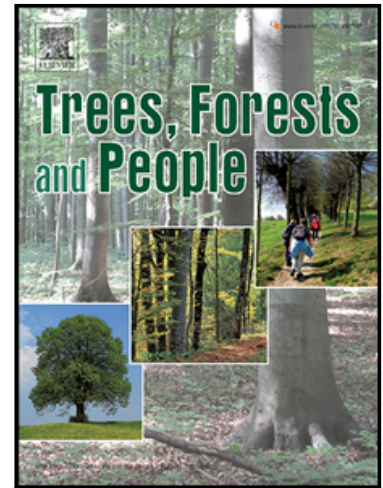


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Experiences and Emotional Responses of Farming Communities
Living with Asian Elephants in Southern Sri Lanka

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Title: 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 the “Remover of Obstacles”) (Flood, 1996; Dwyer, 2015) to dreams of white elephants signaling the 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 “fortress conservation” paradigms, which can drive unfavorable 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 be central in shaping people's thoughts and behaviors. Individuals 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 '*hena*' or '*heng*'), 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, respondent's 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 each household's 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 (*don't know*). Elephant-caused damage to respondents' houses or other property in the last five years was measured 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 cultivations during specific months. From the respondents' experience in the past five years, they were 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 on any financial assistance received from the respondents' description 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 *I don't know* (6). 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, personal responsibility, government agencies, other/specified, don't know*). In addition, this section included respondents' primary source of information about elephants, as well as trust toward them. 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)

rotations. Oblimin rotation yielded the most parsimonious structure (fewest factors) for axis loadings with a weight $>|0.3|$ and therefore was chosen for subsequent analyses. The internal consistency of a set of latent variables was evaluated using Cronbach's alpha (*psych* package). For factors consisting of variables with an alpha > 0.7 , responses were then summed to yield a single composite score, whereas those that had lower α (V3, Table 1) were left as separate predictors. The responses to two questions (Q4.1 and Q4.16) loaded onto multiple axes, and therefore were omitted from the model as they were uninformative. We then used a Generalized Linear Model (function *glm* in the *stats* package in R (R Core Team, 2020)) to test what types of variables exerted an influence on three separate measures of the emotional response to elephants, as reflected by participants' rating of three specific items. The association of isolated predictors with emotional response variables was separately evaluated using Fisher's exact test.

3. Results

3.1 Respondent attributes and lived experience

We surveyed 300 individuals, consisting of 163 (54.3%) men and 137 (45.7%) women, with a median age of 43 years old (range: 19-88 years). The participants were 100% Sinhala Buddhist. The majority of respondents had not themselves completed any degree, with only 25 (8.3%) of respondents having passed their Ordinary Level (O/Level) exams at the end of their secondary education. There was some indication that younger generations were receiving more education than the respondents themselves, as 25% of households had at least one member who had passed O/Levels.

The majority of respondents ($n=269$; 89.7%) claimed that they had rights to the land they managed within the study area. All households relied on agriculture as their primary or sole source of income and the average household income was Rs. LKR 339,555 ($\pm 205,479$ S.D.; median: Rs. 300,000) per year, an equivalent of roughly USD \$2,612 at the prevailing 2019 exchange rate. Henceforth,

amounts will be given in USD. Earnings could be lost for a variety of reasons such as health, weather, and other environmental events. The average loss amounted to \$779 (\pm \$1,503 S.D.), representing on average 45% of household income (although the median was 12%). However, losses could sometimes exceed annual income when accounting for crop types such as tree species that provided multi-year yields; 32 (10.7%) of respondents reported losses $\geq 100\%$, the highest amounting to 748% of annual household income. More than half of households, 171 (57%), had experienced loss attributed to elephants within the preceding five years, on average amounting to \$449 (\pm 76 S.D.) or 26% of their annual household income (median: 4%). For 21 (7%) of households, the loss attributed to elephants was $\geq 100\%$ of their annual income. Based on the total economic loss reported and the numerical value attributed directly to elephants, elephants accounted for around two thirds of cases in which entire household earnings were wiped out. Those who encountered elephants more frequently were significantly more likely to report damage from elephants ($F=28.1$, $d.f.=2$, $p<0.001$). None of the households surveyed received any revenue from tourism associated with the protected areas.

Households cultivated a range of crops, including rice, other grains, fruits, vegetables, roots, spices, and other cash crops (Figure 2). Crops were grown for both home consumption and local markets. There was no significant difference in the crop types grown by households that experienced damage from elephants and those that did not ($\chi^2=3.492$, $d.f.=10$, $p=0.97$). However, there was a significant association between the presence of electric fences and propensity to experience damage (Fisher's exact test, $p<0.001$), with those who had an electric fence adjacent to their cultivation area being nearly twice as likely to have experienced damage than those who did not have an electric fence. Respondents were skeptical of compensation, with only one person having tried to claim any and none having received it.

[Figure 2. about here](#)

Six respondents (2%) reported knowing someone who had been killed by an elephant, each in separate incidents, all of whom were males aged between 30-54 years old. The reported incidents occurred between 2001-2018. Three of these incidents occurred as the person was going to or from their *chena* cultivation (two on bicycles), while the other three occurred around the person's home or backyard. Five of the six incidents involved a sudden encounter, whereas the sixth involved a person defending a home garden. However, these incidents appear to be relatively rare as most individuals reported seeing elephants either every day (n=155; 51.7%) or every week (n = 35; 11.8%). The majority (n=291; 97%) stated that the frequency of their encounters with elephants did not vary between the dry and wet seasons. The majority (n=238; 79.3%) believed elephant numbers had slightly increased in the area over the previous 5 years, and 261 (87%) thought that it would continue to increase in the future.

3.2 Respondents level of agreement to social-psychological items

Respondents' levels of agreement with statements regarding views toward wildlife, as well as elephants specifically, are presented in Figure 3. The majority of respondents (n=238; 79.3%) were neutral as to whether human needs should take priority over wildlife protection (Q4.1), but the large majority (n=289; 96.4%) stated that was not acceptable to kill wildlife that threatens life (Q4.3), or property (n=287; 95.6%, Q4.4). A very small minority (n=8; 2.6%) felt a strong emotional bond with animals (Q4.5), but most people (n=287; 95.6%) disagreed that wildlife are on earth primarily for people to use (Q4.2).

Only four individuals thought wild elephants were sacred (1.3%, Q4.7), though a slightly larger minority believed that temple elephants were sacred (n=13, 4.3%, Q4.8). Only four individuals agreed that it was possible to coexist with elephants (1.3%, Q4.9), but the majority of respondents (n=274, 91.3%) agreed that it was "important to preserve elephants for ourselves and future generations" (Q4.6). The majority (n=287, 95.7%) thought that elephants should not be near their homes (Q4.11) or

agricultural lands (n=293, 97.7%, Q4.12). At the same time, they did not think it acceptable to shoot at elephants as a deterrent (n=280, 93.3%, Q4.10) nor did they think that people in their community did so (n=257, 85.7%, Q4.15), contending that others in their family (n=288, 96%, Q4.14) and community (n=280, 83.3%, Q4.13) held similar views. Instead, the majority (n=270, 90%) agreed that problem elephants should be removed by authorities (Q4.16).

Figure 3. about here

Only two people expressed any positive feelings toward elephants living in their area (less than 1%, Q4.21), while three people expressed that having elephants in the area is positive (<1%, Q4.22), and that living with elephants is positive for them (<1%, Q4.23). Although most people did not believe they could coexist with elephants (Q4.9), the distribution was significantly different and less negative when asked how they felt about living with elephants (Q4.23; Fisher's exact test, $p < 0.0001$).

Figure 4. about here

Many respondents (n=206, 68.7%) were scared of elephants that live in the area (Q6.1.8). In addition, the majority of respondents (n=237, 79%) were worried that elephants would cause crop damage in the next year (Q6.1.1), but fewer were concerned with damage to stored crops (n=155, 51.7%, Q6.1.2). The majority (n=219, 73%) were also worried about property damage (Q6.1.3), and felt the need to harvest early due to the risk from elephants (n=222, 74%, Q6.1.5), but fewer were concerned about personal injury (n=144, 48%, Q6.1.4). More respondents (n=185, 61.7%) thought that the creation of a "holding ground" for problem elephants would *reduce* the risk of encountering a problem elephant (Q6.1.6), than the number thought that it would *increase* it (n=162, 54%, Q6.1.7).

3.3 Significant predictors of feelings toward elephants

Variables that had a significantly positive association with neutral or positive feelings toward elephants were the highest household education level, acreage of land holding, encounter rates with elephants over the past 5 years, worry about personal injury, and acceptability of elephants near croplands (Table 2). Conversely, variables that had a significantly negative association were the expected future population trend, worry about future crop damage, fear of elephants, unacceptability of elephants near homes, social norms (latent variable 1), utilitarian wildlife value orientations (latent variable 4) and agency (latent variable 5; Table 2). As the worry of personal injury (Q6.1.4) had an effect contrary to what one would expect, and runs in opposition to general fear of elephants (Q6.1.8) which had a strongly significant negative coefficient, we ran post-hoc regressions to determine whether this might be related to perceptions of sacredness. However, there was no correlation between the fear of injury and the tendency to view wild elephants as sacred (Spearman's $r[298]=0.08$, $p=0.16$), though there was a significant correlation with the tendency to view temple elephants as sacred (Spearman's $r[298]=0.16$, $p<0.01$). All other variables, including those representing economic losses, were not significant (see Table A1 in Appendix A for full model).

One variable, concerning whose responsibility it is to maintain the safety of people and wildlife when living close together (Q 5.1), was marginally non-significant in the overall model (Table 2), but was highly significant when separately tested against all three response variables (Bonferroni-corrected $\alpha=0.025$, Fisher's exact test, $p=0.0183$). Nearly everyone (99.3%) ascribed responsibility to officers of the Department of Wildlife, followed by government agencies in general (73.7%) and officers of the Forest Department (52.3%). However, a third of respondents (34%) also thought that people held some responsibility for their own safety and tended to have less negative feelings toward elephants. Specifically, 60.0% of those who believed individuals have responsibility for their safety and the safety of wildlife, felt negatively toward elephants living in the area as compared to 75.3% of those who did not believe individuals have responsibility (Q4.21, Fisher's exact test, $p=0.0126$); 49.5% felt negatively about

having elephants in the area, compared to 66.6% (Q4.22, Fisher's exact test, $p=0.0053$); and only 36.3% felt negatively about living with elephants, compared to 51.3% (Q4.23, Fisher's exact test, $p=0.0183$). A very small minority (2.3%) felt it was also the responsibility of other parties including volunteers, cattle owners/herders, private companies, and agricultural boards.

[Table 2. about here](#)

4. Discussion

So-called "human-elephant conflict" exemplifies challenges presented by sharing the landscape with one of the most iconic, but also potentially problematic, wildlife species (Nayak & Swain, 2022). The cultural significance of elephants to Sri Lanka and dense overlap between elephants and people, offers a good opportunity to evaluate the relative importance of individual, sociocultural, and experiential factors that may shape people's views of Asian elephants and the prospect of living with them (Köpke et al., 2023). As with studies of emotional responses to carnivores, we find that tangible and measurable costs are less important relative to intangible costs arising from fear and perceived risks; but we also reveal the importance of sociocultural beliefs, norms, and perceptions of behavioral controls (see also Saif et al., 2020). The relationships among these variables, however, are not necessarily straightforward. For context, our study focused on a rural Sri Lankan, Sinhala-Buddhist population. —agriculture was the primary if not sole source of income, and the sample was ethno-religiously homogeneous. Median household income in the area was below the national median in 2019, calculated as Rs. 639,996 (Central Bank of Sri Lanka, 2019). Nationally, 15.3% of the population had passed O/L in 2016 (Central Bank of Sri Lanka, 2019), thus respondents themselves were less educated than the national population as a whole, but at the level of households it was higher (though a direct comparison cannot be drawn). Our sample thus does not capture other ethno-religious traditions, which include Tamils (15% inclusive of Sri Lankan

and Indian Tamils), most of whom are Hindus (12% of population), or Muslim (10%, various ethnicities) and Christian (7%, various ethnicities) minorities that make up the remainder.

4.1 Key Findings

Our first observation is that although respondents do not hold a purely utilitarian view of wildlife (items # 4.2-4.4, see Table 1), and claim they do not advocate for lethal measures even as a form of defense, this is not because they feel any particular sense of affinity toward animals or reverence toward elephants specifically. They espouse sentiments consistent with general respect toward (non-human) life rather than sentiments that are overtly spiritual. The association of some wildlife with sacred places, such as temples, distinguishes and perhaps elevates these (non-human) individuals specifically in the eyes of some people, but most generally distinguish between these and wild conspecifics. Moreover, manifestations of the sacred need not always be positive – problem-causing elephants may also be viewed as a curse or punishment from the divine (Thekaekara et al., 2021). It is therefore important not to oversimplify and conflate general respect for life with the spiritual significance assigned to individual members of particular species, either positive or negative. Indeed, this seems to create some ambivalence and uncertainty insofar as how respondents weigh their own human interests against that of other species. In particular, it may underlie seemingly contradictory associations such as between fear of personal injury (Q6.1.4) and less negative feelings. Participants did not misinterpret the question, since nearly half of respondents feared personal injury, while the remainder were neutral and only one person disagreed. We propose instead that such fear accompanies a greater tendency to view elephants as having a place in sacred spaces such as temples, although these stances were not significant in the overall model.

Second, despite responses that conveyed a general pro-wildlife stance, and agreement that it is important to preserve elephants specifically, people for the most part did not believe it was possible to

live with elephants, and felt negative or at best neutral about living with the species. Factors associated with more favorable feelings were the highest household education level, extent of acreage held, perceived increase in the rate of elephant encounters compared to the past, fear of personal injury (remarkably, as noted in results), and acceptance of elephants near farmland or homes. Conversely there was a negative association with the expectation of future increase in elephant numbers, future crop loss (or marginally, worry about the need for early harvest), general fear and composite variables pertaining to behavioral control over crop defense. This was true regardless of whether they actually experienced any damage or loss. Indeed, neither absolute income nor income loss due to elephants were significant in the overall model. Interestingly, value orientations pertaining to sacredness, emotional attachment to (non-human) animals grouped together with beliefs about whether they could live with elephants or defend their crops (Table 1), but this latent variable had no effect on affective responses in the overall model (Table 2). The factor with the strongest effect on their overall feelings toward elephants was worry about future crop damage, followed by general fear of elephants. It is relevant to highlight that in this area it appears people perceive the risk of economic loss to be greater than the risk of personal harm, which is largely accurate given the frequency with which people claim to see elephants, compared to the frequency with which elephants are actually observed (SdS, unpublished data) and the rarity of human fatalities (three human deaths were attributed to a single elephant during a single incident in the area during the study year and only six cases were reported from memory). This contrasts with a study in India, where it was found that economic losses resulting from human deaths by far outweighed other losses (Gulati et al., 2021). Here, neither tangible costs nor intangible benefits were as important as intangible costs in shaping peoples' feelings.

Third, although elephants can potentially yield tangible benefits in the form of economic revenue, we found that none of the respondents in our study received such benefits. The complete lack of economic gain from elephants among those we surveyed is relevant as it is often promoted as a

mechanism for deriving community benefits from wildlife, for instance through ecotourism (Meyer & Börner, 2022). Community-based conservancies that participate in tourism have shown some success for protecting species such as lions (Blackburn et al., 2016). However, the conservancy model does not fit local land governance structure, where over 80% of the land is state owned (Köpke et al., 2023); nor does it suit the behavior of Asian elephants, which are largely cryptic outside protected areas. Another study conducted around the same National Park examined the specific beneficiaries of ecotourism activities (Kariyawasam et al., 2020). It found that although this location reported earnings in excess of Rs. LKR 200,000,000 (over \$1.5 million USD) in 2015, making it the third highest earner among all National Parks in the country, the portion of the value chain captured by local constituents was low relative to external actors. Specifically, 66% went to outsiders (including 31.68 % that went directly back to the central government through park revenues) and the remaining 34% went to local service providers. Likewise, a study assessing the effects of wildlife tourism participation on local households in India found that the tourism sector neither significantly increased income nor offered better employment opportunities. Similar results have been reported in Botswana (Mbaiwa, 2017) and China (Wu et al., 2023). In these contexts, there is a need for a mechanism for both the government and private tourism sectors to redirect resources more intentionally toward those that are unable to participate in the tourism value chain.

Respondents' stated opposition to killing wildlife and specifically elephants either as a deterrent or form of defense is consistent with the overall view above, as well as studies including other parts of the country (Köpke et al., 2023). Though there was disagreement with lethal measures, respondents reported fear of elephants and do not wish to have elephants nearby. It is possible that some respondents are being untruthful with respect to the extremity of measures they actually would take; on the other hand, it is also possible that they are tolerating elephants *despite* their discomfort (*i.e.*, elephants belong in forest, but not in the back yard). For context, Sri Lanka as a whole averages 272

human-caused elephant deaths per year, logged a 'record number' of elephant deaths in 2019 (*BBC News*, 2020) and then broke its own record with 407 elephant deaths in 2020, a world record for the species (*Daily News* 2020) and annually exceeded this number between 2021-2023 according to official records of the Department of Wildlife Conservation. A study of the causes of elephant mortality in a different region of Sri Lanka between 2008-2018 showed that ~70% were human-related, with intentional methods (shooting, explosives and poisonings) accounting for 51% (LaDue et al., 2021). Residents of the study area are also known to possess rifles, though illegal, and elephants in the population do evidence injuries as well as deaths through human action (de Silva et al., 2013). In 2020, 112 people were killed by elephants, according to the Department of Wildlife Conservation (as reported in *The Hindu*, 2021). But curiously, at the same time, farmers in the Southern region (closer to the study area) in 2021 engaged in a hunger strike asking the government to address the elephant problem, not by eradication, but by setting aside a "Managed Elephant Range" as had been promised. As reported in the press, some farmers offered a remarkable degree of empathy for the elephants:

"With their own lands gone, the animals come into our agricultural plots, destroy all our crops, kill our people. This has been going on for 13 years now." – S.P. Surasena (*The Hindu*, 2021)

"Farmers like me are facing a severe crisis, losing lakhs of rupees every time an elephant attacks. There are about 450 elephants in our area. They need protection too." – C. Gamage (*The Hindu*, 2021)

The protesting farmers characterized elephants as fellow sufferers and victims of development strategies largely benefitting agribusiness at the expense of small holders. Another study in the same area reported that residents view elephants as belonging in the environment, their rightful place (Sunila de Silva & Srinivasan, 2019). This perception of the indigeneity of elephants may create reluctance to take extreme retaliatory measures. Nevertheless, the fact that there are so many cases of human-

induced elephant mortality suggests a threshold beyond which tolerance may be eroded despite these sentiments, at least for some people.

4.2 Implications and Recommendations

Religious and cultural context has elsewhere been found to be a strong predictor of feelings toward elephants (Thekaekara et al., 2021), but these attributes cannot ethically be shifted on a relevant timescale. Even if they could, our results indicate that at a local scale they may not matter as the respondents already hold positive non-utilitarian views toward wildlife in general and recognize the need to protect elephants specifically; they are uneasy about living with elephants despite all of this. Formal education may play some role in shifting feelings in a more positive direction, but this may be because such individuals expect to go on to hold jobs that do not incur risks due to elephants. This suggests some parallels to forest-adjacent communities in Thailand, where it was found that individuals over the age of 35 were more likely to have had negative experiences with elephants and thus less likely to view elephant conservation as important (van de Water & Matteson, 2018). The most important consideration is the *fear* of economic loss, even when there is no direct relationship between the cost itself and the negative feelings toward elephants.

Logically, in order to reduce the fear of economic loss, one needs to reduce the actual economic loss. The dominant approaches to doing so involve various forms of fencing and deterrents (Shaffer et al., 2019); however these have limitations. Electric fences represent a hazard and can impede elephant movement unless strategically placed. Our observations do not establish why fences are associated with a greater potential for damage (perhaps these cultivation areas were simply closer to a managed forest edge), but are consistent with another study of mitigation techniques practiced across Asia and Africa, which also found electric fences to increase the likelihood of experiencing crop loss especially when accompanied by people chasing elephants (Gross et al., 2019). Beehive fences, which have enjoyed a

certain amount of success in the African context and been promoted as a means of supplementing incomes through the production of honey (Branco et al., 2020), have so far not worked with native Asian honeybees. The only documented success used European honeybees (van de Water et al., 2020), but there are concerns about their invasiveness in non-native range (Moritz et al., 2005).

5. Conclusion

In light of the above, it is worth re-examining the cost/benefit considerations of living with elephants with a practical question: what does coexistence actually entail? Humans are not strictly rational actors, and perceived risk of future loss and control over a risk can be influenced by social context as well as by conservation interventions. Moreover, dualistic characterizations (people/nature; costs/benefits; tangible/intangible) may iron out complexities and even contradictions in human thought and behavior (de Silva & Srinivasan 2019; Brenner & Metcalf, 2020). Our findings further suggest that it is not sufficient to reduce losses solely at an individual level, but perhaps that interventions should target communities as a whole so as to reduce the spill-over effects of worry and anxiety by association with others who have experienced loss. This cannot be achieved through compensation schemes, as people perceived the process as being fruitless or too complicated. Failures of governance as well as proposed mitigation methods create frustration and may encourage the illicit and under-acknowledged use of lethal measures (Köpke et al., 2023). At the same time, people correctly perceive the problem as being driven by land management, thus it is this root cause that must be addressed. Concurrently, given the scale of the problem, it is important to look beyond small-scale interventions and develop alternative economic/livelihood opportunities in forest-adjacent areas to reduce the dependence on conflict-prone crop species, or on agriculture altogether.

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News:

[SL ranks as highest elephant deaths reported country in the world – COPA | Daily News](#) (2020)

[Sri Lanka elephants: 'Record number' of deaths in 2019 - BBC News](#) (2020)

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Figure 1. Map of Study Area. Surveyed households were located within the areas enclosed by dashed lines.

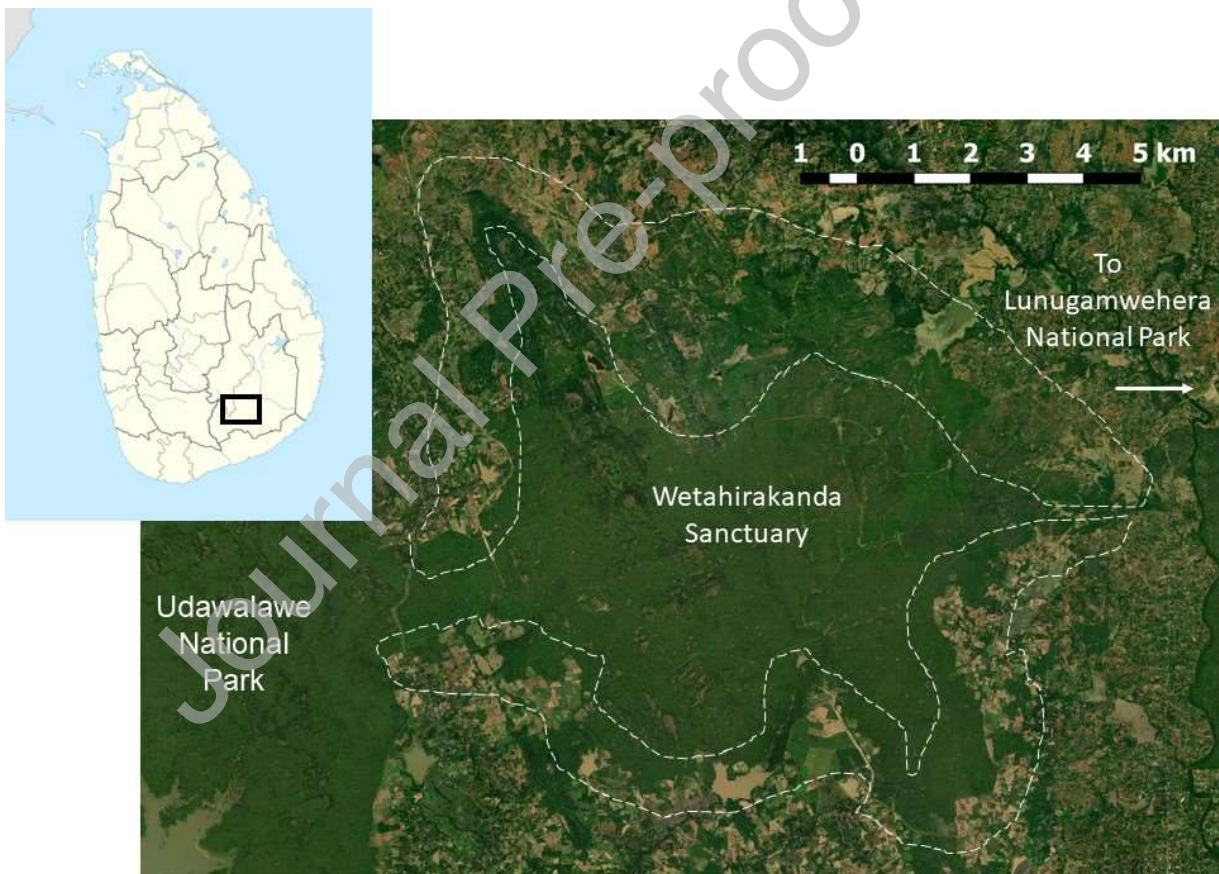


Figure 2. Crops types grown among households with and without damage from elephants. There was no significant difference in the types of crops grown by those that experienced damage and those that did not ($\chi^2=3.492$, d.f.=10, $p=0.97$).

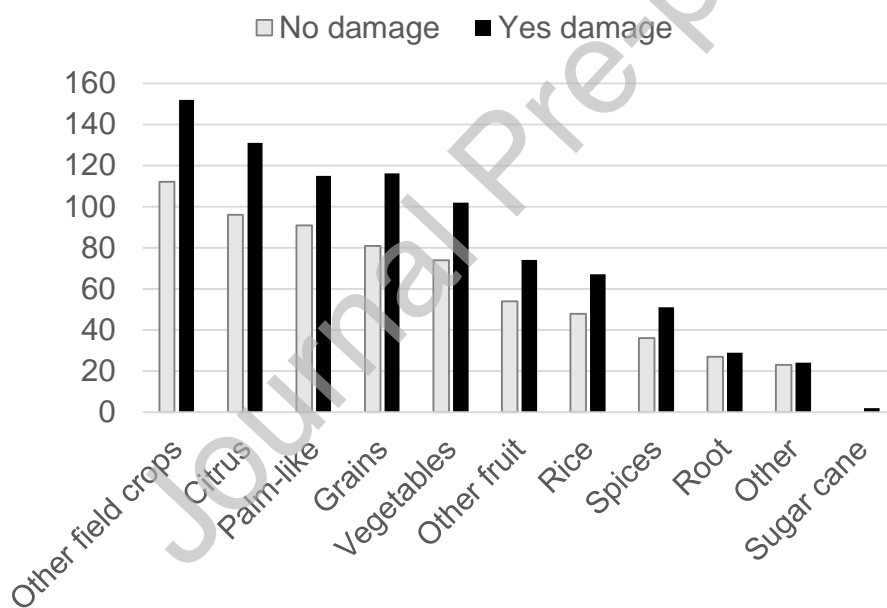


Figure 3. Responses to statements concerning wildlife, and elephants. For purposes of visualization, neutral responses are grouped together with “don’t know” responses. The corresponding statements are given in Table 1.



Figure 4. Emotional responses to elephants. Respondents were asked to rate their feelings from strongly negative to strongly positive with respect to the following questions or statements: (Q4.21) “Which best describes your feelings towards elephants living in this area?” (Q4.22) “To have elephants in this area is for you...” (Q4.23) “Living with elephants is for you...”

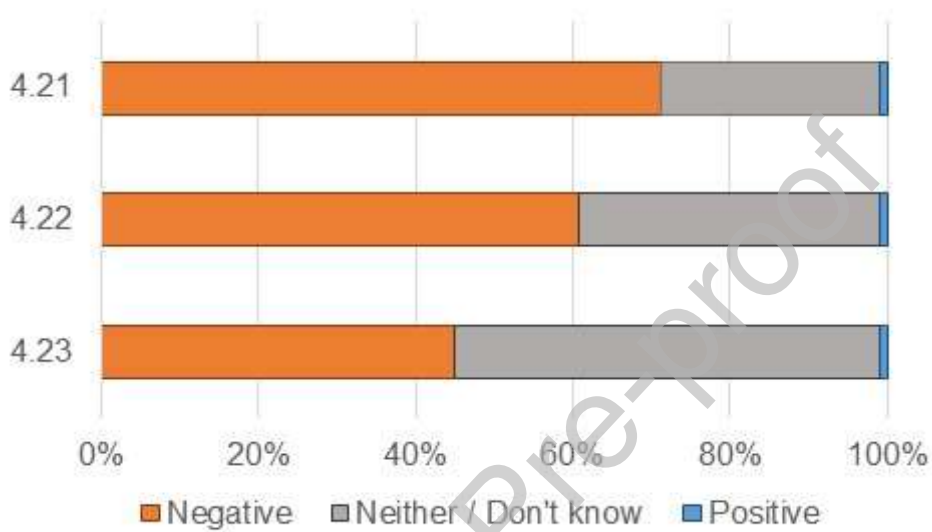


Table 1. Latent variables concerning attitudes and perceptions (Section 4). Only the loadings with values $>|0.3|$ are shown. Two questions loaded weakly onto multiple axes and are omitted: (4.1) “The needs of humans should take priority over wildlife protection” and (4.16) “Problematic elephants should be removed by authorities.”

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	-
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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	<i>0.090</i>
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	<i>0.19</i>	<i>0.11</i>	<i>1.67</i>	<i>0.097</i>
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	<i>0.17</i>	<i>-1.68</i>	<i>0.095</i>
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