–elephant conflict in Africa. *Human Dimensions of Wildlife: An International Journal* 9(4): 271–278.

Gupta, C. 2005. *A study of the decision to construct the Makgadikgadi Wildlife Fence and its subsequent impacts on the Makgadikgadi Pans Region*. Dartmouth College, Hanover, New Hampshire.

Gusset, M., M.J. Swarner, L. Mponwane, K. Keletile, and J.W. McNutt. 2009. Human wildlife conflict in northern Botswana: livestock predation by endangered African wild dog *Lycaon pictus* and other carnivores. *Oryx* 43(1): 67–72.

Hanks, J. 2006. Mitigation of human-elephant conflict in the Kavango-Zambezi Transfrontier Conservation Area through community based problem animal control, with particular reference to the use of chilli peppers. http://www.dlistbenguela.org/sites/default/files/doclib/human%20elephant%20conflict%20TFCA.pdf. Accessed on March 15, 2015.

Hemson, G., S. Maclennan, G. Mills, P. Johnson, and D. Macdonald. 2009. Community, lions, livestock and money: a spatial and social analysis of attitudes to wildlife and the conservation value of tourism in a human-carnivore conflict in Botswana. *Biological Conservation* 142: 2718–2725.

Hill, C. M. 1998. Conflicting attitudes towards elephants around the Budongo Forest Reserve, Uganda. *Environmental Conservation* 25(3): 244–250.

Hill, C.M. 2004. Farmers' perspectives of conflict at the wildlife-agriculture boundary: some lessons learned from African subsistence farmers. *Human Dimensions of Wildlife* 9: 279–286.

Hill, C.M. 2015. Perspectives of "conflict" at the wildlife-agriculture boundary: 10 years on. *Human Dimensions of Wildlife: An International Journal* 20(4): 1–6.

Hoare, R. 1999. Determinants of human–elephant conflict in a land-use mosaic. *Journal of Applied Ecology* 36(5): 689–700.

Hoare, R. 2000. African elephants and humans in conflict: the outlook for coexistence. *Oryx* 34(1): 34–38.

Hovorka, A. 2012. Women/chickens vs. men/cattle: insights on gender-species intersectionality. *Geoforum* 43: 875–884.

Jackson, T. P., S. Mosojane, S.M. Ferreira, and R.J. van Aarde. 2008. Solutions for elephant *Loxodonta africana* crop raiding in northern Botswana: moving away from symptomatic approaches. *Oryx* 42(1): 83–91.

Jachowski, D.S., R. Slotow, and J.J. Millspaugh. 2014. Virtual fences make good neighbours: opportunities for conservation. *Animal Conservation* 17: 187–196.

Jadhav, S. and M. Barua. 2012. The elephant vanishes: impact of human-elephant conflict on people's wellbeing. *Health & Place* 18: 1356–1365.

Kaswamila, A., S. Russell, and M. McGibbon. 2007. Impacts of wildlife on household food security and income in northeastern Tanzania. *Human Dimensions of Wildlife: An International Journal* 12(6): 391–404.

Ketlogetswe, C., T.H. Mothudi, and J. Mothibi. 2007. Effectiveness of Botswana's policy on rural electrification. *Energy Policy* 35: 1330–1337.

Kesch, K. 2015. *Game fencing as a human-wildlife conflict mitigation strategy and its implications for conservation*. Ph.D. thesis. University of Hamburg, Hamburg, Germany.

Khumalo, K.E. and L.A. Yung. 2015. Women, human-wildlife conflict, and CBNRM: hidden impacts and vulnerabilities in Kwandu Conservancy, Namibia. *Conservation & Society* 13(3): 232–243.

Kimega, G.M. 2003. Unresolved human-wildlife conflict in Kenya – the source of misery and poverty. http://www.ogiek.org/indepth/human-wildlife-conflict.htm. Accessed on May 4, 2015.

Lamarque, F., J. Anderson, R. Fergusson, M. Lagrange, Y. Osei-Owusu, and L. Bakker. 2009. *Human–wildlife conflict in Africa: causes, consequences and management strategies*. FAO Forestry Paper 157.http://www.fao.org/docrep/012/i1048e/i1048e00.pdf. Accessed on June 22, 2015.

Mackenzie, C.A. and P. Ahabyona. 2012. Elephants in the garden: financial and social costs of crop raiding. *Ecological Economics* 75: 72–82.

Madden, F. 2004. Creating coexistence between humans and wildlife: global perspectives on local efforts to address human–wildlife conflict. *Human Dimensions of Wildlife* 9(4): 247–257.

Madden, F. and B. McQuinn. 2014. Conservation's blind spot: the case for conflict transformation in wildlife conservation. *Biological Conservation* 178: 97–106.

Marchais, J.E.S. 2008. Field notes about human-elephant conflict in the southern buffer zone of the Okavango Delta, Botswana. *Pachyderm* 44: 96–97.

MEA (Millennium Ecosystem Assessment). 2005. Ecosystems and human well-being health synthesis: a report of the Millennium Ecosystem Assessment. http://www.millenniumassessment.org/documents/document.356.aspx.pdf. Accessed on July 23, 2015.

Meynell, P. J. and D. Parry. 2002. *Environmental appraisal for the construction of a game proof fence around Makgadikgadi Pans National Park*. Gaborne: Scott Wilson Kirkpatrick & Partners.

Naughton-Treves, L. 1998. Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology* 12: 156–168.

Naughton-Treves, L. and A. Treves. 2005. Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. In: *People and wildlife: conflict or coexistence?* (eds. Woodroffe, R., S. Thirgood, and A. Rabinowitz). Pp. 252–277. Cambridge: Cambridge University Press.

Nyhus, P., S. Osofsky, P. Ferraro, F. Madden, and H. Fischer. 2005. Bearing the costs of human-wildlife conflict: the challenges of compensation schemes. In: *People and wildlife: conflict or coexistence?* (eds. Woodroffe, R., S. Thirgood, and A. Rabinowitz). Pp. 107–121. Cambridge: Cambridge University Press.

O'Connell-Rodwell, C.E., T. Rodwell, M. Rice, and L.A. Hart. 2000. Living with the modern conservation paradigm: can agricultural communities co-exist with elephants? a five-year case study in East Caprivi, Namibia. *Biological conservation* 93: 381–391.

Ogra, M. 2008. Human-wildlife conflict and gender in protected area borderlands: a case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India. *Geoforum* 39: 1408–1422.

Ogra, M. and R. Badola. 2008. Compensating human-wildlife conflict in protected area communities: ground-level perspectives from Uttarakhand, India. *Human Ecology* 36: 717–729.

Parker, G., F. Osborn, R. Hoare, and L. Niskanen. 2007. Human-elephant conflict mitigation: a training course for community-based approaches in Africa, participant's manual. https://cmsdata.iucn.org/downloads/heccombappmen.pdf. Accessed on June 15, 2015.

Peterson, M., J. Birckhead, K. Leong, M. Peterson, and T. Peterson. 2010. Rearticulating the myth of human-wildlife conflict. *Conservation Letters* 3: 74–82.

Roskaft, E., T. Larsen, R. Mojaphoko, A.H.M. Raihan Sarker, and C. Jackson. 2014. Human dimensions of elephant ecology. In: *Elephants and savanna woodland systems: a study from Chobe National Park, Botswana* (eds. Skarpe, C., J. du Toit, and S. Moe). Pp: 271–288. Chinchester: John Wiley & Sons Ltd.

Sallu, S., C. Twyman, and L. Stringer. 2010. Resilient or vulnerable livelihood? assessing livelihood dynamics and trajectories in rural Botswana. *Ecology and Society: A journal of integrative science for resilience and sustainability* 15(4): 1–34.

Songhurst, A. 2010. Working towards coordinated regional approaches in human elephant conflict management. In: *Proceedings of a workshop for the Kwando Kavango region*. Organised by Conservation International, June 8-9, 2010, Maun: Botswana.

Sporton, D., D. Thomas, and J. Morrison. 1999. Outcomes of social and environmental change in the Kalahari of Botswana: the role of migration. *Journal of South African Studies* 25(3): 441–459.

Suggs, D. 2002. A bagful of locusts and the baboon woman: constructions of gender, change, and continuity in Botswana. Florida, U.S.A.: Harcourt, Inc.

Thirgood, S., R. Woodroffe, and A. Rabinowitz. 2005. The impact of human-wildlife conflict on human lives and livelihoods. In: *People and wildlife, conflict or coexistence?* (eds. Woodroffe, R., S. Thirgood, and A. Rabinowitz). Pp. 13–27. New York, NY: Cambridge University Press.

Woodroffe, R., S. Thirgood, and A. Rabinowitz. 2005. *People and wildlife, conflict or coexistence?* New York, NY: Cambridge University Press.

WB (World Bank). 2005. Botswana- wildlife conflict management and biodiversity conservation for improved rural livelihoods in Botswana project –project information document (concept stage). http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/09/27/000104615_20050928093708/Rendered/PDF/Project0Inform1ment010Concept0Stage.pdf. Accessed on December 25, 2014.

WB (World Bank). 2008. Botswana- wildlife conflict management and biodiversity conservation for improved rural livelihoods in Botswana project –integrated safeguards data sheet (concept stage). http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/06/26/000076092_20080627145031/Rendered/PDF/Integrated0Saf10Concept0Stage01GEF1.pdf. Accessed on December 25, 2014.

Received: September 2016; **Accepted**: May 2017