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UNDERSTANDING THE DYNAMICS AND FACTORS OF HUMAN-WILDLIFE CONFLICT IN THE VIRAJPET DIVISION AROUND RAJIV GANDHI NATIONAL PARK, KARNATAKA, INDIA

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ABSTRACT

The concept of Human-Wildlife Conflict (HWC) is indeed a pervasive and age-old issue that has existed since humans and wild animals began sharing the same landscape and resources. HWC has negative consequences for both humans and wildlife. It can lead to economic losses for farmers, displacement of wildlife, injury or loss of human life, predation on livestock, crops raiding and property damage. The present study was carried out to assess the impact of Human-wildlife conflict on the stakeholders in the in Virajpet division around the Rajiv Gandhi National Park during 2005 to 2020. A semi-structured questionnaire was used to collect primary data on human-animal conflict and socioeconomic status in the study area, while secondary data was collected from the Karnataka Forest Department. The results revealed that number of HWC cases increased significantly over the period of time. The highest number of human death (4) due to HWC were reported during 2009-10 and 2019-20 and human injuries (8) were recorded during 2017-18. The study also found that highest number of cattle kill (39) and property damage (42) cases were recorded during 2019-20 and highest crop predation (1704) cases were recorded during 2014-2015. Whereas, significantly lower cases of HWC was observed during 2005 to 2010. It is also evident from the study that HWC leads to significant impact on the total crop (> 25 % to 50 %). This is mainly due to increase human and wildlife population in the study area and competition for resources. Thus, addressing HWC requires a combination of conservation efforts, community engagement, research and policies to find sustainable solutions that balance the needs of humans and the preservation of wildlife and their habitats.

Key words : Human Animal Conflict, Livestock predation, Crop raiding.

Introduction

Human-Wildlife Conflict (HWC) is defined as any interaction between wildlife and humans, which causes harm, whether it is to the humans or wild animals or property (including the destruction of crops). Conflict arises from a range of direct and indirect negative interactions between humans and wildlife (Agarwal *et al.*, 2016). The global rise in Human-Animal conflict can be attributed to several factors. These include the growing human population, extensive deforestation, forest degradation and the fragmentation of wooded areas. Additionally, changes in land use, including agricultural practices and infrastructure development, significantly

contribute to this conflict. Uncontrolled livestock grazing, poorly planned conservation efforts and the impacts of climate change such as drought, along with unpredictable events like fires, further worsen the challenges. Furthermore, increased access to nature parks, biosphere reserves, and wildlife sanctuaries also intensifies interactions and conflicts between humans and animals on a global scale (Distefano, 2005). Human-wildlife conflict (HWC) has a longstanding history, but in today's world, the dynamic between human populations and other species has evolved, leading to a heightened awareness and concern for HWC. The control exerted by humans over various species has altered the perception and

understanding of these conflicts, generating increased attention. Simultaneously, efforts to conserve and protect wildlife have intensified. Individuals residing in the corridor heavily rely on the adjacent forests for essential domestic and subsistence resources. These include necessities like fuelwood, fodder, grazing land, thatch grass, building materials, medicinal plants and wild fruits. Villagers commonly face challenges such as the predation of livestock by leopards and tigers, as well as the predation of crops by wild boars, elephants, birds and various ungulates.

HWC is a ubiquitous issue arising wherever human needs intersect with those of wildlife, such as in shared spaces, agricultural fields and other natural resources. The rising demands of a growing human population and resulting land use patterns, incompatible with wildlife in forest fringe areas, significantly contribute to this problem. The expansion of human settlements, uncontrolled encroachment into wildlife habitats, construction projects, and developmental activities in marginal areas are identified as fundamental causes of conflicts in many regions (Romanach *et al.*, 2007; Sharma *et al.*, 2011). The present study deals with dynamics and factors of Human Wildlife Conflict (HWC) in the Virajpet division around Rajiv Gandhi National Park.

Materials and Methods

The study was conducted in Virajpet division in the central Western Ghats, Kodagu district Karnataka, in particular around the Rajiv Gandhi (Nagarahole) national park of the Karnataka Forest Department. This part of Rajiv Gandhi national park is surrounded by the lush green coffee agroforestry system and it is one among the severe Human-Wildlife conflict affected area.

The pertaining to Human Wildlife Conflict (HWC) was obtained from Karnataka Forest Department and from the respondents from five range offices namely Thithimathi, Shrimangala, Ponnampet, Kallahalla and Nagarahole located in Virajpet division. Detailed interview with a prepared semi structured questionnaire was conducted to gather primary information from the local farmers (N=300). Information on the damages caused by the wildlife on the people's livelihood and the general characteristics of the instances was obtained during the survey. Open ended questions were also asked to get the people's perception on the causes of HWC instances (Ramakrishnan *et al.*, 1997; Ramkumar *et al.*, 2014).

To understand the causes of HWC in the study area, Wildlife population data particularly tiger and elephant population over the last fifteen years in the Rajiv Gandhi

national park was obtained from National Tiger Conservation Authority, Synchronized Elephant Census and Nagarahole Tiger Conservation Plan. Land Cover classification of Virajpet taluk was prepared using QGIS software. Landsat 8 cloud free satellite data was downloaded from USGS Earth explorer for three time periods namely 2010, 2015 and 2020. Landsat provides images with 30m spatial resolution and 16 days temporal resolution. The images were radiometrically and atmospherically corrected using SCP plugin. After pre-processing of the image, classification was carried out using Semi-automatic classification plugin. The image was classified into four major land uses *viz.*, Agriculture, Built-up, Water and tree cover. The minimum distance algorithm was trained with 10 training inputs for each class, keeping false color composite image as the reference layer.

Results and Discussion

In the research area, the data synthesized from respondents and information gathered from the forest department regarding Human-Animal Conflict indicates that elephants are the primary cause of severe crop damage and livestock predation, followed by wild boars, wild guar, deer, monkeys and tigers. Among all respondents (N=300), 96% reported encountering Human-Animal Conflict due to elephants, which is the highest compared to other wildlife species, followed by wild boars (29%), wild guar (27%), deer (22%), monkeys (21%) and tigers causing the least percentage of Human-Animal Conflict (11%) (Fig. 1). These findings highlight that elephants pose the most significant threat in terms of Human-Animal Conflict. Similar results were also observed in a study conducted by Karthik 2020, which identified the highest occurrences of Human-Animal Conflict due to elephants and wild boars in Kerala.

According to the survey respondents, significant factors contributing to severe Human-Wildlife Conflict (HWC) in the research area include changes in land use, degradation and fragmentation of habitats, a rise in wildlife populations, rapid human population growth and increased tourism activities. Data from the Synchronized Elephant Census and Nagarahole Tiger Conservation Plan 2014-15 to 2023-2024, regarding the population dynamics of major wildlife species, particularly elephants and tigers in Nagarahole National Park, indicate a significant increase in their populations over time. The elephant population in Nagarahole National Park was 1143 individuals in 2002, declining to 804 in 2005, 591 in 2007, and 617 in 2010. Subsequently, there was a notable increase to 1078 elephants in 2012 and a drastic rise to 1602 elephants in 2017 (Fig. 2). Conversely, the data

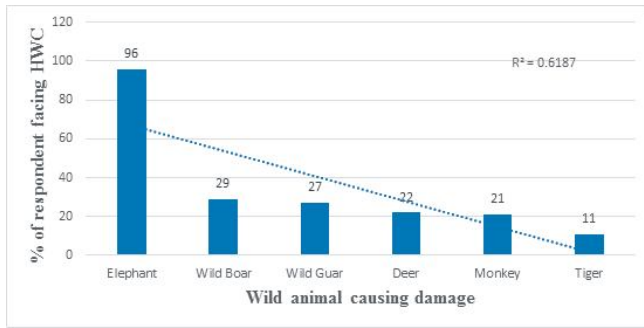


Fig. 1 : Wild Animal causing the most damage to crops or livestock.

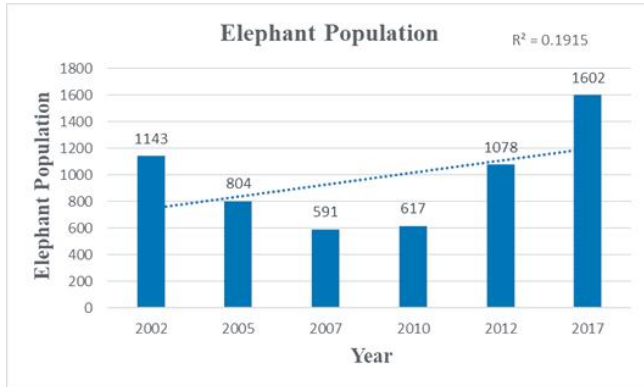


Fig. 2 : Elephant population dynamic in Nagarahole National Park from 2002 to 2017 (Synchronized Elephant Census).

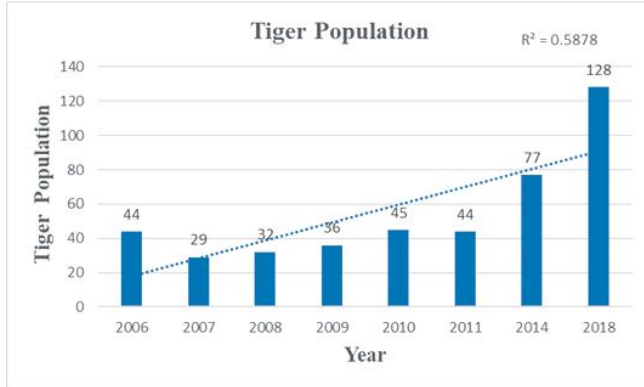


Fig. 3 : Tiger population dynamic in Nagarahole National Park from 2006 to 2018.

related to tiger population shows a continuous positive growth trend. Only 44 tigers were reported in Nagarahole during 2006, with numbers decreasing until 2011. However, there was a significant jump in the tiger population to 77 individuals in 2014, further increasing to 128 tigers in 2018 (Fig. 3). This notable increase in elephant and tiger populations over the last decade is attributed to the successful implementation of projects like Project Elephant and Project Tiger, resulting in habitat enrichment and restoration efforts. Hence drastic increase in wildlife population dynamics is one of driving factor for Human Wildlife Conflict (HWC) in the study area. Therefore,

Table 1 : Land Use Land Cover (LULC) dynamics from 2010 to 2020 in Virajpet Taluq.

LULC	2010 (sq.km)	2015 (sq.km)	2020 (sq.km)
Agriculture	103.4737	117.8584	176.517
Built-up	90.0542	95.9475	124.4061
Water	23.9751	15.2973	38.277
Tree cover	1434.581	1422.981	1312.883
Total	1652	1652	1652

the significant increase in wildlife population dynamics serves as one of the driving factors for Human-Wildlife Conflict (HWC) in the study area. As the populations of elephants and tigers, among other wildlife species, have notably risen over the years, there is a greater likelihood of interactions between humans and these animals. With more wildlife venturing into human-inhabited areas in search of food, water, and space, conflicts arise as they compete with humans for resources and sometimes cause damage to crops and livestock. Thus, the escalating wildlife populations contribute substantially to the frequency and intensity of Human-Wildlife Conflict in the study area.

The total area recorded in Virajpet taluq is 1652 km², encompassing four primary land-use types: water bodies, built-up areas, tree cover, and agricultural fields. Table 1 and Figs. 4, 5 and 6 present the net change and spatial patterns of land use in Virajpet taluq at three intervals: 2010, 2015, and 2020. As per the Land Use Land Cover (LULC) change dynamic analysis of study area, there has been a significant increase in the land-use types of agricultural fields and built-up areas over the span of ten years from 2010 to 2020, while the area under tree cover has decreased. The area occupied by water bodies experienced a significant decrease in 2015, but rebounded in 2020. These fluctuations are primarily attributed to seasonal effects captured in satellite imagery and variations in temporary irrigation ponds. Between 2010 and 2020, the tree cover area decreased by 121.698 km² (7.366% of the total area), while the area occupied by agricultural fields increased by 73.0433 km² (4.42% of the total area). Additionally, the built-up area expanded by 34.352 km² (2.079% of the total area) from 2010 to 2020. Over the last decade, every gram panchayat has witnessed expansion. The rise in human population pressure is identified as the primary driver behind the increased built-up and agricultural areas and the decrease in the area occupied by tree cover. Land use changes entail modifications in how land is employed for different purposes across time. These alterations may encompass shifts from one form of land use to another, including conversions from agricultural to urban areas, forests to

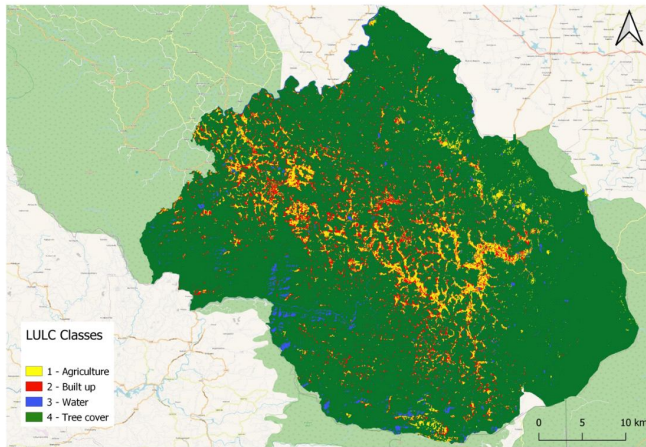


Fig. 4 : LULC of Virajpet Taluq in 2010.

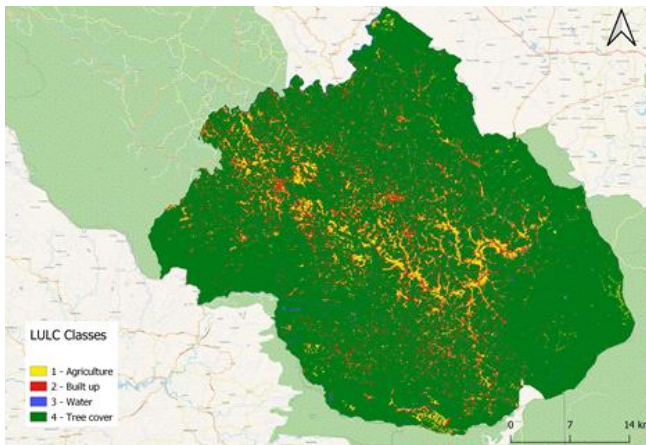


Fig. 5 : LULC of Virajpet Taluq in 2015.

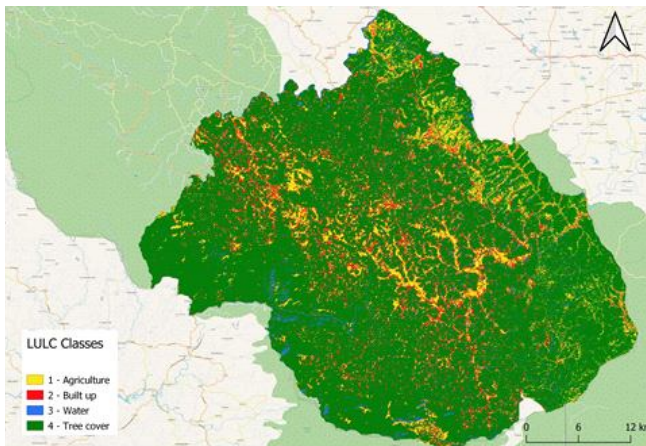


Fig. 6 : LULC of Virajpet Taluq in 2020.

agricultural lands, or natural habitats to recreational or settlement areas. Land use changes carry considerable social, economic and environmental consequences, impacting ecosystems, biodiversity, climate patterns and human livelihoods. These changes can indirectly lead to Human Wildlife Conflict (HWC) by causing deforestation, habitat loss, habitat fragmentation and alterations in the availability of water and other resources, thus affecting wildlife habitats and ecosystems (Alfred *et al.*, 2012).

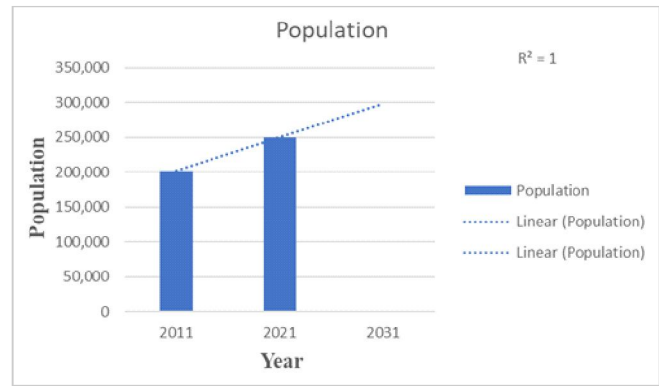


Fig.7 : Human population dynamic in Virajpet taluq (Census, 2011 & 2021).

Numerous investigations conducted in Asia (Sukumar, 1991) and Africa (Barnes *et al.*, 1995; Graham *et al.*, 2009) have highlighted that the destruction of wildlife habitats heightens the likelihood of interactions between human settlements and wildlife, leading to an increase in crop raiding incidents. Wildlife resort to raiding agricultural crops when the resources within their habitat range become insufficient (Madhusudan, 2003).

According to Census data from 2011 and 2021, there has been a noteworthy increase in the human population in Virajpet Taluq over the span of a decade. In 2011, the human population was recorded at 201,431 individuals, comprising 99,754 males and 101,677 females. By 2021, this figure had risen to 249,774, with 124,442 males and 125,332 females. Further human population in the study area is expected to rise up to 3,00,000 (Fig. 7). The significant growth in the human population can be attributed to various factors such as advancements in medical care, improvements in sanitation, developments in agriculture, and technological progress.

It is imperative to recognize that discussions concerning the human population often intersect with matters related to sustainability, resource management, social equity, and global development. Efforts aimed at addressing the challenges associated with the human population should adopt a comprehensive approach that takes into account the needs of individuals, the environment, and future generations. A recent study on Human-Wildlife Conflict (HWC) in West Bengal emphasized the significance of implementing innovative strategies, such as livestock and crop insurance, rights settlement and incentive programs. These approaches have proven effective in managing HWC situations and fostering positive attitudes towards wildlife conservation, as highlighted by Manoj *et al.* (2013).

Understanding the dynamics and factors contributing to Human-Wildlife Conflict (HWC) is crucial for effective

management and mitigation strategies. Through comprehensive research and analysis, it becomes evident that HWC is a multifaceted issue influenced by various factors. Key findings reveal that rapid land use changes, including agricultural expansion and urbanization, have led to habitat loss and fragmentation, increasing interactions between humans and wildlife. Furthermore, the significant growth in the human population in the region exacerbates HWC as communities encroach upon wildlife habitats, leading to conflicts over resources and territory. Additionally, studies indicate that destruction of wildlife habitats intensifies crop raiding incidents, as wildlife seek alternative food sources due to dwindling resources within their habitat range. Moreover, factors such as climate change, inadequate conservation measures and insufficient infrastructure further escalate HWC in the region.

Conclusion

Addressing HWC in the Virajpet Division requires a holistic approach that incorporates sustainable land management practices, community-based conservation efforts, and effective conflict resolution strategies. Collaborative initiatives involving government agencies, local communities, and conservation organizations are essential for promoting coexistence between humans and wildlife while safeguarding biodiversity and ecosystem integrity. By prioritizing research, education, and proactive conservation measures, stakeholders need to work towards mitigating HWC and fostering harmony between human populations and wildlife in the Virajpet Division and beyond. This holistic approach ensures the long-term sustainability of ecosystems, promotes biodiversity conservation, and enhances the well-being of both humans and wildlife in the region.

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