

Human–Snake Conflict Patterns and Implications for Urban Biodiversity Conservation in Gadchiroli District, Maharashtra, India

Saurabh N Satpute^{*1},  and Pravin M Telkhade² 

¹IHLRSS Dr. Khatri Mahavidyalaya, Tukum, Chandrapur, Maharashtra, India

²Department of Zoology, Dr. Khatri Mahavidyalaya, Tukum, Chandrapur, Maharashtra, India

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*Corresponding Author: Saurabh N Satpute | Email Address: saurabhsatpute41@gmail.com

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Abstract

Human–snake conflict has emerged as a significant ecological and public health issue in rapidly transforming landscapes of Gadchiroli District. Expansion of urban settlements, agricultural intensification, habitat fragmentation, and increasing anthropogenic pressure on forest ecosystems have intensified encounters between humans and snakes. The present study examines the spatial and seasonal patterns of human–snake conflict and evaluates its implications for urban biodiversity conservation in Gadchiroli district, Maharashtra. Conflict incidents were highest during the monsoon season and were concentrated near peri-urban settlements, agricultural fields, drainage systems, and forest-edge villages. Habitat degradation, rodent abundance, improper waste disposal, and lack of awareness were identified as major factors increasing snake encounters in urbanizing landscapes. The study highlights the ecological role of snakes as regulators of rodent populations and emphasizes the importance of coexistence-based conservation approaches. provide baseline information for developing sustainable human–wildlife coexistence strategies in central Indian landscapes.

Keywords: Human–snake conflict, urban biodiversity, snake conservation, Gadchiroli, Maharashtra, biodiversity conservation, conflict hotspots.

1. Introduction

Human–snake conflict (HSC) is a growing issue in regions where human populations encroach upon natural habitats [1]. In the case of Gadchiroli District, located in Maharashtra, the rapid expansion of urban and agricultural areas has led to more frequent interactions between humans and snakes [2]. Gadchiroli, Forest, is known for its rich biodiversity, including several species of snakes that play an important ecological role [3]. However, as urbanization advances, human–snake conflicts have intensified, with increasing encounters between people and snakes [4]. Among reptilian fauna, snakes are one of the most misunderstood vertebrate groups despite their major ecological role in maintaining trophic balance and controlling rodent populations. In India, a widespread health issue is a snakebite envenomation, especially in rural and tribal areas where dependence on forest and agricultural resources is high.

This paper aims to explore the patterns of human–snake conflict in Gadchiroli, investigate its impact on biodiversity conservation, and discuss potential strategies for conflict reduction [5].

2. Literature Review

Human–wildlife conflict, including human–snake conflict, is a pressing concern in urbanizing areas. Several studies have shown that urbanization, agricultural expansion, and habitat fragmentation lead to increased interactions between humans and wildlife [6]. In the case of snakes, such conflicts often arise from the displacement of these creatures from their natural habitats [7]. The ecological role of snakes in controlling rodent populations, for example, is well-documented, but their increasing exposure to humans has led to misunderstandings and fear, often resulting in the retaliatory killing of snakes [8].

In India, similar conflicts have been documented in rural and urban settings, with local communities often killing snakes due to fear or the perception that snakes are dangerous.

Studies suggest that human-induced habitat fragmentation is a significant factor contributing to human-snake conflicts. Day by day agriculture expands due to this human expansion in natural habitat, snakes are forced into closer proximity to people [9]. The lack of knowledge about the ecological role of snakes further exacerbates the issue, as communities often resort to killing snakes instead of taking preventive measures. Education and awareness campaigns have been shown to be effective in reducing human-snake conflict, as seen in other regions of India, where local communities have been taught to coexist with wildlife.

3. Study Area

For the present study Gadchiroli District which is located in eastern part of Maharashtra is selected. It is a region which is rich in biodiversity and home to numerous wildlife species, including snakes. The Gadchiroli forest is a major conservation area in the district, supporting a variety of snake species, such as the Russell's Viper, Indian Cobra, and Rat Snake. These snakes are integral to maintaining ecological balance by controlling rodent populations[10]. However, the growing human population in Gadchiroli, along with the expansion of agriculture and infrastructure, has led to the fragmentation of natural habitats, forcing snakes into urban and peri-urban areas[11].

The district is characterized by a combination of dense forests, agricultural land, and urban settlements. This unique topography creates a complex environment where human and snake populations often overlap[12]. The increasing frequency of human-snake interactions can be attributed to both the loss of natural habitat and the increasing urban sprawl[13]. As forests are cleared for agriculture and development, snakes are displaced and forced to inhabit human-dominated areas, leading to more frequent encounters.

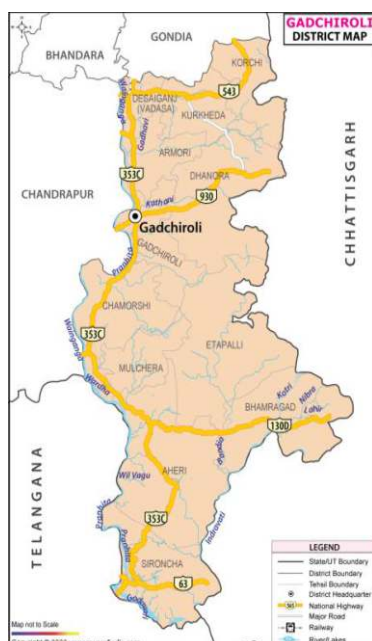


Image 1: Map of Gadchiroli District

4. Research Methodology

To study human-snake conflict in Gadchiroli, a mixed-methods approach was employed, combining field surveys, interviews, and spatial analysis. Data were collected through interviews with local residents, farmers, healthcare providers, and wildlife officials. These interviews focused on snakebite incidents, sightings, and the causes of human-snake conflict in the region. Additionally, healthcare centers and wildlife rescue organizations provided quantitative data on snakebite cases over the past five years[14].

Geographic Information System (GIS) tools were utilized to map conflict hotspots in the region, correlating snake sightings with human activity, land use patterns, and seasonal variations[15]. The study was conducted in both rural and urban areas to assess the differences in conflict patterns. Surveys were conducted to assess community perceptions of snakes and the factors contributing to the killing of snakes [16].

5. Results and Discussion

Conflict Patterns

The analysis revealed that human-snake conflicts in Gadchiroli are most frequent in rural and semi-urban areas, where agricultural and forested regions intersect. The highest number of incidents occurred during the post-monsoon months (September to November), when snake activity peaks due to abundant food sources and favorable weather conditions[17]. Agricultural activities, such as plowing and harvesting, increase the likelihood of encounters between humans and snakes, as people often work in areas that overlap with snake habitats.

The results also indicated that the expansion of human settlements into agricultural and forested areas is a key factor driving the increase in human-snake conflicts. Dhanora and Bhamragad, two rural areas in Gadchiroli, were identified as high-conflict zones, with snake sightings and bite incidents being reported frequently[18]. These areas are particularly vulnerable due to the proximity of farms and forest edges, where snakes seek refuge and food.

Interestingly, urban areas, while experiencing fewer direct encounters with snakes, showed a growing number of sightings in newly developed green spaces and parks. These urban parks, which often have water bodies and vegetation, attract snakes and other wildlife, increasing the chances of human-snake conflict [19].

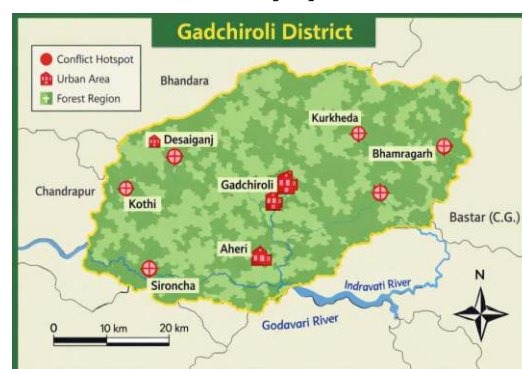


Image 2: Seasonal Distribution of Snake Sightings and Incidents

Impacts on Human Populations

Snakebites are a significant health concern in Gadchiroli, particularly in remote villages and tribal communities. Data from local hospitals indicate that around 30-40 snakebites occur annually and the post-monsoon is a significant period of these bites. Although fatalities are rare, the severity of snakebites can lead to prolonged health issues, like organ failure, necrosis, and disability.

The impact of snakebites extends beyond health, affecting the local economy. In Gadchiroli District, farmers make up a substantial segment of the population, are often the victims of snakebites while working in fields. The fear of snakebites has led to psychological trauma, with many residents avoiding agricultural activities during certain times of the year. This avoidance leads to crop losses and economic strain on families dependent on farming for their livelihood.



Image 3: Role of Snakes in the Ecosystem

Impacts on Snake Populations

The retaliatory killing of snakes remains one of the most significant threats to snake populations in Gadchiroli. For every reported snakebite, it is estimated that 5-10 snakes are killed in retaliation. This mass killing disrupts the ecological balance, as snakes play crucial role in rodent population control. Increased rodent numbers can lead to further crop damage and the spread of disease.

Furthermore, the loss of snake populations has broader ecological consequences. Many predators, including birds of prey and larger mammals, rely on snakes as a food source. As snake populations decline, these predators face a loss of food resources, leading to potential declines in their populations as well. The loss of snakes, therefore, not only affects agricultural health but also disrupts the local food web, potentially affecting a wide range of species in the ecosystem.

6. Implications for Urban Biodiversity Conservation Ecological Importance of Snakes

Snakes are often overlooked in biodiversity conservation efforts, but they play a vital role in regulating ecosystems.

By controlling rodent populations, snakes help reduce crop damage and limit the spread of diseases such as leptospirosis and malaria. Rodents are major agricultural pests, and their overpopulation can lead to significant losses in food production. Snakes also help maintain balance in the food chain by serving as prey for larger predators, including raptors and larger mammals.

In urban environments like Gadchiroli, snakes contribute to the health of green spaces, such as parks and gardens, by controlling pest populations. However, urban expansion and habitat destruction are leading to the fragmentation of natural habitats, making it harder for snakes to thrive in these spaces. As cities expand and green spaces shrink, snakes are increasingly forced to enter human-dominated areas, leading to more frequent conflicts[20].



Image 4: Common Snake Species in Gadchiroli

Conservation Challenges

Urbanization in Gadchiroli presents several challenges for wildlife conservation. As agricultural and urban land use expand, snake habitats are being lost or fragmented, leading to increased conflicts with humans. The increase in agricultural intensification and infrastructure development poses further threats to the already fragile ecosystems. Pesticide use and road construction also contribute to the decline in snake populations, further exacerbating the issue. Additionally, the lack of green spaces and wildlife corridors in urban planning limits the ability of snakes to move freely between natural habitats. As a result, snakes are forced to migrate through human settlements, increasing the risk of conflict. To address these challenges, it is crucial to integrate wildlife-friendly urban planning practices that take into account the needs of both human populations and wildlife.

Policy and Management Implications

The conservation of snakes in urbanizing areas like Gadchiroli requires a multi-faceted approach. The following strategies are recommended to mitigate human-snake conflict and promote biodiversity conservation:

1. Urban Planning: Incorporating wildlife corridors and green spaces in urban planning can help snakes and other wildlife move between natural areas and urban environments. This will help reduce the frequency of human-snake conflicts.

2. Community Awareness: Education and awareness campaigns are essential to reduce the fear and misunderstanding of snakes.

Local communities should be taught about the ecological role of snakes and how to safely coexist with them.

Biodiversity Conservation: It is vital to protect and restore snake habitats, particularly in areas that are crucial for maintaining ecological balance. Restoration efforts should focus on reintroducing and preserving natural habitats that support snake populations.



Image 5: Community Awareness Program Poster

7. Conclusion and Recommendations

In conclusion, human-snake conflict in Gadchiroli is a significant challenge for both human safety and biodiversity conservation. The ongoing urbanization and agricultural expansion are leading to increased interactions between humans and snakes, with profound implications for both parties. The human health risks posed by snakebites, combined with the retaliatory killing of snakes, threaten the ecological balance of the region.

To address these challenges, comprehensive strategies involving urban planning, community education, and biodiversity conservation are necessary. Protecting snake habitats, promoting safe coexistence, and educating the public about the ecological importance of snakes will be crucial to reducing human-snake conflicts.

By adopting a holistic approach to conservation, Gadchiroli can ensure that both its human population and its wildlife can coexist harmoniously.

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