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Human–Wildlife Conflicts and Conservation Strategies in the Buffer Zones of Chitwan National Park

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Abstract:

Human–wildlife conflict (HWC) is an escalating issue in conservation science, especially in regions where human settlements interface with protected natural habitats. In Nepal's Chitwan National Park (CNP), which is a UNESCO World Heritage Site, the buffer zones have become key battlegrounds for the coexistence of humans and wildlife. This paper examines the underlying causes, frequency, and impacts of human–wildlife conflicts in the buffer zones of CNP, and evaluates current mitigation strategies with an aim to suggest holistic, community-inclusive solutions. The study uses qualitative and quantitative methodologies including literature review, interviews with local stakeholders, and field observation. It concludes with policy-level recommendations for sustainable conservation and cohabitation strategies.

Keywords: human–wildlife conflict, conservation, buffer zones, Chitwan National Park, biodiversity, community-based conservation, Nepal.

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I. Introduction

Human–wildlife conflict has become a significant conservation and socio-economic issue globally. In regions where human populations border protected areas, the overlap of habitats leads to competition for resources, resulting in both human and animal casualties [1]. Chitwan National Park in Nepal, known for its rich biodiversity including the Bengal tiger (Panthera Tigris Tigris), one-horned rhinoceros (Rhinoceros unicorns), and Asian elephant (Elephas Maximus), has been at the center of such interactions. The establishment of buffer zones in the 1990s sought to integrate conservation with community development, yet the conflicts have continued and, in some areas, intensified. The buffer zones, although intended as protective barriers, have become arenas of frequent confrontations between humans and wildlife. This paper explores these dynamics, offering insight into root causes, consequences, and mitigation approaches within the context of Chitwan [2].

Chitwan National Park (CNP), established in 1973 as Nepal's first national park and later designated a UNESCO World Heritage Site in 1984, is a cornerstone of biodiversity conservation in South Asia. Located in the Terai lowlands of central Nepal, CNP is home to a wide range of endangered species including the Bengal tiger, one-horned rhinoceros, sloth bear, and gharial crocodile. The park's success in wildlife protection has been bolstered by the introduction of buffer zones in the mid-1990s—areas surrounding the park where human activities are regulated to reduce pressure on the core protected area. These buffer zones, meant to serve as ecological transition zones, were developed to integrate local communities into conservation efforts through benefit-sharing and participatory forest management. However, the close interface between human settlements and wildlife habitats has also led to increasing incidents of human–wildlife conflict (HWC), presenting new challenges for sustainable conservation [3]. With over 250,000 people living in buffer zones and depending heavily on natural resources for their livelihoods, the tension between conservation goals and human needs continues to shape the socio-ecological dynamics of the region. Understanding this context is essential to formulating effective conservation strategies that balance ecological integrity with the socio-economic realities of local communities.

II. The Ecological and Socioeconomic Setting of Chitwan National Park

Chitwan National Park is located in the subtropical Inner Terai lowlands of south-central Nepal, covering an area of 952.63 square kilometers. It is bordered by human settlements and agricultural fields which comprise the buffer zones—spanning roughly 750 square kilometers and home to over 250,000 people. These areas are inhabited predominantly by indigenous Tharu communities, along with migrants from the mid-hills. The ecological richness of CNP includes over 700 species of wildlife, but it also places humans in direct proximity to potentially dangerous fauna. The expansion of agriculture, infrastructure, and settlement in the buffer zones has increased pressure on forest resources [4]. Communities rely heavily on firewood, fodder, and non-timber forest products, leading to encroachments that reduce natural prey availability for carnivores. The depletion of natural food sources compels predators and herbivores to forage in farmlands, leading to incidents such as livestock depredation, crop raiding, and even human fatalities. This setting creates a fragile interface where conservation and human livelihoods intersect in complex ways [5].

These human communities, including indigenous Tharu people and migrants from the mid-hills of Nepal, rely heavily on the natural resources of the buffer zone for their subsistence. Agricultural activities are the primary occupation, with crops such as rice, maize, mustard, and wheat forming the economic backbone. In addition, people depend on forest products for fodder, firewood, timber, and non-timber forest products [6]. Despite development interventions, poverty rates remain high in many parts of the buffer zones, exacerbating the dependency on natural ecosystems and increasing the risk of conflict with wildlife.

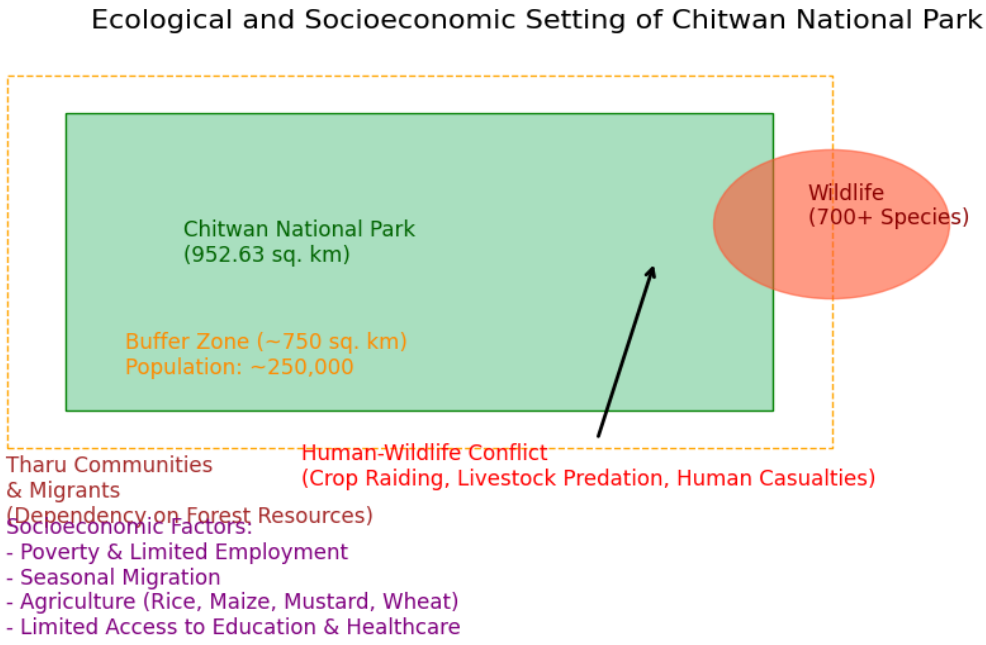

Figure 1: Ecological and Socioeconomic Setting of Chitwan National Park

Explanation:

- The **main park area** is represented as a green rectangle, indicating the boundaries of **Chitwan National Park**.
- A **buffer zone** (orange dashed line) surrounds the park, highlighting the areas where human communities reside.
- The **Tharu communities and migrants** are mentioned in the buffer zone, emphasizing their dependency on natural resources.
- A **wildlife zone** is shown with a red circle, representing the area rich in biodiversity with over 700 species.
- An **arrow depicting human-wildlife conflict** shows the interaction between human settlements and wildlife, leading to incidents like crop raiding, livestock predation, and human fatalities.
- A separate section highlights **socioeconomic factors**, including poverty, employment issues, and reliance on agriculture.
- The figure effectively captures the complex interaction between the ecological and socioeconomic elements of Chitwan National Park.

Socioeconomically, the region is marked by limited employment opportunities, seasonal labor migration, and uneven access to education and healthcare [7]. Infrastructure development such as roads and irrigation channels has opened up the region to greater human mobility and economic activities, but it has also contributed to habitat fragmentation and increased human–wildlife interactions. In many villages, people live within a few kilometers of dense forests or grasslands, with limited physical barriers between human settlements and wildlife habitats. This proximity often results in crop depredation, livestock predation, and, in extreme cases, attacks on humans, leading to loss of life and property.

III. Nature and Frequency of Human–Wildlife Conflicts

Conflicts in Chitwan's buffer zones are diverse and vary seasonally. Elephants often raid crops during the harvest season, while rhinos trample fields and sometimes homes. Tigers and leopards are known to prey on livestock, and on rare but alarming occasions, attack humans. According to local statistics and conservation reports, there are dozens of human fatalities or serious injuries each year due to animal encounters [8]. Livestock loss and crop damage are even more frequent, contributing to economic hardship and negative attitudes toward wildlife conservation. Local interviews and surveys reveal that many residents feel abandoned by park authorities after incidents, especially when compensation is delayed or insufficient. Moreover, many attacks occur near forest edges, where people venture for fodder or firewood. Inadequate fencing, poorly maintained watchtowers, and lack of early warning systems exacerbate the frequency and intensity of these conflicts. The issue is compounded by limited livelihood alternatives and ineffective communication between communities and conservation agencies [9].

Crop Raiding and Agricultural Damage: One of the most common and widespread forms of human–wildlife conflict in Chitwan is crop raiding. Elephants, rhinos, and wild boars are the primary culprits, with the majority of damage occurring during the agricultural growing and harvesting seasons. Elephants, often in small herds, venture into fields to feed on crops such as rice, sugarcane, and maize. This damage not only results in the loss of vital food resources but also in financial strain for the affected farmers. The one-horned rhinoceros, another large herbivore, is notorious for destroying crops like maize, wheat, and vegetables. As both species are drawn to these agricultural zones due to the availability of food, crop raiding can be particularly devastating for subsistence farmers who rely on their harvests for

survival. The frequency of such incidents increases during the dry season, when wild herbivores seek out additional food sources outside the park boundaries due to reduced vegetation cover in the core area. **Livestock Depredation:** Livestock depredation is another significant form of conflict in the buffer zones, particularly involving carnivores such as tigers, leopards, and wild dogs [10]. These predators often stray into human settlements or venture close to grazing areas where livestock are left unattended. Tigers are particularly dangerous, as they have been known to prey on domestic cattle, goats, and sometimes even buffaloes. Leopards are another major threat, preying on smaller livestock such as goats and chickens. The loss of livestock can be devastating for rural families who rely on them for food, income, and transport. In some cases, depredation incidents can result in financial ruin, especially for poorer households with limited assets. Additionally, fear of such attacks often leads to retaliatory killings of wildlife, which exacerbates the conflict and further threatens biodiversity conservation.

Human Attacks and Fatalities: While rare compared to crop raiding and livestock depredation, direct human attacks by wildlife are a more alarming aspect of the conflict. Attacks on humans by tigers, elephants, and rhinoceroses have been reported in the buffer zones, with fatal outcomes in some cases. These attacks typically occur when humans accidentally come into close proximity to animals, particularly in dense vegetation or at night. In addition, human fatalities sometimes occur during activities such as collecting firewood or fodder, when people inadvertently surprise or corner a large animal. Such incidents tend to fuel resentment toward wildlife and can create a hostile attitude among local populations toward conservation efforts [11]. Fear of attacks often leads to a reluctance to enter the forest or participate in certain agricultural activities, further straining the relationship between humans and wildlife. **Seasonal and Spatial Variations in Conflict**: The frequency and nature of human–wildlife conflicts in Chitwan also exhibit significant seasonal and spatial variation. During the monsoon season, the availability of water and vegetation inside the park typically reduces the movement of wildlife into agricultural areas. However, once the rains subside and the dry season sets in, herbivores, in particular, are forced to venture beyond park boundaries in search of food, leading to an increase in crop raiding and grazing-related conflicts. The proximity of human settlements to forest edges and wildlife corridors increases the likelihood of encounters. In areas closer to the park's core, where habitats are more intact, larger herbivores such as elephants and rhinos frequently move across cultivated lands, leading to crop destruction. Conversely, settlements located

farther from the park tend to experience fewer conflicts, though issues of livestock depredation may still persist due to the movement patterns of carnivores. Moreover, the intensity of human–wildlife conflict is also determined by the level of conservation and management interventions in specific areas. Regions with effective monitoring and protection mechanisms, such as electric fencing, watchtowers, and active community engagement programs, generally experience lower levels of conflict. On the other hand, areas with inadequate infrastructure, poor law enforcement, or weak community involvement are more prone to frequent and severe conflicts [12].

IV. Community Perceptions and Attitudes toward Wildlife

Understanding the human dimensions of wildlife conflict is essential for developing effective conservation strategies. In many buffer zone communities, perceptions of wildlife are ambivalent. On one hand, there is cultural reverence for animals like the elephant and tiger, embedded in Hindu and Buddhist traditions. On the other hand, economic realities drive resentment and fear. Repeated damage to property and threats to safety result in retaliatory actions such as poisoning or trapping of wildlife, particularly in areas with minimal conservation outreach.

Community-based surveys show a significant correlation between education levels and attitudes toward wildlife. Areas with active community forest user groups (CFUGs) and conservation education programs tend to show higher tolerance and cooperation. Where such engagement is lacking, misinformation and fear often dominate. Women and children, who are more frequently involved in resource collection, are particularly vulnerable to wildlife encounters, yet are rarely consulted in decision-making processes.

Several mitigation strategies have been implemented in Chitwan's buffer zones, with varying degrees of success. Physical barriers such as electric fencing and bio-fencing (using thorny plants) have reduced incidents in some areas but are costly to maintain. Compensation schemes provide financial relief to affected households, but bureaucratic delays often frustrate communities. More innovative approaches include predator-proof livestock corrals, early warning systems using mobile technology, and community-based rapid response teams.

Buffer zone community forests, a hallmark of Nepal's conservation policy, have empowered locals to take stewardship of natural resources. Revenue-sharing mechanisms from tourism

help fund development activities and conflict mitigation. However, challenges remain in terms of equitable distribution of benefits, enforcement of conservation rules, and building technical capacity within community institutions. Moreover, climate change poses an additional stressor, altering animal behavior and habitat use in unpredictable ways.

V. Policy Recommendations and Way Forward

To address the complexities of human–wildlife conflict in Chitwan's buffer zones, a multidimensional approach is necessary. First, conservation policies must be more participatory and inclusive, integrating women, indigenous groups, and youth in planning and decision-making. Second, investment in education and livelihood diversification can reduce dependency on forest resources. Ecotourism, beekeeping, and sustainable agriculture are promising alternatives that need scaling and support.

Strengthening early warning systems and incentivizing coexistence through insurance schemes or wildlife guardianship programs can also improve community resilience. At the policy level, coordination between the Department of National Parks and Wildlife Conservation (DNPWC), NGOs, and local governments must be institutionalized through clear mandates and communication protocols. Long-term success depends on aligning conservation goals with human welfare, recognizing that protected areas cannot function in isolation from the socio-economic systems that surround them.

VI. Conclusion

Human–wildlife conflict in the buffer zones of Chitwan National Park represents a significant challenge to biodiversity conservation and rural livelihoods. While various strategies have been implemented, their efficacy is often hindered by limited resources, inadequate stakeholder engagement, and socio-political constraints. Moving forward, a holistic, inclusive, and adaptive management approach is vital. Conservation must go hand-in-hand with community empowerment and economic sustainability. With the right interventions, Chitwan can become a model for human–wildlife coexistence not only in Nepal but across similar ecological landscapes worldwide.

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