

Where the Wild Elephants Are: Assessing the Distribution of Asian Elephants Using Media Reports

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Abstract. We present the first systematic use of news articles to map districts with wild Asian elephants in India. We analysed news articles mentioning human-elephant conflict between 2004 and 2018 and found that conflict was reported from 40 districts outside the elephant range published by IUCN, the only open data source for Asian elephant range in India. Sixteen of those districts reported multiple conflict incidents between 2004 and 2016, suggesting that the IUCN maps were outdated. Our analysis shows that news articles can be a useful tool for updating range information for charismatic species.

Introduction

The Asian elephant (*Elephas maximus*) is listed as a Schedule I species under the Wildlife (Protection) Act of India 1972, and since 1986 it also appears in Appendix 1 of CITES (Convention on International Trade of Endangered Species of Wild Fauna and Flora), granting it the highest legal protection against poaching and trafficking. Despite the physical size of Asian elephants and substantial conservation attention, information on the geographical range of Asian elephants in India is limited and may be outdated (Calabrese *et al.* 2017; Padalia *et al.* 2019). The International Union for Conservation of Nature (IUCN) is the only open data source on the range of Asian elephants in India. Developed based on 'expert opinion', the IUCN range maps are updated infrequently. The official government elephant census that is conducted every five years does not provide range maps that are accessible to the public. This makes conservation planning and effective conservation of elephants in India difficult.

Asian elephant distribution in India is predicted to change due to climatic and human pressures (Kanagaraj *et al.* 2019). Given the costs and logistical difficulties of systematically collecting data on the ranges of wildlife, methods that utilise readily available data from the public or the

internet can help provide information on the whereabouts of wildlife (Doyle *et al.* 2010; Chauhan *et al.* 2021). The most popular way to get such low-cost data is through citizen science – for example, smartphone applications such as eBird and iNaturalist, as used to document wildlife sightings (Baker 2016). News articles are another source of such data; the location and date included in news articles can be used to create range data for species (Doyle *et al.* 2010; Chauhan *et al.* 2021). This can contribute to conservation (McKinley *et al.* 2017) and support researchers.

Asian Elephants, as a flagship species, attracts media attention (Barua *et al.* 2010). Human-elephant conflict (HEC) resulting in human or elephant fatalities or injuries are often reported in the news (Barua 2010; Doyle *et al.* 2010). Barua (2010) looked at different HEC news articles in India and analysed how HEC events are framed in regional, national and international media. Doyle *et al.* (2010) used news articles published in the English media between 2006 and 2008 in 13 different countries to explore the level of HEC reported in the news and assess the utility of using news articles to monitor HEC in Asia. Madhusudan *et al.* (2015) created an elephant presence map for the state of Karnataka in India, using a combination of media reports, dung counts, interviews and government data.

In this study, we assess whether media reports can provide a relatively low-cost way to improve on the range maps of a charismatic species. Specifically, we explore whether articles in a media database on HEC could be used to update Asian elephant ranges in India.

Methods

To assess whether media reports can be used to improve our understanding of the range of Asian elephants in India, we analysed locations contained within HEC articles in the database of news articles compiled by the NGO Save the Elephants and compared these locations with the IUCN range map for Asian elephants.

HEC media database

Save the Elephant has consistently conducted web searches for Asian elephants since January 2004, creating an archive of media articles on Asian elephants. WWF-India was given access to all the articles compiled from January 2004 to December 2018. WWF-India employees created a HEC media database by analysing 10,296 English media articles in the Save the Elephant archives and coding the ones involving human death due to HEC or elephant death due to HEC. While crop damage affects a far greater number of families (about 500,000 a year as of 2010, Rangarajan *et al.* 2010) than deaths, it is comparatively rarely documented in media articles. We therefore focussed on human and elephant death reports in preference to crop damage reports. Elephant deaths and injuries included intentional and unintentional shooting, poisoning, electrocution, and accidents caused by trains. Human deaths and injuries included those arising from direct confrontation with elephants and incidents resulting from elephants destroying huts or other live-in structures. For each incident, all available location data were recorded, including the name of the village, sub-district, district, state, and country in which the event happened. In some cases, a single HEC news article mentioned two or more events with varying locations, dates, and casualties (human/elephant deaths and injuries); in these cases, multiple entries were made into the database from a single article. Media reports focusing on captive elephants were disregarded.

When more than one article reported the same event (same date, location and details about an incident) only one event was included in the database. Only HEC reports in India were used for this study. All the districts mentioned in the media articles were adapted to match the 640 district boundaries as per the 2011 Indian Census. The Indian Census is the main source of information on the characteristics of people in India and provided standardised district names and district boundaries.

IUCN data

The IUCN publishes worldwide ranges of threatened species. The IUCN ranges are created based on the available scientific data and rely on experts to validate them (Red List Technical Working Group, 2018). The IUCN published the current elephant range shapefile in 2020; however, it covers exactly the same geographical area as the one published in 2016. The IUCN Range shapefile was obtained directly from the IUCN website (IUCN 2020).

Mapping of data

The IUCN range covered multiple districts across different states. To identify the districts included in the IUCN ranges, the IUCN range was overlaid on the India 2011 Census map, using QGIS version 3.16.14. and the districts covered entirely or partially by the IUCN range were identified and labelled as “IUCN range districts”.

We mapped the HEC media events to districts identified in the 2011 Census of India but were unable to use the HEC media database to identify the locations of HEC to the sub-district, taluk, or village level. This was largely because the village and location names used in media articles did not allow for a one-to-one match with the villages in the census. Either they differed in spelling, matched the spelling of multiple villages in a district, or were absent from the census altogether (they were local but not official names).

We defined an ‘article’ as a unique written media piece collected by Save the Elephant mentioning wild elephants, an ‘event’ as a single in-

cident of HEC happening at a location on the given date, and a ‘casualty’ as a human or elephant death or injury. One article could contain more than one event, and each event could involve more than one casualty. For example, if one article describes two incidents of HEC happening at different locations and on different dates, with each resulting in 2 human deaths and 1 elephant injury, we would refer to it as 1 article with 2 events and 6 casualties. We summed the number of HEC media events reported from each district throughout the study period.

Results

According to the IUCN ranges, elephants were found in four regions: northern, northeastern, southern and east central (Fig. 1). The IUCN range depicts Asian elephant presence in 182 (28%) of the 640 districts in India (Fig. 1a). In some cases, the IUCN Asian elephant range covered the entire district; in others, only a small portion of it.

Of 10,296 articles mentioning elephants in Asia (Bangladesh, Bhutan, Burma, Cambodia, China, India, Indonesia, Malaysia, Nepal, Sri Lanka, Thailand, and Vietnam), 1730 (16%) mentioned HEC casualties in India, of which 1461 articles (1635 events) were matched with the district names according to the 2011 India

census (Table 1). These 1635 events referred to a total of 2488 casualties (898 elephant and 1590 human casualties). The conflict incidents occurred across 160 (25%) districts of the total 640 districts in India. The number of events associated with each district varied greatly (Fig. 1b). The most heavily affected districts were widely dispersed. In the southern region, Coimbatore district in Tamil Nadu state reported 82 HEC events; Sundargarh district in Odisha in the east central region reported 77 events; and Jalpaiguri district in West Bengal in northeast India reported 69 events. While some districts appeared frequently in the news, some districts (37) were reported only once.

A total of 1269 (86.9%) articles used reported either an elephant or human death. Injuries of either elephants or humans were reported alongside fatalities in 107 articles and 211 articles reported injuries without reporting any human or elephant fatality.

A total of 222 (35%) of the 640 districts in India were included in either the IUCN range or mentioned in HEC media database (Fig. 2). Of the 222 districts, 120 were included in both, 62 only by IUCN, and 40 were only mentioned in HEC articles (Fig. 2).

In the northeastern region, the IUCN range included a greater number of districts (68) than

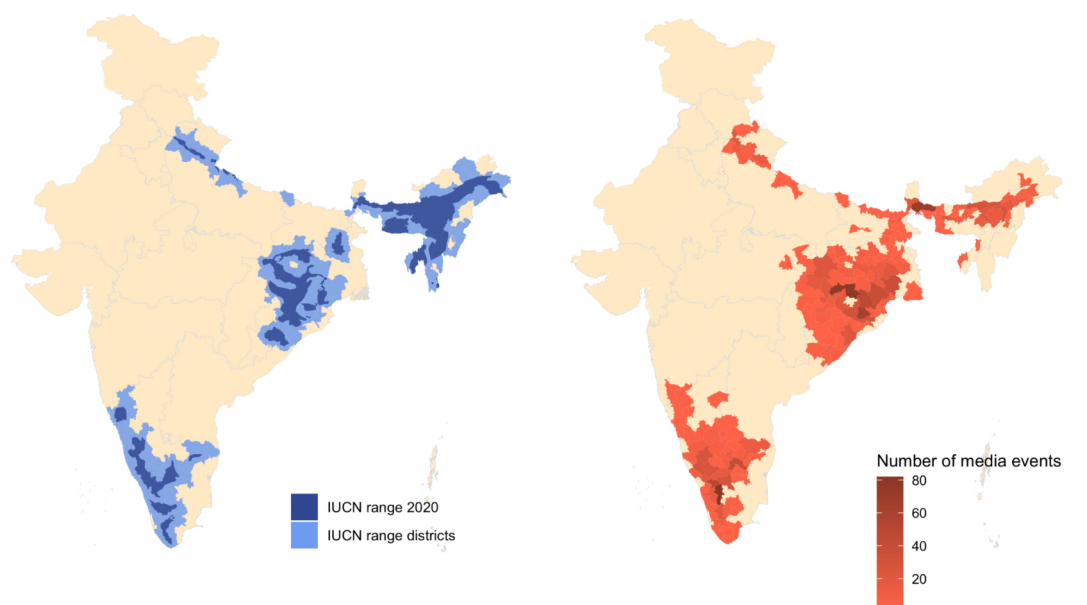


Figure 1. Asian elephant ranges. (a) Asian elephant range in India (IUCN shape file) and the districts with which it overlaps (i.e., IUCN range districts). (b) the number of media events reported for each district between 2004 and 2018.

Table 1. Summary of casualties by states ordered by the number of events (2004–2018).

Region	State	Elephant casualties		Human casualties		Total	
		Death	Injury	Death	Injury	Casualties	Events
East central	Odisha	199	11	256	117	583	398
Southern	Tamil Nadu	103	10	107	78	298	230
Northeastern	Assam	142	18	185	61	406	219
Southern	Karnataka	85	4	88	66	243	178
East central	West Bengal	117	21	101	60	299	175
East central	Jharkhand	47	2	107	46	202	113
Southern	Kerala	58	3	41	27	129	94
East central	Chhattisgarh	13	0	89	11	113	84
Northern	Uttarakhand	34	2	34	8	78	64
Southern	Andhra Pradesh	7	0	24	7	38	27
East central	Bihar	1	0	30	14	45	20
Northern	Uttar Pradesh	4	0	9	8	21	12
Northeastern	Meghalaya	7	0	3	0	10	6
East central	Madhya Pradesh	4	0	0	0	4	4
Northeastern	Tripura	1	0	2	1	4	4
Northeastern	Arunachal Pradesh	0	0	1	1	2	3
Southern	Maharashtra	3	0	0	6	9	2
Northeastern	Nagaland	2	0	1	1	4	2
Total		827	71	1078	512	2488	1635

the HEC media database (26), with 43 districts being only included in the IUCN range. In the northern region, the IUCN range included 13 districts, and the HEC media database reported 10 districts as having HEC, with the IUCN identifying 4 districts with elephants beyond those identified through the media. One district in each of the northern and northeastern regions found in the HEC media database was not included in the IUCN range. In the southern re-

gion, the IUCN range and HEC media database identified 46 districts and 49 districts, respectively, as having elephants, with the HEC media database showing elephant presence outside the IUCN range in 11 districts. The IUCN range data included eight districts in the southern region that were not identified as having HEC in the HEC media database. In the east central region, the IUCN range included 55 districts and the HEC media database identified 75 districts

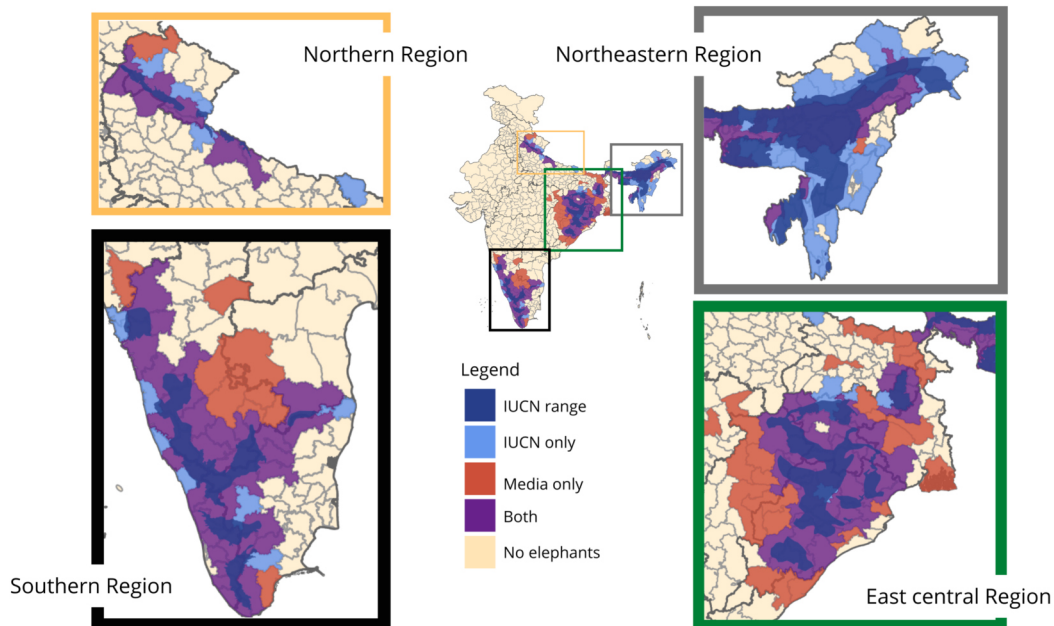


Figure 2. The range of Asian elephants as per the IUCN and HEC districts according to the HEC media database in the four regions of India. “IUCN only” refers to districts identified as having elephants by IUCN but not the HEC media database. “Media only” refers to districts where the IUCN data did not indicate elephant presence, but the HEC media database did. “Both” refers to districts where both the IUCN data and HEC media database indicate elephants are present.

Table 2. Count of districts with elephants by state and region as indicated by the IUCN and our HEC media database.

Region	State	IUCN & Media	IUCN only	Media only
East central	Bihar	4	1	7
	Chhattisgarh	3	0	6
	Jharkhand	17	4	2
	Madhya Pradesh	0	0	2
	Odisha	18	1	6
	Sikkim	0	1	0
	West Bengal	6	0	4
	Total East Central Region	48	7	27
Northeastern	Arunachal Pradesh	2	10	0
	Assam	19	8	0
	Manipur	0	6	0
	Meghalaya	2	5	0
	Mizoram	0	7	0
	Nagaland	1	4	1
	Tripura	1	3	0
	Total Northeastern Region	25	43	1
Northern	Uttar Pradesh	4	1	0
	Uttarakhand	5	3	1
	Total Northern Region	9	4	1
Southern	Andhra Pradesh	1	0	3
	Karnataka	14	1	6
	Kerala	11	2	0
	Maharashtra	0	0	1
	Tamil Nadu	12	3	1
	Goa	0	2	0
	Total Southern Region	38	8	11
Total		120	62	40

with elephants, with the HEC media database showing elephant presence outside the IUCN range in 27 districts. The IUCN range data included 7 districts in the east central region that were not identified as having HEC in the HEC media database.

A total of 31 districts with HEC that were not included in the IUCN range data had human-elephant conflict before 2016, with 14 districts having had multiple HEC incidents reported in the media before 2016 (Fig. 3). Two districts had conflict as far back as 2005.

Discussion

The geographical distribution of Asian elephants in India based on our HEC media database differs significantly from that derived from the official IUCN elephant range. Overall, the HEC media database showed elephants to be

present in 40 districts that were not in the IUCN range, which amounts to a 22% increase in the number of districts with elephants. The difference cannot be wholly attributed to recent range expansion by elephants. The IUCN range data was last updated in 2016, and reports on HEC from fourteen districts predate this, with two districts having had elephants at least as far back as 2005 (Fig. 3), suggesting that the IUCN range map excluded areas where Asian elephants had been present for over a decade prior to its updating. Thus, the IUCN range map underestimates the distribution of elephants in India, and media data could be a useful tool to help identify and update elephant distribution.

While both spatial distributions show Asian elephants in the same four main regions (northern, northeastern, southern and east central), the districts identified as having elephants by each data set were different. In the southern and east cent-

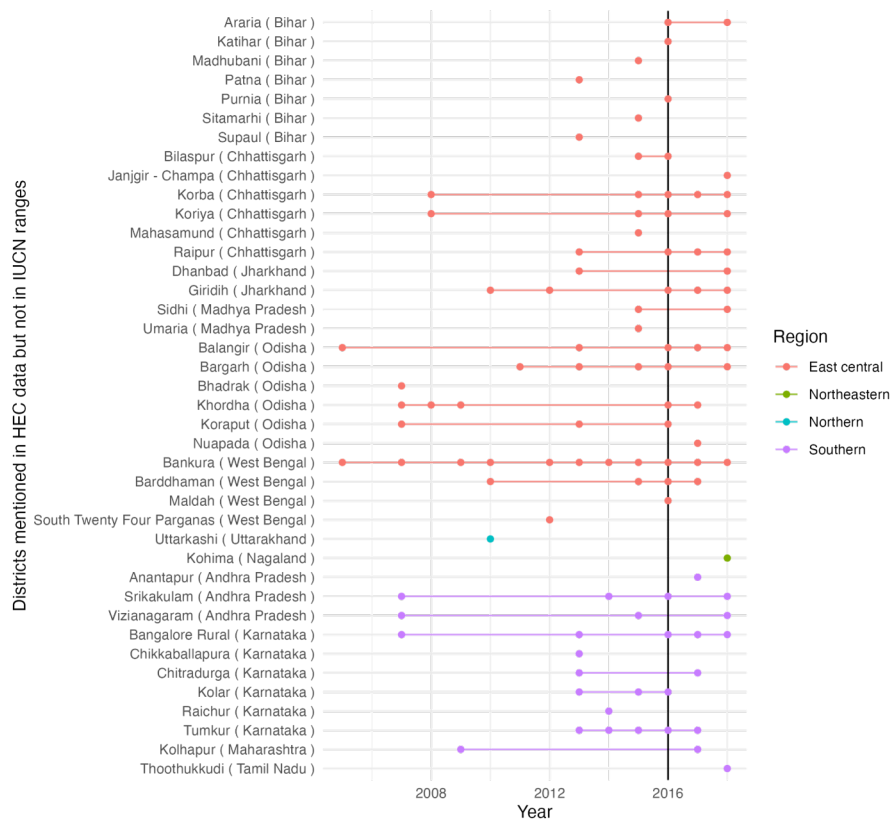


Figure 3. Timeline of fatal HEC events in the districts shown to have conflict in the HEC media database but not included in the IUCN range maps. The black vertical line indicates the year the IUCN range map was last updated (2016).

ral regions, elephants occurred in many districts outside the IUCN ranges, and there were only a few districts in the IUCN range that were not captured by the HEC media database. On the other hand, in the northern and northeastern regions, the IUCN range covered more districts than the HEC media database, and only one district in each region not in the IUCN range was shown to have elephants by the HEC media database. These discrepancies are likely driven by different phenomena. In South India, English media reporting may be more common than in the rest of the country, improving detection of elephant presence in this region by our study. In east central India, the recent range expansion of elephants (and resulting HEC) into Central India is probably deemed as more news-worthy, resulting in more English-language coverage. In contrast, in North and Northeast India, there has probably neither been a significant range expansion nor is there as strong a presence of English-language media. In theory, some areas may also have elephants but little HEC, and hence may also not be represented in media reports. Incorporating local-language media reports in the

analysis could greatly increase the detection of elephant presence and make it more robust.

Our study also demonstrates that media articles can be used to identify areas with relatively high levels of conflict. Longitudinal analysis of data from particular districts could also indicate changes in conflict levels, suggesting changes in the effectiveness of mitigation or elephant presence or behaviour. Although again subject to the media biases discussed, information from a particular region over time is likely to be more comparable, hence identification of high conflict areas within regions may be more accurate. Although not specifically addressed in our study, media articles could also detect range expansion of elephants. Information on relative level of conflict, changes in conflict levels, and range expansion or contraction could be used for prioritising and guiding conflict mitigation and elephant conservation.

Given the limitations of media-sourced data, it is not a perfect tool for range mapping by itself. Nor are media data a good replacement for offi-

cial HEC data as only about 25% as many incidents recorded in the government data from 2014–2015 (Ministry of Micro, Small & Medium Enterprises, Government of India, 2021) were detected through the HEC media database. However, the availability of media data online means it could be used to improve our understanding of Asian elephants' range. For a relatively small expense, analysts (or an algorithm) could periodically repeat our approach, using media to identify districts that have elephants outside of the known range. Further refinement of the range can be conducted in districts outside of the established elephant range through field visits or by contacting experts there.

Our study shows that media articles can provide data that can effectively update Asian elephant range maps and contribute to HEC mitigation and elephant conservation. Media analysis may be made even more useful by the use of automated tools like 'web-scrappers' to extract date and location information from HEC articles, or even identify the HEC articles themselves.

While not every species will generate as much media attention as Asian elephants, our paper demonstrates large-scale utilisation of news articles to obtain data relevant to the conservation and management of an endangered species. Our method can be easily used with other charismatic species, especially those involved in fatal human-wildlife conflict, and spur research and conservation outcomes for them as well.

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