



Original Research Paper/Review Paper

Assessment of Human–Wildlife Conflict Patterns and Community-Based Conservation Strategies for Sustainable Coexistence

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Key Words	Abstract
Human–Wildlife conflict, Community-Based conservation, Sustainable coexistence, Wildlife management, Conservation strategies, Human–Animal interactions, Biodiversity conservation, Conflict mitigation, Participatory conservation, Environmental governance.	Human-wildlife conflict (HWC) is an enduring and escalating problem in the world of conservation that emerges when the need for space and resources of human beings and wildlife clash with each other. In this systematic review of literature, the state-of-the-art on the HWC, including its patterns and causes, effectiveness of interventions used to address it, compensation mechanisms, and impact of community-based conservation approaches on HWC have been discussed. Factors causing HWC are varied and include ecological, social, economic, and institutional elements. Scholarship in this area has moved from focusing solely on HWC to addressing it within the framework of coexistence and the need for integration and participatory approach rather than technical solutions. There is inadequate evidence on the effectiveness of common interventions due to the absence of well-controlled studies. The results of a systematic evaluation of compensation and governance tools from four continents reveal that although monetary compensation increases short-term tolerance, it alone fails to reduce conflict incidence, and lasting coexistence takes place only if compensation is part of governance frameworks that include prevention, participation, and land-scale planning. Community-based natural resource management efforts, in particular communal conservancies, that yield direct financial and non-financial gains from tourism and trophy hunting activities, are one such practical illustration of this holistic strategy and have the potential to balance economic motivations of local communities with conservation goals. In summary, these findings clearly show that for sustainable coexistence to take place, both scientific evidence-based mitigating measures and proper governance systems must be put into practice.

Introduction

With increasing human populations and encroachment into or close to wildlife habitat, human-wildlife encounters are growing more common and, in most instances, more expensive. Human-wildlife conflict can be defined in broad terms as any encounter between humans and wildlife that results in adverse consequences to one or both, and includes incidents such as crop raiding, livestock predation, property destruction, and dangers posed to human lives, all of which carry significant costs in terms of economics and psychology. To respond to this challenge, conservation efforts have increasingly moved away from focusing solely on mitigating conflict to addressing the more holistic issue of coexistence, acknowledging not only the ecological but also the social, economic, and institutional facets of human-wildlife encounters. This paper summarizes existing scientific knowledge on human-wildlife conflict patterns, assesses what is known about the effectiveness of mitigation measures, and reviews the scientific support for community-based conservation as a means towards coexistence.

Drivers and Patterns of Human-Wildlife Conflict

Ecological and Social Drivers

Human-wildlife conflict occurs because of multiple reasons and cannot be attributed to just one particular reason. According to a review of the literature on human-wildlife conflict and coexistence, the reasons that contribute to human-wildlife conflict include species-related ecological characteristics, land-use patterns, and the social, cultural, and economic background of communities that are affected. Traditionally, human-wildlife conflict was solved through reducing or eliminating populations of dangerous animals (Nyhus, 2016). Recently, however, the trend has started to change towards coexistence due to rising awareness of the importance of biological diversity and the means of conserving it Nyhus (2016). The same review reveals that gender has emerged as an important factor that

has been insufficiently researched in terms of human-wildlife conflict and that women and men interact with the environment in their own unique ways, and thus, gender should be considered when analyzing conflict and its consequences. In particular, women living in agricultural areas have faced such negative consequences of conflict as reduced food security, increased workloads, and poor physical and psychological well-being as a result of crop-raiding activities (Nyhus, 2016). Past experiences of communities with regards to the management of the conflict can influence the attitude of people today.

Reframing Conflict as Coexistence

A complementary approach stresses the differences in human-animal interactions and their perception between and within rural, urban and peri-urban regions, and the need for integrated, participative and scientific information for the development of management strategies, as the land users who incur costs from animal depredation claim that the loss must be compensated for and preventive strategies subsidized (König et al., 2020). It also highlights that new assemblages of animals are increasingly meeting each other at times and places where people are not ready to handle the interaction that occurs as a result due to the changing resource availability owing to climate changes, leading both the animals and the human land users such as the pastoralists who move their livestock during drought periods into the same area which previously did not witness any conflict (König et al., 2020). Both syntheses reach the same conclusion in terms of the fundamental heterogeneity of conflict in geographic, cultural and policy settings, implying that there will be no generalized technical solution without taking into consideration the local social and economic setting, and that fragmentation between cultures and policies may lead to more conflicts because of spillover effects on communities adjacent to conservation areas (König et al., 2020).

Effectiveness of Conflict Mitigation Interventions

Even as interventions designed to reduce livestock depredation and conflict continue to be implemented, the scientific evidence base underpinning many popular interventions continues to be surprisingly scanty. In a systematic review of the scientific literature published from 1990 to 2016 that evaluated interventions designed to reduce the impact of predation by large carnivores on livestock, such as switching livestock type, using livestock enclosures, employing guarding animals, removing predators, employing shock collars, employing sterilization, and using visual/auditory deterrents, the findings revealed a scarcity of experimental or quasi-experimental designs used to assess the effects of such interventions. Only 21 of the 570 reviewed interventions (3.7%) adopted an intervention case-control approach rigorous enough to determine the impact of interventions (Eklund et al., 2017). In the cases of interventions with sufficient scientific evidence, interventions exhibited varying effectiveness depending on context. For instance, while night enclosures proved effective at preventing bear and wolf predations in Europe and puma predations in South America, other commonly used interventions proved ineffective. The implication is that many interventions used to mitigate conflicts are recommended on the basis of insufficient empirical knowledge even as they continue to be recommended.

Compensation Schemes and the Governance of Coexistence

Financial compensation in response to wildlife-related damages is one of the most commonly used policies aimed at addressing human-wildlife conflicts; however, the effectiveness of such policies in promoting sustainable coexistence remains debatable. In fact, a large-scale study of 250 peer-reviewed and gray literature sources covering Africa, Asia, the Americas, and Europe, evaluated the effectiveness of compensation, mitigation, and coexistence governance tools on the grounds of their success in terms of financial sustainability,

administrative efficiency, equity, integration with preventive strategies, and social legitimacy (Zhang et al., 2026). According to the findings of this analysis, while financial compensation can help increase tolerance to the damage caused by wildlife in the short term, the use of financial compensation alone does not result in a decrease in the incidence of conflicts due to the fact that it treats only one aspect of the problem (Zhang et al., 2026). Another long-term observation from the review is that coexistence results will be most successful where it is not because compensation programs are bigger or better funded but because there is an overall governance framework, which combines prevention, participation of local bodies, and landscape-level planning so that compensation forms just one element of an integrated strategy and is not an end by itself (Zhang et al., 2026). This makes an immediate impact on how policies should be designed: if compensation is introduced without investment in the construction of mitigation infrastructure and governance, it might become an endless and expensive burden for managing the financial effects of conflicts but not their frequency.

Community-Based Conservation and Economic Incentives

Conflict tolerance being strongly related to the economic costs and benefits associated with wildlife led to the emergence of community-based natural resource management initiatives, which provide direct benefits to the communities from wildlife as one of the practical approaches for encouraging coexistence, and as an applied example of an integrated governance system that was found to be the most effective means of ensuring sustainable coexistence (Zhang et al., 2026). Evaluation of 77 communal conservancies in Namibia, where community-based wildlife conservation was encouraged to complement the existing subsistence agriculture land use, indicated similar growth rates in benefits provided through tourism and regulated hunting activities over the 1998-2013 period under study, while the conservancies usually started providing

hunting benefits in about three years and tourism benefits in six years after their creation (Naidoo et al., 2016). It became apparent that the two sources of income served different groups of the local population in distinct ways, with the former being directed at funding the conservancy management activities and providing the meat for community use, while the latter was mainly used to pay salaries to staff working in lodges; an imposed ban on trophy hunting activity was expected to greatly decrease the number of conservancies that would be able to cover their expenses, while the absence of income from tourism was relatively less influential (Naidoo et al., 2016). This demonstrates that diversified and mutually supplementing sources of income, rather than one type of wildlife-based earnings, could be considered a strong economic motivation system, which could help preserve long-term support of the community for conservation efforts, thus confirming the theoretical approach concerning the integration of preventive approaches into the coexistence model (Zhang et al., 2026).

Discussion

When combined, this evidence highlights the fact that sustainable human-wildlife coexistence hinges upon the combination of at least four unique components which tend to be considered individually when studied or implemented in conservation practices. First, resolving conflicts necessitates consideration of the different types of ecological, social and institutional factors in the local context, given the fact that the literature related to coexistence does not offer a generic model applicable to all contexts due to the differences in species, landscape and people that the conflict affects, and that certain impacts for example the disproportionate impact of women in some agricultural areas cannot be accounted for through simple statistics (Nyhus, 2016; König et al., 2020). Second, the types of interventions that are most often used to manage human-wildlife conflict, namely livestock protection interventions, lack the robust evidence basis which might be expected considering the extent of their deployment in conflict management,

implying that conservation practitioners and local communities may be investing in unproven interventions (Eklund et al., 2017). Third, the synthesis of large-scale governance shows that compensation, which is by far the most widely used policy solution to conflict, works best not as an isolated mechanism but as one element within an overall package, which involves prevention measures and participatory local governance, thus explaining why it is that isolated compensation schemes often prove to be ineffective in reducing conflict frequency despite their success in fostering short-term tolerance (Zhang et al., 2026). Fourth, in those cases of community-based conservation which have been studied using longitudinal and quantitatively sound methods, such as the Namibian conservancy case study, it becomes apparent that channeling of revenues from wildlife utilization through several parallel avenues of benefit generation tailored to the specific community needs at various stages of implementation of the program may create stronger incentives for coexistence than relying on a single source of benefit (Naidoo et al., 2016; Zhang et al., 2026). Taken together, all these studies provide strong arguments against the notion of human-wildlife conflict being a purely technological problem which could be managed through isolated mechanisms of conflict mitigation or compensation payments and suggest that structures of governance and benefit sharing created in collaboration with the communities concerned should play a key role in any approach towards sustainable coexistence.

Conclusion

Human-wildlife conflicts arise as a result of a range of context-dependent and highly complex socio-economic and ecological factors which cannot be managed through a blanket solution and technical fixes to a great extent. The scientific research to support the use of many common mitigation interventions appears to be much less abundant than the practical application of those interventions. Compensation policies may help improve tolerance in the short run but they fail to decrease the occurrence rate of

conflicts in the absence of prevention efforts and community participation in decision-making, which shows that financial incentives alone are not enough to manage coexistence between humans and wildlife. Communal conservancies appear to provide sufficient empirical evidence for the sustainability of such a coexistence in the face of economic benefits provided by wildlife directly to the community members. Sustainable coexistence in the future can only be achieved through a dual effort of pursuing the implementation of proven mitigation interventions and ensuring community involvement.

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