frontiers | Frontiers in Conservation Science

TYPE Editorial
PUBLISHED 11 December 2025
DOI 10.3389/fcosc.2025.1740942

OPEN ACCESS

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RECEIVED 06 November 2025
REVISED 18 November 2025
ACCEPTED 27 November 2025
PUBLISHED 11 December 2025

CITATION
Şekercioğlu ÇH, Neate-Clegg MHC, Ocampo-Peñuela N, Jankowski JE, Peres CA and Terborgh J (2025) Editorial: Long-term research on avian conservation ecology in the age of global change and citizen science. *Front. Conserv. Sci.* 6:1740942.
doi: 10.3389/fcosc.2025.1740942

Editorial: Long-term research on avian conservation ecology in the age of global change and citizen science

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KEYWORDS

ecology, ornithology, conservation biology, climate change, LTER (long term ecological research), population biology, community-based conservation, community science

Editorial on the Research Topic
Long-term research on avian conservation ecology in the age of global change and citizen science

Birds are among the most effective indicators of environmental change, and long-term avian research provides critical insights into biodiversity dynamics in the Anthropocene. Centuries of ornithological research combined with citizen science have produced some of the most comprehensive ecological trait datasets for any taxon, enabling detailed ecological and conservation assessments (Kittelberger et al., 2021a), including those of population trends and at-risk functional groups (Figure 1). Databases such as BIRDBASE (Şekercioğlu et al., 2025), combined with over two billion eBird records (Sullivan et al., 2009) now support global-scale analyses, including in historically understudied regions (Kittelberger et al., 2023).

Despite these advances, major data gaps persist in tropical regions where biodiversity is richest, yet monitoring is most limited. Integrated projects combining systematic monitoring, citizen science, education, and local engagement remain rare, even as global bird declines accelerate (Şekercioğlu et al., 2023). Many biodiversity hotspots also overlap with areas of frequent armed conflict (Hanson et al., 2009), creating additional barriers to sustaining research in some critical regions of high endemism (e.g. Kittelberger et al., 2021b).

This Research Topic synthesizes ten studies spanning tropical and temperate regions, urban and forested landscapes, and employing diverse methodologies from mist-netting and citizen science to molecular ecology. Collectively, these contributions underscore the importance of sustained avian monitoring and inclusive conservation strategies. We organize their findings under five overarching themes: trait-based vulnerability,

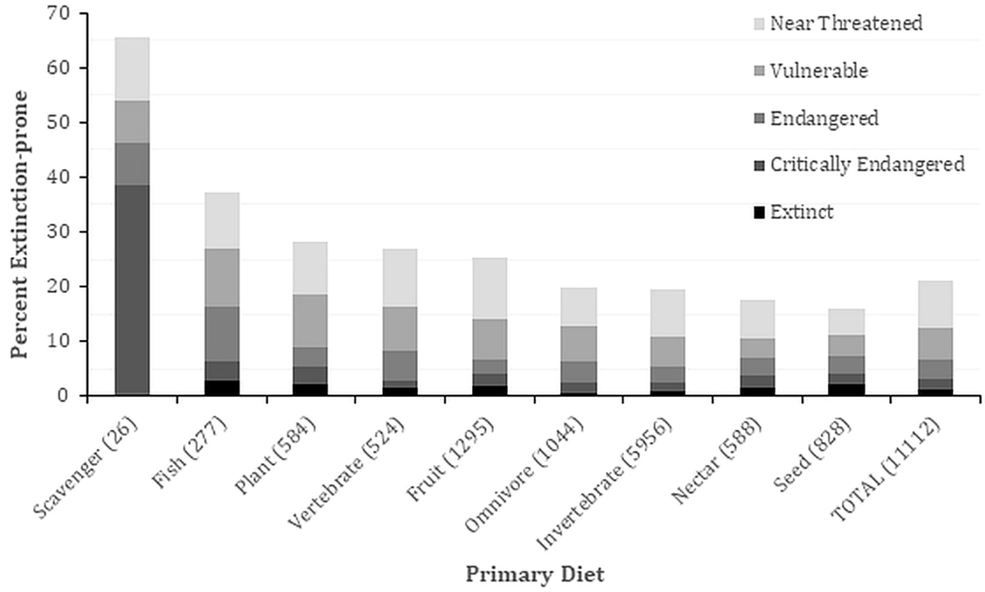

FIGURE 1
Percent of extinction-prone bird species based on primary diet preference (see Şekercioğlu et al. (2025) for diet descriptions). Conservation status is from BirdLife International (2025). The number of bird species which prefer that diet category most is in parentheses. Extinct includes species extinct in the wild.

demographic and physiological responses, climate impacts, landscape transformation, and integrative conservation approaches.

Trait-based vulnerability and community composition

Barrie et al. compared bird communities in primary versus logged forests in Equatorial Guinea, revealing a 47% reduction in individuals and the losses of ant-followers, mixed-species flock participants, and terrestrial insectivores in secondary forests. These guild-specific declines highlight the sensitivity of forest specialists to habitat degradation and reinforce the need for intact habitats, strengthening trait-based vulnerability frameworks widely applied under climate and land-use change (Cazalis et al., 2021; Jiguet et al., 2007). Nikolaou et al. extended this work by examining demographic and physiological traits of ant-following birds, uncovering demographic bottlenecks and variable body condition despite similar breeding status and stress hormone (fCORT) levels. These nuanced responses align with broader evidence that insectivores and forest specialists are particularly vulnerable to anthropogenic disturbance (Şekercioğlu, 2002; Powell et al., 2015).

Demographic stability and long-term monitoring

Long-term datasets provide critical insights into population dynamics and community stability. Wambugu et al. analyzed 13 years of mist-netting data of 18 understory bird species from Mt. Kasigau, Kenya, finding most understory species stable, though the endemic Taita White-eye declined—underscoring the need for continued monitoring. In a temperate context, Cooper (2025) examined nearly seven decades of Harvard Forest data, documenting turnover in one-third of species between years, with 18 colonizations and 16 declines since 1948. Colonizers were dominated by species near their northern range limits, rather than those expanding southward, while declines involved migratory and open-habitat birds. Forest interior species generally increased whereas declining species tend to favor open-country and shrubland habitats. Targeted management, such as clear-cuts and the removal of non-native conifer plantations, aided some declining species, illustrating the complex interplay of climate, habitat, and conservation actions.

Measuring and mitigating climate impacts

Mota et al. assessed climate change impacts on endemic and near-endemic birds in Colombia's Chocó hotspot. Using eBird data and climate projections, they modeled distributions for 27 species and found nearly universal losses of climate-suitable areas, driving upslope shifts and reductions in species richness. Scarlet-and-white Tanager and Chocó Warbler face the steepest losses—84% and 60%, respectively—threatening ecological services such as seed dispersal and insect control. These results emphasize the urgency of expanding protected areas, promoting reforestation, and enhancing habitat connectivity to match shifting climatic niches (Tingley et al., 2009). Integrating citizen science with ecological modeling offers a powerful framework for community-engaged conservation. Complementing these findings, Gale et al. demonstrated how precipitation patterns shape breeding phenology in Thailand's dry forests: extended droughts delayed egg-laying, while reduced rainfall postponed fledging, highlighting precipitation as a key driver of reproductive timing.

Landscape transformation and functional homogenization

Urbanization and land-use change are restructuring avian communities worldwide. Danmallam et al. analyzed African Bird Atlas data from Kenya and Nigeria, showing declines in taxonomic richness and functional diversity with increasing urbanization, alongside rising functional redundancy. Across gradients from pristine habitats to cities, ecological specialists were filtered out, reducing functional richness and ecosystem services. Although functional diversity increased slightly, patterns indicate a shift toward generalist-dominated assemblages, consistent with global biotic homogenization trends (McKinney, 2006). In Ecuador's Chocó region, a biodiversity hotspot also facing intense landscape transformation, Karubian et al. (2025) highlight the role of equity and inclusion in conservation success through two decades of community-engaged monitoring. By integrating Traditional Ecological Knowledge with scientific research, their approach produced tangible outcomes, including reserve establishment and youth programs, offering a replicable model for participatory conservation.

Integrative conservation and molecular approaches

Several studies underscore the value of linking ecological research with practical interventions. Briceño-Linares et al. documented population rebounds of Yellow-shouldered Amazons in Venezuela following habitat restoration, nest-site provisioning, and community education, with populations doubling and tripling on Bonaire and Margarita by increasing nesting success and, critically, by reducing poaching rates. Nikolaou et al. advanced conservation physiology by analyzing stress hormones (fCort), a sensitive indicator of sublethal disturbance, in birds exposed to selective logging. Finally, Esperanza et al. contributed a genomic perspective by examining transcriptomic responses of Common Murres to *Babesia* infection and oil contamination. RNA sequencing revealed hundreds of differentially expressed genes, with shared immune suppression and oil-induced lipid metabolism changes, illustrating mechanisms that heighten vulnerability to disease and environmental stressors. These findings demonstrate how molecular tools complement traditional monitoring and demographic indicators in measuring wildlife health (Acevedo-Whitehouse and Duffus, 2009) while supporting community-based conservation strategies essential for mitigating global change impacts on tropical and marine birds.

Synthesis and future directions

The ten papers in this Research Topic highlight key strategies for avian conservation: long-term monitoring to detect subtle ecological changes, trait-based approaches for identifying vulnerable species, tracking climate change impacts, leveraging citizen science and community engagement, and applying interdisciplinary methods from molecular ecology to spatial modeling. A common theme is the indispensability of long-term, locally grounded research for detecting ecological change and guiding conservation. Whether through mist-netting, citizen science, or molecular tools, these studies exemplify best practices. Birds remain vital indicators of ecosystem health; integrating ecological data, community knowledge, and interdisciplinary approaches is essential as global pressures intensify.

Author contributions

ÇŞ: Writing – original draft, Writing – review & editing, Conceptualization. MN-C: Writing – original draft, Writing – review & editing. NO-P: Writing – review & editing, Writing – original draft. JJ: Writing – review & editing. CP: Writing – review & editing. JT: Writing – review & editing.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was not used in the creation of this manuscript.

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