Human–wildlife coexistence in science and practice

Human–wildlife interactions shape human cultures, animal communities, and species evolution. They are ubiquitous, diverse in nature, leading to desirable and undesirable consequences (Frank, Glikman, & Marchini, 2019; Nyhus, 2016). The human–wildlife interface is dynamic; emerging where humans expand into natural habitats or where wildlife populations expand into human-dominated areas. For example, human–wildlife interactions increased through better habitat protection, climate change induced range shifts, and where agricultural lands provide food and shelter to wildlife (König et al., 2020). Agricultural landscapes, because of the amplification of food production and relatively low-density human population, are a major arena for human–wildlife interactions. From an anthropocentric perspective, wildlife provides both benefits and costs. Benefits include ecosystem services such as pollination, seed dispersal, pathogen control, recreational value and income through tourism (Power, 2010). Disservices include damage to livestock, crops, pathogen transmission, or loss of human life (Ceausu, Graves, Killion, Svenning, & Carter, 2019; Swinton, Lupi, Robertson, & Hamilton, 2007). Effectively and equitably governing these ecosystem service tradeoffs remains a key challenge to sustainably sharing landscapes with wildlife in agricultural landscapes (Redpath et al., 2013).

Coexistence science is challenging because it is fundamentally multidimensional and comprises complex interactions and feedbacks. In the last decades, research on human–wildlife coexistence has rapidly increased (König et al., 2020). Consolidating insights from those studies to achieve sustainable coexistence on the ground remains a formidable challenge (Carter & Linnell, 2016; Lamb et al., 2020; Lute, Carter, López-Bao, & Linnell, 2018).

Human–wildlife interactions are often framed as human–wildlife conflicts, yet this likely overly-simplifies a more complex and nuanced array of interactions (Mason et al., 2018; Redpath, Gutiérrez, Wood, & Young, 2015). Evidence-based conservation typically addresses such problems by systematically reviewing the scientific knowledge base and synthesizing the findings (Sutherland et al., 2020). While systematic assessments have addressed specific issues of human–wildlife interactions (Eklund, López-Bao, Tourani, Chapron, & Frank, 2017), they also suggest that generalizations and predictions of conservation outcomes are often elusive. Achieving coexistence in practice is difficult, being influenced by a plethora of forces, including local histories, political dynamics, and uncertainty. Integrating place-based knowledge with applied conservation science can generate new insights that may help achieve human–wildlife coexistence in a changing world.

This special issue “Methods for integrated assessment of human–wildlife interactions and coexistence in agricultural landscapes” features a collection of articles proposing, implementing and reviewing a variety of interdisciplinary, socioecological tools for addressing human–wildlife conflicts (Table 1). The case studies and tools proposed here support conservation practice in the context of agricultural landscapes, where benefits and costs of wildlife are experienced within the same area but distributed unevenly among different groups of people. The articles in this special issue introduce suitable and interdisciplinary tools that support the assessment of human–wildlife interactions and promote human–wildlife coexistence. In addition, the case studies highlight the inherent complexity of human–wildlife interactions. In total, this issue features 13 contributions, including three perspective essays, and 10 research papers.

1 | NEW PERSPECTIVES ON HUMAN–WILDLIFE COEXISTENCE

How we study human–wildlife coexistence evolves alongside our strategies for reducing conflict and amplifying benefits. Three papers in this issue touch on this evolving scholarship. van Eeden, Dickman, et al. (2021) propose a theory of change framework for promoting coexistence between dingoes and livestock,
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and highlight the importance of an evidence-based understanding of the barriers and opportunities to changing human behavior toward wildlife. König et al. (2021), present an integrated assessment framework that provides guidelines for systematically analyzing the multistage process of stakeholder participation,
enabling a holistic approach for addressing the complex challenge of human–wildlife conflicts. Finally, Osterman-Miyashita et al. (2021) emphasize opportunities that Citizen Science offers in the field of monitoring and managing human–wildlife interactions.

### 2 | SOCIAL–ECOLOGICAL APPROACHES TOWARD COEXISTENCE

For conservation science to provide actionable scholarship in support of human–wildlife coexistence will require social–ecological approaches to theory, multidisciplinary assessments and case studies.

Understanding stakeholder concerns and action is one primary vector of interest. Jin et al. (2021) mapped stakeholder networks, and revealed that trust between stakeholders and fair benefit sharing are key for coexistence between humans and two threatened crane species in Korea. van Eeden, Rabotyagov, et al. (2021) identified political ideology as critical in stakeholder conflicts while examining human-wolf conflicts in the United States. Also examining human-wolf conflict in the United States, Martin (2021) shows that openly addressing struggles in project implementation can provide important lessons for practitioners in landscapes recolonized by wolves. McInturff et al. (2021) combine ecological information and stakeholder perception to map predation risk and show that integrated social–ecological approaches improve the management opportunities for reducing livestock depredation by carnivores. Delclaux and Fleury (2021) describe dynamic changes in media coverage of the biodiversity-agriculture theme and how these changes are related to environmental issues and political events.

We also need to enhance our understanding of interventions on human–wildlife interactions. Plaschke et al. (2021) show that strategically planned overpasses can effectively enable connectivity and recolonization of wolves and their prey in human-dominated landscapes in Germany. Barzen et al. (2021) analyze nonlethal mitigation methods for reducing yield loss by Greater Sandhill cranes. Kiffner et al. (2021) tested the effectiveness of chili and beehive fences in reducing crop raiding by African elephants and found that chili fences had higher acceptability of implementation and reduced crop damage. Marino et al. (2021) investigated human tolerance for potentially problem-causing species such as brown bears and wolves in Italy. Kansky et al. (2021) assessed tolerance toward multiple wildlife species in the Kavango-Zambezi Transfrontier Conservation Area. Both studies found that human tolerance for wildlife was both species and area specific. While many factors may be associated with tolerance for a given species, increasing tangible and intangible benefits and reducing tangible and intangible costs are key for increasing tolerance.

### 3 | CONCLUSIONS

By highlighting advances in assessing, evaluating, and managing human–wildlife interactions, this special issue emphasizes the advantages of system thinking and employing holistic and transdisciplinary approaches. While such integrated approaches are unlikely to fully resolve the complex and unique nature of most human–wildlife interactions, they will contribute toward making better decisions while promoting human–wildlife coexistence.

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