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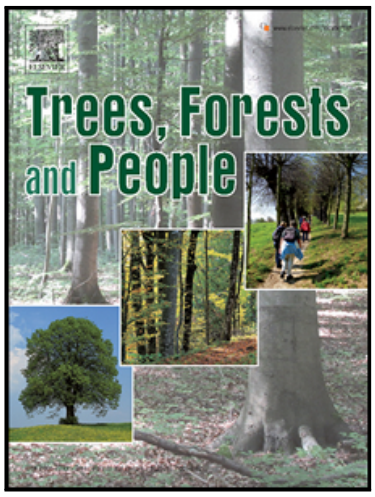

Experiences and Emotional Responses of Farming Communities Living with Asian Elephants in Southern Sri Lanka

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Abstract

Individuals tolerance toward wildlife can be based on a combination of tangible benefits and costs (e.g. economic gains and losses) as well as intangible benefits and costs (e.g. shared values and risk perceptions). Asian elephants (*Elephas maximus*) potentially present both types of benefits and costs for rural communities. We examined which factors were associated with emotional responses toward wild Asian elephants among agriculturalists using a questionnaire survey of 300 households situated around the Wetahirakanda sanctuary connecting Udawalawe and Lunugamwehera National Parks, Sri Lanka. Respondents were all from the Sinhala-Buddhist ethno-religious majority with average annual household incomes of Rs. 339,335 LKR (~$2610 USD). We found that none of the surveyed households derived any economic benefits from tourism despite the proximity of two national parks, whereas 171 (57%) had experienced crop damage by elephants. Though the median annual income lost due to elephants was Rs.50,000 LKR (4%), 21 households (7%) had losses exceeding 100%. Only six individuals (2%) recollected any human fatalities in their communities. Only three individuals reported positive feelings toward elephants, whereas all others had negative or neutral feelings. Economic factors were not significant predictors of feelings toward elephants, whereas fear of elephants and worry about crop damage had the largest and most significant negative effects. Our findings suggest that it might not be sufficient to reduce losses solely at an individual level, but that human-elephant coexistence interventions should target communities as a whole to reduce the spill-over effects of worry and anxiety by association with others who have experienced loss.

Keywords: benefits & costs, feelings, human-elephant coexistence, human- elephant conflict, tolerance

1. Introduction

1.1 Framework for tolerance of wildlife

Tolerance of wildlife is determined by a complexity of factors and there is a need to better understand the nature and extent of the local situation that drives the degree of tolerance (Thekaekara et al., 2021). The level of tolerance can be associated with the perceived costs and benefits of living with wildlife, which can be classified as either tangible or intangible (Kansky et al., 2016). Examples of tangible benefits may include revenue generated from wildlife tourism, whereas intangible benefits may include those associated with cultural significance (e.g., Kansky et al., 2016; Saif et al., 2020). Tangible costs include economic or physical harm to people (Gulati et al., 2021; Braczkowski et al., 2023), which accompany intangible costs, such as time and resources spent protecting crops, or feelings of worry, anxiety, and fear (Barua et al., 2013; Jacobsen et al., 2021). Although tolerance toward wildlife has been defined in the literature in different ways (e.g., Bruskotter & Fulton, 2012; Brenner & Metcalf, 2020; Lehnen et al., 2022), more recently, some conceptualizations have shifted to include an emotional component (Delie et al., 2022). However, research on affective components (Bruskotter & Wilson, 2014; Frank et al., 2015; Marino et al., 2021) and risk perception (*i.e.*, feelings of dread associated with the threat) has overwhelmingly focused on carnivores (Gore et al., 2006; Zajac et al., 2012). For instance, in examining the relative influence of intangible vs. tangible benefits on tolerance for wildlife, Marino et al. (2021) found that residents in Italy who felt more intangible benefits from wolves and bears held higher tolerance whereas tangible benefits (*i.e.*, increased tourism) did not influence the level of tolerance. Far fewer studies have similarly investigated the emotional dimensions of human relationships with large herbivores. We examine what drives (in)tolerance toward Asian elephants (*Elephas maximus,* Linnaeus, 1758) among rural agricultural communities, measured in terms of emotional responses and other factors such as socio-demographic and experiential.

1.2 Benefits and costs of living with elephants

In general, research on human-elephant relationships has focused on conflict mitigation and management (e.g., Shaffer et al., 2019), but there is need for more holistic understanding of the shared costs and benefits to society, including recognition of different non-monetary value systems (Nyhus, 2016; van de Water et al., 2022; van de Water et al., 2022). Not only do elephants attract millions of dollars per year in tourism revenue (e.g., Strödeck & Häusler, 2021), but also they have historically been admired by societies across the world, from the Hindu epics (with god Ganesh playing essential roles as ůKŝ ǵRemover of Oõǎů·ŏfŝǎ£ú óCf22ŘΣ мффcT 5ǿèŜℕΣ нлмрú ů2 ŘℕŜI·Yă 2ŦǿKƙůŝ ŜfŜLJKI·yΰă ǎλƎy1·fůyƎ ůKŝ birth of children in China (Shen, 1972) to the important role of elephants in Buddhist iconography and cultural practices (Fernando et al., 2011). The enormous economic and cultural values of elephants, representing both tangible and intangible benefits, is thought to explain (at least in part) why the species appear to enjoy a greater degree of tolerance than expected, at least among some communities, given their potential to inflict harm (van de Water & Matteson, 2018).

However, elephants also potentially impose tangible as well as intangible costs on agricultural communities. Elephants are responsible for hundreds of human deaths worldwide each year (Choudhury, 2004; Dunham et al., 2010; Gulati et al., 2021). Fear of elephants is not only driven by physical harm, but may stem from potential economic hardships due to crop loss and property damage (van de Water & Matteson, 2018; Sunita de Silva & Srinivasan, 2019; Saif et al., 2020). These can result in feelings of worry and anxiety (Barua et al., 2013). Indeed, a study investigating human-elephant relationships in Bangladesh found that intangible costs (and benefits) were more significant in determining levels of tolerance toward elephants than tangible costs (Saif et al., 2020).

Views toward wildlife species outside protected areas can differ among stakeholders, as costs and benefits can be shared unequally (Kariyawasam et al., 2020; van de Water & Matteson, 2018). Examining the influence of costs and benefits on tolerance for elephants is especially relevant when

engaging with rural forest-adjacent communities, many of which constitute some of the most economically disenfranchised segments of society (Sampson et al., 2019; Köpke et al., 2023). These communities are important constituents and stakeholders in conservation as they impact and are impacted by local wildlife populations (Sunila de Silva & Srinivasan, 2019; Guru & Das, 2021). Therefore, understanding their perspectives is critical to designing ethical, just, and effective conservation policies. Despite clear differences in attitudes toward elephant conservation between urban and rural populations (Bandara & Tisdell, 2003; Sampson et al., 2022), the experiences and sentiments of the latter are often not well represented in conservation discourse. This limitation aligns with critiques of άŦƵǊúǊŜăă ŎƵŷãŜǊØl·úƛƵŷέ ǈJl·ǋl·ŘƛƎϒăΣ ǿKƛŎK Ŏl·ŷ ŘǊƛØŜ ǳnfavorable outcomes for both people and wildlife. More specifically, some protected area management systems have unjustly displaced local human communities (Sirua, 2006; Agrawal & Redford, 2009). At the same time, wildlife may require and often use landscapes that extend beyond the reserves (Fernando et al., 2006; Western et al., 2020; de la Torre et al., 2021).

1.3 Social and psychological constructs

Aside from costs and benefits, varying social and cultural norms can influence emotional and behavioral responses to a species (Jordan et al., 2020). For example, norms, which guide what people should or should not do (i.e., social norms) or what most people are doing (i.e., cultural norms) in given circumstances (Decker et al., 2012), can help explain why people behave in certain ways, as well as why people accept or support certain behaviors (IUCN, 2023). When direct observation of behaviors is not possible, behavioral intentions are often used as a proxy to measure and determine the behavior of an individual (Vaske & Donnelly, 1999). Theoretical frameworks such as the Theory of Planned Behavior (Ajzen, 2002) describes relative influences on behavioral intentions, including perceived behavioral control, which represents the perception of difficulty performing a behavior considering individual and

circumstantial limitations. In addition, two predominant wildlife values orientations (WVO), utilitarian and mutualistic, have been shown to bŜ ŏŜyǘǊl·f ƛyƴ ăKl·ǋƛyƎ ǋŜƵǋfŜΩă ǘKƵdzƎKǘă l·yŘ ōŜKl·ǾƛƵǊăΦ Lyř ƛǾƛŘdzl·fă with a mutualism WVO tend to see animals as family or companions, caring for them as they might for other humans (Manfredo et al., 2020). On the contrary, those with more utilitarian-oriented views believe human needs should be prioritized over wildlife. As such, they endorse killing of wildlife that pose a threat to human life or property, and support activities such as hunting and fishing of wildlife. Consequently, understanding these factors, as well as the real context and associated tangible and intangible costs and benefits, can facilitate understanding and addressing emotional responses (and possible associated behaviors) towards the target species.

1.4 Study aims

We examined the experiences and perspectives toward elephants of residents of rural agricultural villages in Sri Lanka. We took an exploratory approach to identify possible relationships and constructs (instead of a confirmatory evaluation of existing frameworks) because these communities have not previously been studied in this manner. Sri Lanka hosts the second largest population of wild Asian elephants, with humans and elephants overlapping over the majority of the island at some of the highest densities found in Asia (de Silva et al., 2011; Fernando et al., 2021). Elephants are also integral to cultural heritage and intrinsic to Sri Lankan society (Bandara & Tisdell, 2005; Köpke et al., 2021) and, in modern Sri Lanka, can be important sources of tourism revenue. We assessed both tangible and intangible costs and benefits of living with elephants. We additionally assessed individual, household, and sociocultural attributes. We expected that emotional responses to elephants would be related to lived experiences, costs, benefits, individual and sociocultural variables (Gogoi, 2018).

2. Materials and Methods

2.1 Study Area and Sampling Method

Our study focused on communities living on either side of the Wetahirakanda Sanctuary, which is a wildlife corridor linking Udawalawe and Lunugamwehera (now known as Yala Block 6) National Parks (Figure 1). The corridor stretches approximately 18 km East-West, with Thanamalwila road to its south, the Hambegamuwa-Kaltota road running along its Western edge, and Colombo-Wellawaya Road intersecting its Eastern edge. The sanctuary and adjoining forest land are managed by both the Department of Wildlife Conservation (DWC) and the Forest Department (FD), with some portions containing electric fencing maintained by the DWC. Residents of the area engage in both permanent agriculture and seasonal shifting cultivation known as *chena* (locally referred to as ψKŜy1·Ω 2ℕ ψKŜyƎΩύ, which has been practiced for centuries throughout the dry zone of Sri Lanka (Gunasena & Pushpakumara, 2015). Permanent agricultural fields are located outside reserve boundaries, whereas some chena plots can also occur inside sanctuaries.

Figure 1. about here

Data were collected between February and March 2019 using a structured questionnaire through face-to-face interviews, conducted by four enumerators, and took an average of thirty minutes time to complete. Households were accessed either by vehicle or on foot. The sampling area was limited to households located within 5 km of the protected area boundary. The survey participants were further narrowed to include only those respondents who claimed that they had cultivation within this boundary area, even if such cultivation was not located directly adjacent to the household. Interviews were completed in the Sinhala language, and consistency with translation was ensured by forward and back-translation of the survey, followed by a pilot study with 20 participants who were not included in the final sample. Only one person from each household was surveyed: Either the primary income earner or the spouse of a primary income earner. Every household within a given sampling area (i.e., village road

segment) was visited and invited to participate. Participation was voluntary and conducted under informed consent with a participation rate of 100%. Responses were anonymous and no personally identifying information was recorded on data sheets. We attempted to balance the gender of respondents by alternating men and women respondents on consecutive surveys, to the extent that their availability permitted. At the end of the interview, respondents were provided a token of appreciation for their time, consisting of a small packet of school supplies for their children.

2.2 Survey Instrument

The structured questionnaire contained 120 close-ended items organized in seven sections to measure demographic attributes, household livelihood characteristics, experiences with elephants, and social psychological variables (see complete questionnaire with exact item wording in Appendix A). Demographic information included among others items gender, age, previous living occupancy within the park boundary, and highest completed level of education. Household livelihood characteristics included items like possession of land rights within study area, ℕŜăĽJ2yŘŜyűℚă primary occupation, and annual amount. Primary sources of income were recorded by indicating the top three sources from a categorical list (*agriculture, wages/salary, tourism (non-salary), fishing, poultry, cattle, vehicle hires, government support, NGO support, and other*). To capture ŜI·ŏK K2ʤăŜK2fŘℚă most frequently cultivated crops, respondents were presented with a list of 11 crop types and asked to identify which they cultivated, as well as whether those crops were grown for household consumption, market sale, or both. Respondents were also asked about the total financial loss caused by crop damage over the last five years.

The third section of the questionnaire asked respondents their experience with elephants, such as how often elephants were seen by them or a member of their household (*rarely, every season, every month, every week, every day*), and when elephants were most frequently seen (*months, seasons, and time of day*). In addition, respondents were asked their perceptions about whether and how the local

elephant population has changed over the last five years, and their future trends. These items were all measured on a 5-point scale (*decrease a lot, decrease a little, maintain the same, increase a little, increase a lot*); for each of these questions, respondents were also given an opt-out option (*Ř2yǚű ʅy2ǿ*). Elephant-ŎI·dzăŜŘ ŘI·ϒI·ƎŜ ű2 ǌŜăǇ2yŘŜyűăǚ K2dzăŜă 2ǌ 2űKŜǌ Ǉǌ2ǇŜǌűè ʎyʼ űKŜ fI·ăű ƮʎǾŜ èŜI·ǌă ǿI·ă ϒŜI·ădzǌŜŘ as a dichotomous variable (*Yes/No*), with a follow up question to specify financial loss caused by that damage. Respondents were also asked if they experience more elephant-related problems at ŎdzfűʎǾI·űʎ2yã Řdzǌʎy∃ ăǇŜŎʎƮʎŎ ϒ2yűKăȸ CǌΖϒ űKŜ ǌŜăǇ2yŘŜyűăǚ ŜȅǇŜǌʎŜyŎŜ ʎyʼ űKŜ ǇI·ăű ƮʎǾŜ èŜI·ǌăΣ űKŜè ǿŜre asked to rank the top three types of crops damaged by elephants and the resulting financial loss from those events (measured in Sri Lankan rupees). Respondents were also asked if they received government support to manage elephants beyond financial compensation and, if they indicated that they had, were asked to select all that apply from the following categories: electric fences, extension services, chasing wild elephants away, distribution of safety tools and instructions, or other (specified). Finally, respondents were asked about any experiences with human death or injury of family members and/or neighbors caused by elephants, and researchers/data collectors/enumerators recorded details 2yʼI·yè ƮʎyI·yŎʎI·f I·ăăʎăűI·yŎŜ ǌŜŎŜʎǾŜŘ ƮǌΖϒ űKŜ ǌŜăǇ2yŘŜyűăǚ ŘŜăŎǌʎption of the incident(s).

Sections four and six included seven social-psychological concepts: 1. utilitarian wildlife value orientations such as level of agreement whether wildlife are on earth primarily for people to use (see items 4.1-4.4 in Table 1); 2. existence values about elephants such as the importance to preserve elephants for future generations (items 4.6-4.8); 3. subjective norms such as acceptability from the community or family members in shooting elephants as a deterrent (items 4.10-4.16); 4. Perceived behavioral control of the respondent to protect their crops (items 4.17-19); 5. behavioral intention of shooting an elephant seen next to agricultural land (4.20); 6. risk perceptions such as level of agreement whether respondents were worried about being injured by an elephant (items 6.1.1-6.1.8). Respondents stated their level of agreement with all these statements on a 5-point Likert scale from *strongly disagree*

(1) to *strongly agree (5)*. Finally, respondents were asked how they felt toward elephants (items 4.21-23) on a 5-point scale with response options from *strongly negative (1)* to *strongly positive (5).* All the statements had the possibility for respondents to opt out with [illegible]. Exact wording for items included in latent variables is included in Table 1.

Table 1. about here

Section five looked at the perceived responsibility in maintaining public safety, which was measured through a multiple response categorical item (Q5.1 response options: *Wildlife Dept, Forest Dept,* [illegible]). In addition, this section [illegible]

Finally, section seven included questions for potential follow-up with the participant (e.g., willingness to establish alternative crops and to maintain fences), as well as willingness to participate in a follow-up survey.

Every respondent was assured of their anonymity and the confidentiality of the survey and told that they could drop out of the interview at any point, and for any reason. Every interview was anonymized, to ensure participant confidentiality. This project obtained ethical approval from Colby College and was granted IRB exemption under category 45 CFR 46.101 (b)(2).

2.3 Data Analyses

We performed preliminary data processing in Excel, with subsequent analyses in R v 4.0.1 (R Core Team, 2019). We conducted exploratory factor analysis (*psych* package, R (Revelle, 2019)) of items in section four to identify the underlying relationships between latent variables (see Table 1 for specific items). Missing responses were first imputed using Predictive Mean Matching, implemented in the *MICE* (Multiple Imputation by Chained Equations) package (van Buuren & Groothuis-Oudshoorn, 2011). The resulting five factor axes were rotated using both oblique (promax, oblimin) and orthogonal (varimax)

Table 1. Latent variables concerning attitudes and perceptions (Section 4). Only the loadings with values >µлΦoµ I·ℕŜ ăK2ǿyΦ ¢ǿ2 IjdzŜăűλ2yã f2I·ŘŜŘ ǿŜI·ʅfè 2yű2 Ydzfű\LJfŜ I·ÈŜă I·yŘ I·ℕŜ 2Yλűű\ŜŘY óпΦмú ά¢KŜ ySŜŘă 2ŧ KdzYI·yã ăK2dzfŘ űI·ʅŜ LJNλ2NλűèNλűè 2ØŜℕ ǿλfŘf\ŧŜ LJN2űŜŎúλ2yε I·yŘ óпΦмcú άtℕ2ōfŜYI·ûλŎ ŜfŜLJKI·yűă ăK2dzfŘ ōŜ ℕŜY2ØŜŘ ōè I·dzűK2ℕλűλŜăΦέ

Item	Loading	Cronbach's α
V1: Social norms		
4.13: Most of my community thinks that shooting at an elephant (as deterrent) is acceptable.	0.689	0.8
4.14: My family thinks that shooting at an elephant (as deterrent) is acceptable.	0.903	
4.15: People in my community shoot at elephants (as deterrent).	0.540	
V2: Sacredness, emotional bonds, confidence		
4.5 I feel a strong emotional bond with animals.	0.568	0.73
4.7 Wild elephants are sacred.	0.831	
4.8 Elephants in temples are sacred animals.	0.793	
4.9 I can live with elephants.	0.417	
4.19 I am able to protect my crops from elephants.	0.447	
V3 Normative beliefs		
4.10 Shooting at an elephant (as deterrent) is acceptable.	-0.391	
4.11 Elephants should not be near our homes.	0.797	0.53
4.12 It is acceptable for elephants to be on our crop lands	-0.427	

V4: Utilitarian wildlife value orientations		
4.2 Wildlife are on earth primarily for people to use.	0.594	0.85
4.3 It is acceptable for people to kill wildlife if they think it poses a threat to their life.	0.993	
4.4 It is acceptable for people to kill wildlife if they think it poses a threat to their property.	0.816	
V5: Agency		
4.17 The decision to shoot at an elephant (as deterrent) after a loss is my own.	0.674	0.72
4.18 I have the ability to kill an elephant.	0.666	
4.20 If I see an elephant near my cropland, I would try to shoot at it.	0.677	
V6: Elephant protection		
4.6 It is important to protect elephants for ourselves and future generations.	0.574	-

Table 2. Variables associated with feelings toward elephants. Significant variables are in bold, marginally non-significant variables are italicized, other non-significant variables (see results) are not shown. See Table 1 for composition of latent variables.

	Coefficient estimate	Std Error	t	p
Intercept	9.33	1.08	0.01	<0.001
2.2.1 Highest household education level	0.32	0.16	1.98	0.049
2.8.1 Acreage of land holding	0.06	0.03	2.05	0.042
3.7.1 Past 5yr elephant population trend	-0.31	0.18	*-0.95*	*0.090*
3.7.2 Past 5yr change in encounter rate	0.32	0.15	2.02	0.044
3.7.3 Expected future population trend	-0.28	0.11	-2.43	0.016
5.1 Safety is a shared responsibility	*0.19*	*0.11*	*1.67*	*0.097*
6.1.1 Worry about future crop damage	-0.59	0.21	-2.84	0.005
6.1.4 Worry about personal injury	0.25	0.11	2.27	0.024
6.1.5 Worry about early harvest	*-0.27*	*0.17*	*-1.68*	*0.095*
6.1.8 Fear of elephants	-0.47	0.11	-4.11	<0.001
4.11 Unacceptability of elephants near homes	-0.22	0.10	-2.10	0.037
4.12 Acceptability of elephants near croplands	0.39	0.10	3.88	<0.001
Latent V1: Social norms	-0.12	0.050	-2.17	0.031
Latent V4: Utilitarian wildlife VO	-0.11	0.04	-2.66	0.008
Latent V5: Agency	-0.15	0.05	-3.08	0.002

Declaration of interests

☐The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☒The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Shermin de Silva reports financial support was provided by US Fish and Wildlife Service. Shermin de Silva reports a relationship with Trunks & Leaves Inc that includes: board membership. Jenny A. Glikman and Jillian Knox, worked for the the San Diego Zoo Wildlife Alliance (SDZWA). Kirstie Ruppert and Elizabeth O. Davis work for the San Diego Zoo Wildlife Alliance (SDZWA), a global conservation organisation