

## Villagers' Experiences, Perceptions of Human-Elephant Conflict and Attitudes Towards Elephant Conservation in South-Eastern Bangladesh

Shorfu A. Chowdhury<sup>1</sup>, Karl W. Larsen<sup>2</sup> and Robert Hood<sup>3\*</sup>

<sup>1</sup>*Environmental Science Program, Thompson Rivers University, Kamloops, BC, Canada*

<sup>2</sup>*Department of Natural Resource Sciences, Thompson Rivers University, Kamloops, BC, Canada*

<sup>3</sup>*Department of Tourism Management, Thompson Rivers University, Kamloops, BC, Canada*

\*Corresponding author's e-mail: rhood@tru.ca

**Abstract.** We describe villagers' experiences and perceptions of human-elephant conflict (HEC), and attitudes towards elephant conservation near elephant habitat in south-eastern Bangladesh. The study was based on a questionnaire survey administered through in person interviews. We sampled 171 respondents across 109 villages. The results showed that crop raiding and damage to houses, fruit gardens, and seedlings were perceived as the causes of conflict. Seventy percent believed habitat improvement as useful for HEC mitigation and 73% favoured elephant conservation, at least in principle.

### Introduction

Conflict between humans and elephants has occurred for centuries (Nelson *et al.* 2003). Elephant crop raiding has been recorded in Asia as early as 300 BC (Sukumar 1994). Records in Africa show colonial farmers incurred huge losses from elephant depredation (Schweitzer 1922). As human populations grow, elephant habitat is converted into agriculture and other land uses which leads to increased contact with elephants, and subsequent conflict. Understanding the reasons, nature, extent and implications of conflict are useful for long-term conservation strategies.

The Asian elephant (*Elephas maximus*), once found throughout Asia, now exists in a limited number of localities in 13 countries in south and southeast Asia (IUCN 2014). Threats to elephants are largely due to (1) habitat loss, fragmentation and degradation, mostly due to agricultural demands; (2) illegal killing for ivory, skin or calves; and (3) conflict with people. Direct conflict between humans and elephants perhaps is the most challenging threat, resulting in the loss of human and elephant life. Human-elephant conflict (HEC) affects large numbers of people (Barua *et al.* 2013) and generates anti-conservation sentiment among local communities (Desai & Riddle 2015).

At the time of the study, there were thought to be around 210–330 elephants in Bangladesh (Motaleb *et al.* 2016) with HEC occurring wherever there were elephants (Sarker & Røskoft 2010). At least 231 people were killed from 2003–2015 and 92 elephants from 1992–2015 due to HEC (unpublished data, Bangladesh Forest Department 2016). Villagers responded to raiding by elephants by killing them through poisoning, electrocution and shooting. This study was conducted to document villagers' experiences and perceptions of HEC, and attitudes towards elephant conservation in south-eastern Bangladesh.

### Methods

#### Study area

The study was conducted in the Chittagong and Cox's Bazar Districts of south-eastern Bangladesh within elephant habitat (Figs. 1 & 2).

The study area was around 1904 km<sup>2</sup> in extent, of which around 1370 km<sup>2</sup> were hilly areas. There were around 1.5 million people in the area and the literacy rate was approximately 52% (BBS 2010). Most residents in the area were subsistence rice farmers. The climate was tropical with monsoon rains occurring from



**Figure 1.** Map showing elephant distribution in Bangladesh.

June to October resulting in a dry season extending from December to May. The temperature range was 11–32°C. Although the area was once rich in wildlife, it has been degraded over time, with all primary forests removed and only secondary forest cover remaining.

### Survey

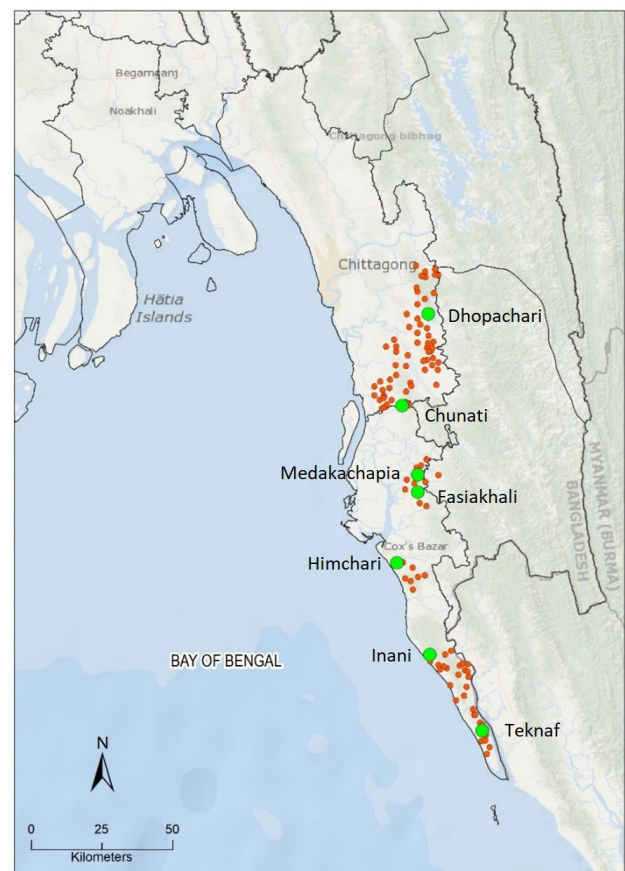
The questionnaire was designed to collect data on (i) respondent background, (ii) experience with elephants over the past three years, (iii) types of problems created by elephants, (iv) consequences of local elephant incursions, (v) feelings and perceptions about elephant incursions, and (vi) thoughts about elephant conservation, using open- and close-ended questions. Interviews were conducted in Bangla and responses recorded on prepared forms. The Research Ethics Board at Thompson Rivers University approved the survey design.

There were around seven elephant-habitat patches, namely Teknaf, Inani, Himchari, Medakachapia, Fasiakhali, Chunati and Dudpukuria-Dhopachari, and 306 villages in the survey area (Fig. 2). The survey was conducted

in 109 of the 306 villages from mid-May to September 2015 (Fig. 2), selected in consultation with the Forestry Department and local government officials, as it was essential to secure local support to administer the survey. Selected villages were classified into 3 categories according to location in relation to elephant habitat as (i) inside forest (ii) at forest edge and (iii) outside forest.

In each village surveyed, a household was selected every 0.5 km to administer the questionnaire. Rice, wheat, maize, vegetables and sugarcane were considered ‘crops’ and fruit trees considered a separate category. Verbal consent to the interview was requested before the interview. Respondents were informed that they could refrain from answering any question and/or stop the interview at any time if they became uncomfortable. An interview took 25–45 minutes.

Quantitative data were analysed using IBM SPSS Statistics version 23. An alpha value of 0.05 was used to determine significance.



**Figure 2.** Map showing survey distribution near elephant habitat patches (green dots) and villages (red dots).

## Results

Answers were received from 171 respondents from 109 villages (1–4 respondents/village).

### Respondent characteristics

A total of 171 people participated in the survey ranging from 18 to >60 years of age. Eighty percent (137) of the respondents were male. Most respondents (83%) earned less than US\$ 2000 per year. People earning less than US\$ 394 per year are considered living below the poverty line in Bangladesh (United Nations 2009). Ninety-one percent were either illiterate or possessed only basic education (i.e. < secondary school). The respondents consisted of 104 farmers (61%), 13 labourers (8%), 29 housewives (17%), and 10 businessmen (6%). Respondents were evenly distributed within the three geographical strata – home relative to the forest (Table 1).

**Table 1.** Characteristics of survey respondents.

Descriptor	Response	Respondents	
		#	%
District	Chittagong	93	54
	Cox's Bazar	78	46
Age	18–28 years	29	17
	29–39 years	59	35
	40–50 years	46	27
	50–60 years	28	16
	> 60 years	9	5
Sex	Male	137	80
	Female	34	20
Yearly income	< US\$ 2000	142	83
	US\$ 2000–2990	25	15
	> US\$ 2990	4	2
Education	< Secondary school	156	91
	High school	12	7
Livelihood	Farmer	104	61
	Labour	13	8
	Housewife	29	17
	Businessman	10	6
	Other	15	9
Homestead	Inside forest	61	36
	Edge of the forest	51	30
	Outside forest	59	34

### Experience with elephants

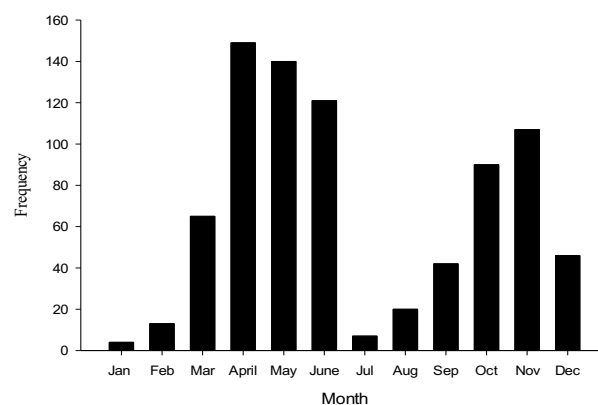
Elephant incursion into crops occurred throughout the year, with two peaks in April – June, and October – November (Fig. 3). In response to the question “How often do elephants come into your village?”, 165 (97%) of respondents indicated incursions occurred every year. All but one reported that incursions occurred at night, and 32 (19%) of respondents reported incursions taking place during dusk. Elephants were considered a problem by 86% of the respondents.

### Problems created by elephants

Crop raiding was identified as a major problem by 164 (96%) respondents, followed by house damage 65 (38%) and raiding of fruit trees 51 (30%). Rice was the crop most frequently impacted by elephants (141 (83%) respondents). Ninety four percent of respondents reported damage to mature crops and 46% to immature crops. Damages caused by elephant raids between 2013 and 2015 to respondents, affected a total land area of ~67 ha.

### Human death and injury, and property damage

A total of 50 people (45 men and 5 women) were reported killed and 51 injured by elephants during 2013–2015 in the study region (Table 2). Farmers (25) and firewood collectors (13) were the majority of people killed. More people were killed within forest habitat and on the edge of the forest than outside ( $\chi^2 = 14.9$ ,  $df = 2$ ,  $P = 0.001$ ). These findings were compared to government records for the study region and found



**Figure 3.** Number of respondents reporting the occurrence of elephant incursions for each month of the year.

**Table 2.** Human death and injury caused by elephants in 2013–2015 by forest proximity. Data from Bangladesh Forest Department (2016).

Location	Death				Injury			
	2013	2014	2015	Total	2013	2014	2015	Total
Inside forest	3	9	9	21	7	11	1	19
Forest edge	8	10	7	25	11	8	13	32
Outside forest	1	3	0	4	0	0	0	0
Total	12	22	16	50	18	19	14	51

to match the number of officially recorded deaths, with a slight discrepancy in the number of injuries reported. The respondents reported 18 elephant deaths during 2013–2015, of which 15 were females.

In addition to crop raiding and death and injury to both humans and elephants, 65 respondents (38%) reported house damage, 51 fruit tree damage (30%) and 3 reported livestock death.

Perceptions of elephant incursions and human response of respondents are given in Table 3.

All but 2 respondents ‘agreed’ or ‘strongly agreed’ that there is a ‘declining food base’ and ‘shrinking habitat’ for elephants. Without prompting, six respondents identified bamboo masting as responsible for an increase in elephant incursions.

Views of respondents about elephant conservation and measures to mitigate conflict are given

in Table 4. Most respondents (73%) favoured elephant conservation, with no difference by respondent village location ( $\chi^2 = 3.952$ ,  $df = 2$ ,  $P = 0.139$ ). Sixty-five percent of female ( $N = 34$ ) favoured elephant conservation compared to 75% of male ( $N = 137$ ) respondents.

In addition to the options provided on the survey, the respondents suggested relocation of elephants (25% of respondents) and the cessation of exotic crop planting (1% of respondents). A small number of respondents in one village indicated that relocating a nearby army-training zone would result in fewer elephants being frightened into settlements by artillery firing practice.

#### *Government responsibility toward elephant incidents*

Few respondents were aware of any role played by the Forest Department in the case of elephant incidents. When asked “What role did the

**Table 3.** Perceptions of elephant incursions and human response.

Descriptor	Response	# respondents	% respondents
Incursion rate	Increasing	153	90
	No change	18	10
Single and/or group of elephants	Single & group	70	41
	Group	163	95
Most common group	Female elephant	3	2
	Bull elephant	2	1
	Mixed herd	164	96
Peoples’ response to elephant incursion	Firecrackers	97	57
	Drumming	68	40
	Nothing	5	3
Condition of elephant habitat	Moderate	29	17
	Bad/poor	139	81
	Not aware	3	2
Reason for elephant incursion	In search of food	169	99

**Table 4.** Methods to prevent or mitigate elephant incursions.

Method	Not useful		Useful		Very useful		Don't know	
	#	%	#	%	#	%	#	%
Habitat improvement	0	0	6	4	120	70	0	0
Community awareness	1	1	14	8	111	65	0	0
Erection of physical barrier	8	5	48	28	8	5	62	36
Electric or solar fence	8	5	3	2	2	1	113	66
Chili cultivation	3	2	12	7	6	4	105	61
Apiculture	1	1	3	2	0	0	122	71
Tourism (elephant viewing)	0	0	75	44	96	56	0	0
Tourism revenue sharing	0	0	41	24	130	76	0	0

Bangladesh Forest Department play following the last elephant incident that involved death and/or injury?”, most respondents (84%) felt the Forest Department did “nothing”. Also, most respondents (64%) were unaware of compensation provided by the Forest Department for elephant damage.

## Discussion

The respondents typified the population living in the south-eastern region of Bangladesh at the time of the study. Most respondents were men, due to the village culture dissuading women from conversing with outsiders. The respondents were characterised by having low income, engaging in subsistence farming and their agricultural lands being situated in or on the periphery of elephant habitat. All respondents had direct or near-direct experience with elephant conflict indicating that interaction with elephants was a common occurrence, and such interaction is primarily described in terms of conflict versus compatible co-existence.

Results showed a year-round pattern of elephant incursions and HEC in south-eastern Bangladesh. Year round raiding by elephants could be explained by the presence of both ‘push factors’ (reduced native forage pushing elephants to raid) and ‘pull factors’ (crops pulling elephants toward alternative food resources). Elephant incursions tended to increase during the transition between dry and wet seasons in April-June and October-November. Two rice harvesting seasons occur in Bangladesh: Aman (December – January) and Boro (April – June). Vegetables are mostly cultivated during September – January, with jack-

fruit ripening during April – June. Wild forage contains less nutrients compared to cultivated crops, and hence elephants likely maximise quality as well as quantity in their nutrient intake by raiding crops (Sukumar 1994).

Most respondents reported that incursions mostly involved both male and female elephants. This differs from suggestions that elephant incursions tend to be dominated by males for example in Uganda (Chiyo & Cochrane 2005), Sri Lanka (Ekanayaka *et al.* 2011) and Botswana (Jackson *et al.* 2008) but consistent with other studies stating that bulls, cows, and entire herds take part in crop raiding, for example in southwest Uganda (Musaasiza *et al.* 2005) and south India (Ramkumar *et al.* 2014). Cows would be expected to benefit from nutritional gains from raiding, with improved nutrition leading to shorter inter-birth intervals and healthier babies (Chiyo & Cochrane 2005).

The consequences of elephant incursions represent a significant cost to people residing in and around elephant habitats of south-eastern Bangladesh, particularly in view of their poor economic status. We found that farmers and firewood collectors were the primary victims. Because such persons are often the breadwinners of the family, their death and/or injury represents a major economic cost on the affected families. Injured workers also may suffer from depression, post-traumatic stress disorder or other psychological impacts. In certain cultures, death or injury caused by elephants maybe considered a foreordained punishment (Jadhav & Barua 2012) with accompanying implications for future well-being. All told, the losses generated from HEC are likely to have immediate as

well as long-term negative impacts on the people in proximity to elephant habitat in south-eastern Bangladesh.

Drumming and firecrackers were the most common measures used to deter elephant incursions, but some farmers believed that any kind of disturbance created by noise, yelling or other means made the elephants aggressive and resulted in more damage to properties. Participants were sceptical or not knowledgeable of elephant-conflict mitigating measures attempted in other countries, such as erection of physical barriers, electric fences, chili cultivation, and apiculture. These measures were reported to be effective at least for short durations or in some contexts but ineffective over extended periods of time (Santiapillai & Suprahman 1986). A few respondents recommended non-traditional measures of mitigation, such as relocating elephants, and not planting exotic species such as acacia. These approaches may contribute to a larger HEC mitigation plan but are unlikely to succeed on their own within the current economic and cultural environment of Bangladesh.

Results confirmed that elephants get killed every year, consistent with regional unpublished data (Bangladesh Forest Dept. 2016). Although villagers openly recounted the number of elephants killed in their locality, they were reluctant to reveal details about actions such as poisoning, electrocution and shooting. Possibly such reluctance is due to knowing that such action is punishable under Bangladeshi law.

Despite the increasing trend of incursions, a large portion of respondents expressed support for elephant conservation locally. A similar finding was observed in a study in Myanmar (Sampson *et al.* 2021), while a study in India found only 57% of respondents favoured elephant conservation (Jasmine *et al.* 2015). While the result in Bangladesh is encouraging, it can only be transformed into conservation action when HEC is reduced. Villagers will not care about elephant conservation from a moral or ecological–evolutionary argument when their subsistence and wellbeing are not secured (Balmford & Whitten 2003). Therefore, continued losses from HEC will eventually exceed the limits of tolerance for elephant incursions.

Participants showed varied support for HEC mitigation options. Habitat improvement was rated ‘very useful’ by most villagers, thus positive for conservation efforts directed at elephant habitat. ‘Community awareness’ was equally rated as ‘very useful’ thus suggesting villager’s desire for maintaining or improving awareness of HEC mitigation options and elephant conservation.

Compensation has been the most visible HEC mitigation tactic adopted by the Bangladesh government, and it appeared to be attractive to participants. The policy “Human-wildlife conflicts: Wildlife Compensation Policy, 2010” empowers the government to compensate victims of wildlife. Under this, any death/ injury/ damage caused by wildlife occurring on private lands are compensable. At the time of this study, families experiencing a death due to elephant attack were compensated with US\$ 1250 and injuries with US\$ 625. However, deaths on government land (public land) were not addressed. People may also not apply for compensation because they have to sacrifice work time and travel considerable distances to government offices to register a complaint, and crop and property damage alone are currently not compensated. In some areas in Africa, compensation has proven to be an ineffective elephant conservation strategy as it addresses the outcome rather than the root cause of conflict (Hoare 1995). Moreover, compensation will not deter future elephant incursions.

### **Acknowledgements**

Financial support for SuAC was furnished by the Strengthening Regional Co-Operation for Wildlife Protection Project, through the World Bank. Additional costs were covered by a grant from the Natural Sciences & Engineering Research Council of Canada to KL. Logistical support was provided by the Forest Department of Bangladesh.

### **References**

Balmford A & Whitten T (2003) Who should pay for tropical conservation, and how could the costs be met? *Oryx* **37**: 238-250.

- BBS (2010) *Statistical Yearbook of Bangladesh 2010*. Bangladesh Bureau of Statistics, Dhaka, Bangladesh.
- Bangladesh Forest Department (2016) Unpublished raw data, Bangladesh Forest Department, Agargaon, Dhaka, Bangladesh.
- Barua M, Bhagwat SA & Jadhav S (2013) The hidden dimensions of human-wildlife conflict: Health impacts, opportunity and transaction costs. *Biological Conservation* **157**: 309-316.
- Chiyo PI & Cochrane EP (2005) Population structure and behaviour of crop-raiding elephants in Kibale National Park, Uganda. *African Journal of Ecology* **43**: 233-241.
- Desai AA & Riddle HS (2015) *Human-Elephant Conflict in Asia*. Report.
- Ekanayaka SK, Campos-Arceiz A, Rupasinghe M, Pastorini J & Fernando P (2011) Patterns of crop raiding by Asian elephants in a human-dominated landscape in southeastern Sri Lanka. *Gajah* **34**: 20-25.
- Hoare R (1995) Options for the control of elephants in conflict with people. *Pachyderm* **19**: 54-63.
- IUCN (2019) *The IUCN Red List of Threatened Species. Version 2019*. <<https://www.iucnredlist.org/>>
- Jackson TP, Mosojane S, Ferreira SM & van Aarde RJ (2008) Solutions for elephant *Loxodonta africana* crop raiding in northern Botswana: Moving away from symptomatic approaches. *Oryx* **42**: 83-91.
- Jadhav S & Barua M (2012) The elephant vanishes: Impact of human-elephant conflict on people's wellbeing. *Health & Place* **18**: 1356-1365.
- Jasmine B, Ghose D & Das SK (2015) An attitude assessment of human-elephant conflict in a critical wildlife corridor within the Terai Arc Landscape, India. *Journal of Threatened Taxa* **7**: 6843-6852.
- Motaleb MA & Ahmed MS (2016) *Status of Asian Elephants in Bangladesh*. IUCN, Bangladesh Country Office, Dhaka, Bangladesh.
- Musaasiza J, Andama E, Ruta D & Byamukama B (2005) *Management of Conservation Based Conflicts in South Western Uganda*. ECAPAPA - ASARECA, Entebbe, Uganda.
- Nelson A, Bidwell P & Sillero-Zubiri C (2003) *A Review of Human-Elephant Conflict Management Strategies*. People & Wildlife, A Wildlife Conservation Research Unit, Born Free Foundation Partnership.
- Ramkumar K, Ramakrishnan B & Saravanamuthu R (2014) Crop damage by Asian elephants *Elephas maximus* and effectiveness of mitigating measures in Coimbatore Forest Division, South India. *International Research Journal of Biological Sciences* **3(8)**: 1-11.
- Sampson C, Rodriguez SL, Leimgruber P, Huang Q & Tonkyn D (2021) A quantitative assessment of the indirect impacts of human-elephant conflict. *PloS One* **16**: e0253784.
- Santiapillai C & Suprahman H (1986) *The Ecology of the Elephant (Elephas maximus L.) in the Way Kambas Game Reserve, Sumatra*. World Wildlife Fund. Indonesia.
- Sarker AHMR & Røskaft E (2010) Human attitudes towards conservation of Asian elephants (*Elephas maximus*) in Bangladesh. *International Journal of Biodiversity and Conservation* **2**: 316-327.
- Schweitzer A (1922) *On the Edge of the Primeval Forest*. Adams & Charles Black, London.
- Sukumar R (1994) Wildlife-human conflict in India: An ecological and social perspective. In: *Social Ecology*. Guha R (ed) Oxford University Press, New Delhi. pp 303-317.
- United Nations (2009) Rethinking poverty. In: *Report on the World Social Situation 2010*. United Nations Publication, New York.