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Elephant and Human Mortality in the Bannerghatta-Hosur Landscape, Southern India

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Introduction

India is home to more than 50% of the world's Asian elephants with around 28,000 individuals (MoEF 2017), of which approximately 10,000 occur in the southern states (Project Elephant 2008). Historically, elephants inhabited a large part of southern India (Baskaran 2013). The Nilgiris-Eastern Ghats landscape holds the largest contiguous population of the species (Sivaganesan *et al*. 2005).

The stretch from Bannerghatta National Park in South Karnataka to the North Cauvery Wildlife Sanctuary and the Hosur scrublands (both located in northern Tamil Nadu) are critical for elephant movement within the Eastern Ghats, and are known collectively as the Bannerghatta-Hosur Landscape. The Bannerghatta-Hosur Landscape also includes certain areas that receive an efflux of elephants from the Bannerghatta National Park and the North Cauvery Wildlife Sanctuary such as Tumakuru in Karnataka and Koundinya Wildlife Sanctuary in Andhra Pradesh.

Elephants in the region exhibit seasonal migration, through corridors that connect Bannerghatta National Park and North Cauvery Wildlife Sanctuary (Ramkumar *et al*. 2017). Urbanisation and habitat loss have forced them to travel through human settlements and agriculture (Sukumar 1989).

Around 300 elephants are thought to pass through the Bannerghatta-Hosur Landscape every year (AERCC 1998). Small groups of elephants from the Bannerghatta National Park move through human-dominated landscapes into the northern ranges of the Tumakuru District in the dry season (Sridevi & Reddy 2018), and east into the Hosur forests in Tamil Nadu before reaching Andhra Pradesh through the Koundinya Wildlife Sanctuary (Manakadan *et al*. 2009). However, due to habitat loss, anomalous movement is becoming more frequent, leading to the establishment of populations in areas outside historical elephant ranges (this includes Koundinya Wildlife Sanctuary). These movements have resulted in an increase in human-elephant conflict (HEC).

HEC has become a major issue throughout India in recent times (Lenin & Sukumar 2011). At least 200 people and 100 elephants die every year from HEC (MoEF 2010). In addition, almost 500,000 households are affected by crop depredation (Sukumar 2006). Despite the increasing conflict, farmers may have a positive attitude towards elephants, which could change unless the conflict is mitigated (Stone *et al*. 2019).

Methods

The Bannerghatta-Hosur Landscape is comprised of the Bannerghatta National Park, which is 260 km^2 in extent, and lies between 12º34' – 12º50' N, and 77º31' – 77º38' E, and the North Cauvery Wildlife Sanctuary, which is 504 km^2 in extent and is situated between 12°07' – 12°44' N and 77°30' - 78°27' E.

The Bannerghatta-Hosur Landscape is estimated to hold close to 650 elephants, with Bannerghatta National Park harbouring up to 164 elephants, and the North Cauvery Wildlife Sanctuary-Hosur region holding around 500 individuals (MoEF 2017).

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The Bannerghatta-Hosur Landscape is bordered by the Cauvery Wildlife Sanctuary to the south-west, which forms a critical corridor for elephant movement into and out of the Eastern Ghats (Ravindranath *et al*. 2011).

The vegetation in the study area is dominantly dry deciduous forests and scrub forests. The area is characterised by a dry season from March to May followed by a rainy season from June to November, with rainfall in the early months owing to the south-west monsoon, and later from the north-east monsoon. Most areas outside the protected areas are heavily cultivated.

Records of human and elephant casualties due to conflict from 1980–2020 were obtained from Forest Department records, newspapers, and scientific publications.

Results and discussion

Seasonal variation of casualties

There were 153 human and 69 elephant deaths recorded over the study period (Fig. 1). Human deaths were high in September, December and January and elephant deaths in September and December.

The elephant population in Bannerghatta-Hosur Landscape increases due to movement of elephants into the area in September – November, when major crops are harvested (Thirunavukarasu 2014). Concurrently human-elephant conflict increases, as elephants raid the mature crops and most human and elephant casualties occurred during the period of high crop-raiding. Elephants raid more when crops are mature leading to more conflict (Naha *et al*. 2020), which is consistent with our finding of increased HEC incidents in September. However, October and November did not show an increase in casualties and the increase in December and January were after the harvesting season.

Causes of elephant and human mortality

Human deaths happened when farmers attempted to protect crops from elephants, and from

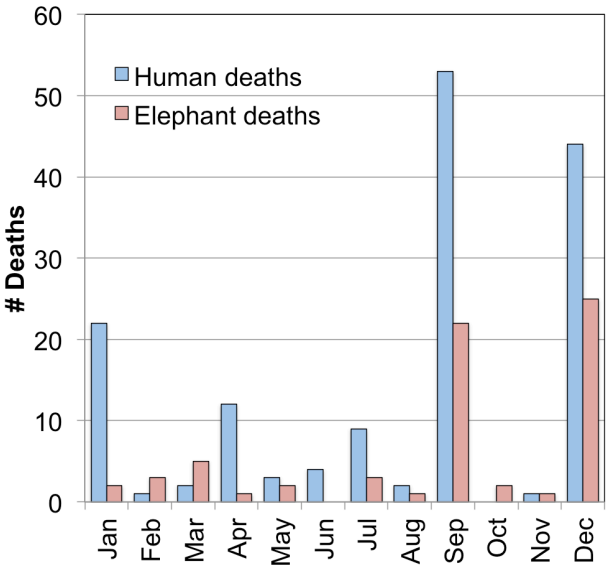


Figure 1. Human and elephant casualties by month.

accidental encounters while collecting firewood and around forest edges after dark.

Of the 69 recorded elephant deaths, electrocution (Fig. 2) caused the highest mortality accounting for 81.15% of deaths, followed by poaching/gunshot wounds (10.1%), and railway accidents (8.7%). Electrocutions were mostly caused by illegal electric fences placed around farmlands, or low-slung electrical wires from pylons.

Temporal variation of casualties

Almost all (89.7%) elephant deaths occurred between 20:00 to 00:00 hrs. Elephants in an anthropogenic environment tend to become more nocturnal to avoid humans and raid farms under the cover of darkness (Loarie *et al*. 2009). To protect crops, farmers may erect lethal electrical barriers, causing elephant deaths during the night. Some casualties (8.8%) also occurred



Figure 2. An adult makhna succumbed to electrocution death in a park-edge village.

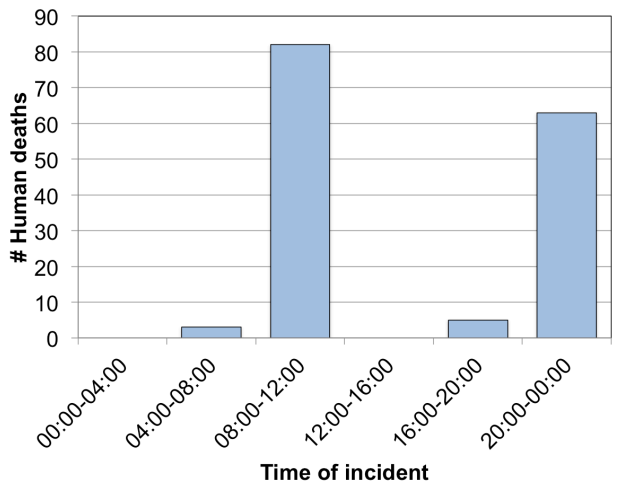


Figure 3. Human casualties by time of incident.

between 12:00 to 16:00 hrs due to shooting, by poachers or farm owners trying to protect crops.

Most human casualties occurred between 08:00 to 12:00 hrs, and from 20:00 to 00:00 hrs (Fig. 3). Many casualties occurring early in the day were due to encountering elephants accidentally while collecting firewood (10.5% of deaths) and open defecation (7.8% of deaths). Most villagers in Karnataka still practice open-defecation, as many households in South Karnataka do not have access to toilets. As this practice is usually conducted in the early hours of the morning and close to forest patches, the possibility of encountering elephants is particularly high. Farmers guarding crops accounted for many of the deaths at night. The majority of landowners in the study region guard their crops after nightfall, to drive away elephants, leading to confrontations and human mortality.

Spatial variation of casualties

The majority of human casualties were concentrated towards the Bannerghatta National Park side of the Bannerghatta-Hosur Landscape (Fig. 4), whereas the majority of elephant casualties occurred in the eastern regions of the North Cauvery Wildlife Sanctuary. Koundinya Wildlife Sanctuary recorded mainly elephant casualties towards the periphery of the park, while the Tumakuru District recorded exclusively human casualties due to conflict.

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The authors dedicate this publication to the legendary elephant scientist, Ajay Desai (1957–2020), who was an untiring campaigner for

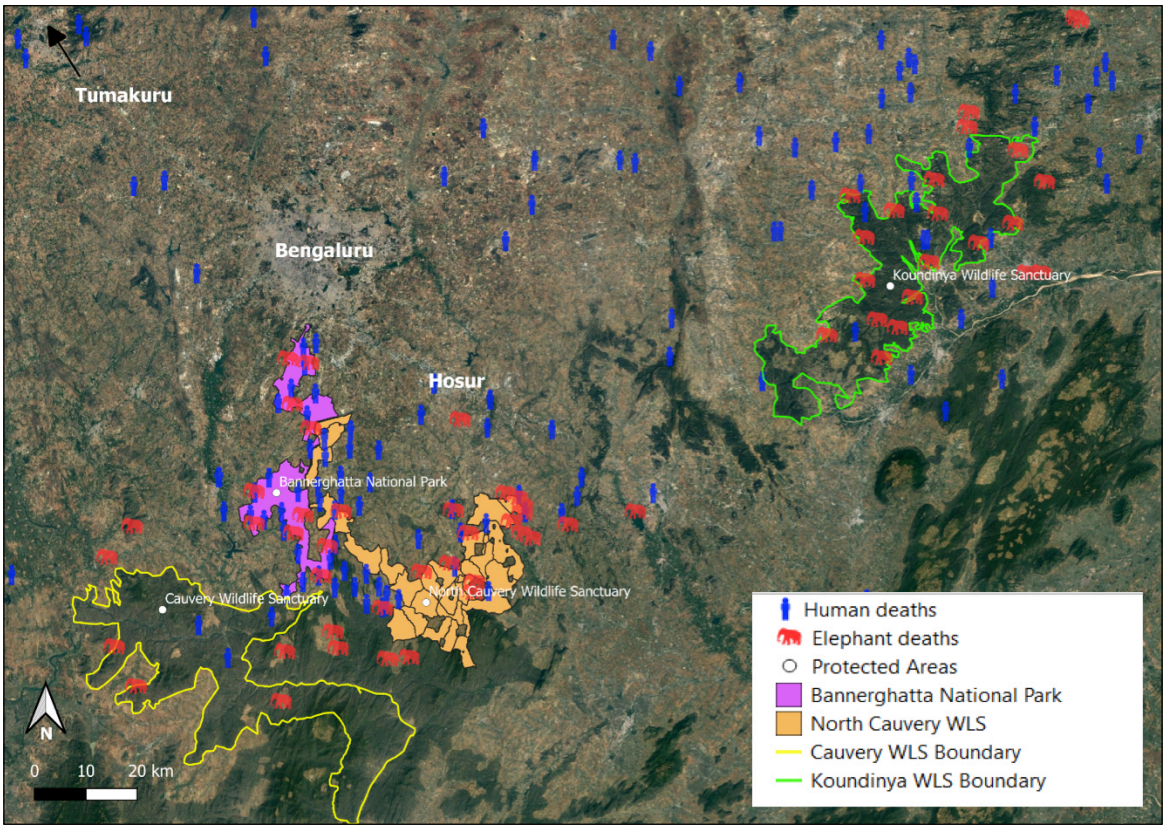


Figure 4. Map of human and elephant casualties within the study area.

Asian elephant conservation. We miss him dearly. We are indebted to the support rendered by A Rocha India and the Forest Departments of Bannerghatta and Hosur Divisions. We thank the anonymous reviewer for the valuable inputs in refining this manuscript.

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