



ISSN 2248-9649

International Journal of Research in Chemistry and Environment

Available online at: www.ijrce.org



Research Paper

Assessment of Human-Elephant Conflicts, Vulnerabilities and Sustainable Mitigation Approaches in Omkar and Kundakere Ranges of Bandipur National Park

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(Received 06th February 2016, Accepted 20th February 2016)

Abstract: Human-elephant conflict impact is upon the wellbeing of the people and their assets worldwide. Conservation of wildlife has been a big challenge in human dominated landscapes as they frequently come into conflict with humans. It is one of the major threats for long-term survival species of wildlife and land use patterns of the region. Human-elephant conflict data was collected during 2014–2015 at Omkar and Kundakere ranges of Bandipur National Park by following the standard survey techniques. Information about conflict area, conflict reasons, its vulnerabilities, habitation, land use patterns and current mitigation methods were collected from 60 pre-identified informants. A GIS technique was used for coordination of forest boundary, conflict zones and severity of conflicts around the study sites. More than 180 incidents of conflicts were reported within Omkar and Kundakere ranges with a high intensity. Crop damage was reported as the most common and frequent impact along with the death of humans and elephants. About 95% of respondents have the perception that human-elephant conflict has increased gradually from the last three years due to destruction of natural habitat, encroachment, crop pattern and other natural calamities like drought and uncertain diseases in forest plants. A significant number of human-elephant conflicts were reported only in Omkar and Kundakere ranges when compared to other ranges of the reserve forest. This is due to location of this region towards human habitats with severe fragmentation and encroachment of elephant corridor and natural habitats. In addition to that, severe deforestation, location of peripheral highways and agricultural land and failure of elephant ride barrier in these ranges were the reasons for frequent conflicts and impacts between humans and elephants.

Keywords: Human-elephant, Bandipur National Park, Omkar range, Kundakere range, GIS, land use pattern.

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Introduction

Wildlife constitutes a vital link in the survival of human species and it is a subject of interest, fascination and research all over the world. In recent years, habitats of wild animals are under destruction and a large number of species of wildlife have become endangered and at risk. The effective conservation of wildlife is very important in order to maintain the ecological stability. India has a rich heritage of diverse wild animals with a long history and tradition of conservation of the ecosystem by the ashrams of the sages, which were the seats of learning in the country's history. India is unique and diverse in the richness of its wildlife and conservation strategies. Human-wildlife conflict is the act between wild animals and people that result in a negative impact on the people and wildlife,

assets and habitats. It is mainly occurring due to the enormous growth of human population, encroachment of natural habitats of wildlife and other natural calamities, thereby creating a shortage of space and resources for wildlife habitation [1-5]. Human-wildlife conflicts are common in various parts of the country and many conflicts have been reported from the union territories as well. The conflicts between humans and wild elephants in India are more than the other human-wildlife conflicts. Due to later expansions of human populations and man's activities in wildlife's habitats, natural wildlife territory and resources are displaced. Shortage of basic resources such as natural food and water sources in the natural habitats are leading to wild animals seeking alternate sources in human habitats. The population of both the elephants and humans is

increasing and this overlaps with the same geographical areas and causes the physical conflicts. Growing human population and his activities like encroachment and interference, a decline in the prey species, deforestation, other natural calamities, etc are the major reasons for human-elephant conflicts in India. Encroachment and harvesting of enormous natural resources in natural habitats and peripheral agricultural activities are the serious causes of conflicts [5-6]. The elephants are the largest terrestrial mammals of India and they require large geographical areas for their habitation with enough resources. According to Hindu mythology, the elephant took birth from celestial waters and they are closely associated with water rich or rain forests. The requirement of water and food for elephants is very high and their population can be supported by only forests that are under optimal conditions. About 50% of the Asian elephant population are distributed in different parts of India. The current distribution of the wild elephants in India is confined to south Indian forests. In Karnataka, the elephant population is distributed in two reserves that are Bandipur and Nagarhole National Parks. Wild elephants do not cause any overall damages when taken at the regional level and within forest areas. Elephants elicit the greatest fear from the rural communities because they have potential to destroy the properties, cause crop damage, human death and injuries. Consequently, human-elephant conflicts are the cause of severe concern in the elephant conservation in both Asia and Africa [7-8]. Today, managing and mitigation of human-elephant conflict is one of the greatest challenges of local conservation authorities and ministries in Asia and Africa and debates on conflicts are now becoming more public as well as political. Across the world, it is generally accepted that conflict affects public support and builds animosity against wild elephant conservation. It may affect the wild elephant conservation strategies at individual levels through the processes of extinction, population suppression and behavioural changes [9-12]. The elephant is one of the most conflict-prone wildlife species in India and it causes large-scale damage to crops production, human lives, assets, etc. In India, nearly 275-330 people and 100-150 elephants are killed or injured each year along with crop and asset damages. Destruction and fragmentation of elephant habitats and corridors, encroachment, deforestation, failure and mismanagement of physical barriers, land use patterns, etc are causing the human-elephant conflicts in the country. Especially in the south, a better scientific assessment of human-elephant conflicts and mitigation measure strategies are required along with restoration of natural habitats. In the present study, we have attempted to quantify the human-elephant conflicts and causative factors around the Omkar and Kundakere ranges where conflict frequency is high. Demographic factors such as a habitat loss, crop patterns, human behaviour and livestock density, and other causative factors are considered as key motive factors of conflicts. The results obtained are illustrated by using geological information system tool and sustainable

mitigation approaches of human-elephant conflicts is stated based on the local conditions.

Material and Methods

Study area

Bandipur National Park lies in between the latitudes 11°35'34" N and 11°57'02" N and the longitudes 75°12'17" E to 76°51'32" E. It covers an area of 868.63 sq km and shares boundaries with Nagarhole National Park (Karnataka) to its northwest, Wynaad wildlife sanctuary (Kerala) to its southwest, Mudumalai wildlife sanctuary (Tamil Nadu) to its south. It was established in 1974 as a tiger reserve under Project Tiger; it is located in Karnataka. Bandipur National Park is known for the variety of its wild animals and diverse biological resources. It consists of two sub-divisions with 11 major forest ranges such as Gundre, Begur, Moliyur, Ainurmarigude, Hediya, Maddhur, Moolehole, Gopalswamy Betta, Omkar, and Kundukere. On the basis of recent human-elephant conflict intensity areas, Kundukere and Omkar ranges are categorized as a high risk zone in Bandipura National Park. Maddhur ranges, Gopalswamy betta, and Hediya are categorized as medium risk zone and Gyndre and N. Begur ranges can be considered as low risk zone. In addition to this, territorial ranges like Gundlepet of Kollegala division, Sargur and Nanjungud of Mysore divisions are also affected by elephants that are migrating from the Bandipur National Park. All these reserved areas are part of the Nilgiri biosphere reserve, which is the favourable ground for the Asian elephant. Two national highways connecting Mysore - Ooty and Mysore - Calicut pass through the park. Omkar and Kundukere ranges were selected for the present study to assess possible causative reasons for high conflict incident in the regions and the map of the study areas in Bandipura National Park is shown in Figure 1.

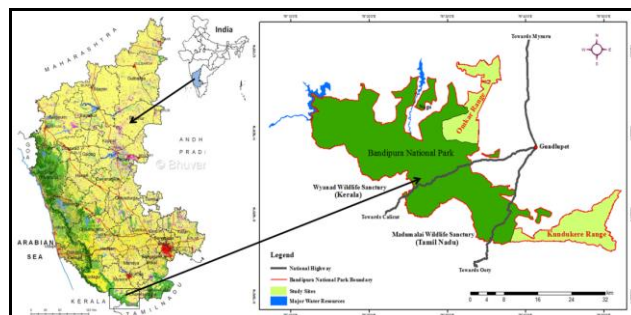


Figure 1: Location Map of study areas: Omkar range and Kundukere ranges of Bandipura National Park

Required data on human-elephant conflict incidents were collected during 2014–2015 (from February 2014 to January 2015) at Omkar and Kundakere ranges by following the standard survey techniques. Information related to conflict spots, habitat status, causative reasons, vulnerabilities, peripheral human communities and interferences, land use patterns, current mitigation methods, etc were collected by using a well-designed questionnaire

and field survey. During the field survey, frequent visits to conflict spots, elephant habitats and corridors, peripheral croplands were carried out along with personal interview and group discussions. Required information was collected from 160 pre-identified local informants (115 men and 35 women) including, local farmers, villagers, workers, other employers; forest staffs (guards, officers and rangers) and recorded documents in the forest and agricultural departments. Behaviours and perspective of local communities on elephant rides and conflicts were personally collected and documented during the field survey. The routes and locations of conflict, habitats and corridors were extracted from the forest department records and with the help of field staff. As collected information was verified during survey and conflict locations, frequencies, buffer zones, etc were coordinated by using GPS instrument (Trimble Judo™ series). Geographic information tool (Arc GIS 10.2.2) was used to analyze the conflict incidents, forest boundary, conflict zones and severity of conflicts around the study areas. Based on the results obtained and considering local conditions, the sustainable mitigation approaches are recommended to control human-elephant conflicts and habitat loss.

Results and Discussion

Human-elephant conflict intensity in Omkar and Kundakere ranges seems to be critical in contrast to other areas of Bandipur National Park in southern India. Around 812 human-elephant conflicts were recorded in and around the Bandipur National Park (11 major forest ranges) and about 180 conflicts were extensively reported around Omkar and Kundakere ranges of the Bandipur National Park. The distribution of human-elephant conflict incidents and coordinates around study areas are shown in Figure 2. The mean human-elephant conflicts frequency of 11 ranges in National Park was 16.36 and mean human-elephant conflicts frequency of these 2 ranges was 90 which are comparatively higher than other ranges. Conflicts incidents were reported in all the seasons across the year around these two ranges but frequency was critically observed only in the winter and summer seasons and conflict incidents in different months around Omkar and Kundakere ranges are illustrated in Figure 3. In winter, the conflicts coincided with the peaking of post-monsoon (November to January) during the harvest season of the annual crops like Paddy, Sugarcane, Ragi, Dal, Corn, Lettuce, Peas, Watermelon, Beans, Celery, etc. The elephants prefer these crops more than the regular wild plants in their natural habitats. Many research reports also suggested that elephants in regions prefer crops over wild plants for their greater palatability and nutritional contents^[13-19]. Due to the shortage of food and water availability within the natural habitat in summer seasons (March to June), the wild elephants travel towards human habitats for finding water resources and regular crops grown by farmers. The present investigation revealed less conflict incidents during pre-monsoon season (July to October) due to the availability of enough food and water sources within the elephant habitats. The possible reasons

for high conflict frequency in Omkar and Kundakere ranges could be fragmentation of the natural habitat by encroachment and large-scale settlement of villages at the periphery of these ranges. Many villagers have come up in Omkar and Kundakere regions by encroaching the forest area for agriculture and other recreational activities.

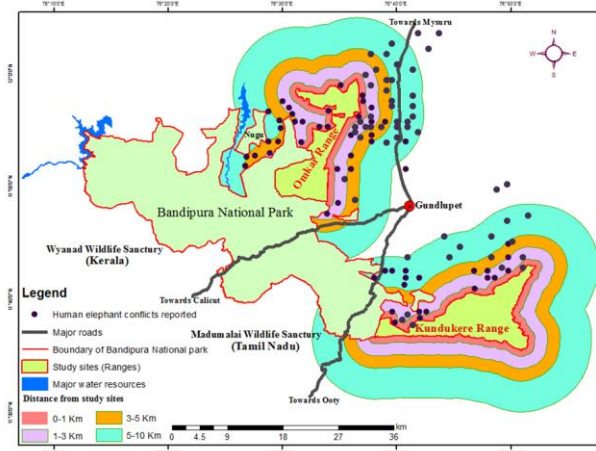


Figure 2: The distribution of human-elephant conflict incidents and coordinates around Omkar and Kundakere ranges of Bandipura National Park

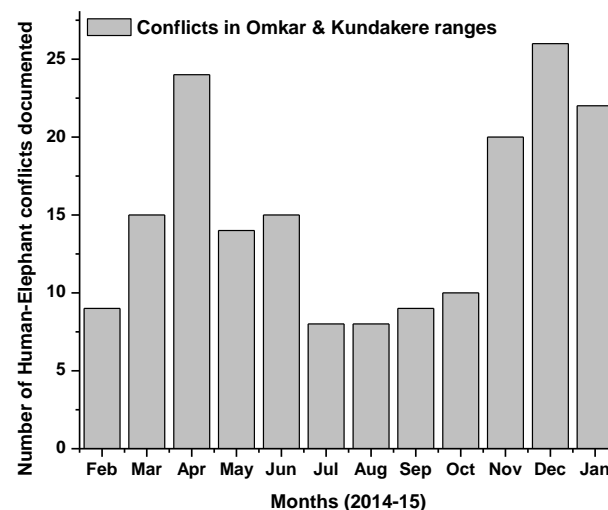


Figure 3: Human-elephant conflict incidents in different months around Omkar and Kundakere ranges of Bandipura National Park

The study revealed that elephants have an ancient route (corridors) from Bandipura National Park towards Satyagal and Tamarakarai forest areas and through the periphery of Omkar and Kundakere ranges that have been encroached and converted as agricultural lands. A large number of villagers have settled within the periphery of these ranges thus disturbing the elephant corridors and the normal movement on the elephant paths. The existence of villages with 80-300 houses within encroached forest areas and across the elephant corridors is one of the important causative factors for conflict incidents. Also, three national

highways that pass through elephant corridors and periphery of these two ranges have bi-furcated the elephant corridors and disturbed the natural habitat that interfused the human beings and wild elephants, thereby causing conflicts. The ultimate human-elephant conflict consequences such as crop damage, injuries and death of both human and elephants and asset damages have been reported frequently at peripheral villages and agricultural land around Omkar and Kundakere ranges. The study exhibited that frequent elephant rides have damaged several hectares of sugar cane (12-15%), ragi (18-21%), maize (10-13%) grains (15-19%) and other biennial crops in the study areas. Uprooting of banana and coconut cultivations for consumption was common in several infringing villages around the study areas. About 79 % of conflicts have been reported at agricultural lands, followed by forest boundaries (7%), beside high ways and roads (5 %), water bodies (2%) and others areas (7%). Human-elephant conflicts intensities were observed comparatively higher around the agricultural lands in the study regions and conflicts intensities at different spots are illustrated in Figure 4. More than 23 human deaths and serious injuries were reported during the investigation and acute conflicts were reported at peripheral village boundaries of study areas. Total 9 high risk zones as shown in Figure 5 are identified in the study area based on the conflict frequencies. More number of human-elephant conflicts was reported from 0-20 kms (Figure 2) distance from the forest boundary and in rare cases, it extended up to 50-100 kms.

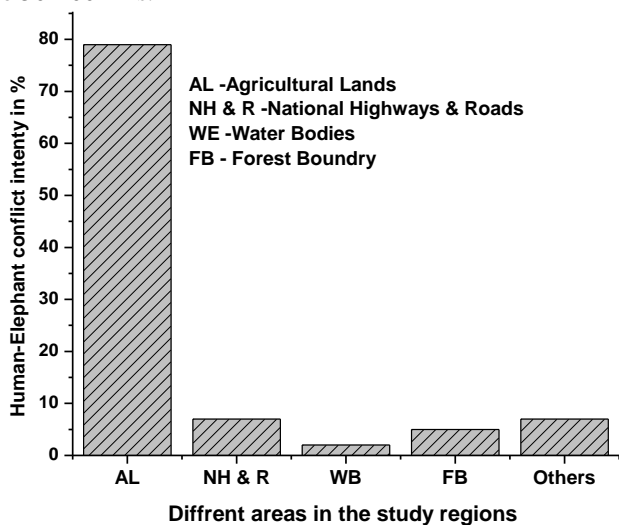


Figure 4: Human-elephant conflicts intensities at different spots around Omkar and Kundakere ranges of Bandipura National Park

The major anthropogenic causes of human-elephant conflict in these regions were mining extractions, construction of houses, roads and recreation spots near the natural habitat and elephant corridors. Climate change, rainfall variation, drought and critical diseases spreading in bamboo plants, in natural habitats were some natural causes of conflicts. The micro climate change in local habitat has

many detrimental effects on the wild plants consumed by elephants and shortage of food and space in the natural habitat has forced elephants to migrate towards crop lands and human habitats.

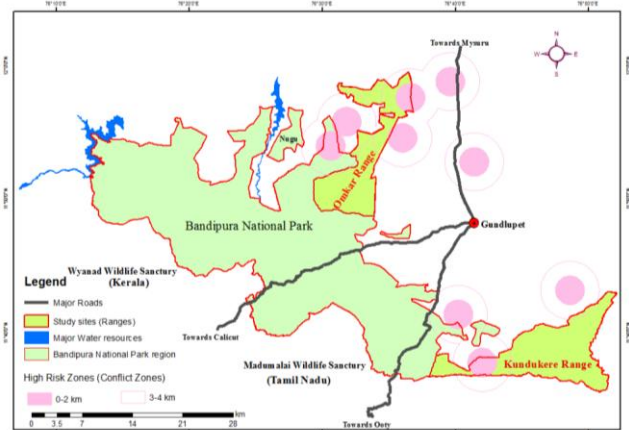


Figure 5: High risk zones of human-elephant conflicts around Omkar and Kundakere ranges of Bandipura National Park

The land use pattern, crop types and growing patterns have also affected on the behaviors of elephants and have lead to conflicts. Failure and inefficient management of elephant control barriers such as solar fences and trenches around the forest boundaries were the major causes of severity of conflicts around Omkar and Kundakere ranges (Figure 6). Despite the increased human-elephant conflict incidents and crop damages in that area, about 50-55% of respondents showed a positive attitude towards elephant conservation and sustainable mitigation measurements, but most of the responders expressed mental illness and social pathological related problems, caused by frequent occurrence of conflicts.

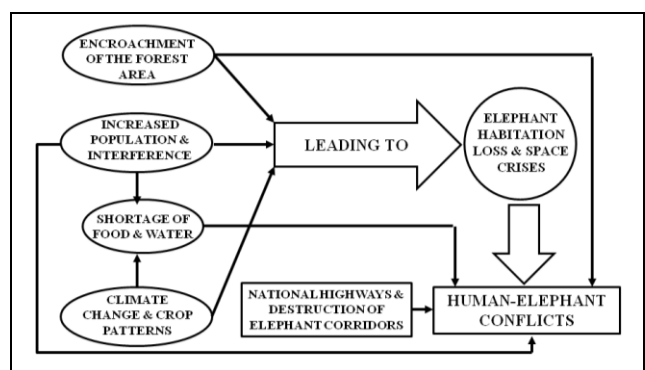


Figure 6: Interweaves of human-elephant conflicts around Omkar and Kundakere ranges of Bandipura National Park

Sustainable Approaches for Mitigation of Human-Elephant Conflicts

Destruction and diminishing area of natural habitat of elephants resulting from encroachment, illegal harvesting

of resources, increased human interference in its periphery combined with other natural calamities such as drought and diseases is responsible for human elephant conflicts. Impact of human-elephant conflict can be minimized by implementation of suitable mitigation techniques. Based on the survey results obtained, some sustainable and appropriated mitigation approaches are recommended to draw the attention of respective authorities for need full action. Natural habitat restoration by planting endemic plants is one of the admirable strategies that provides enough food resources and also helps to resetting of suitable environment for elephant habitation within the boundary.

Conflict frequency has also been observed during summer due to unavailability of water resources within the forest boundary. The proper emphasis to develop permanent water resources should be given, so that sufficient water for elephants in summer can also minimize the elephant movement toward human habitats. In addition to that, establishment of permanent and effective barriers such as solar fence with backup and trenches should be built around elephant habitation as an emphasized defence strategy to mitigate conflicts. Strict enforcement of anti-encroachment measures should be implemented to prevent confining of natural habitat and prevent harvesting of endemic plants which are consumed by elephants in the forests by humans. Long term and sustainable mitigation strategies include shifting of conventional agriculture patterns into novel patterns by growing elephant's irritant crops like zinger, tobacco, chilli, sunflower and green fencing around elephant habitats by planting strong thorny bushes with continuous maintenance till it is strengthened.

Correct planning and execution of suitable mitigation strategies is important to control uncertain loss of asset and death when elephants involuntarily step into human habitats. Therefore, farmers should be trained and educated to tackle and prevent the impact of conflicts by evading unscientific methods like bursting crackers, throwing stones, firing with flammables, beating, etc. Farmers can be encouraged to take more responsibility in implementing long term and sustainable conflict mitigation strategies such as crop pattern shifting, evacuation of encroached forest land, green fencing to their crops etc by credible and incentives approaches. Respective authorities should conduct regular meetings with the villagers who are sheltered around the elephant habitats to cooperate with them, in order to minimize the conflicts. It is necessary to derive a solution to open up elephant corridors for free movement outside the reserve forest area without disturbing the settlement areas. So, elephant corridors should be cleared by avoiding illegal encroachment and emphasizing eco-friendly construction of highway roads and channels. Elephant corridors should be maintained by providing a natural bypass structure to cross national highways and channels.

Conclusion

The present study clearly revealed that frequent human-elephant conflicts in Omkar and Kundakere ranges of Bandipur National Park is an outcome of the destruction and refining of natural habitats by encroachment, peripheral agricultural activities, failure in elephant barriers and other natural calamities such as drought and uncertain plant diseases. In addition to that, shortage of food and water in summer along with growing space crisis in the reserve forest due to increased elephant population and deforestation has led to elephants moving toward agricultural land. In addition to the presence of national highways, human interferences within elephant corridors and crop patterns around the study areas have contributed to a considerable range of human-elephant conflicts. It is extremely important to look at conflicts as a serious threat to the conservation of elephants by the concerned authorities and adjacent people.

Acknowledgment

The authors would like to thank the Karnataka Forest Department for providing the data and for overall support. Support of Mr. Rajkumar, Mr. Anil Kumar KM and Mr. Midhun G, pallavi S, research scholars in field survey is highly appreciated. Inputs of Prof. S Suriyanarayanan, the Head, greatly helped improve the manuscript that for which we are grateful.

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