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Mark A Elgar,
The University of Melbourne, Australia

*CORRESPONDENCE
Paulo Estefano D. Bobrowiec
✉ paulobobro@gmail.com

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Editorial: Human impacts on bats in tropical ecosystems: sustainable actions and alternatives

Paulo Estefano D. Bobrowiec^{1,2*}, William Douglas Carvalho^{3,4,5},
Ana Rainho⁶, Paul W. Webala⁷ and Ludmilla M. S. Aguiar⁸

¹Programa de Pós-Graduação em Ecologia, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil, ²Instituto Tecnológico Vale, Belém, Brazil, ³Terrestrial Ecology Group (TEG-UAM), Departamento de Ecología, Facultad de Ciencias, Universidad Autónoma de Madrid, Madrid, Spain, ⁴Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Universidad Autónoma de Madrid, Madrid, Spain, ⁵Programa de Pós-Graduação em Biodiversidade Tropical, Universidade Federal do Amapá, Macapá, Brazil, ⁶CE3c-Centre for Ecology, Evolution and Environmental Changes & CHANGE - Global Change and Sustainability Institute, Departamento de Biologia Animal, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal, ⁷Department of Forestry and Wildlife Management, Maasai Mara University, Narok, Kenya, ⁸Laboratory of Bat Biology and Conservation, Department of Zoology, Biological Science Institute, University of Brasília, Brasília, Brazil

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Editorial on the Research Topic

[Human impacts on bats in tropical ecosystems: sustainable actions and alternatives](#)

Background

Globally, the most extraordinary biodiversity is in the tropics, spread in a great diversity of vegetation types and habitats. Among the myriad mammalian groups, bats stand out for their remarkable taxonomic, functional, and phylogenetic diversity (Wilson and Mittermeier, 2019). Within the tropics, bats can be found in different vegetation types varying in a gradient of structural complexity from dense ancient forests to more open landscapes and woodlands in the savannas and fields (Meyer et al., 2004; Carvalho et al., 2021). Bats provide essential ecosystem services such as seed dispersal and pollination of the many plants that have a role in the income of the most impoverished human populations and the formal economy (Lacher et al., 2019). Moreover, as voracious insect predators, bats play a vital role in suppressing agricultural pests, an invaluable service in this part of the world, and disease vectors for humans (Aguiar et al., 2021; Tuneu-Corral et al., 2023).

It is widely recognized that the main threat to bats globally is the extensive conversion of natural ecosystems, especially in tropical developing countries (Meyer et al., 2016). This shift in land use results in habitat loss and environmental degradation, with consequent loss of species, ecosystem services, and lineages (Frick et al., 2020; Atagana et al., 2021; Colombo et al., 2023). There is thus an urgent need to disseminate correct information about bats and

explore best practices for mitigating the adverse effects stemming from human activities such as vegetation clearing for cattle ranching, agriculture, human settlements, and urbanization. Therefore, in this Research Topic, we aimed to bring together current research that assesses the influence of multiple environmental transformation drivers on the diversity of tropical bats. Nine papers were published in this Research Topic, and they present novel insights into how bats react to human-driven environmental changes and address significant gaps in bat conservation. These studies were conducted by 36 authors in six countries across the American, African and Asian continents (Figure 1). While the sampling was local in seven studies, [Brasileiro et al.](#) used data spanning Brazilian biomes, and [Xavier et al.](#) carried out a global systematic review. Three key themes emerge from the papers presented in this Research Topic, and we discuss the findings and knowledge gaps related to each theme in the following sections.

Critical role of forest cover in bat conservation

Most studies underscore the critical role of forest cover in bat conservation within human-made landscapes. These papers assessed various environmental perturbations, including mining, selective logging, rubber plantations, agricultural systems, and vegetation modified by pasture and farming activities. [Cory-Toussaint and Taylor](#) found that insectivorous bat activity of open-air and clutter-edge foragers was negatively impacted over areas close to diamond opencast mining devoid of vegetation cover in South Africa. According to [Deshpande et al.](#), the areas in India with the greatest levels of forest cover and the fewest rubber plantations also had the highest levels of bat activity across all insectivorous bat guilds. This suggests that maintaining undergrowth can help lessen the negative impacts of rubber plantations. [BakwoFils et al.](#) showed a difference in species composition between disturbed and undisturbed habitats of the Afromontane biome of Cameroon. This difference is primarily caused by the high presence of closed-spaced insectivorous bats in the undisturbed habitat and the high proportion of frugivorous bats in the altered habitats, which are drawn in by fruit trees. [Costa and Ramos Pereira](#) found that the structural connectivity of the landscape in the Brazilian-Uruguayan savanna played a pivotal role in the occupancy of edge-space foraging bats, suggesting that landscapes with natural elements favor aerial insectivores. On the other hand, [Peña-Cuéllar and Benítez-Malvido](#) found that species capture rates in southern Mexico were skewed towards females in riverine corridors surrounded by pastures. Together, these articles show that human-modified landscapes reduce the richness and abundance/activity of species of different neotropical bats. Considering the alarming rates of loss and fragmentation of tropical forests, the preservation of large areas of undisturbed forest, as well as the use of forestry systems that keep, for example, the understory standing, is necessary to maintain bat species diversity and its related ecosystem services.

Interactions between bats and other organisms

Maintaining interactions in biological communities is a key factor in maintaining biodiversity and ecosystem services. In this regard, two studies delved into the interactions between bats and other organisms. [Hemprich-Bennett et al.](#) found minimal variation in prey richness consumed by the fawn leaf-nosed bat *Hipposideros cervinus* in both selectively logged and preserved forests in Borneo. This suggests that this bat species may be resilient to habitat degradation. [Ramalho et al.](#) showed that ecological networks between parasitic flies and host bats were more nested in disturbed sites, with a decrease in the specialization of the bat-fly interaction in the Brazilian Cerrado. In this case, reduced roost density in altered habitats can lead to higher species aggregation within a single roost, potentially promoting parasite transmission amongst bat species. Therefore, these studies show that the level of landscape modification can influence interactions between bats and prey and ectoparasites. On one side, planned timber harvesting in selectively logged forests has little influence on the diet of an insectivorous bat. On the other hand, the loss and modification of forests in the Brazilian Cerrado alter the bat-parasite relationship with increased transfer of parasites between species. For the Cerrado biome, we still do not have a solution to block the effects of forest degradation, as there are few studies on bats in this Brazilian biome.

Impacts of environmental transformation on ecosystem service provision by bats

Habitat loss and fragmentation are the main drivers of species losses globally, resulting in significant impacts on ecological services and ecosystem functioning through species extinction and replacement. At a large scale, the findings of [Brasileiro et al.](#) reveal a substantial decline in the ecosystem services provided by bats in the central and eastern Brazil, with species loss being an important factor in the Atlantic Forest and Cerrado and reduced species occurrence in the Amazon, Caatinga, and Pantanal regions. In their global review of research on bats in agricultural systems, [Xavier et al.](#) highlighted aspects requiring empirical investigation, such as biogeographic regions, sampling methods and scale, and biodiversity descriptors, to understand the factors influencing bat survival in cultivated landscapes. Also, these authors address that these knowledge gaps could foster cooperation with rural producers, facilitating bat protection and the development of relevant public policies. Therefore, we see that locally or globally, the effects of man-made changes in different landscapes have a major impact on bat fauna. However, there are solutions to reduce these impacts and many of these solutions involve improving the sustainability of the production system, with direct action from agricultural producers.

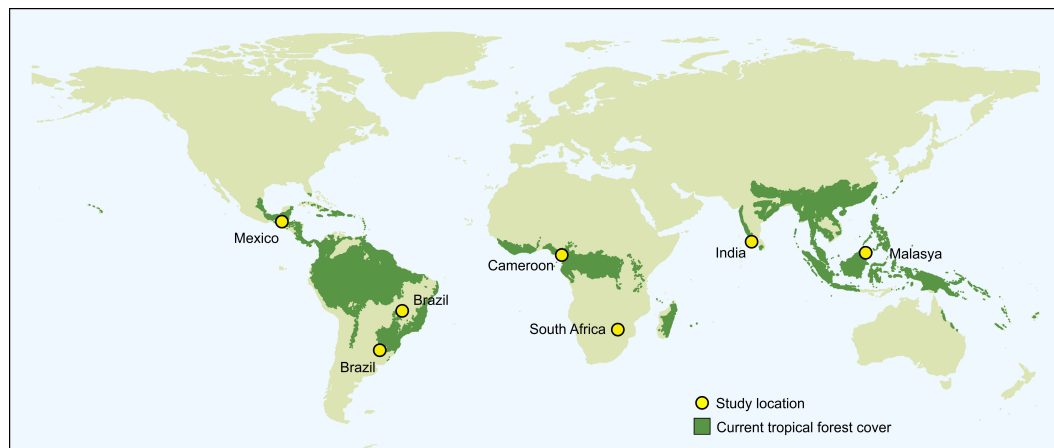


FIGURE 1

Global map with the distribution of sampling sites of the nine papers published in this Research Topic. Only seven sampling sites are represented, as two papers used data from multiple locations and countries.

Practical actions for a sustainable future

We learned in this Research Topic that the preservation of intact forests, the restoration of secondary forests, and initiatives with local populations and producers were the primary mitigating strategies for the conservation of tropical bats in the face of anthropogenic landscape changes. As suggested by studies here, this can be accomplished by designating new protected areas and enhancing the management of existing ones near major developments, and provide enough space to support both the original diversity of bat species and the potential or actual ecosystem services that bats provide. Additionally, restoring secondary forests has also been suggested as a way to lessen edge effects by increasing the size of the forest and improving connectivity between forest patches. It is our hope that this Research Topic will stimulate further research that offers insights and fill knowledge gaps into management actions, public policies and sustainable alternatives that effectively alleviate human impacts on bat biodiversity.

Author contributions

PB: Conceptualization, Data curation, Investigation, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. WC: Conceptualization, Data curation, Investigation, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. AR: Conceptualization, Data curation, Investigation, Project

administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. PW: Writing – review & editing. LA: Conceptualization, Data curation, Investigation, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

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