Sustainable Coexistence through Wildlife Behaviour in Anthropogenic Landscapes: A Review Study

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Abstract: Habitat fragmentation threatens biodiversity by isolating wildlife populations and restricting their movement, reproduction, and access to resources. To counter this, maintaining or restoring landscape connectivity is a key strategy. Traditional connectivity planning emphasizes landscape resistance, which considers how natural features facilitate or hinder movement. However, it often overlooks human behaviour, a critical factor influencing wildlife movement. The concept of anthropogenic resistance addresses this gap, capturing how human actions, attitudes, and land-use decisions affect species mobility. Psychological and socioeconomic factors such as fear of dangerous species or economic interests can increase resistance, leading to barriers, habitat destruction, or persecution. Conversely, species with cultural or economic value may face less resistance and receive conservation support. These dynamics significantly influence the effectiveness of wildlife corridors. Integrating anthropogenic resistance into connectivity planning requires interdisciplinary approaches, including social science, ecology, and GIS tools like surveys and participatory mapping. These methods help assess human-wildlife interactions and improve corridor design. By adopting a social-ecological perspective, connectivity efforts can better support both conservation goals and human well-being. Multidisciplinary collaboration is essential for creating ecologically viable and socially acceptable solutions that ensure long-term sustainability.

Key words: Coexistence, Wildlife, Behaviour and Anthropogenic Landscape

Introduction

Human activities such as land use changes, urbanization, and infrastructure development have extensively altered natural landscapes worldwide, leading to significant habitat loss and fragmentation [1]. This fragmentation disrupts wildlife habitats by isolating populations, reducing available space, and creating physical barriers to movement. Such conditions negatively impact wildlife in multiple ways [2-4]. Fragmented habitats often result in reduced genetic diversity and overall fitness within populations, as isolated groups face limited opportunities for gene flow [5]. Moreover, animals attempting to move between habitat patches are exposed to increased mortality risks, including vehicle collisions, predation, and retaliatory killings linked to human-wildlife conflict. Species that require large, continuous habitats are especially vulnerable to these anthropogenic changes [6-9]. However, the effects of habitat fragmentation are evident across a broad spectrum of species, even in landscapes that have been heavily modified by humans. Reduced landscape connectivity has been shown to negatively influence individual survival rates, population stability, and, ultimately, the long-term persistence of species [10-11. To counter these adverse effects, enhancing functional connectivity the ease with which species can move and interact across the landscape is a Critical Conservation Strategy [12-13]

Anthropogenic Landscape

Anthropogenic landscape or resistance refers to the impact of human behaviours on the movement of wildlife through landscapes, encompassing not only an organism's physical ability to traverse an area but also the changes in its survival chances and physiological costs associated with such movement. Unlike traditional measures of landscape resistance that rely on biophysical features, anthropogenic resistance emphasizes the complex social, psychological, and policy-driven factors influencing human-wildlife interactions [14-16]. Human behaviours are shaped by individual attitudes, social identities, cultural norms, values, and formal regulations. For instance, negative perceptions of certain species, such as those viewed as threats to agriculture or personal safety, may lead to behaviours like lethal control or habitat exclusion, thereby increasing resistance to wildlife movement. Conversely, economic incentives, legal protections, and cultural reverence can promote tolerance and even support for wildlife, thereby lowering resistance and enhancing landscape connectivity [17].

These dynamics can be understood by some Real-world examples, like in Nepal's Khata wildlife corridor, communities maintain a generally positive attitude toward tigers (*Panthera tigris*), despite suffering livestock losses and human injuries [18]. Supportive factors include compensation programs and community development initiatives, which increase local acceptance and facilitate tiger movement. Similarly, in the Amboseli region of Kenya and Tanzania, the Masai pastoralists despite experiencing significant livestock depredation by lions (*Panthera leo*) participate in conflict mitigation efforts and receive compensation, thereby supporting lion connectivity across the landscape [19].

These cases illustrate that livelihoods alone do not determine anthropogenic resistance. Broader influences such as economic incentives, participatory governance, and cultural or religious beliefs (which may promote wildlife reverence) significantly affect how people interact with species [20]. Therefore, integrating social and psychological variables into connectivity analyses—beyond what can be captured through remote-sensing data or land cover models—provides a more accurate and comprehensive understanding of functional connectivity. Such insights are vital for developing effective, socially informed conservation strategies. [21]

Effects of Anthropogenic Landscape

The effects of anthropogenic landscape may be direct where animals move less across areas with high anthropogenic impact, or indirect where human disturbances alter intra or interspecific interactions [10]. Neglecting the direct and indirect impacts of anthropogenic landscape can significantly distort assessments of landscape connectivity and compromise the effectiveness of wildlife corridors. Anthropogenic resistance includes human behaviors such as persecution, land-use practices, and cultural attitudes, which can either hinder or facilitate wildlife movement. When these factors are ignored, connectivity models may overestimate or underestimate the true ease with which species can move between habitat patches, leading to flawed conservation strategies [22-23]. One major risk is the creation of ecological traps, where corridors designed based solely on biophysical features funnel animals into areas with high human-caused mortality, such as roads, settlements, or zones of active persecution [24-25]. For example, even when habitats are physically connected, returning species may face continued hostility from humans, leading to unsuccessful dispersal or population declines. Another concern is the development of landscapes of fear, where frequent hunting or other threats make corridors psychologically or behaviorally inaccessible to wildlife [26-28]. Such anthropogenic pressures can deter species from using otherwise suitable movement pathways, thereby reducing corridor effectiveness [29]. Conversely, areas with favorable human attitudes, strict hunting bans, or supplementary feeding may attract wildlife, facilitating higher connectivity than predicted by landscape features alone. These low-resistance zones can become vital conduits for movement, demonstrating that functional connectivity may be better than modeled if anthropogenic resistance is low. Thus, incorporating human behavioral, cultural, and regulatory influences into connectivity planning is essential. Recognizing these factors ensures a more realistic and holistic understanding of wildlife movement, leading to more effective and resilient conservation efforts [30]

Summary

The Anthropocene epoch, marked by unprecedented human influence on Earth's systems, has brought about profound changes in natural landscapes. Urbanization, deforestation, agriculture, mining, and industrial activities have altered habitats, fragmented ecosystems, and introduced new stressors into the environment. These anthropogenic changes have far-reaching effects on wildlife, particularly in terms of behaviour. As animals face novel challenges and opportunities in human-modified landscapes, they are forced to adapt in ways that can have significant consequences for their survival, reproduction, and ecological roles. One of the most noticeable impacts of anthropogenic landscapes is habitat fragmentation. As natural habitats are converted into urban or agricultural zones, animals often encounter physical barriers such as roads, fences, and buildings. These barriers can restrict movement, limit access to resources, and isolate populations. Consequently, animals may alter their movement patterns, home ranges, and dispersal strategies. For example, some species may become more nocturnal to avoid human activity, while others may shift their feeding times or travel routes. Urbanization has also led to behavioural changes due to increased exposure to light, noise, and chemical pollution. Artificial light at night disrupts circadian rhythms in many species, affecting sleep, mating, and foraging behaviours. Noise pollution, common in urban and industrial areas, interferes with acoustic communication, especially in birds, amphibians, and marine mammals. Animals may change the frequency or timing of their calls, potentially reducing mating success and increasing stress levels. Furthermore, anthropogenic landscapes often bring animals into closer contact with humans and domestic animals, leading to altered risk perception and predator avoidance behaviours. Some species become habituated to human presence, showing reduced fear and increased boldness, which may enhance their access to food resources but also increase vulnerability to human-related threats like vehicle collisions or intentional harm. On the other hand, increased human presence may cause some animals to avoid valuable habitats altogether, leading to reduced fitness and population declines. In addition, land-use changes often result in the introduction of invasive species and new competitors, forcing native animals to adapt their foraging strategies and territorial behaviours. Changes in resource availability, such as food and shelter, can also lead to increased aggression, altered social structures, or changes in reproductive strategies. For instance, animals may invest more in reproduction under uncertain conditions or display opportunistic feeding behaviours in urban areas. Despite the many challenges posed by anthropogenic landscapes, some species exhibit remarkable behavioural plasticity that allows them to thrive in modified environments. Urban-adapted animals, such as raccoons, pigeons, and foxes, often exploit human-provided resources, demonstrating innovation and learning. However, this adaptability is not universal, and many specialist species with narrow ecological requirements struggle to cope with rapid changes, leading to biodiversity loss.

Conclusion:

Human-altered landscapes have significant and complex effects on animal behaviour. These changes can influence individual fitness, population dynamics, and broader ecosystem processes. Understanding how animals respond behaviourally to anthropogenic pressures is essential for developing effective conservation strategies and ensuring the coexistence of wildlife and human development in an increasingly urbanized world.

Ultimately, integrating anthropogenic landscape offers a more comprehensive model of functional connectivity. This approach acknowledges that human presence alone does not determine connectivity rather, it is the diversity and intensity of human actions, policies, and cultural factors that influence how wildlife move through landscapes. By incorporating these nuanced human dimensions into connectivity planning, conservation practitioners can identify more effective and socially viable corridors that truly reflect on-the-ground realities for both humans and wildlife. This is typically achieved through the creation and maintenance of wildlife corridors, which facilitate safe and efficient movement between habitat patches, supporting both biodiversity conservation and ecosystem resilience.

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