Journal of Threatened Taxa

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION

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26 June 2018 | Vol. 10 | No. 7 | Pages: 11844–11849
10.11609/jott.3015.10.7.11844-11849

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Journal of Threatened Taxa | www.threatenedtaxa.org | 26 June 2018 | 10(7): 11844–11849

ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

OPEN ACCESS

Assessment on the impacts of human-tiger conflict and community-based conservation in Bandhavgarh Tiger Reserve, Madhya Pradesh, India

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Abstract: Bandhavgarh Tiger Reserve (BTR) is one of the famous tiger reserves in India, situated in Uamria District of Madhya Pradesh. Data on human-tiger conflict were collected from the forest record during the period from 2001 to 2011 and a questionnaire survey was conducted to know the level of human-tiger conflict. A total of 27 human casualties were recorded, of which 40.75% were lethal (death) and 59.25% were injuries. A total of 1,603 livestock killing were recorded by tiger, of which consisting of 76.54% (1227) cattle (cow/ox), 22.52% (361) buffaloes and 0.93% (15) goats. Illegal entry into the core and buffer area for collection of minor forest produce, daily needs, and livestock grazing were observed to be the major reasons behind the existing conflict. Poor livestock shelter was also found responsible for mauling of cattle by tigers. The forest department had provided adequate compensation for the losses, but most of the respondents were unsatisfied due to assorted reasons. Poaching and retaliation killing of tiger is also a serious issue in and around BTR. A total of four tiger poaching and one revenge killing case was recorded. Conflicts create a negative impact on people, even then majority of the respondents (83.89%) felt the necessity for tiger conservation. Wildlife habitat improvement, restocking of prey base by translocation of herbivores, fencing of protected areas, controlled grazing and rangeland management, adequate compensation, eco-development, promoting the use of toilets in surrounding villages for safety, proper housing of livestock, and community-based conservation are some options for control and management of human-tiger conflict.

Keywords: Bandhavgarh Tiger Reserve, compensation, conflict, human casualties, livestock depredation, prey base, restocking.

DOI: http://doi.org/10.11609/jott.3015.10.7.11844-11849

Editor: Hari Balasubramanian, EcoAdvisors, Nova Scotia, Canada. **Date of publication:** 26 June 2018 (online & print)

Manuscript details: Ms # 3015 | Received 31 October 2017 | Final received 24 March 2018 | Finally accepted 29 May 2018

Citation: Chouksey, S. & S. Singh (2018). Assessment on the impacts of human-tiger conflict and community-based conservation in Bandhavgarh Tiger Reserve, Madhya Pradesh, India. *Journal of Threatened Taxa* 10(7): 11844–11849; http://doi.org/10.11609/jott.3015.10.7.11844-11849

Funding: Self-funded.

Competing interests: The authors declare no competing interests.

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Author Contribution: SC - Study design and Data collection. Compilation of the results, analysis and writing the manuscript. Making all the correspondences pertaining to the manuscript. SS - Obtaining necessary permissions for the study, designing the synopsis, data compilation, analysis and interpretation; and drafting and finalizing the manuscript.

Acknowledgements: We would like to acknowledge Forest Department of Madhya Pradesh for providing necessary permission to carry out the research work. We would like to thank all the colleague, teachers and friends of the School of Forestry and Environment, SHUATS, Allahabad, UP for their support. Special thanks to the family. The study would not have been possible without their support and assistance.

INTRODUCTION

The rising human and livestock population around tiger reserves often leads to increasing interfaces of humans and tigers in many places across their range often results in human-tiger conflict situations. Tigers share common land with humans from time immemorial. The explosion in human population with the rising demand for agricultural and grazing land, however, has left the tiger struggling for its very survival. Tigers have two ecological requirements that place them in direct conflict with humans. First, they need large areas of forest habitat (Sunquist 1981; Smith et al. 1987), and second, they require abundant large prey (Smith et al. 1987). Tigers are severely affected by anthropogenic factors because of their involvement in conflicts with humans historically and even today. Tigers mostly survive in small numbers in protected areas which are isolated due to habitat fragmentation and disturbances.

As growing human population encroaches further into natural habitats, people and tigers are increasingly competing over living space and food. Large forest tracts have been degraded and fragmented for constructing rail routes and roads. Fragmentation of forest, expansion of agriculture fields, human settlement, mining and dams not only destroy the habitat of wild tiger but also expose tiger to straying out to people creating conflict with humans. The human activities tend to move out the tigers from such disturbed forests in human settlement in search of food, water and shelter, causing conflict situations.

Human-tiger conflict is frequently associated with attacks on humans and livestock depredation. In the past humans hunted tiger's prey, leaving them with less and less to eat. If tigers do not have enough prey they will instead hunt domestic livestock, which many local communities depend on for livelihood. When tigers kill or predate upon humans, they are treated as enemies and declared man-eater or man killer, and humans often kill them. Human-killing is the ultimate expression of human–tiger conflict. It is a complex issue that needs to be addressed to maintain support for tiger conservation in areas where human killing is prevalent (Gurang et al. 2008). Conflict with people and their livestock is a significant source of mortality for large carnivores and there is an urgent need to characterize and develop measures to reduce these conflicts (Nowell & Jackson 1996; Woodroffe & Ginsberg 1998; Linnell 1999). Local people might take advantage of depredations on domestic animals as an opportunity to poach a tiger when it returns to feed on the carcass of depredated livestock (Johnson et al. 2006).

Bandhavgarh Tiger Reserve (BTR) is one of the famous tiger reserves in India having a large number of tigers in a small area. The human-tiger conflict is on the rise in the area for the past few years and several cases of tigers attacking humans have been recorded. Without a better understanding of human-tiger conflict and a concerted effort to proactively address the problem, future landscape-level tiger conservation and management efforts may be jeopardized (Nyhus & Tilson 2004).

Therefore the present study was planned to estimate the level of existing human-tiger conflict, factors associated with conflict and impacts on the community based conservation.

MATERIALS AND METHODS

Study Area

Bandhavgarh Tiger Reserve lies in Zone 6E - Deccan Peninsular Central Highlands. It supports a corresponding platitude of fauna. The reserve has earned reputation worldwide for its high density of tigers. Located between the Vindhya and the eastern flanks of Satpura hill ranges. The reserve falls mostly in Umaria District and a chunk of 19.26km^2 in Katni District of Madhya Pradesh (Fig. 1). The area of the tiger reserve is 1161.471km^2 including both the units of protected area and buffer area. The reserve lies between 23.502–23.952^{0}N & 80.784–81.195^{0}E. The tiger reserve has six ranges namely Tala, Kalwah, Patour, Magdhi, Khitoli and Panpatha (Fig. 2) (Prakasam 2005).

Methods

The present study was conducted between July 2011 to June 2012 in and around Bandhavgarh Tiger Reserve. Secondary data on human casualties, livestock depredation, poaching and compensation were collected from the forest department archives. While primary data was collected by direct observation and monitoring were made by visiting conflict site/village time and date of conflict, activity of victims and livestock-tiger interface were recorded. The evidence such as pugmark, scratch marks, human mauling, livestock depredation, etc. were observed.

Questionnaire surveys were performed in peripheral villages. Twelve villages were randomly chosen for survey from the six forest ranges (Tala, Kalwah, Patour, Magdhi, Khitoli and Panpatha) of BTR. Two villages from each range were chosen. The pre-testing of questionnaire was also done. Total n=180 surveys were carried out. Discussions were also made with the village council and local residents to get the basic information about existing conflict. Mean, standard deviation, standard error and chi

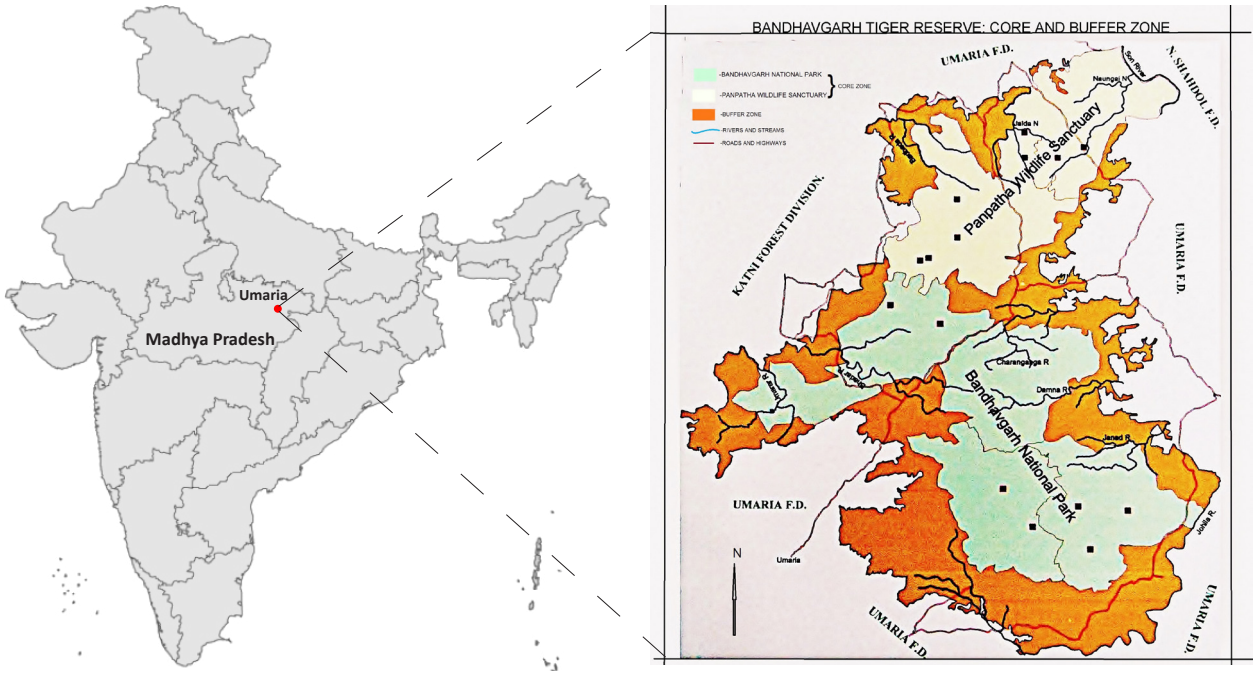

Figure 1. Location of Bandhavgarh Tiger Reserve in Umaria District of Madhya Pradesh, India

Figure 2. Different ranges of the Bandhavgarh Tiger Reserve

square test were calculated using MS excel and statistical tool (R Studio).

RESULT AND DISCUSSION

Human casualties

A total of 27 human casualties were recorded, out of which 11 humans were killed and 16 were injured by tigers from the year 2001 to 2011 (Fig. 3). No deaths were recorded between the year 2001 to 2005. Out of 27 human casualties, 22 were male and five were female. Maximum human injuries were recorded during the rainy season (12) followed by summer (8) and winter (7). Among the six different forest ranges maximum casualties were recorded in Panpatha range (5), followed by Khitoli range (4), Patour range (3), Tala range (2) and Kalwah range (2), with no injuries recorded in Magdhi range in any year.

Livestock depredation in and around BTR

A total of 1,603 livestock killing cases were reported from the year 2001 to 2011 in BTR, out of which 1,227 (76.54%) were cattle (cow/ox), 361 (22.52%) were buffaloes and 15 (0.93%) were goats (Table 1; Fig. 4). The mean of livestock killing per year by tiger attack was 204.5±29.29 for cattle; 60.17±6.44 for buffalo and 2.5±0.98 for goat. Maximum livestock killing were reported in Khitoli Forest Range then Patour, Kalwah, Panpatha, Magdhi and Tala (x^2=92.3, df=10, P< 0.00001). Livestock grazing in core and buffer area were found to be the main reasons behind livestock depredation.

Table 1. Human-wildlife conflict incidents in Bandhavgarh Tiger Reserve between 2001 to 2011

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Human casualties												
Death	0	0	0	0	0	2	1	2	2	1	3	**11**
Injury	0	2	3	1	1	2	1	1	1	2	2	**16**
Total	**0**	**2**	**3**	**1**	**1**	**4**	**2**	**3**	**3**	**3**	**5**	**27**
Livestock depredation												
Cattle (cow/ox)	9	24	64	81	51	105	67	127	152	193	354	**1227**
Buffalo	3	11	22	45	19	21	18	55	44	54	69	**361**
Goat	0	0	0	0	0	0	1	1	0	2	11	**15**
Total	**12**	**35**	**86**	**126**	**70**	**126**	**86**	**183**	**196**	**249**	**434**	**1603**

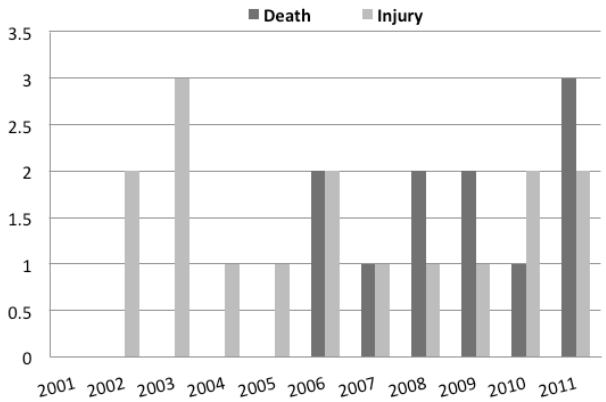

Figure 3. Human casualties (Deaths and Injuries) from 2001 to 2011

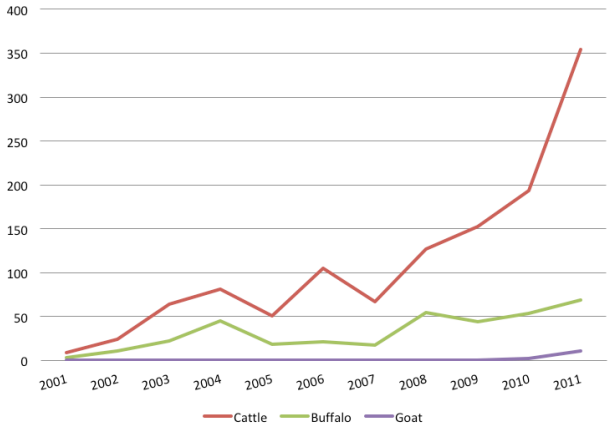

Figure 4. Showing rising trend of livestock depredation from 2001–2011

Attitudes of local inhabitant towards conflict and conservational aspects

Discussions and surveys were conducted with affected people to know the views about existing conflict and its alleviation. A total of 180 survey were conducted, of which, 82 (45.55%) felt that a tiger attacks when humans approach to their range, 61 (33.88%) believed that humans are easy prey for them, 22 (12.22%) suggested that a tiger attacks during minor forest produce (MFPs) and timber collection, 3 (1.67%) considered attacks while illegal hunting and 12 (6.68%) felt livestock grazing in protected areas to be responsible for tiger attacks on humans. Of 180, 83 (46.11%) respondents lost their livestock due to attack of tiger, 34 (18.89%) by other carnivores while 63 (35%) did not report such losses. Of 63 (35%) respondents believed livestock grazing in tiger habitat being the major reason of livestock depredation followed by 31 (17.22 %) noticed less number of natural prey in the reserve, 51 (28.34%) considered livestock killings being an easy prey, 20 (11.11%) found these attacks by chance and 15 (8.33%) considered other reasons behind the livestock depredation by tigers. Out of 180, 151 (83.89%) respondents opined that tigers should be conserved, while 29 (16.11%) felt that such conservation was not required. Among those who deny conservation measures, 16 (55.18%) stated that livestock killing are the reason for their denial, 8 (27.58%) considered the animal a threat to human life, while 5 (17.24%) stated other reasons.

Out of 180, 111 (61.66%) believed the best conflict alleviation method is to relocate the problematic tigers to other places, 38 (21.11%) suggested creation of a physical barrier, 19 (10.56%) suggest possibility of using lethal methods, 12 (6.67%) considered habitat improvement be the most feasible methods to alleviate conflict.

DISCUSSION

Rising human population is creating biotic pressure in and around the Bandhavgarh Tiger Reserve that led to human mauling and casualties. High rate of human population growth and the successfully restored habitat

Image 1. (A) - A herdsman mauled by a tiger showing the site of attack in Buffer zone of BTR; (B) - Tiger scratch marks in a house after it entered in Nadavan Village; (C) - A person whose son was killed by a tiger; (D) - Track formed in the crop field due to dragging of a cow by tiger from poor animal shed in Ghaghud Village; (E) - Poor livestock shed from where a tiger lifted a cow during night hours in Majhkheta Village; (F) - A case of livestock depredation by tiger in the crop field at Bagdara Village in Khitoli range. © Sandeep Chouksey

in the community forests of in Bardia National Park, Nepal have accelerated the conflicts due to the dispersal of tigers into these forests where they share these resources (Bhattarai 2009). Human-tiger conflicts tend to be more frequent near forest edges at the interface of human and tiger activity, and in areas of high human density (Nyhus & Tilson 2004; Miquelle et al. 2005; Gurung et al. 2008; Nugraha & Sugardjito 2009). Lethal or serious attacks on people often lead to retaliatory or defensive killings, which result in additional injuries to people and/or carnivores (Sillero-Zubiri et al. 2006). In 2008 and 2009 two tigresses were poisoned in Bandhavgarh Tiger Reserve by villagers in an act of revenge for having allegedly killing of their cattle (Williams & Seigal 2010).

The population of livestock were reported more than 48,200 in villages around the reserve including in the proposed Buffer area. Cattle rearing is a common occupation of the people and they have large herds of unproductive and poor quality cattle which graze in and around the tiger reserve. During summer the area becomes dry and thus water and fodder scarcity was seen. As there is no practice of stall feeding, villagers let loose

Image 2. Fencing done by forest department in some parts of Bandhavgarh Tiger Reserve

their cattle into the forest. This huge cattle population exerted tremendous biotic pressure on the resources of the Reserve. The study conducted in Bardia National Park reported the livestock grazing and human intrusion into tiger habitat besides poor husbandry being the causes of conflict. It is advocated to improve the cattle breeds by adopting and implementing cross breeding programmes (Bhattarai 2009). Thus, the villagers will be promoted to focus on high yielding cattle instead of keeping large number of less productive stock. The grazing should be controlled and strictly prohibited. Grazing and rangeland development practices would be a better way to reduce the grazing pressure and entry of livestock in protected areas. The poor livestock shelter was also reported to be the reason behind cattle lifting. Tiger often lift the animal in the night. The livestock housings should be properly protected. Livestock insurance system can be adopted for a reasonable compensation for livestock damages.

Though the collection of MFP is restricted in core zones it becomes difficult to prevent the local people from collecting MFP as it is one of the major sources of their livelihood. People often collect these items from the buffer zone and sometime also from the core zone. Most of the attacks were reported during MFP collection. Toilets need to be constructed in the villages to avoid the unnecessary movement of peoples near forest areas for defecation.

Compensation is paid to villagers for human life loss and injury and livestock predation by the forest department of Madhya Pradesh. State government of Madhya Pradesh provides Indian Rupees (Rs.) 100,000 for human death and Rs. 20,000 for injury. For the loss of livestock Rs. 10,000 to 5,000 is paid. Eco-development committees were founded by the forest department in villages present in and around BTR. Fencing is used to reduce the intensity of human-tiger conflict but is expensive if done properly (Image 2).

Wildlife habitat improvement has a significant role in mitigating conflict. Tigers often come out of the forest in search of food, water and shelter. Conservation education and awareness of local people may be a useful tool in conflict mitigation strategy. Conservation education can change the attitude and behavior of people and increases the tolerance of losses (Matarasso 2004).

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Journal of Threatened Taxa

www.threatenedtaxa.org

OPEN ACCESS

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

June 2018 | Vol. 10 | No. 7 | Pages: 11831–11998
Date of Publication: 26 June 2018 (Online & Print)
DOI: 10.11609/jott.2018.10.7.11831-11998