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Influence of Elephant-Human Interactions on Agrarian Communities in the Bengaluru-Bannerghatta Landscape – A Perspective Survey

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Abstract. A survey of the perceptions and attitudes of farmers towards human-elephant conflict was conducted in 17 villages abutting Bannerghatta National Park. Human-elephant conflict was found to be high with 89.68% of respondents having experienced crop damages. Human-elephant conflict impacts on the lives of people consisted of economic loss, stress and lack of food for subsistence. Economic status, gender and religion influenced their attitudes towards elephants. The majority of respondents had positive attitudes towards elephants but indicated the need for more intervention from the Forest Department in managing and mitigating human-elephant conflict.

Introduction

The Asian elephant (*Elephas maximus*) is of cultural, religious and national reverence in India. However, with escalating human-elephant conflict (HEC), on-going socio-cultural and economic transformations, and diminishing religious sentiments (Varma *et al*. 2009), the tolerance for elephants is drastically reducing. Approaches supportive of conservation attributed to religious symbolism, especially in rural communities (Bandara & Tisdell 2003) are frequently subdued by socio-economic issues from crop depredations (Jasmine *et al*. 2015). Individual perception of confrontations gradually eliminate public acceptance of co-existence (Barua *et al*. 2010). In India where HEC can be primarily attributed to agriculture-related conflicts, conflict mitigation favours an anthropocentric approach (see Doyle *et al*. 2010).

Anti-depredation measures such as electrocution and gunshots have resulted in the death of about 105 elephants between 2007 and 2012 in the State of Karnataka (KETF 2012). Comprehending underlying factors that determine people's attitudes towards elephants may aid in creating better mitigation measures and a possibility for co-existence (Nath *et al*. 2015).

In villages abutting Bannerghatta National Park (BNP) despite escalating HEC, 85.09% of residents felt that elephants need to be conserved (Varma *et al*. 2009). Nevertheless, about 2 elephant fatalities are reported every year around BNP, mostly from electrocution (Gopalakrishna *et al*. 2010).

In this study, we gauge the level of tolerance of communities abutting BNP, by conducting a survey of the perceptions and attitudes of farmers towards HEC. We surveyed selected conflict-prone villages abutting the Bannerghatta Wildlife Range (BWLR) of BNP. The range was chosen based on:

1. Presence of Bannerghatta Biological Park within BWLR, harbouring 19 captive elephants (8♂:11♀) (pers. comm. Phalke S) potentially attracting wild bulls during the mating period, ascertained by reports suggesting seasonal movement of wild bulls between BNP and Savandurga State Forest (12º84'–94'N, 77º27'–32'E) through the northern regions of BNP (Ralph *et al*. 2015).
2. Being the northern most range, it would be influenced by Bengaluru city lying about 20 km north, altering rural culture and perceptions.

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Methods

Study area

Bannerghatta National Park (N 12°20'–50' and E 77°27'–38') positioned on the northern most tip of Eastern Ghats in the state of Karnataka is part of the Mysore Elephant Reserve. The 260 km^2 park adjoins the North Cauvery Wildlife Sanctuary (Tamil Nadu) in the south-east and the Cauvery Wildlife Sanctuary (Karnataka) in the south-west. It has two of the 20 identified elephant corridors in South India - the 0.3–0.4 km wide Karadikkal – Madeswara and the 1 km wide proposed Tali corridor.

BNP, however, has a shape index of 5.46, including enclosures, exposing 280 km of the perimeter to non-forested regions (Karikalan 2013) (Fig. 1). There are more than 130 settlements within 5 km from the park with half the population practicing subsistence agriculture. Analysis of compensation claims found 8 villages (3 around BWLR) to have experienced crop depredation every year between 1999 and 2005, with the intensity of depredation being more in BWLR than in other areas (Varma *et al*. 2009). About 37 types of crops are cultivated around BNP and all of them are damaged and/or consumed by elephants (Varma *et al*. 2009).

Mitigation efforts from the Forest Department included installation of elephant barriers along the boundary, and compensation for crop damages. During 2013-2014, crop compensation amounting to USD 126,243 was paid for 2089 incidents.

Methodology

17 villages abutting western and eastern margins of BWLR were surveyed between 28th February and 23rd April 2016. In-person interviews were conducted with informed consent, by visiting houses and agricultural fields, using pre-framed open and close-ended questions. The questions were based on previous studies in BNP by A Rocha India - a wildlife conservation NGO, and a reconnaissance survey that was conducted with the local community. Questions on perceived causes of HEC, mitigation measures being practiced and measures proposed to Forest Department, were asked, to aid in assessing residents' level of tolerance towards crop-raiding and probable level of threat posed to the elephants. Attitudes suggesting repulsion or fear towards elephants were noted. Use of words such as 'devil', 'bad', 'anger' and 'not always good' used in relation to elephants, was taken to indicate repulsion. The survey also attempted to understand the influence of economic status on perception, by taking three acres of cropland owned as the dividing line between low and high economic strata. Supplementary data collected included demography, history of agricultural practices, religious views and knowledge on forests and elephants.

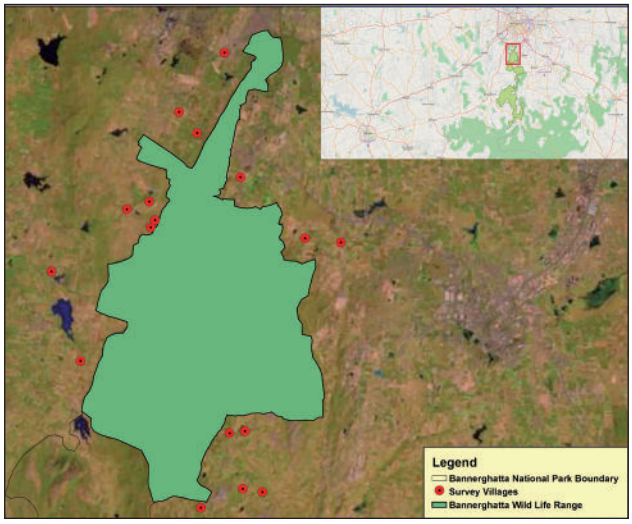

Figure 1. Map of Bannerghatta Wildlife Range showing locations of surveyed villages. Inset: Bannerghatta National Park.

Analyses were performed using R-Studio (version 3.1.2) and Excel. Significance was tested using Pearson's χ^2 Test or Fisher Exact Test with $P<0.05$.

Results

The questionnaire was administered to 320 people (64.5% men and 35.5% women) comprising predominantly subsistence farmers (88.75%, n = 284) from 17 villages. The villages were located at a mean distance of 567 m (Range 85 – 1380 m, SD ± 390 m) from the park boundary. The mean distance between crops and park boundary was

0.79 km (Range 0.01 – 4 km, SD ± 0.81 km). Finger-millet (*Eleusine coracana*) (n = 254) and jowar (*Sorghum bicolor*) (n = 86) were the crops predominantly cultivated. Crop damages were experienced by 89.68% of respondents.

Majority of the respondents (71.3%) felt that crop depredations had declined in the past five years, while 8.8% stated that it had remained the same and 19.8% that it had increased (Fig. 2).

Feelings towards elephants by respondents were mostly positive (57.4%, n = 179) while 31.4% (n = 98) were negative and 11.2% (n = 35) ambivalent. Of the people who supported protection of elephants (71.6%, n = 229), most did so because of religious precepts (70.7%, n = 162). Among those with negative (22.6%) and ambivalent (76.47%) responses, those who were for protection of elephants, attributed it to religious significance (53.8%, 62% respectively). Of respondents who did not support protecting elephants, 41.0% (n = 32) were religious. Women expressed more fear (96.4%) and repulsion (34.5%) towards elephants than men (86.6%, 16.9%) (Chi^2 = 0.53, P = 0.47 for fear, Chi^2 = 6.03, P = 0.01 for repulsion).

With regard to the influence of economic status on perception of conflict, respondents from the high economic stratum revealed more tolerance to crop depredation than those from the low economic stratum (Chi^2 = 9.98, P = 0.04). Among the impacts of HEC in their lives, most stated multiple impacts with economic loss (n = 224), stress (n = 207) and lack of food for subsistence of the family, caused by crop depredation (n = 196) (Fig. 3).

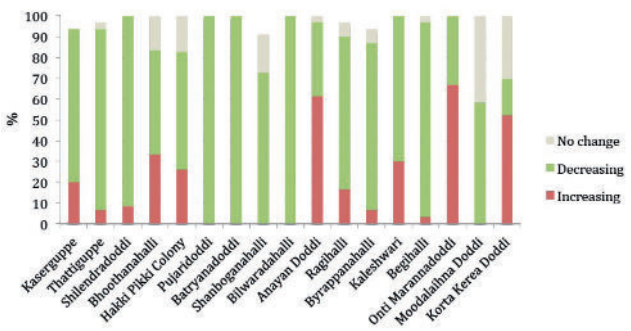

Figure 2. Perceived trend of HEC by farmers in the last five years, by village.

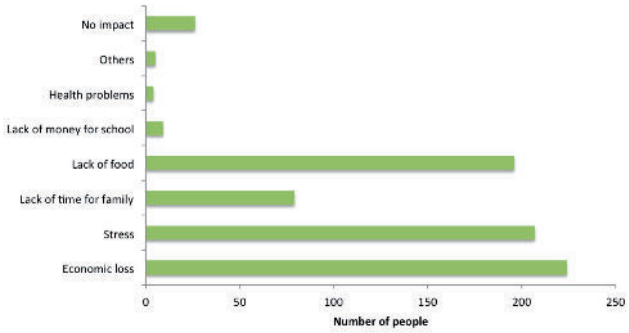

Figure 3. Stated impact of HEC by the farmers.

Majority of people claimed that they did not receive compensation (58.1%, n = 186). People who received compensation were generally unsatisfied (90.1%) by the compensated value. Most people (45.9%, n = 147) considered elephant proof barriers inefficient and preferred active methods such as chasing elephants with torches, fire or loud noises for mitigating HEC.

Of the respondents, 58.8% (n = 188) considered the Forest Department to be responsible for HEC. The main cause of HEC highlighted by the interviewees was the lack of resources in the park for elephants (67.8%, n = 217). Suggested ways of mitigating HEC better, included improving barrier systems (21.6%), patrolling the forest (12.5%) and providing forage and water within the park (11.6%) (Fig. 4).

Discussion

The survey indicated that overall crop depredations were perceived to have declined in the past five years. This is in contrast to many studies of HEC such as around Manas National Park (Nath *et al*. 2015) and, Chitwan National Park and Parsa Wildlife Reserve, Nepal (Pant *et al*.

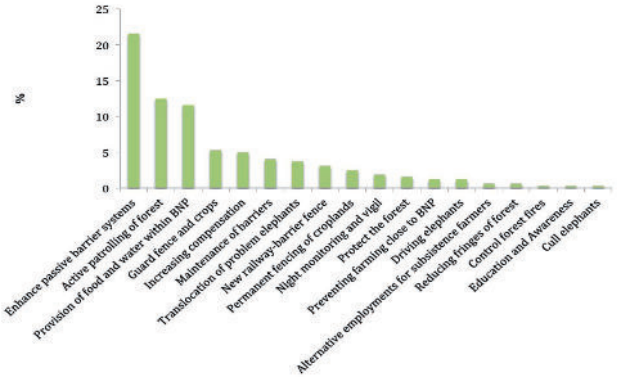

Figure 4. Solutions proposed by farmers in order to mitigate HEC around BNP.

2016). In our study area, crop depredations may have actually reduced because of electric fences that were installed in many regions of BWLR since 2010 (pers. comm. Avinash K), suggesting that perception of conflict is directly proportional to actual conflict, in this community. Which also is different to findings in other regions (Nath *et al*. 2015).

Decrease in crop depredation could be expected to result in increased support of elephant conservation. However, compared to (Varma *et al*. 2009) who found 85.1% (n = 97) of people around BWLR to be supportive of elephants in 2005, we found a somewhat lower percentage of people favouring conservation of elephants. Despite HEC being perceived to have declined, the continued occurrence of HEC in some regions could cause high levels of stress in protecting croplands and perceived fear may have gradually reduced tolerance for elephants.

We found the majority of the farmers to report crop depredations in their croplands, suggesting that all surveyed villages were within the conflict-zone around BWLR. Similarly, a study around Savandurga State Forest reported that all crop depredations occurred within 4 km from the forest boundary, marking it as a conflict zone (Ravindranath *et al*. 2014). The high level of conflict observed by us may also be because of the widespread cultivation of finger-millet and jowar, both of which are very attractive to elephants. As these are the predominant crops cultivated around BNP (Varma *et al*. 2009) the results from this study may reflect the situation all around BNP.

We found women to express more negative opinions about elephants, than men. A similar finding was reported by Hill (1998) in Budongo Forest Reserve, Uganda, which was attributed to women having restricted exposure to 'appropriate knowledge', minimum education and low encounters with elephants preventing personal judgement of underlying causes of elephants' reaction to people. The gender bias in our area could be due to the different social roles, where men work and women are responsible for the wellbeing of the family. Consequently the impact of socio-economic losses from elephants may be felt more by women than men. This may not be a generality and may depend on the area and communities, as contrasting results have also been reported (Nath *et al*. 2015).

Despite economic losses being one of the primary concerns, especially for the lower income strata group, elephants still hold reverence in the minds of many, due to religious precepts. This is furthermore indicated by the finding that people with negative and ambivalent attitudes towards elephants still suggested their protection. Such beliefs support conservation of elephants universally (Santiapillai *et al*. 2010). However, religious symbolism may be declining in our study area, as indicated by the number of 'religious yet not protective' responses. Such negative attitudes may increase further with frequent crop depredation.

The causes stated for crop depredations as lack of resources in the forests for elephants possibly indicates the acknowledgement of elephants' ecological needs by the people, which may be the source of their current tolerance. The farmers were considerably negative towards the Forest Department. This is in contrast to farmers around Manas National Park (Nath *et al*. 2015). The difference in our study area maybe linked to problems with the compensation scheme, non-effective barriers and perceived lack of resources for elephants inside the park. Previous surveys have revealed that 97% of respondents believed that there has been no involvement from NGOs in BNP, but are open to getting aid in mitigating HEC from them (Varma *et al*. 2009). Therefore, the negative attitudes towards the Forest Department around BNP may be long standing.

The overall impact of HEC on the agrarian communities around BWLR can be considered to be high. Addressing the issue of crop compensation would be an important factor in mitigating HEC in the area. Advocating community leadership in HEC mitigation not only help minimizes HEC but also instigates responsibility in people for guarding their crops (Fernando 2010). Such an approach with the collaboration of communities, Forest Department, conservation NGOs and

other stakeholders may provide a platform for co-existence of elephants and people in this landscape.

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