

Research Article:**CONFLICT BETWEEN HUMAN AND ASIAN ELEPHANT IN THE BUFFER ZONE OF PARSA-CHITWAN COMPLEX, NEPAL****Rubi Shah* and Jhamak Bahadur Karki**

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DOI: <https://doi.org/10.3126/jafu.v6i1.79095>**ABSTRACT**

Asian elephants are the largest land mammals, faced significant threats because of the loss and fragmentation of their natural habitat mainly due to the cropping patterns near the protected areas contributing human-wildlife conflict. The aim of this study was to find out conflict between Human and wild elephant in buffer zone of Parsa and Chitwan National Parks. Social survey with a semi structured questionnaire with Fifty-two elephant affected respondents, three focus group (6-8 people) in each discussion as per the agreed discussion guides and direct field observation were done. The elephants were attracted by agriculture crop near the park. Crop damage predominantly occurred at night, especially during the ripening periods of paddy and maize from June to November. Elephants, initially led by a solitary male, enter after sunset and evaluate the conditions for foraging the crops. Later, a group of 2-3 elephants, including the male, engaged in nocturnal crop raiding before departing by dawn. Crop raiding incidents peaked during this time, aligning with the harvesting seasons for both winter and summer paddy. The damage increased notably during the Paddy season, followed by the Maize season and other crops. Villagers employed active methods like noise making and lighting, while some locals adopted passive strategies such as cultivating alternative crops and harvesting maize prematurely to minimize damage. Villagers prioritized chasing, sound, and stone pelting as effective deterrents against elephant intrusion. These observations underline the seasonal and crop-specific nature of elephant-induced crop damage, and the varied strategies used to mitigate these conflicts.

Key words: Crop raiding, damage, *Elephas maximus*, mitigation, seasonal**INTRODUCTION**

Asian elephants (*Elephas maximus*) are endangered and one of the protected species under NPWC Act, 1973 in Nepal and CITES has listed this species in Appendix I. They are extreme threat due to habitat loss and fragmentation, poaching for ivory, trophy hunting, etc. (Barnes, 1996; Sukumar, 2006). Escalating Human-elephant conflict (HEC) is another major threat to the elephants, putting them at risk of local extinction in some localities (Baral et al., 2022; Hoare, 2000; Pradhan et al., 2011; Sukumar, 2006).

Wildlife like elephants and other mega herbivores need more forage for food and space than other small herbivores (Owen-Smith, 1988). Elephants are generalist herbivores (IUCN, 2013); as they are both grazers and browsers, and seasonal variations in their food selection occur (Sukumar, 1989). Previous studies on the diets of elephants have been carried out at several sites across Asia and Africa (Baral et al., 2022; Baskaran et al., 2010; Chen et al., 2006; Sukumar, 1990). Asian elephant feeding ecology in three specific habitats, short, tall and mixed/tall grasslands, was obtained in South India and that study found that during the dry season, most of the elephant diet consisted of woody plants, while grasses comprised most of the elephant's

diet during the wet season (Sukumar, 1989, 1992, 2006). In contrast, grass dominates the diets of elephants all year round in dry deciduous and dry thorn forests (Baskaran et al., 2010). A study in Parsa-Chitwan Complex indicates that Asian elephants have a diverse diet including monocot and dicot plants. Their diet in the dry season (February–April) contained a higher proportion of dicot compared to that of the wet season (June–September) (Koirala et al., 2016).

Crop raiding was highest during post monsoon season (June–August) in different parts of Nepal (Dangol et al., 2020; Neupane et al., 2013; Pant et al., 2016; Shrestha, 2007; Silwal et al., 2016). During post-monsoon season, the palatable and nutritious crops like paddy (Sukumar, 1992) are ready to harvest. In the foothills of the Himalayas, human - elephant conflict increases during maize or wheat maturing time (June – July) and also at paddy maturing time (September – November) (WWF, 2007). Thus, elephant activity shows a seasonal peak when crops are maturing, with the majority of conflicts involving elephants destroying maturing food crops (Hoare, 1995; Kangwana, 1995).

Crop raiding by elephants is mostly initiated by bull elephants; this is due to the male strategy of risk-taking that maximizes reproductive success via better nutrition (Hoare, 1999; Sukumar & Gadgil 1988). This behavior can be considered consistent with the predictions of optimal foraging theory (OFT) (Schoener, 1971). Raiding of crops by elephants also seems to occur irrespective of the availability of natural forage (Chiyo et al., 2005; Hoare, 1995; Sukumar, 1989). Cultivated crops are thought to be much richer in macronutrients and mineral salts compared to wild plant varieties of the same taxa (Sukumar, 1989) and thus, if within their range, cropped varieties will attract elephants.

This study was conducted to find out main reason of Conflict between Human and Asian elephant in the buffer zone of Parsa-Chitwan Complex and people's strategy to minimize the negative impact caused by elephant's conflict which is one of the gap to understand the feeding behavior of elephant and the strategies applied by local inhabitant to mitigate the problem.

MATERIALS AND METHODS

Study area

The study area selected for this study is a buffer zone that lies in the Manahari Rural Municipality (Pratappur and Sunachuri), which has the connection to both Chitwan National Park (CNP) and Parsa National Park (PNP) National parks and highly affected areas from the wild elephant according to the PNP, CNP and buffer zone authorities. Most of the land is not registered in the study area, and the claim for compensation is not regarded legal.

The northern side of the park represents inner-Terai and consists of features of both Terai and hills. Grassland species such as Kans (*Saccharum spontaneum*), Dubo (*Cyanodon dactylon*) Bans (*Dendrocalamus strictus*), Simal (*Bombax ceiba*), Tantari (*Dillenia pentagyna*) etc are dominant in the study area. Hasta Khola, Bhalu Khola and Bagau Khola are the important streams that flow northward from Churia and are tributaries of the Rapti River. Agriculture -Maize (*Zea mays*), Wheat (*Triticum sp.*), Paddy (*Oryza sativa*), sesame (*Sesamum indicum*), potato (*Solanum tuberosum*) etc. are dominant crops in the study area.

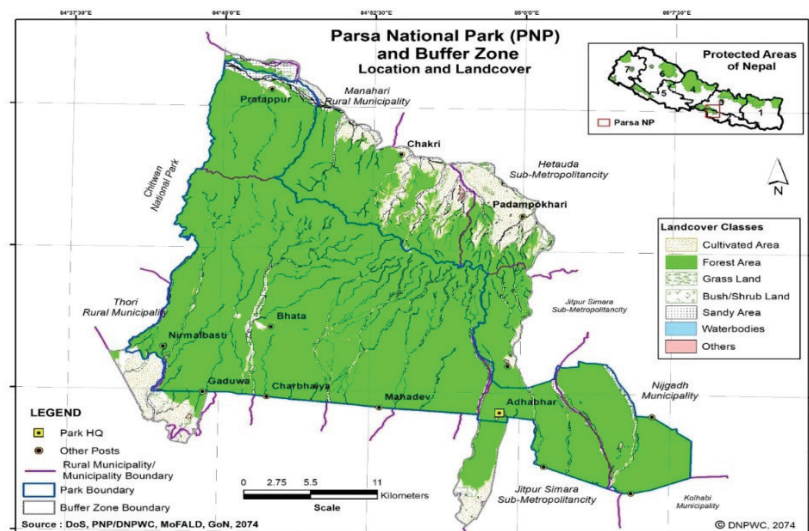


Fig. 1. Map of the study area

Data collection

Household survey: Primary data were collected through semi-structured questionnaires with 52 purposefully selected households affected by elephants in Manahari Rural Municipality. The survey focused on local perceptions of elephant crop-raiding behavior, coping strategies, and seasonal patterns of elephant entry.

Key informant interview: Five key informants, including protected area managers, conservation partners, buffer zone representatives, agriculture workers, media personnel, and elephant experts, were surveyed (some via Google Forms due to COVID-19). The focus was on human-elephant interactions, crop-raiding behavior, and mitigation measures, with efforts to ensure gender balance among respondents.

Focus group discussion: Three focus groups (6–8 participants each) were conducted with stakeholders such as local officials, forest user groups, farmers, program staff, and protected area representatives to gather diverse perspectives on human-elephant conflict. Participants were grouped based on similar backgrounds.

Field observation: Site visits to affected croplands were conducted to verify survey and discussion findings and assess the impacts of elephant crop-raiding on local communities.

RESULTS AND DISCUSSION

Respondent's general information

Respondents gave their consent prior to the interview, and none of the selected respondents hesitated to participate. Out of 52 respondents, 54% were female and 46% were male. In the study area, most of the people's main occupation was agriculture. More than 90% of respondents have less than 0.3 ha of land even 50% having less than 0.1 ha (Table 1).

Table 1. Quantity of Land owned by respondents

Quantity of Land Owned(ha)	No. of Respondent	No. Respondent (%)
0-0.1	26	50.0
0.1-0.2	12	23.1
0.2-0.3	10	19.2
0.3-above	4	7.7

Cropping pattern

Majority of the crop types were paddy and maize. Paddy is grown two times in a year. Summer paddy (May - August) and Winter paddy (August - November). Crops such as wheat and mustard are also planted but in less quantity. They also grow vegetables, potato, coriander, cabbage, pumpkin, radish, cucumber etc. to fulfill their daily needs of vegetables. The grains were found to be stored for most of the year around. In the study area, most of the land is not registered, so there is a problem while claiming compensation which ultimately forced towards the negative perception of elephants.

Movement of Elephant to Buffer zone

More than 50% of the respondents believed that Crops next to the park is the main reason of entering the elephant into the buffer zone followed by the food quality decreased in the forest (Fig. 2). More than 90% of the respondents in the household survey revealed that all types of damage occur mainly during night. A solitary male elephant initially encroached upon the buffer zone post-sunset, foraging and damaging crops. Subsequently, after a few days, a collective group of 2-3 elephants, including the male, engaged in crop raiding during nocturnal hours, departing before dawn.

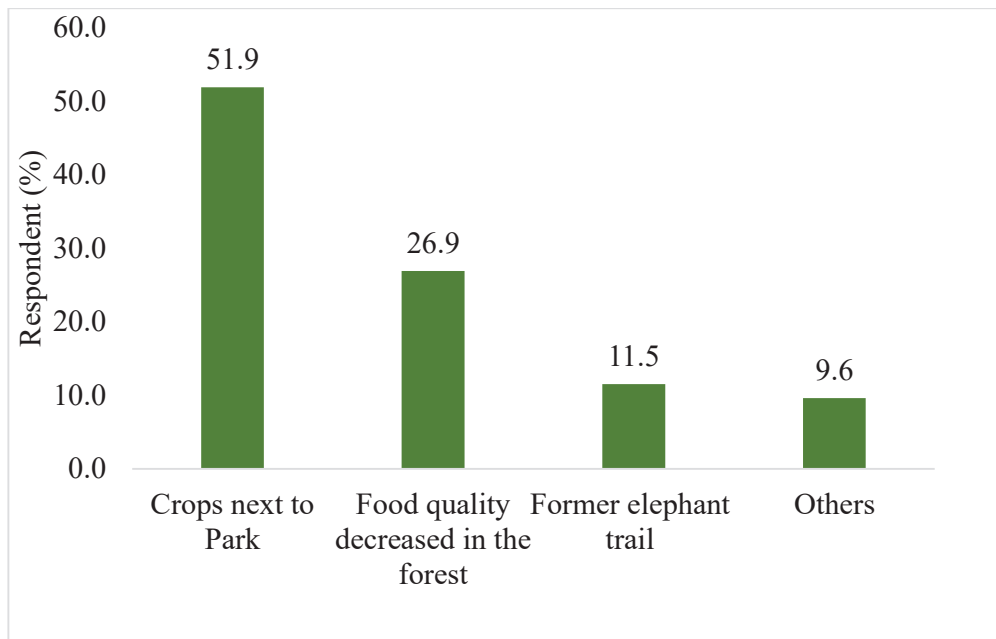


Fig. 2. People's perception on reason for entering elephant to the buffer zone

The presence of agricultural lands can significantly alter the foraging behavior of herbivores (Fox & Abraham, 2017). The study area surrounds the agricultural crops such as paddy, maize, vegetables etc. is proximity to the park and elephant frequency of raiding the crops was high. This is due to the Agricultural lands attracts the wildlife for various reasons; being, closer to the forest and crops more palatable and nutritious compared to the food in the forest, and also contain lower levels of toxins (Sukumar, 1990, 1992) or secondary metabolites (Osborn & Hill, 2005), or crops contained higher digestible energy than wild food plants, but comparable (and sometimes lower) levels of digestible protein, suggesting that this foraging strategy maximized energy rather than protein intake (Paola et al., 2019). Most crop raiding incidents are observed in croplands near the forest (Chen et al., 2016; Graham et al., 2010; Naughton Treves, 1998) and thus, conflict will always be higher at the edges of protected areas (Chen et al., 2016). Similarly, our findings also agree with the above findings. Most of the damage occurred during nighttime similar to that found by Shrestha (2007).

The respondent also believed that food quality decreased in the forest may also one of the crucial reasons of elephant entering the buffer zone. This is due to the natural food in the forest is draining as a result of increasing human encroachment and settlement near forest (Chen et al., 2016). Hence, encroachment of elephant habitat by humans resulting in increased croplands with palatable food near forest area is one of the precursors of increased crop raiding incident. During dry season when food is scarce in forest, elephants were recorded to travel up to 30 km to raid crops in southwest of China (Chen et al., 2016).

Most crop raids by a single or a few bull elephants identified by respondents as repeat visitors that returned multiple times over a period of several years. This repeat crop-raiding behavior could be correlated with adult bulls having higher nutritional requirements than other elephants because of their size and the high energy behaviors associated with the male drive for reproductive success (Sukumar & Gadgil, 1988). For many large herbivores, phenological changes in plant nutrient content play a strong role in determining the timing and frequency of crop-raiding behavior (Chiyo et al., 2005; Osborn, 2004).

Nature and extent of Damage

The 22-year period (1998 - 2020) of elephant and human interaction in the buffer zone (BZ) areas of CNP and PNP were taken for the analysis of its interaction. There were 925 incidents of human-elephant conflict interaction reported from BZs of Chitwan and Parsa NPs. The damage caused by elephants was categorized as property damage, crop damage and human casualty. Of these, 420 (45.41%) incidents were the cases claimed on property damage while 418 (45.19%) incidents were the cases claimed on crop damage which shows the elephant movement was significant towards the buffer zone. In the case of property damage, 92 incidents were reported on stored grain structures. Paddy was the most raided crops (364 incidents) followed by maize (30 incidents and wheat (only 2 incidents). Elephant movement was frequent in the search for food crops in the buffer zone areas (Table 2).

Table 2. Type of elephant damage and frequency of reported combined cases of the incidents in the bufferzones of Chitwan and Parsa National Parks between 1998 and 2020

Damage type	Damage	No of Incident	Percentage of incident
Property Damage	House only	314	420 (45.41%)
	Stored grain only	92	
	Others	14	
Crop Damage	Paddy	364	418 (45.19%)
	Maize	30	
	Wheat	2	
	Banana	1	
	Others	21	
Human Casualty	Human death	43	87 (9.40%)
	Human injury	44	
Total		925	

The past data indicates that the compensation claimed for the property damage was high followed by the crop damage. However, our survey data shows that crop damage by the elephant was the most common (Fig. 3). This is also aligned with the study in Eastern Nepal (Shrestha, 2007; Neupane et al., 2018) in Western Nepal (Neupane et al., 2013; Perera, 2009) in entire

lowlands of Nepal (Wilson et al., 2015; Nsonsi et al., 2018; Stone et al., 2019). Another reason of Property damage may occur when elephant search for stored grains and liquor (Prakash et al., 2020). Thus, elephants move to the buffer zone to raid the searching of foods which causes sometimes damage of the property.

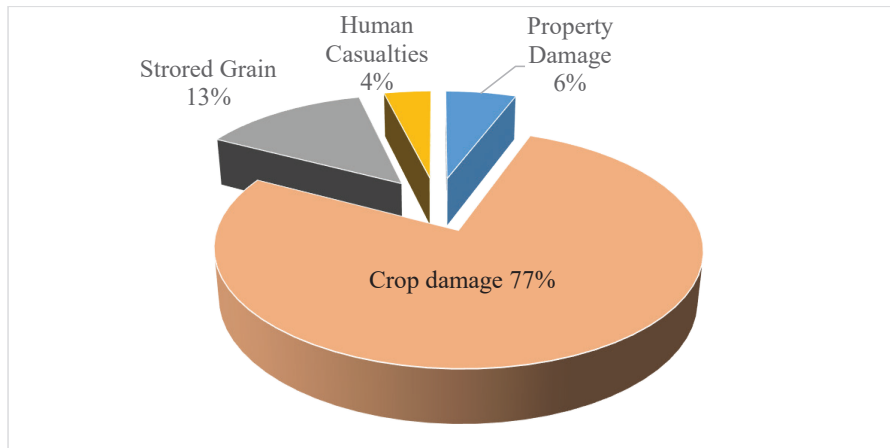


Fig. 3. Type of damage by wild elephants in the study area

Month wise crop raiding incidents

More than 85% of the respondents to the household survey claimed that elephant entered the field seasonally while about 10% and 5% of the respondent answered occasionally and weekly respectively. There are two seasons of paddy cultivation in the study area. Summer Paddy (May-August) also coincides with the season of Maize cultivation and Winter Paddy season (September - November). The entry of elephant is mainly in this specific seasons i.e. Summer Paddy and Maize season (May–August) and Winter Paddy season (September - November). Crop raiding incident peaks in the study area in the month of June-July, when ripening of the paddy and maize occurs. It is believed that elephant having special character to smell the ripening of these crops. Another incident (Fig. 4) peaks are in the month of September, which is maturing and harvesting time of Summer paddy was July-August and after that started the planting of the winter paddy while winter paddy is harvested during October-November which make the crop raiding incident peaked in the study area. This finding is similar to Subedi et al. (1993). The high crop raiding from July to November accords with the ripening period of paddy as the harvesting periods of both winter and summer paddy coincide with this increase in incident.

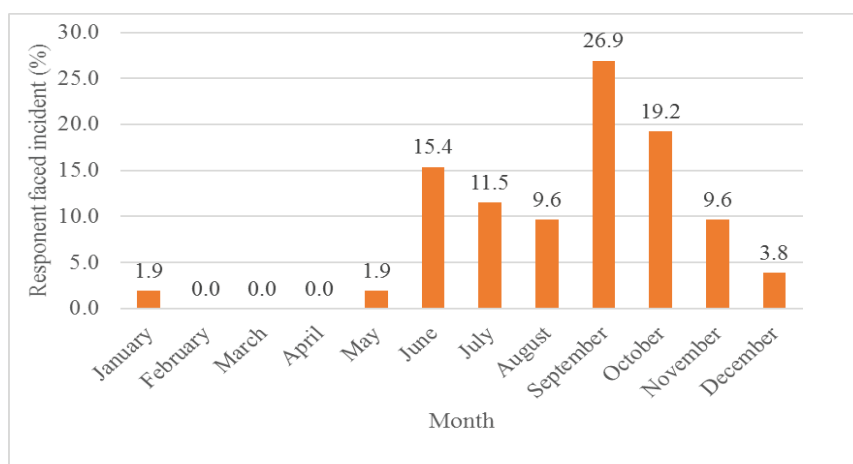


Fig. 4. Month wise incident faced by respondent

Thus, paddy is the most raided crop in the Buffer zone of Parsa- Chitwan Complex agreed with the finding of Sukumar, (1990). The number of Crop raiding increases in the Paddy season (Fig. 5) followed by Maize season and others (potato, wheat, mustard etc.). Crop raiding starts right from the vegetative stage and continues through the reproductive period till the crops get maturity and reaches the harvesting stage. However, the intensity of crop raiding attains the highest level as the crops Similar results were observed in different parts of Nepal (Neupane et al., 2013; Pant et al., 2016; Shrestha 2007; Silwal et al., 2016), Assam (Wilson et al., 2015), Karnataka (Stone et al., 2019) and southern India (Rohini et al., 2016).



Fig. 5. Crop wise incidents in study area

Mitigation Measure

Study site had different nature of local resident and it is unlikely that any single method will work in all situations once elephants reach crop fields and enter the villages. Active methods include noise-making activities like shouting, drum beating, firing gun shots into the air (by forest officials only), using torch light, pelting stones and lighted fuelwoods and kerosene etc. (Fig. 6).

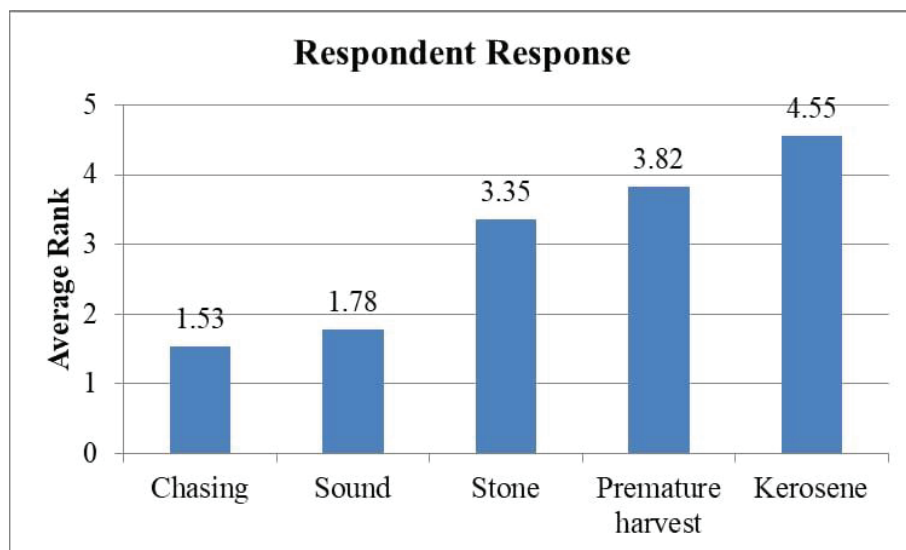


Fig. 6. Mitigation measures adopted by respondents in study area

Some villagers also adopted passive method i.e., cultivation of alternative crops (sesame) and also harvest premature maize to minimize the risk of damage since last 2/3 years. Highest priority is given to the chasing followed by sound, stone and others by the local people aligning with the findings of Neupane et al. (2018).

However, the key informants and focal group discussion also indicate that major drawback of using all these methods is that these may provoke the raiding elephants increasing the possibility of more damage to the crops and other properties as well as higher risk to the farmer's life. Crop damage during paddy and maize seasons is the most significant impact of human-elephant conflict in the Parsa-Chitwan Complex, driven largely by the expansion of agriculture into elephant habitats. Communities employ both active methods (noise-making, lighting, chasing, stone pelting) and passive strategies (alternative crops, early harvesting) to reduce damage. Mitigating human-elephant conflict requires a balanced approach—protecting elephant habitats while promoting community-based, locally adaptable deterrent methods.

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