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Review article

Investigating trends in human-wildlife conflict: is conflict escalation real or imagined?

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ABSTRACT

Human–wildlife conflict (HWC) has a history that is as old as human civilization; yet currently the phenomenon poses a serious environmental challenge for human society. Both due to their biogeographical and social characteristics, developing regions of the world such as South and Southeast Asia are particularly vulnerable to this problem. Although the popular perception is that HWC intensity has escalated over the past few decades, there is little published literature to support this view. We argue that insights into the historical trajectories of HWC are important to comprehend past trends and set up future priorities. As a case study, we review conflict literature from India to analyze trends in HWC in the country over the past four decades. Our analysis reveals that there has been a consistent increase in the number of HWC publications, and that nearly 90% of the country is currently afflicted by HWC. A total of 88 species belonging to nine taxonomic groups are involved in HWC. Yet, research has been limited to select species and geographical locations. We discuss potential causes for this bias and set out research directions for efficient management of this issue.

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Introduction

The existence of human–wildlife conflict (HWC) dates to human prehistory; the earliest forms of conflict occurred in the form of predation of ancestors of prehistoric man and early hominoids (the Taung Child, *Australopithecus africanus*; Berger and McGraw 2007; Lee-Thorp et al 2000). This later extended to crop and livestock deprecations, first recorded around 10,000 years ago, in the current Cenozoic era (Gordon 2009). Today, HWC occurs in several different contexts and spans a range of animal taxonomic groups and countries (Baruch-Mordo et al 2008; Davison et al 2011; Hoffman and O'Riain 2012; Okello 2005; Walpole et al 2003). Although, HWC has a long historical existence, its increasing severity and complex nature has made it a central issue to wildlife management. The increase in severity of HWC has been attributed to a number of factors, such as expansion of human activities into wildlife habitats, recovery, and expansion of a few wildlife populations and large scale environmental changes (reviewed in Treves 2008). Previously, human wildlife conflict was considered a “rural or agricultural

problem” (Messmer 2000), that mainly affects communities living in close proximity to forests. However, with increase in human population and expansion of human developmental activities, HWC incidences are now common in urban and suburban areas (Soulsbury and White 2015). Urban/suburban HWC incidents typically involve wildlife species that have a history of coexistence with humans or the ability to survive in human-dominated environments.

Currently, HWC is a global issue that encompasses a wide range of events that have adverse consequences for both humans and wildlife. With its far-reaching impacts in the domains of species conservation, protected area management and sustainable livelihoods (Bowen-Jones 2012; Dickman 2010), it is increasingly acquiring the attention of ecologists, wildlife biologists, and wildlife managers across the globe (Messmer 2000). Unmitigated conflict levels deplete local support for conservation (Hill et al 2002) and result in retaliatory killing of wildlife species (Inskip and Zimmerman 2009; Mateo-Tomás et al 2012), thus threatening the long-term survival of wildlife species. Declines in wildlife population levels tend to be associated with areas that show a high degree of conflict between humans and wildlife (Michalski et al 2006; Woodroffe et al 2005). Thus, unmitigated conflict presents a very real, perceivable threat to the long-term survival of species. It also poses a danger to human lives and is a challenge for the

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sustainability of human livelihoods (Gillingham and Lee 2003; Rao et al 2002; Sahoo and Mohnot 2004). Concomitantly, resultant economic loss due to crop and livestock damage (Brara 2013; Mackenzie and Ahabyona 2012; Schön 2013) and management of HWC drains the affected countries of financial and human resources (Lamarque et al 2009). In addition to direct, observable impacts, HWC, particularly in developing countries, creates a larger conflict of values and class, which weaken the effectiveness of state institutions (Anthony and Wasambo 2009).

Though the need for HWC mitigation is well-established, a number of factors make it an extremely complex challenge: (1) traditional methods of lethal elimination to deal with problem-wildlife is no longer a desirable option due to increasing concerns over species conservation (Sillero-Zubiri et al 2009, more examples reviewed in Treves et al 2006) or social opprobrium (Jones and Thomas 1999). This means that HWC needs to be managed in a way that is publicly acceptable and does not jeopardize wildlife conservation goals; (2) people's perception regarding conflict is not only dependent on the actual damage by wildlife but is also shaped by a number of socio-cultural factors. In such cases, conflict continues to exist even after damage-control measures have been put in place; and (3) implementation of any mitigation intervention without a comprehensive understanding of species behaviors and human social factors often fails to achieve its desired result, and in some cases, may even increase the level of conflict.

Although HWC is a global phenomenon, there are certain differences in its manifestation and magnitude across the developed and developing regions of the world. Developed regions of the world exhibit low dependency on forest ecosystems and an exclusionary management approach for wilderness areas. This essentially limits interactions between humans and wildlife to selected areas and consequently, HWC incidences tend to occur only in areas where there is a significant degree of interaction between humans and wildlife (Pack et al 2013), such as urban and suburban areas (Gompper 2002; Jones and Thomas 1999; Lay et al 2001; Poessel et al 2013). HWC in the developed world is also less about competition for limited resources (Engeman and Sterner 2002; Tzilkowski et al 2002), and instead more about the nuisance activities of wildlife that interferes with the lifestyles of residents (Townes et al 2009; Wambuguh 2008). As opposed to this, developing regions of the world such as south and south-east Asia exhibit great propensity for HWC due to their rich biodiversity and human developmental characteristics (Madhusudan and Karanth 2002). A high degree of dependence on forest ecosystems and prevalent poverty has led to unsustainable extraction of forest resources and conversion of forests into agricultural land. (Chao 2012; Sodhi et al 2010; The World Bank 2015). Data for south-east Asia shows that 14.5 million hectares of forest were lost during 2000–2010, primarily due to cash crop plantation (Sodhi et al 2010). Overlapping resource use increases interactions between humans and wildlife leading to high incidences of conflict (Treves et al 2006). The existing state of HWC in the developing world is most likely to increase in the future due to several factors such as “expanding human settlement, growth of outdoor recreation, and the increase of species adapted to living in human dominated landscapes” (Manfredo 2015).

The HWC scenario in India may be considered representative of the conflict situation in south and south-east Asia. Incidences of HWC involving numerous species have been widely reported from different parts of the country. Although the popular perception is that HWC has increased in intensity over the past few decades (Sinu and Nagarajan 2015, Sundriyal and Dhyani 2014), there is no published literature to support this view. There is also little information on the geographical distribution of conflict or the total

number of species involved in conflict currently. To address this research gap, we analyzed HWC literature from India, to assess: (1) changes in the geographical distribution of HWC over time; (2) the number of species involved in conflict and changes in their relative representation over time; and (3) prominent themes in HWC research and any changes in such concerns over time. Additionally, we also aimed to analyze the magnitude of conflict intensity over time in order to substantiate/disprove the popular perception regarding increasing level of HWC in India.

Materials and methods

We conducted an internet-based search of online cross-reference databases namely Web of Science, Scopus, Google Scholar, JStor, and Springer to obtain literature for our review. We used different combinations of keywords such as “human-wildlife conflict” AND India, “wildlife damage” AND India, “animal damage” AND India, “crop depredation” AND wildlife AND India, “crop depredation” AND animal AND India, “crop loss” AND wildlife AND India, “crop loss” AND animal AND India, “crop depredation” AND wildlife AND India, “crop depredation” AND animal AND India, “livestock depredation” AND wildlife AND India, “livestock depredation” AND animal AND India, “livestock mortality” AND wildlife AND India, “livestock mortality” AND animal AND India, “human attack” AND wildlife AND India, “human attack” AND animal AND India, “human injury” AND wildlife AND India, “human injury” AND animal AND India, “human mortality” AND wildlife AND India, and “human mortality” AND animal AND India”. The time period for the search was limited from 1900 to present. Types of resources searched for were limited to journal articles, conference proceedings, reports, and magazine articles. The minimum requirement for a literature resource to be included in the analysis was the presence of a fully accessible abstract. Obtained search results were included in the analysis, only if the study was based in India and it focused on at least one wildlife species. Approximately 37% of our total search results referred to crop damage caused by insects; these were not included in the analysis. We excluded insects from our analysis primarily because insect damage to crops comes under the domain of crop pest management, where the entire focus is on the lethal elimination of damage-causing species. Management of crop loss due to larger vertebrates, however, is a rather more complex issue due to differing human perceptions regarding animal species and varying wildlife conservation and management practices across the globe. In order to check for changes with respect to time, we classified available records into two time periods of 20 years each (1976–1995 and 1996–2015) and then carried out our analysis. The date of publication could not be established for a small percentage of the search records ($n = 8$). We categorized search records in terms of geographical distribution of conflict incidences, taxonomic identity of conflict species, forms of conflict, and focus areas of study investigation. In order to assess changes in geographical distribution of conflict incidences over time, we extracted study location/area of focus for each record, listed the parent state, and identified if conflicts occurred in sites formally protected/not protected by the forest department. We also calculated the total (unique) number of times a state was mentioned as a conflict location in a search record or a wildlife species was mentioned as a conflict species. To evaluate changes in conflict intensity over time, we listed all reported instances of livestock depredation and human injury or death and plotted it across the years. However, a similar analysis could not be carried out for crop depredation, as various studies differed in their measurement of crop damages.

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