A Qualitative Analysis of the Main Threats to Asian Elephant Conservation

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Abstract. In this study we identified the main threats to the conservation of Asian elephants and discuss their causes and implications. Primary data from interviews and secondary data from published articles were gathered and analysed using inductive and deductive thematic content analysis assisted by NVivo 10. Our results indicate that the three main threats for the species are human-elephant conflict, habitat loss, and poaching. The conversion of forests into plantations and human-dominated areas, including infrastructure developments, are the primary causes for human-elephant conflict and habitat loss. Meanwhile, the high demand and monetary return from ivory trade are the primary causes to illegal poaching.

Introduction

Asian elephants (*Elephas maximus*) are endangered due to the ongoing decline of their populations. The current wild Asian elephant population is estimated to be between 36,000 and 50,000 individuals (Santiapillai & Sukumar 2006). The Asian elephant has been categorised as 'endangered' in the IUCN Red List of Threatened Species since 1986 and listed in the Appendix I of CITES since 1975. The classification of 'endangered' status is being assigned to any species, which has experienced more than 50% population reduction in three generations (IUCN 2012). In forest ecosystems, elephants are excellent seed dispersers of many plant families, such as Euphorbiaseae, Poaceae, Fabaceae, Moracear, Saporaceas and Malvaceae (Campos-Arceiz & Blake 2011). The decline of Asian elephant numbers will therefore alter many plants population dynamics.

In many of the Asian elephant range states, massive destruction of forest mainly due to agricultural, industrial and infrastructure expansion has put pressure on the remaining Asian elephant population (Joshi & Singh 2007; Promsouvanh 2009). The large forest destruction pushes elephants closer to human-dominated areas. Worse still, habitat loss and fragmentation intensify the conflict between elephants and humans where both coexist in similar ranges (Leimgruber *et al*. 2011; Pradhan *et al*. 2011; Mehta & Kulkarni 2013). Although human-elephant conflict (HEC) mitigation measures have been implemented, HEC remains high in most elephant range states. Furthermore, all the 13 Asian elephant range states are classified as developing countries and are seeking more developments. Subsequently, rapid human developments are likely to continue, which may worsen the impact of HEC in the future.

In this context, it is imperative to analyse the main threats to Asian elephants and the causes and implications of the identified main threats. However, the published journal articles related to Asian elephants is scarce, especially in Southeast Asian countries like Malaysia. Here we present an analysis of the current main threats for Asian elephant populations, with a special focus in their situation in Peninsular Malaysia. Our qualitative analyses are based on interviews with key informants and the text analyses of available published information.

Methods

In this study we utilised both primary and secondary data. Primary data was collected through semi-structured interviews with 10 key informants from Malaysian government agencies and non-governmental organizations (NGOs) involved in research, law enforcement, threat mitigation, and management of Malaysian elephants. The interviews were conducted either face to face or by e-mail. The interviews were then transcribed and sent back to the interviewees for validation.

The secondary data was systematically compiled from published articles in two academic databases: Science Direct and Springer Link. Additionally, articles from the journal *Gajah* were also included because the journal is specifically devoted to Asian elephants. In order to identify relevant articles in the databases and *Gajah* we conducted systematic searches using the term 'elephant' in the title of articles published between 2004 and 2014. The search was then refined looking for the terms "Asian elephant AND *Elephas maximus*" within the results of the previous search. We further refined these results by reading the abstracts or introduction and retaining only articles relevant to the conservation of Asian elephants (e.g. we excluded articles about African elephants, elephant biology and behaviour, and other wildlife such as elephant seal and elephant fish).

The contents of both the interview transcripts and the selected journal articles were analysed with inductive and deductive thematic content analysis. In the process of analysis, the documents were uploaded into NVivo 10 (QSR International) followed by the formation of appropriate nodes (themes and subthemes) inductively (Dey 1993; Elo & Kyngäs 2008; Miyashita *et al.* 2008; Mazaheri *et al.* 2013; Kadir *et al.* 2013; Woo & Heo 2013; Fletcher *et al.* 2014; Rivera *et al.* 2015). The contextual definitions of the nodes were also included (Dey 1993; Miyashita *et al.* 2008; Mazaheri *et al.* 2013; Woo & Heo 2013). Next, the related words, phrases or sentences in the documents were highlighted and coded into respective nodes as codes in accordance to the

contextual definitions. Then, all the codes were outlaid and the frequency of reoccurrence of words, phrases or sentences indicating threats to Asian elephants were calculated manually (NVivo 10 could not detect some words, phrases or sentences according to the contextual meanings). Aside from the frequency calculation, similar theme and subtheme coding and categorisation were further analysed for causes and implications of the identified main threats with highest frequencies (Dey 1993; Son 2011; Kadir *et al.* 2013; Fletcher *et al.* 2014; Rivera *et al.* 2015).

In the context of our study, HEC is defined as the negative contact between humans and elephants, which resulted from human developments. Habitat loss represents the disappearance of forests or elephant habitats. Finally, we define poaching as the illegitimate hunting activities of Asian elephants for their body parts, namely ivory, meat, tail hair, hide, feet, and trunk.

Results

Text content analyses

The analysis of the interview transcripts shows that three issues accounted for 85% (N = 276) of the reoccurrences of words or expressions referring to Asian elephant threats (Table 1). These three threats are habitat loss (38.8% of the codes), HEC (35.1%), and poaching (10.9%; Table 1). Other cited threats for Asian elephants include poor governance, public attitudes, and human population growth, among others (see Table 1 for details).

In our systematic search of articles we retained 76 journal articles relevant to the conservation of Asian elephants. The analysis of the articles text showed the same three most frequently cited threats, although in slightly different order: HEC (41.8%, N = 1887 codes), followed by habitat loss (35.4%), and poaching (11.6%; Table 1).

Human-elephant conflict (HEC)

HEC is the most commonly cited threat to Asian elephants in our analyses. Our text analyses suggest that HEC is aggravated by habitat loss in

Table 1. Frequency distribution of codes (terms) related to Asian elephant threats from text analyses of interview transcripts and journal articles.

Threats or causes	Frequency of codes			
	Interview transcripts		Journal articles	
	N	%	N	%
HEC	97	35.1	1887	41.8
Habitat loss*	107	38.8	1600	35.4
Poaching	30	10.9	522	11.6
Public attitudes	14	5.1	121	2.7
Poor governance	10	3.6	161	3.6
Population growth	6	2.2	99	2.2
Incidental encounters	6	2.2	90	2
Biological reasons	6	2.2	39	0.9
Total	276	100	4519	100

*Habitat loss in this context refers to: agricultural expansion, conversion of lowland forests into plantations, development activities, and habitat fragmentation.

Asian elephant range states. Accordingly, due to habitat loss, elephants are more likely to move into nearby areas to forage, and repeatedly encroach into plantations to raid crops (Fig. 1). HEC is aggravated by factors such as disorganized crop protection and HEC mitigation, such as lack of cooperation among farmers to mitigate HEC and protect crops, as well as by the lack of public education and awareness amongst farmers.

In addition, the lack of corridor maintenance to connect forest patches also worsens HEC. Being restricted to fragmented forest patches, elephants are more likely to wander between plantations and forests to forage. Meanwhile, the lack of public education and awareness on the importance of HEC mitigation also develops knowledge gaps within the community.

Figure 1. Elephant footprints in a paddy field in southern Sri Lanka. Photo by Jennifer Pastorini.

Our analyses also suggest that the knowledge about effective HEC mitigation and general knowledge about Asian elephants are still low, hence hampering the implementation of effective HEC mitigation and elephant conservations strategies. As mentioned by key informant 5: "When the public do not have adequate awareness and knowledge about the species, how do we want to change their mindset for the need to conserve the species?" People might not be aware of the endangered status of Asian elephants and the importance of HEC mitigation for the species conservation.

Farmers are not cooperating with each other to mitigate HEC. This is also supported by key informant 5: "Not many [people] are interested in conserving the elephants and sometimes they are treated as pest. Generally, Malaysians have no clue on why we must protect these animals, so public education or awareness in this area will be very important. Without realizing that elephants are part of our natural heritage, as we move forward there is no future for elephants amongst us in the country." Additionally, key informant 6 also mentioned that: "…low level of awareness among the general public and the government on the importance of protecting our biodiversity" makes it harder to address HEC. Therefore, the better understanding on the endangered status of Asian elephants as well as the implemented HEC mitigations is necessary.

18

Besides the causes of HEC, our analyses show the diversity of losses caused by HEC. The types of losses include monetary loss, property destruction, human injury and fatality, and retaliatory killing of Asian elephants. With the continuous destruction on plantations, properties, human injuries, and fatalities from HEC, farmers feel disappointed, angry, resented, and depressed towards elephants. This leads to less tolerance and willingness to endure HEC incidence among farmers. People, consequently, contribute less to the conservation of elephants. Affected farmers are more likely to retaliate by shooting, poisoning, and electrocuting these elephants to protect their crops, rather than protecting the elephants. Key informant 8 stated that retaliatory killing is one of the main threats to Asian elephants in Peninsular Malaysia; we found similar results in the analysis of journal articles content, although HEC is the leading cause to retaliatory killing.

Habitat loss

The second identified main threat to Asian elephants is habitat loss. Our analyses reveal that the repeated occurrence of habitat loss is due to large conversion of forests into plantations and human-dominated areas including infrastructure developments (e.g. roads - see Fig. 2, highways, and hydro-electric dams), as well as human settlements. The increase of human population resulted in the deforestation of forests to make way to plantations and infrastructure developments. Habitat loss and HEC are closely related. The replacement of natural habitats

Figure 2. Elephants at a road in northern Peninsular Malaysia. Photo by Yen Yi Loo.

Figure 3. Elephant poached inside the Burha-chapori Wildlife Sanctuary of Assam, India. Photo by Smarajit Ojah.

for crops results in an increase of HEC. Key informant 8 mentioned that due to deforestation 'elephants have to compete with development of huge plantation for space'.

Habitat loss has other negative impacts for Asian elephants. For example, it facilitates the access of poachers to the remaining forests. Moreover, habitat loss may disrupt migratory routes of elephants. As mentioned by key informant 4: "…elephants go to the same place every season. Improper planning of land conversion sometimes cut across their migratory routes."

Habitat loss also fragments elephant populations, which leads to low genetic exchange with other groups and populations.

Poaching

Lastly, the third major threat to Asian elephants is poaching (Fig. 3). Illegal trade of elephant parts is dominated by ivory, meat, tail hair, hide, feet, and trunk. It is very common for poachers to shoot, use poison, or electrocute the elephants. Some poachers also set up traps with elephant favourite foods such as banana and sugarcane as decoy to catch the elephants. As indicated by key informant 2: "…poaching and hunting, killing of elephants for their ivory, meat and hide…" are threatening Asian elephants. Apart from that, elephant poaching is fuelled by high demand and monetary returns from international trade. This

was also mentioned by key informant 2: "…the demand for ivory is leading to the elimination of tuskers from some populations in Asia, while the industries in China use hide for bags, shoes, belts, and other items presenting a grave threat to elephants of all ages and sexes." Poaching of males for ivory skews the population sex ratio. Key informant 8 says that illegal poaching is rare in Peninsular Malaysia. Nevertheless, key informant 9 foresees that illegal poaching might get worse in the next five to ten years in Peninsular Malaysia.

Discussion

Human population growth and the subsequent expansion of infrastructure, agriculture, and other human-dominated areas are leading to the rapid decline of Asian elephant populations. In order to implement effective Asian elephant conservation measures, it is imperative to carefully examine the species main threats and consider their causes and implications.

Conservationists in our sample recognized that human population growth has a significant impact on the severity of HEC, habitat loss, and poaching, which threaten the elephants in Asia. With the increment of human population, forest clearance has resulted in habitat loss of Asian elephants. For example, the remaining forest in Sri Lanka constitutes to approximately 20% of the total area of the country (65,000 km^2; Perera 2009). In Bangladesh, the total land covered with forest is less than 0.02 hectare per capita due to timber logging and conversion into agricultural lands (Islam *et al*. 2011).

Habitat loss often leads to the change of forest landscape, which also causes elephant's confusion in their usual movement directions, particularly routes leading to saltlicks, vegetations and water resources (Sukumar & Santiapillai 2006). Consequently, habitat loss leads to elephants' encroachments into nearby plantations, villages, railways, highways, and so on. Habitat corridors to connect forest patches could mitigate the impact of fragmentation, allowing elephants to move from one location to another (Azmi & Gunaryadi 2011).

Habitat loss and fragmentation also influences elephants' crop raiding behaviour. When natural habitats are depleted, elephants may be more inclined to raid crops in nearby plantations due to food sources reduction and the high nutritious value of crops compared with wild plants. In this context, elephants are also more likely to encroach into villages or human settlements for stored rice sacs, water, sugar, salt, and vegetables which much necessary for elephants' diet. Consequently, houses, kitchens and huts are often damaged by elephants. For example, as many as 22 houses were severely damaged by elephants in the dry season of 2004 in a small village of Sri Lanka (Campos-Arceiz *et al*. 2009).

Monetary loss due to crop raiding has adverse impact to villagers' welfare, especially for those whose livelihood depends on the crops. For example, in Karanjia Forest Division in India, a total of 46 acres of croplands were damaged by elephants between 2005 and 2006 (Sahu & Das 2012). Other subsistence activities such as the collection of forest resources are also negatively affected by HEC, hence further impacting on villagers' income and livelihood. Besides the economic cost, HEC can result in severe emotional stress, which might lead farmers to retaliate due to frustration, anger, and resentment. For instance, in India, over 200 elephants were retaliated between 2006 and 2011 via poisoning, electrocuting, and shooting by frustrated farmers (Baskaran *et al*. 2011).

The installation of physical barriers such as trenches and electric fences may be effective locally to mitigate HEC. Their monitoring and management, including long-term maintenance, is crucial for their effectiveness. Long term sustainable funding for their maintenance and monitoring is key.

Additionally, it is also important to consider the influence of negative attitudes among farmers towards willingness to spend on elephant's conservation initiatives. Sometimes, conservation initiatives may also give adverse impacts back to the species. Poor awareness on HEC and effective mitigation strategies further aggravates the conflict between people and

elephants. Farmers generally do not know how to chase elephants away from their plantations or houses effectively. Consequently, they are less prone to cooperate in the mitigation of HEC, making elephant conservation efforts less effective (Haturusinghe & Weerakoon 2012).

Poaching is another important threat identified in our study. The high demand for ivory and huge monetary returns of its trade drive elephant poaching in the region. As an example, in Cambodia, ivory is being sold for economic profit (Maltby & Bourchier 2011). Illegal poaching of elephants in countries like Malaysia is not high but might increase in the coming years. Additionally, snare traps set to capture smaller mammals may also injure elephants (Maltby & Bourchier 2011; Saaban *et al*. 2011). Because only male elephants have tusks, poaching for ivory has skewed the male to female sex ratio of some populations (Sukumar & Easa 2006; Sukumar & Santiapillai 2006; Baskaran *et al*. 2011).

Here we have identified three main threats to Asian elephants: HEC, habitat loss, and poaching. We also identified the complex relationships between the three main threats identified. Public participation should be integrated into education on Asian elephant conservation, likewise as to shorten the knowledge gap in addition to improving current public awareness. Moreover, further work on legislation enforcement is needed to tackle poaching and illicit elephant trade. Reducing the effect of HEC, habitat loss, and poaching of Asian elephants may ease the further decline of Asian elephant's population.

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