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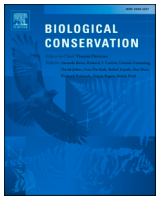

Polarized media coverage of conflicting, yet emblematic species: The ambivalent portrayal of the Asian elephant

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ABSTRACT

Species involved in human-wildlife conflicts are likely to generate polarized framings in the media. Because media contribute to shaping public opinion, an analysis of wild species in the media helps documenting perceptions and attitudes towards wildlife.

The case of the Asian elephant is illustrative because of its ambivalent perception, holding strong cultural and symbolic dimensions, but also feared due to increasing damages and casualties. Through this case, we investigate how media portray an endangered species, both feared and revered. We used text mining, social network and lexical analysis to analyze 11,000 news articles dealing with Asian elephants over 13 years. We found a multifaceted image of the species with various framings. Most prevalent topics were local events recounting damages on crops, villagers' and elephants' deaths. Media also covered various topics from international traffic to conflict mitigation and conservation programs. Thematic articles depicted an institutional representation of human-elephant interactions focusing on global trends and management schemes, using a technical and sanitized lexicon. Conversely, event-driven reports were anchored in spatial and temporal lexicon, recounting elephant encounters and their specific behaviors, while quoting inhabitants with a highly emotional narrative. Our study suggests that event-driven articles highlighted the emotional response to damages caused by individual elephants rather than the demonization of the species. We suggest that, in the context of human-wildlife conflicts, fear and trauma should be better acknowledged to help reducing discrepancies found in media narratives before it fosters other sentiments such as anger and frustration that may impede conservation efforts.

1. Introduction

Over the last decade, scientists have drawn attention on the complexity of conflictual human-wildlife interactions (Peterson et al., 2010; Redpath et al., 2013). The labelling "human-wildlife conflict" has been criticized, along with raising calls for considering conflict as a component of coexistence (Hill, 2021). This perspective is particularly challenging for species that live in human dominated landscapes and interact with humans, causing potential disturbances, damages or casualties. Such interactions involve a wide range of species, from carnivores to ungulates, all the way down to rodents (Redpath et al., 2013; Nyhus, 2016; Lauret et al., 2019; Shaffer et al., 2019). Negative discourses induced by reports of incidents can undermine conservation efforts and ultimately affect the perception of a species among the public. However, communications centered on optimistic messages may also lead to public sentiments, such as disappointment, resistance and accountability towards conservation organizations (Alexander and Quinn, 2011; Mcafee et al., 2019). As a result, there is a need to better understand the perception of a species, including but not restricted to its conflict dimension.

Since media extensively cover environmental issues, they are likely to contribute to shaping public opinion of wild species conservation and human-wildlife interactions. The analysis of media coverage is of particular interest for investigating social opinion and attitudes towards wildlife and informing practitioners about the potential role of media in raising public support or defiance towards conservation programs (Jacobson et al., 2012; Bhatia et al., 2013; Muter et al., 2013; Arbieu et al., 2019). According to the agenda setting theory, media representations of a specific issue have a significant impact on the public perception of the same issue. McCombs & Show observed that the

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audience tends to identify as of importance the topics that are most represented in the media (McCombs and Shaw, 1972; McCombs, 2005).

When it comes to interactions between human and wildlife, media convey multiple framings of the same species, helping to shape public perceptions (Runhaar et al., 2015; Bombieri et al., 2018; Arbieu et al., 2021b). Framings or storylines here refers to the way a given news story is presented in the media (Sei-hill et al., 2002). Episodic frames pertain to specific events or characteristics related to an issue, whereas thematic coverage emphasizes longer-term trends or contextual factors (Jacobson et al., 2012). For instance, media coverage of black bears (*Ursus americanus*) in New York is mostly episodic and does not inform global issues that influence bear management success (Siemer et al., 2007).

Perceptions of wild species in the press are primarily studied using content analysis. This methodology has proved to be a powerful tool to investigate specific issues such as the conflicts between human and wildlife, or the comparison in valence and framing of a species between different types of media (Siemer et al., 2007; Jacobson et al., 2012; Runhaar et al., 2015; Radford et al., 2018; Dayer et al., 2019). Media content analysis allows detailed investigations through manual coding of a limited number of documents. Many of these studies have focused on conflicts with wildlife and the perception of risks (Bhatia et al., 2013; Muter et al., 2013). For example, two studies on the representations of human-elephant conflict in Indian and international media used content analysis to investigate in detail the different causes of conflicts depicted by the press and their reporting variations upon media sources (Barua, 2010; Doyle et al., 2010).

However, when studying public perception of a species, the lens of conflict-related stories may appear restrictive. Recent advances in natural language processing make it possible to search and analyze a broader collection of articles over time. Using probabilistic topic models, researchers can explore topics throughout large archives of documents, independently from their own intuition (Blei et al., 2010). Topic modelling is gaining interest for the study of media framing of wildlife perceptions and interactions as this methodology allows for multifarious topical discernment within a larger issue (Chandelier et al., 2018; Killion et al., 2019; Arbieu et al., 2021a). Among the various models, the Structural Topic Model's key innovation is that it permits users to incorporate metadata, defined as information about each document, into the topic model. In addition, the social network theory (Scott, 2011) applied to topic modelling allows to characterize the connections between topics, map the topics relationships within the corpus and study the network structure such as the aggregation of topics into wider communities depending on the strength of their connections (Kumari et al., 2019).

Species involved in human-wildlife conflicts are likely to be subject to a variety of framings in the media. The case of the Asian elephant (*Elephas maximus*) is of particular interest because of its status as an endangered, emblematic and mediatic species. The elephant holds strong symbolic and cultural dimensions, being revered as a god, a symbol-animal, and deeply rooted in cultures of South and South-East Asia (Ringis, 1996; Sukumar, 2011). The total population estimates vary between 30,000 to 50,000 individuals, although these figures are considered overestimates (Hedges et al., 2005; Sukumar, 2006; Choudhury et al., 2008). However, populations are in overall decline. Over the past three decades, the total number of Asian elephants has been reduced by at least 50 % (Hedges et al., 2005; Choudhury et al., 2008). Asian elephant populations are threatened by habitat reduction, poaching and increasing conflicts with local human communities across all its range (Sukumar, 2006; Dublin et al., 2006; Hedges et al., 2005). Conflicts primarily take the form of crop raiding and property damages but also involve casualties of both the animals and humans (Sukumar, 2011). Government and conservation organizations have embraced programs to protect the species through land planning and mitigation measures, including community-based methods for deterring elephants such as field guarding, fences and trenches or chili repellents (Gunaryadi et al., 2017). These programs are echoed by national and international press but are regularly muffled by dramatic accounts of local raids (Barua, 2010).

Our study aims at investigating how media portrays the Asian elephant – an emblematic and endangered species that is both feared and revered. Our hypothesis is that media representation of Asian elephants is not limited to a sensational framing of the conflicting dimension of human-elephant interactions. We make the assumption that media framing of Asian elephants is built on more complex perceptions of the species. To test this hypothesis, we first used natural language processing to identify the variety of topics addressed by the media and their connectivity in articles, along with network analysis to characterize how these topics are interconnected within the corpus. Secondly, we undertook a comparative linguistic analysis of topics related to the impacts of elephants on human activities, in order to describe the existing variations in the framing of this specific conflicting issue. Based on our findings, we highlight the need to address the complex and ambivalent perceptions of the Asian elephant in media, and discuss the risk of public disappointment and grievance induced by narrative discrepancies found between episodic and thematic articles.

2. Material and methods

2.1. Data collection and preprocessing

Since 2001, Save The Elephant (STE) organization has been providing free news services that disseminates English speaking daily news about elephants from around the world. The Asian Elephant mailing list is dedicated to Asian elephant with an emphasis on wild ones. Captive elephant related articles are not included unless they show relationships with wilds. STE news service administrator claims that "listserv […] try to represent all elephant stories, whether we agree or disagree with the opinions" (Elephants in the Media: A Conversation with Melissa Groo, National Geographic, January 17, 2014). STE news service articles are sent on a daily basis by email to a list of subscribers. First author registered to the Asian Elephant news list on the 6th of April 2006. Articles included in this study are ranging from this date up to May 2019.

Articles were imported as independent text files in program R (R Core Team, 2017) using the stm package (Roberts et al., 2019), keeping track of the publishing date and country. We removed the list service administrator signature, disclaimers, English stop words and punctuation. After inspecting the list of words, we combined most frequent compound names such as Sri Lanka, Viet Nam, Dak Lak, Tamil Nadu or Hong Kong into one word respectively (srilanka, vietnam, etc.). We applied a stemming process reducing words to a common root and removed all terms occurring in <55 articles—0.5 % of the corpus (Roberts et al., 2019).

2.2. Natural language processing

Natural Language processing allows to automatically organize and summarize large collections of textual information from unlabeled documents in an unsupervised way. Among various quantitative methodologies, topic modelling aims to identify semantic structures or patterns typically represented as sets of important words. Topic modelling is based on a statistical approach where topics constitute clusters of specific words or stems that co-occurred with unusual frequency (Blei et al., 2010). Articles usually comprise several topics with variable proportions, with topics being distributions of words. We used the stm R package (Roberts et al., 2019) to investigate the prevalence of topics within the corpus or an article, and explained their variations using covariates—in our case the date of publication and the country. In topic modelling, the total number of topics to be looked for is a balance between generalization versus granularity—the level of details described by the system. More number of topics can provide granularity but may become difficult to divide in clearly segregated topics. On the other

hand, less number of topics can be overly generalized and may combine different topics into one. We used a step-by-step approach to carefully select the optimal number of topics k. We first inspect semantic coherence and held-out likelihood after fitting models from 10 to 100 topics (Roberts et al., 2019) (See Appendixes S1). Based on this first investigation, we reviewed topics' most probable stems for a selected number of models (k = 25, 30, 35) and checked their coherence according to first author knowledge of the corpus. After choosing the optimal number of topics, we validate topic coherence by randomly extracting 20 articles from the corpus and manually checking their topics assignation by the model.

We used the first seven most probable stems as a label for the topic. We retrieved articles that were the most representative of a topic. We also estimated positive correlations between topics (Appendix S4), indicating that both topics are likely to be discussed within a document. The positive correlation matrix describes pairwise associations between topics and therefore can be used for building a network of topics (Kumari et al., 2019). Network analysis provides additional insight to the study of stand-alone pairwise correlations between topics, as it allows the mapping of all connections between topics and the characterization of the network topology and structure. In other words, the social network approach aims at drawing a global portray of all topics, their interconnections, their aggregation in wider communities of topics or their relative isolation within the corpus of articles. Here topics represent the nodes of the network, while the edges are given by the positive correlation between two topics. The size of nodes and thickness of the edges are defined respectively by the expected topic proportion—expected proportion of the corpus that belongs to each topic, and the pairwise topic correlation given by the structural topic model. The network graph is built using Gephi software (Bastian et al., 2009). We used modularity partition and eigenvector centrality to identify the network structure (Newman, 2006). Modularity detects communities of topics, based solely on the network topology and structure. Networks with high modularity have dense connections between the nodes within communities but sparse connections between nodes in different communities. We performed a posteriori validation of the coherence of topic communities by running the topic model based on the number of communities found in the network.

2.3. Comparative analysis of lexicon used to report agricultural destructions

With regards to the polarization of narratives reporting human-elephant interactions, we conducted a lexical analysis of topics that covered the issue of crop destructions in the corpus. We search for topics that include “elephant”, “farmer”, “crop”, “people” in their most probable stems and select them for our analysis. We extracted the 50 most probable stems of each topic in order to assess lexical variations. We categorized each stem through episodic or thematic categories, through negative or positive frame. In addition, we conducted a qualitative analysis of the 20 most representative articles for each topic by manually coding the articles, analyzing how lexical variations appeared in their context of production and identifying the type of sources quoted in each topic (Sakurai et al., 2013).

3. Results

We collected 11,006 English-speaking news articles from April 2006 to May 2019 from the Asian elephant news list. The number of articles regularly increased from 372 in 2007 to 1911 in 2018. These articles were from 15 countries or classified as ‘international’ for those related to more than one country. 6762 articles (61 %) originated from India, varying from 46 % to 74 % depending on the year. We checked for over- or under-representation of the different countries by comparing the relative proportion of articles from each country to the relative proportion of elephants living in that country over the total estimated number of Asian elephants (Chisq = 156, df = 144, p-value = 0.2335). After applying a sparsity coefficient of 0.995 to remove sparse terms, we obtained 3167 stems from an initial number of 61,152. The most frequent stem was « eleph » with >10,000 occurrences, followed by « forest » (>7500), « India » (>6500), then « wild », « offici », « area », « wildlife », « anim(al)», « depart(ment)» totalizing around 5000 occurrences each. Characters in brackets were added by the authors post-hoc to explain the meaning of the stemmed word.

3.1. Topic modelling and social network analysis

The structural topic model was run based on 30 topics (Appendix S1). The 10 most frequent words of the 30 topics are given in Appendix S2. We found 5 topics (Topic 29, 4, 22, 11, 15) showing an expected proportion over 0.05 (Fig. 1).

Apart from the five most prevalent topics, the model identified many other subjects such as elephant deaths due to electrocution (topic 25) or collision with trains (9), the crossing of roads by elephants (1), the arrest of poachers killing elephants for their tusks (27) and related court cases (20), government and ministry plans for the conservation of elephants (16, 30, 6). Several topics address conservation efforts towards wildlife and communities (12,24), transnational issues in elephant conservation (23, 14) and research (8,13). Finally, 7 topics deal with ivory trade and traffic, CITES, wildlife crime and law enforcement or customs seizures of ivory (7,28,5,2,26,10,3). As an article may include several topics, social network structure analysis brings interesting insights on how topics relate to one another within news articles (Fig. 2).

The network is structured into four different communities based on modularity partition (0.428). The first topic community, labelled “local stories”, comprises 7 topics that primarily relate to breaking news and local events in India recounting elephant attacks on people and crops, elephants found dead reported by local officials, capture of rogue elephants by officials. The five most prevalent topics (29, 4, 22, 11, 15) are included in this group. The links in-between these topics are driven by local officials' presence or reporting.

The second group named “managing elephants & humans” is made of 7 topics addressing conservation issues (collisions, electrocutions), management measures (conflict mitigation, corridors and protected areas planning) and court actions by officials from the forest department or the ministry.

The third group “conservation and research” deals with more global conservation programs, bounding communities and wildlife protection: topic 24 [conserv, people, work, community, world, local], topic 12 [conserv, protect, project, wildlife, asian]. They include transnational

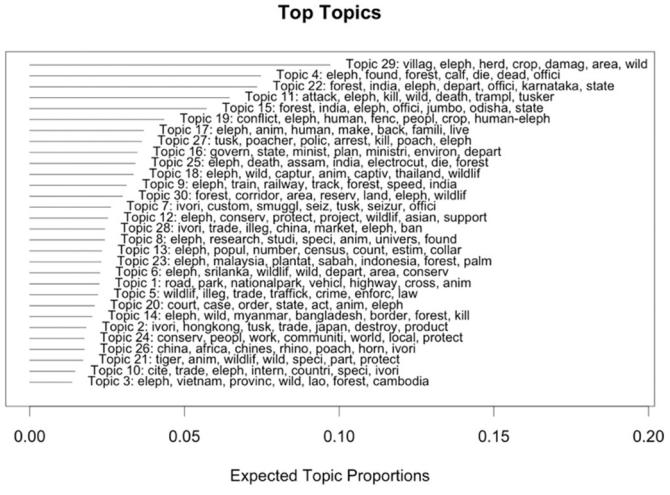

Fig. 1. Expected topic proportions for each of the 30 topics.
We display the 7 words with the highest probabilities indicated after the topic label.

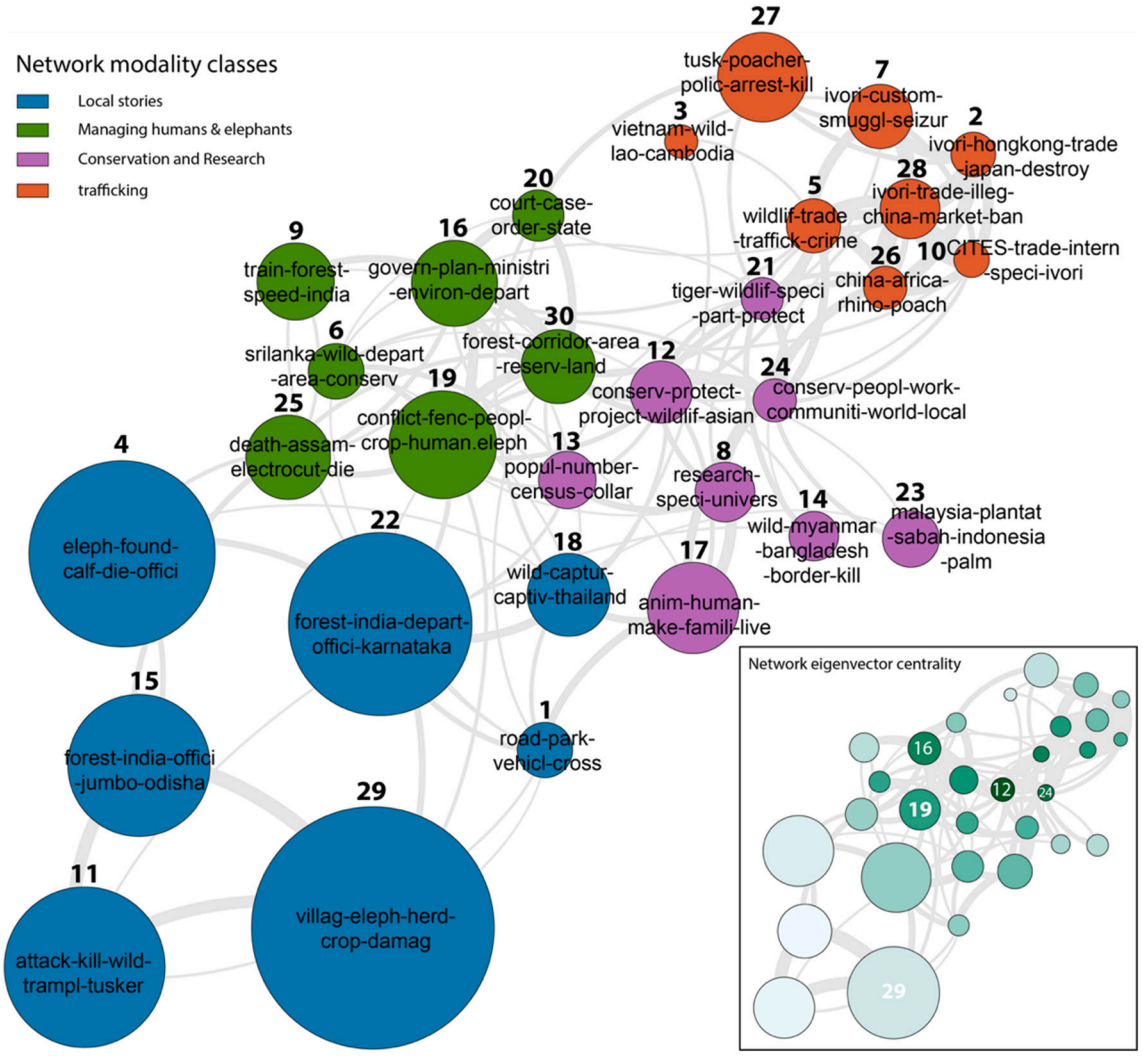

Fig. 2. Social network analysis of topics and their co-occurrence in the corpus.
Topics are defined by their numbers shown in the main graph and the insert for few topics of specific interest. Topic's most probable stems are displayed within the network nodes. Communities of topics are shown in colours and based on modularity partition. 2.b: The insert is showing the eigenvector centrality value for each topic of the network. The colour gradient depends on the eigenvector centrality value.

issues such as Malaysia-Indonesia or Bangladesh-Myanmar. Research topics also belong to this group: topic 13 [popul, number, census, collar] and topic 8 [research, speci, univers]. Topics from 'conservation & research' are also linked with government and officials management strategies.

Finally, the last community named "trafficking" gathers 8 topics with lower proportions. The majority of these deal with trafficking, smuggling, ivory, CITES, trade, seizure or destruction of ivory stocks. They address transnational issues through words like China, Hong Kong, Japan, Vietnam, Laos, international, Africa or rhino. Only Topic 27 [tusk, poach, police, arrest, kill] relates to domestic issues. All trafficking topics are highly interlinked within the group but also with the 'conservation and research' group, as well as 'managing elephants & humans' to a lesser extent.

By inspecting the eigenvector centrality (Fig. 2b), we observe that topic 12 [conserv, protect, project, wildlife, Asian] plays a prominent role in the network, followed by topic 24 [conserv, people, work, community, local] and topic 16 [government, plan, ministry, environment, department] that share the highest levels of connections across the network. However local stories that are the most common topics in the media, are quite isolated from the rest of the network. This suggests articles addressing local stories focus on facts without engaging with broader subjects such as government plans, conservation or research. In particular, topic 29 [villag, eleph, herd, crop, damage, area, wild, destroy, enter, hous] and topic 19 [conflict, eleph, human, fenc, people, crop, human-eleph, area, farmer, habitat] both frame impacts of elephants on agricultural crops but are poorly related: the co-occurrence probability of the two topics within a same article is only 0.04, indicating that articles dealing with one of the two topics do not address the other and thus suggesting that agricultural impacts of elephants have different framings in the media.

3.2. Contrasted analysis of two topics dealing with elephant damages

Contrasted analysis of topics 29 and 19, both related to the agricultural impact of elephants' incursions, enables to identify variations in media representation of human-elephant interactions. To facilitate the reading, topic 19 is labelled "Conflict" and topic 29 "Damages".

The analysis of linguistic variations, framing, valence and sources are summarized in Table 1.

The 50 most probable stems for each topic are given in Appendix S4. Among the most prevalent stems, we observe common stems related to elephant damages on crops [eleph; people; crop; farmer] and stems that are specific to each topic. Stems "conflict"; "man-elephant" and "human-

Table 1
Comparative analysis of topics 29 and 19 based on the 50 most probable stems and the 20 most representative articles of each topic.

	Topic 29: DAMAGES	Topic 19: CONFLICT
Framing	Episodic Depiction of individual incursions in fields: *elephant; jumbo; pachyderm, herd* Temporal, spatial and movement lexicon: *village; house; night; field, paddy; farm; tree; nearby; enter; move; stand*	Thematic Conflict mitigation strategies: *conflict; human; elephant; human-elephant* Institutional & technical lexicon: *Solut; prevent; measure; system; reduc; compens; mitigate; manage; habitat*
Mitigation	Villagers-based methods: *Drive; chase; (fire) crackers*	All mitigation methods quoted: *fence; solar; trench; erect.*
Valence	Strongly negative: *fear; panic; menace; havoc; scare*	Slightly negative: *problem; conflict; affect; cost*
Sources	All articles quoting direct testimonies from villagers No quotes from NGOs, scientists	Primarily quotes from NGOs, scientists, officials reporting villagers' experiences Only 2 articles with villager direct testimony
In brief	Factual depiction of attacks, elephant's behaviors & their psychological impacts using emotional vocabulary	Operational and institutional narrative with euphemistic and sanitized vocabulary

elephant" are specific to the topic Conflict, while the conflicting dimension is not explicitly qualified in the topic Damages. Articles from the Conflict topic focus on management and mitigation strategies using a technical and institutional lexicon ("solut"; "prevent"; "measure"; "system"; "reduc"; "compens"; "mitigate"; "manage"; "habitat"). In contrast, the topic Damages reports specific negative human-elephant interactions (damages on crops, human casualties). This topic is event-driven, anchored in spatial and temporal lexicon ("village"; "house"; "night"; "field"; "paddy"; "farm"; "tree"; "nearby"; "enter"; "move"; "stand"). Elephant presence is apprehended through a much stronger emotional vocabulary. Negative valence is higher for words such as "fear", "panic", "menace", "havoc", "scare" (topic Damages) than for "problem", "conflict", "affect" (topic Conflict). In each topic, conflict mitigation techniques illustrate different representations of human-elephant interactions. Topic Conflict focuses on preventive management measures as shown in the following example:

> *A project implemented in January last year on 27 farms here – at a cost of ₹5 lakh from Thrissur's Agriculture Technology Management Agency (ATMA, a district-level Central and State-funded programme) – involved setting up a two-km-long 'beehive fence' to counter man-elephant conflict.*
>
> *The Hindu*, "When bees battle elephants, farmers win (Thrissur District, India)", 2017-08-26, topic 19.

Topic Damages emphasizes local strategies that rise from specific elephants' encounters:

> *Fearing further attack, many people deserted the village on Wednesday evening and spent the night on a hilltop. "As the elephants entered the village in the evening, we left our homes and took shelter on a neighbouring hill. The elephants have completely destroyed our agricultural land," said villager Bhima Gouda.*
>
> *Times of India*, "Elephant herd runs amok in Koraput villages (India)", 2012-09-28, topic 29.

Fig. 3 illustrates how stakeholders are represented depending on the topic. "Human" and "people" are more associated with topic Conflict, while the topic Damages mentioned predominantly "eleph" and "herd". Topic Conflict is related to human strategies developed to hinder conflicting interactions while topic Damages focuses on the description of elephant's incursions in crops and villages, emphasizing the elephants behaviors during the event ("damage"; "destroy").

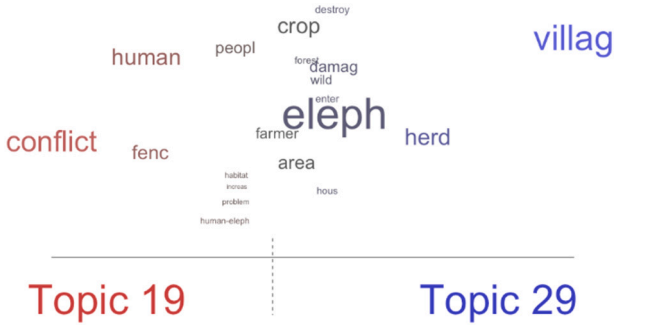

Fig. 3. Lexical variations using topics Conflicts (29) and Damages (19) as a covariate.
This figure calculates the difference in probability of a word for the two topics, normalized by the maximum difference in probability of any word between the two topics (Stm package).

We also compared the 20 most representative articles of each topic. Whether they relay improvements or deteriorations in human-elephant interactions, articles from topic Conflict do not emphasize specific descriptions of elephant encounters. Each of the 20 most representative articles of topic Conflict is based on general trends and management plans implemented to prevent damages or human and elephant casualties:

> *Wild elephants raiding crops and even attacking humans are common, particularly in the villages. This has led to farmers abandoning farming. But the WWF-India has put the technology to use. It has introduced this system, a sort of early warning system, to help protect crops of farmers from getting vandalised by pachyderms.*
>
> *Tribune News Service, "Early warning system helps farmers keep jumbos at bay", 2018-01-08, topic 19*

Articles' titles illustrate the different framings found between the two topics. For instance, titles such as "Fences, trenches have failed to check the human-elephant conflict in Karnataka" and "Bees, acrid smoke from chillies keep elephants away & reduce conflict" are associated with the Conflict topic and provide general information on mitigation methods. Titles from the topic Damages, such as "Jumbo herd on the rampage in Numaligarh" and "Elephant creates havoc in Kanchanpur (Nepal)" show an event-driven representation of the conflict. This major variation in reporting human-elephant conflict is also related to the type of sources mentioned to assess information. All of the 20 articles in topic Damages are quoting farmers or local inhabitants. Locals are thus represented as sources of information and witnesses of direct interactions:

> *Bikash Bista, a local, said, "These elephants enter our farmland on a daily basis. They have destroyed my ready-to-harvest paddy planted on two katthas of land." Bista said the elephants have already destroyed paddy worth around Rs 1.6 million this year alone.*
>
> *The Kathmandu Post, "Wild elephants destroy paddy in Ichanagar", 2018-11-02, topic 29*

But none of these articles are quoting NGOs and scientists, in contrast to Conflict articles that are all relying on these external sources. Instead, only two articles from the Conflict topic are quoting villagers' direct testimonies. Mitigation measure efficiency and technical solutions are assessed through quotes of NGO, scientists and officials who are reporting farmers' experiences:

> *During my discussions with the community, I was told that elephants had on several occasions tried to enter properties after the fencing system was erected in September 2016. Because of the shocks from the fencing, they were unable to do so. As a result, the property and crops were saved.*

IUCN, "How technology helps in human-elephant conflict mitigation", 2017-01-12, topic 19

Therefore, the Conflict framing induces a more distant representation of human-elephant interactions, centered on operational and institutional narrative using euphemistic and sanitized lexicon. The topic Damages consists in factual descriptions of attacks, elephant behaviors and their psychological impact on villagers using highly emotional vocabulary.

4. Discussion

Using text mining and topic modelling on a corpus of 11,000 news articles dealing with Asian elephants, we found that most prevalent topics are reports of local events such as damages on properties and fields, death of villagers or death of elephants. Media also cover a broad range of topics from international trafficking to management schemes undertaken by local or government officials and NGOs to mitigate conflicts or promote conservation. Through a social network analysis, we found that topics can be aggregated in four different communities of topics: local stories, managing humans and elephants, conservation and research, and trafficking. While local stories are the most frequent topics found in the corpus, they are weakly related with other topics and groups. Comparing two topics both dealing with damages caused by elephants, we found diverging framing and valence. Event-driven reports were anchored in spatial and temporal lexicon, depicting elephant encounters and their specific behaviors. Most articles from this topic draw on local inhabitants' quotes using a highly emotional narrative. On the contrary, issue-oriented topics related a more distant representation of human-elephant interactions centered on global trends and management schemes. This topic had a more neutral valence and institutional framing, sourcing NGOs informants or scientists.

The topic modelling methodology enabled us to extract meaningful information from a large set of articles over time, but it also comes with limitations that need to be discussed. First, we restricted our study to English speaking articles. National language media may differ in their reporting of elephant-related issues, framing and valence. However, this study intends to portray the elephant worldwide. Meta-analysis is often used to make generalizations across all available evidence at the global scale. Countries where English is widely used, such as India, may be also overrepresented in our corpus. However, all countries in our study do have English speaking national media and the proportion of articles from each country hosting Asian elephants reflects its own population of elephants. Moreover, we could not automatically extract the news source nor characterize the geographical scope of each media. Adding such covariates may bring additional insights on how topics are discussed depending on the media or the region. Another potential bias is due to the exclusion of captive elephants from the corpus except if there is a link with wild ones. This bias could partly explain the absence of topics dealing explicitly with the cultural significance of elephants in Asian countries, as cultural dimension may be more associated with the captive elephants. Finally, the quantitative statistical approach may lack fine scale interpretative outputs. For that reason, we chose to combine natural language processing with traditional lexical analysis of one subject of interest.

4.1. A multifaceted portray of the species

Above all, our topic modelling approach shows that media are relaying a faceted image of the Asian elephant. Our study draws a portrait of the species in media that resembles a mosaic of topics with various framings and valences. Both episodic (event driven) and thematic (issue oriented) articles are found in our corpus, unlike the media coverage of many other species such as sharks, black bears or coyotes that are mostly episodic (Siemer et al., 2007; Jacobson et al., 2012). Often blamed for negatively stereotyping these animals and their interactions with people (Alexander and Quinn, 2011; Jacobson et al., 2012; Nazareth and Nagarathinam, 2012; McCagh et al., 2015), event driven news are balanced with thematic articles that offer more contextual background, long-term trends and usually provide information on ecological mechanisms and management actions (Bhatia et al., 2013). Given the growing access and number of on-line materials, it is very plausible that most readers will be exposed to both types of articles. The variety of topics induces the presence of both positive and negative valence in the media framing of elephant related issues. On the one hand, many reports relate the damages and casualties caused by individual elephants or elephant herds, mentioning villagers' fear of elephant incursions. These articles depicting negative interactions are the most numerous in the corpus. On the other hand, the Asian elephant is also depicted as a victim of local poaching, train collisions or international traffic. Media regularly echoes epic rescues by villagers of wild elephants stuck in mud or wells. Barua (2010) noticed that Indian regional media showed a tendency to be sympathetic towards elephants. As a result, the portrayal of the Asian elephant in the media mirrors the complex and ambivalent representation of a species that is both feared and revered among Asian cultures.

Therefore, media framing analyses must build on this multifaceted representation of the Asian elephant, in particular while studying conflict issues that are inherently negatively connoted. The choice of keywords used to retrieve news articles should also take this dimension into account. Using "conflict" and "human-elephant" keywords to collect news dealing with human-elephants conflicts in India (Barua, 2010) may be too restrictive. As we have seen in our study, many articles depicting damages caused by elephants did not use the words 'conflict' nor 'human-elephant'. Conflicting dimension of elephants' incursions is shaped through multiple lexical fields that may be excluded by too selective keywords during the retrieval process of media articles. In contrast, unsupervised natural language processing—such as structural topic models—allows for a broader screening of content and sheds light on various narratives independently from the researcher's intuitions, which may be useful in other contexts extending beyond the case of Asian elephants.

4.2. Implications for the conservation of a species that is feared and revered

It has been advocated that media demonization of conflicting species can undermine conservation efforts. Previous studies showed that event driven news reports contributed to a negative image of predators through fearsome or threatening depictions (Alexander and Quinn, 2011; Jacobson et al., 2012; Nazareth and Nagarathinam, 2012; McCagh et al., 2015). The use of emotionally charged and fearful vocabulary to describe sharks and the interactions between human and shark (e.g. "man-eater", "rogue" and "attack") have "led to a criminalization of shark bites" (Neff and Hueter, 2013). Similarly, Alexander and Quinn (2011) describes the criminalization of coyotes in the narrative of newspaper articles, despite the rarity of attacks on pets or humans. Regarding Asian elephants, Barua (2010) notes that those types of stories vilify and demonize the elephant. Nazareth and Nagarathinam (2012) argue that stories of elephant attacks using strong emotional vocabulary can undermine conservation efforts. Our study shows that lexical variations between the Conflict and Damages topics highlight a polarized representation of human-elephant interactions. The highly emotional lexicon commonly found in the reports of elephants' attacks and damages outlines the villagers' emotional and psychic states induced by the event. These stories describe the psychological impact of abnormal human-elephant encounters rather than a demonization and vilification of the species, given that these negative stories are balanced by more neutral or positive ones that express a kind of empathy towards the animal (topic 4).

In contrast, thematic oriented articles dealing with elephant damages poorly addressed the psychological impacts of elephant incursions in human communities. By using "human-elephant conflict"

terminology to qualify this issue, journalists acknowledge the existence of negative interactions without addressing their emotional consequences. The importance of considering social factors for effectively resolving human-wildlife conflict has been advocated (Dickman, 2010), but the emotional dimension is still poorly addressed by conservation organizations. Various emotional responses emerge from wildlife conflicts, such as fear, grief, trauma, anger, disgust, happiness, frustration towards authorities, or the concern for animal welfare (Alexander and Quinn, 2011; Arbieu et al., 2021a). Underlining emotional impacts induced by elephant incursions in thematic articles could help enhance a better representation of human-elephant interactions in the field. Despite some nuances, most studies considered that the polarized communication surrounding conflicting species reflect the antagonist values and opinions among stakeholders and their relative closeness to conflict zones (farmers, shepherds, urban, conservationists) (Killion et al., 2019). Interestingly, an ethnographic study conducted in northern India showed that villagers could express fear following the incursion of wild elephants but still revere and pardon the animal (Keil, 2017). Additional research is therefore needed to better understand emotional and psychological impacts of human-wildlife interactions at the individual and community levels to inform conservation policies and plans. In the very least, acknowledging psychological impacts induced by human-wildlife interactions could help to reduce discrepancies found in media narratives and enhance public acceptance towards wildlife presence in human dominated landscapes.

Studying media coverage informs the perception of emblematic species that generate multiple feelings. Our study shows that restricting analysis to the conflicting aspects of human-wildlife interactions may promote an incomplete or biased image of the species. Some studies have criticized the framing chosen by journalists to report wildlife attacks, suggesting that media staff should be better informed and trained (Barua, 2010). Such initiatives are welcomed, but it appears unrealistic to re-frame most sensational stories into more thematic narratives. Journalists and media content producers will increasingly rely on short descriptive and sensationalist narratives that best fit to social and online media (Nanni et al., 2020).

Mcafee et al. (2019) stressed that realism, the full awareness and acceptance of the possibility of negative events, is needed to balance optimism bias. Consequently, articles quoting NGOS and conservationists should better address the potential emotional responses in their programs and communications instead of poorly mentioning them, to reduce the gap between rhetoric and reality. Being negative towards species does not help in solving human-wildlife conflicts but being exclusively positive or ignoring the potential emotional impacts will also not enable people to move from conflict towards coexistence.

Declaration of competing interest

The authors declare no conflict of interest.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.biocon.2023.110391.

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